TRANSITIONAL PROGRESSIVE REHABILITATION AND CLOSURE PLAN BLUFF MINE

PREPARED FOR
BOWEN PCI PTY LTD

5 June 2025

Cover Page

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AARC	AARC Environmental Solutions
AHD	Australian height datum
AQP	Appropriately Qualified Person
ARD	Acid Rock Drainage
ASC	Australian Soil Classification
ATP	Authority to prospect
BOM	The Bureau of Meteorology
Bowen PCI	Bowen PCI Pty Ltd
CEC	Cation exchange capacity
DCU	Duckworth Creek Upstream
DES	Department of Environment and Science
DNRM	Department of Natural Resources and Mines
DSITI	Department of Science, Information Technology and Innovation
EA	Environmental Authority
EC	Electrical conductivity
EP Act	*Environmental Protection Act 1994*
EPC	Exploration permit coal
EPP	Environmental Protection Policy
ERA	Environmentally relevant activity
ESC	Erosion and sediment control
ESI	Electrochemical Stability Index
ESP	Exchangeable Sodium Percentage
FoS	Factor of Safety
FOS	Factor of safety
GDE	Groundwater dependent ecosystem
GPS	Global Positioning System
GWMP	Groundwater Monitoring Program
HV	High voltage
IA	Improvement areas
LOD	Land outcome document
LOR	Limit of Reporting
LV	Low voltage
MAW	Mine affected water
MIA	Mine infrastructure area
ML / MLs	Mining Lease / Mining Leases
Mpta	Million tonnes per annum
NAF	Non-acid forming
NATA	National Association of Testing Authorities
NUMA	Non-use management area
PAWC	Plant available water capacity
PCA	Potential commercial area (Petroleum)
PCI	Pulverised coal injection
PMF	Probable maximum flood
PMLU	Post-mining land use
PoO	Plan of Operations
PRCP Guideline	Progressive Rehabilitation and Closure Plan Guideline
PRCP	Progressive Rehabilitation and Closure Plan
QLUM	Queensland Land Use Mapping
QWQG	Queensland Water Quality Guidelines
RA	Rehabilitation areas
RCD	Rufus Creed Downstream
ROM	Run of mine

RPEQ	Registered Professional Engineer of Queensland
RUSLE	Revised Universal Soil Loss Equation
SEP	Stakeholder Engagement Plan
SILO	Scientific Information for Landowners
SMART	Specific, Measurable, Achievable, Relevant and Time-Bound
SQP	Suitably Qualified Person
TDS	Total dissolved solids
TNP	Taunton National Park
TPH	Total Petroleum Hydrocarbons
WEPP	Water Erosion Prediction Project
WQ	Water Quality
WQO	Water quality objectives

1 Introduction

AARC Environmental Solutions Pty Ltd has been commissioned by Bowen PCI PTY LTD (Bowen PCI) to develop a Progressive Rehabilitation and Closure Plan (PRCP) for Bluff Mine in accordance with the requirements of the *Environmental Protection Act 1994* (EP Act).

A PRCP transition notice was issued under section 754 of the EP Act by the Department of Environment and Science (DES) to the holders of Environmental Authority (EA) EPML02090614 on 31 May 2022.

The due date for submission of the PRCP to the administering authority was 11 December 2023.

This transitional PRCP has been developed in accordance with sections 126C and 126D of the EP Act and with consideration of the requirements of the *Progressive Rehabilitation and Closure Plan Guideline* (DESI 2024) (PRCP Guideline).

Land outcome documents are defined in section 750 of the EP Act. The PRCP Guideline states that

> *the land outcome documents list is hierarchical; if there are inconsistencies between these documents, on either the final outcomes or details of the outcome, then the document appearing first in the list will prevail to the extent of the inconsistency.*

For the Bluff Mine, the land outcome document is the EA (EPML02090614, dated 7 December 2023). There are no other land outcome documents applicable.

2 Scope and objective

The purpose of this PRCP is to describe how progressive rehabilitation will be carried out at Bluff Mine. The PRCP Guideline states that the PRCP must include the following parts:

Rehabilitation Planning part:

The PRCP guideline states that:

> *the purpose of the rehabilitation planning part of the PRCP is to support and justify the development of the proposed PRCP schedule.*

This part must detail how progressive rehabilitation, and closure will be carried out over the entire Bluff Mine and on both a rehabilitation area basis and improvement area basis. The key components of the rehabilitation planning part for Bluff Mine are:

- community consultation information (refer section 5);
- post-mining land use (PMLU) and/or non-use management area (NUMA) determination (refer sections 6 and 7);
- rehabilitation and management methodology (refer section 8);
- risk assessment (refer section 9); and
- a monitoring and maintenance program (refer section 10).

Rehabilitation Schedule part:

The rehabilitation schedule is a required element of a PRCP. Once approved, the schedule becomes a legally binding and enforceable instrument with which Bluff Mine must comply. The schedule must include:

- nomination of either a PMLU or NUMA for all land within the relevant resource tenures, including land uses for undisturbed land;
- identification of when land becomes available for rehabilitation or improvement;
- rehabilitation or management milestones to achieve the PMLU or NUMA outcomes;
- milestone criteria that demonstrate when each milestone has been completed;
- completion dates for each milestone to be achieved; and
- any conditions considered necessary or desirable.

In accordance with section 206A of the EP Act:

1) *It is a condition of a PRCP schedule that, in carrying out a relevant activity under the schedule, the holder must comply with a requirement stated in the environmental authority relevant to carrying out the activity.*

2) *Also, it is a condition of a PRCP schedule that the holder must comply with the following matters stated in the schedule—*

   a) *each rehabilitation milestone and management milestone;*

   b) *when each rehabilitation milestone and management milestone is to be achieved.*

This PRCP follows the guideline structure.

3 Project Planning: Project overview

Legislative Requirement

Section 126C(1)(b) and (c)(ii) of the EP Act, *"the rehabilitation planning part of the PRC plan must include a description of:*

- each resource tenure, including the area of each tenure;
- the relevant activities to which the application relates;
- the likely duration of the relevant activities; and
- how and where the relevant activities are to be carried out, including maps."

3.1 Site description

Bluff Mine is an open cut coal mine located in the Mackenzie River sub-basin south-east of the town of Bluff in central Queensland, approximately 20 km to the east of Blackwater and 174 km to the west of Rockhampton (Figure 1 and Figure 2). The open cut mining operations employs terrace mining using conventional truck and excavator methods with waste rock placed into the out-of-pit overburden dumps (east and west of the residual void) and then subsequent backfilling of the residual void starting in the north and moving south.

The mine commenced operation in 2018 under ownership of Carabella Resources Pty Ltd and was placed into care and maintenance, when mining services ceased in November 2020. Bowen PCI subsequently acquired the mine in November 2021 and recommenced mining operations on Mining Lease (ML) 80194 in January 2022.

Due to subdued pulverised coal injection (PCI) prices, higher costs of mining and continued lower than forecast production, Bowen PCI has transitioned Bluff Mine into care and maintenance as of 30th November 2023.

Bluff Mine will remain in care and maintenance with minor infrastructure remaining at the mine to aid reopening when PCI coal prices recover sufficiently to cover operational costs and deliver higher profit margins for shareholders. As of this time, resource estimates have confirmed that the site contains a probable or proved ore reserve that could be mined within a 2-year period.

Bowen PCI has approval to produce up to 1.8 Mtpa of ROM PCI, operating wholly within ML 80194 (Table 1). Bluff Mine consists of a single open cut pit, two out-of-pit spoil dumps located east and west of the pit, ROM stockpiles, associated workshop, and mine infrastructure areas (MIA). The main infrastructure located on site includes:

- buildings (including foundations);
- workshop;
- roads and tracks;
- potable water storage facilities;
- chemical/fuel storages;
- laydown yard;
- access/coal haul road and infrastructure corridor;
- ROM pad; and
- pit access road.

The mine plan includes one pit, and two out-of-pit dumps expanding south across ML 80194. Once the out-of pit dumps reach full capacity, spoil will be placed in-pit. The total estimated disturbance across the life of mine is approximately 515.3 ha and is depicted in Figure 2. Significant rehabilitation works have commenced on Bluff Mine and are on track to be completed in accordance with the proposed PRCP schedule (Appendix A).

The resource tenure for Bluff Mine is detailed in Table 1.

Table 1: Project resource tenure

Mining Lease	Authorised Holder	Expiry Date	Area (ha)
ML 80194	Bowen PCI Pty Ltd	30 September 2031	1088.43

3.2 Environmentally relevant activities

Activities on ML 80194 that are Environmentally Relevant Activities (ERAs), as per Schedule 3 of the Environmental Protection Regulation 2019, and as listed in EPML02090614, include:

- Schedule 3 - 13 - Mining black coal;
- Ancillary 08 - Chemical Storage - 1 - Storing a total of 50t or more of chemicals of dangerous goods class 1 or class 2, division 2.3 under subsection (1)(a);
- Ancillary 08 - Chemical Storage - 3 - Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c); and
- Ancillary 60 - Waste disposal - 1(a) - Operating a facility for disposing of, in a year, the following quantity of waste mentioned in subsection (1)(a) - less than 50,000t.

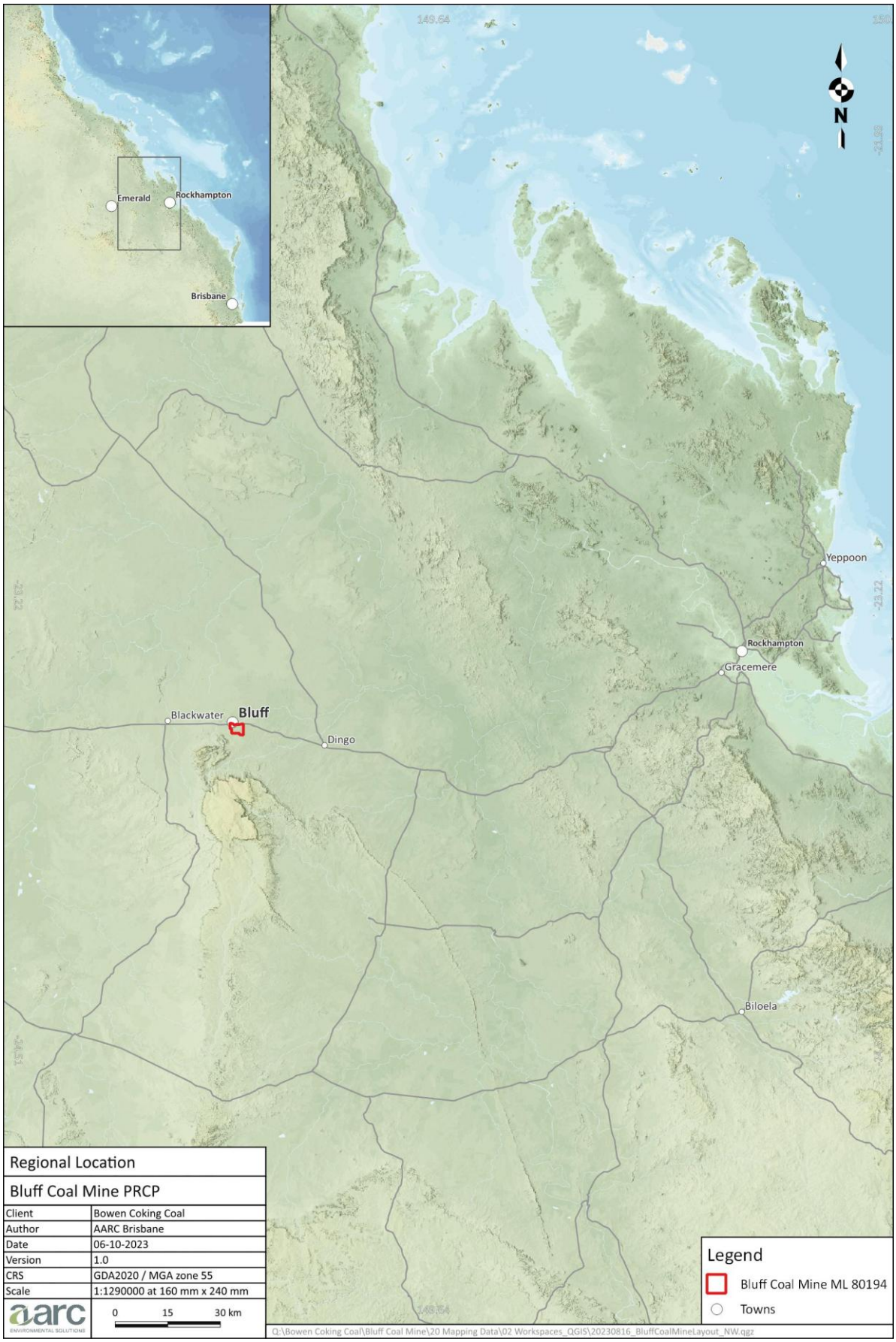

Figure 1: Project locality

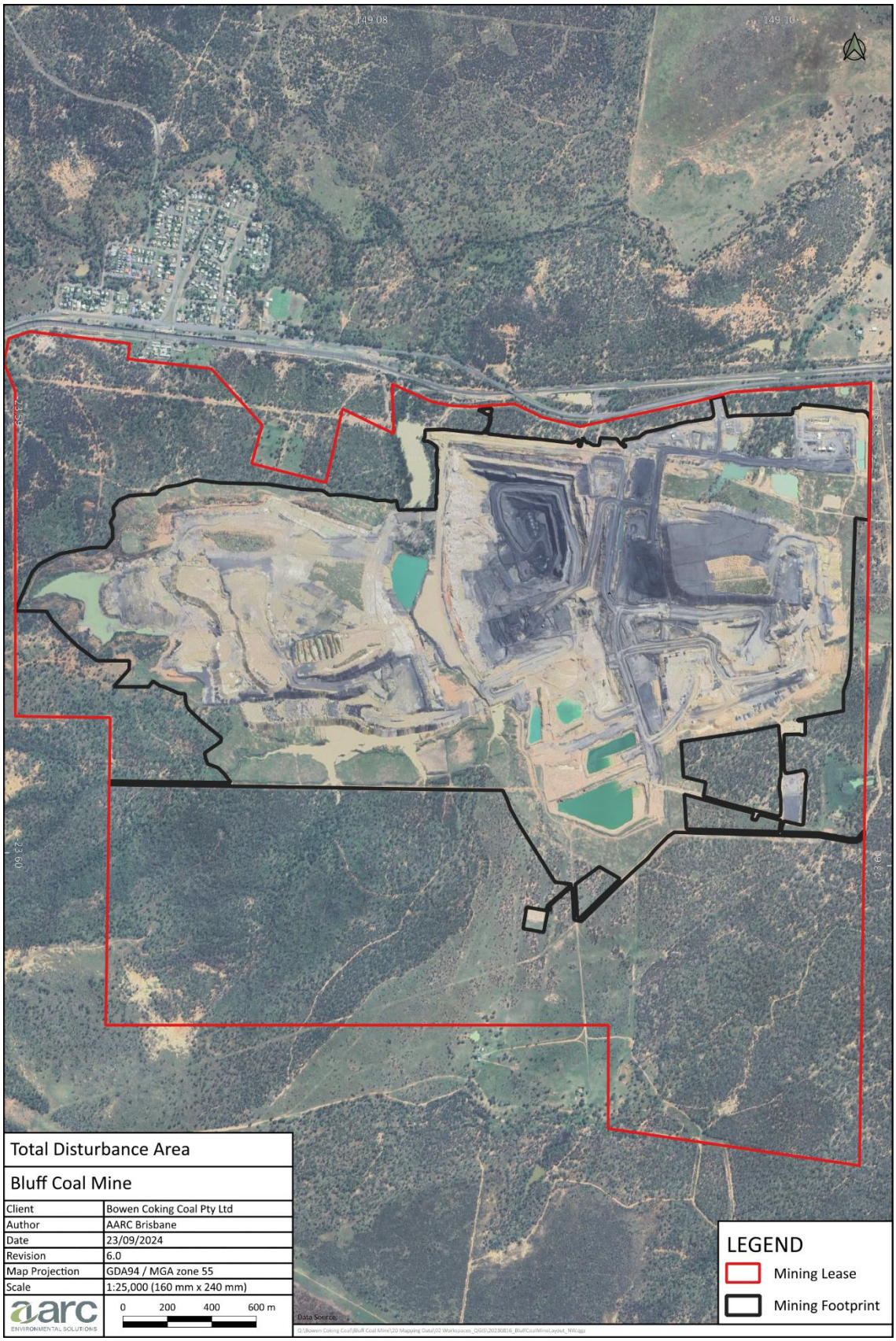

Figure 2: Bluff Mine ML and mining footprint.

3.3 Exploration tenements

The exploration tenements that overlap, or are adjacent to Bluff Mine, are listed in Table 2 and shown in Figure 3.

Table 2: Regional resource tenements and underlying permits

Authorised holder name	Permit number	Location description (from Bluff Mine)
Constellation Mining Pty Ltd	EPC 729	Directly north and overlapping the northeast portion of the Bluff Mine ML
Walton Coal Pty Ltd	EPC 960	Adjacent to the eastern ML boundary
New Cambria Pty Ltd	EPC 1113	Directly northeast across the Capricorn Highway
Belview Coal Pty Ltd	EPC 1114	4.1 km southwest
Belview Expansion Pty Ltd	EPC 1186	3.2 km west
	EPC 1798	3.5 km northwest
Bowen PCI Pty Ltd	EPC 1999	6.4 km southeast
Jindal Steel and Power (Australia) Pty Ltd	EPC 2070	5.5 km south
OME Resources Australia Pty Ltd	ATP 806	Overlapping Bluff Mine area

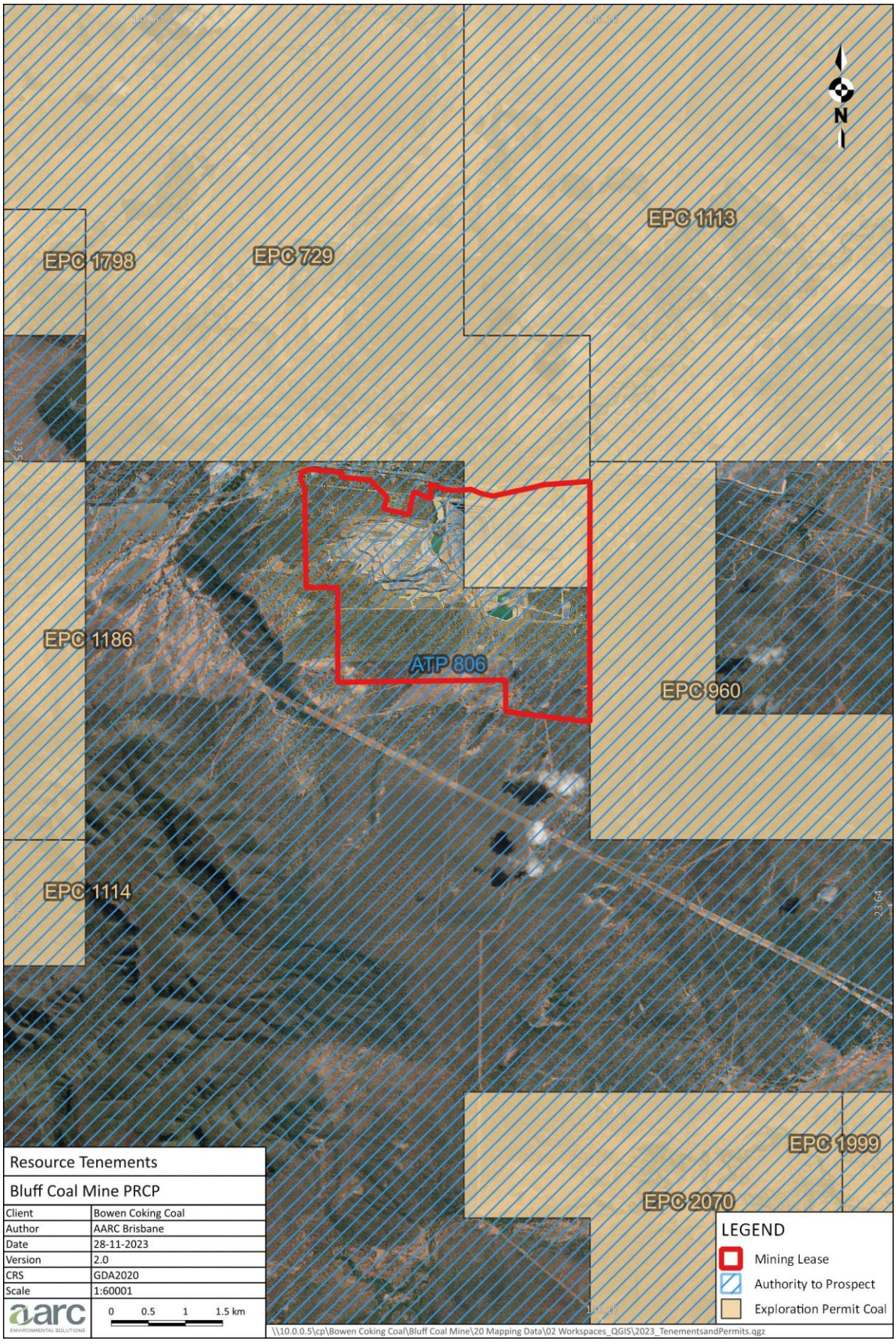

Figure 3: Regional resource tenements

3.4 Underlying landholders

The majority of the Bluff Mine life of mine disturbance is held within two land parcels, Lot 11 on Plan H4023 and Lot 80 on Plan SP232626. The current underlying land tenure is described in Table 3 and depicted in Figure 4.

Table 3: Underlying landholders

Property description	Property tenure	Parcel type
Lot 80 on Plan SP232626	Freehold	Lot parcel
Lot 1 on Plan SP136854	Freehold	Lot parcel
Lot 8 on Plan HT142	Water Supply Reserve	Lot parcel
Lot 11 on Plan H4023	Lands lease	Lot parcel
Lot A on Plan SP311710	Easement	Lot Parcel
Unnamed Road	-	Road parcel

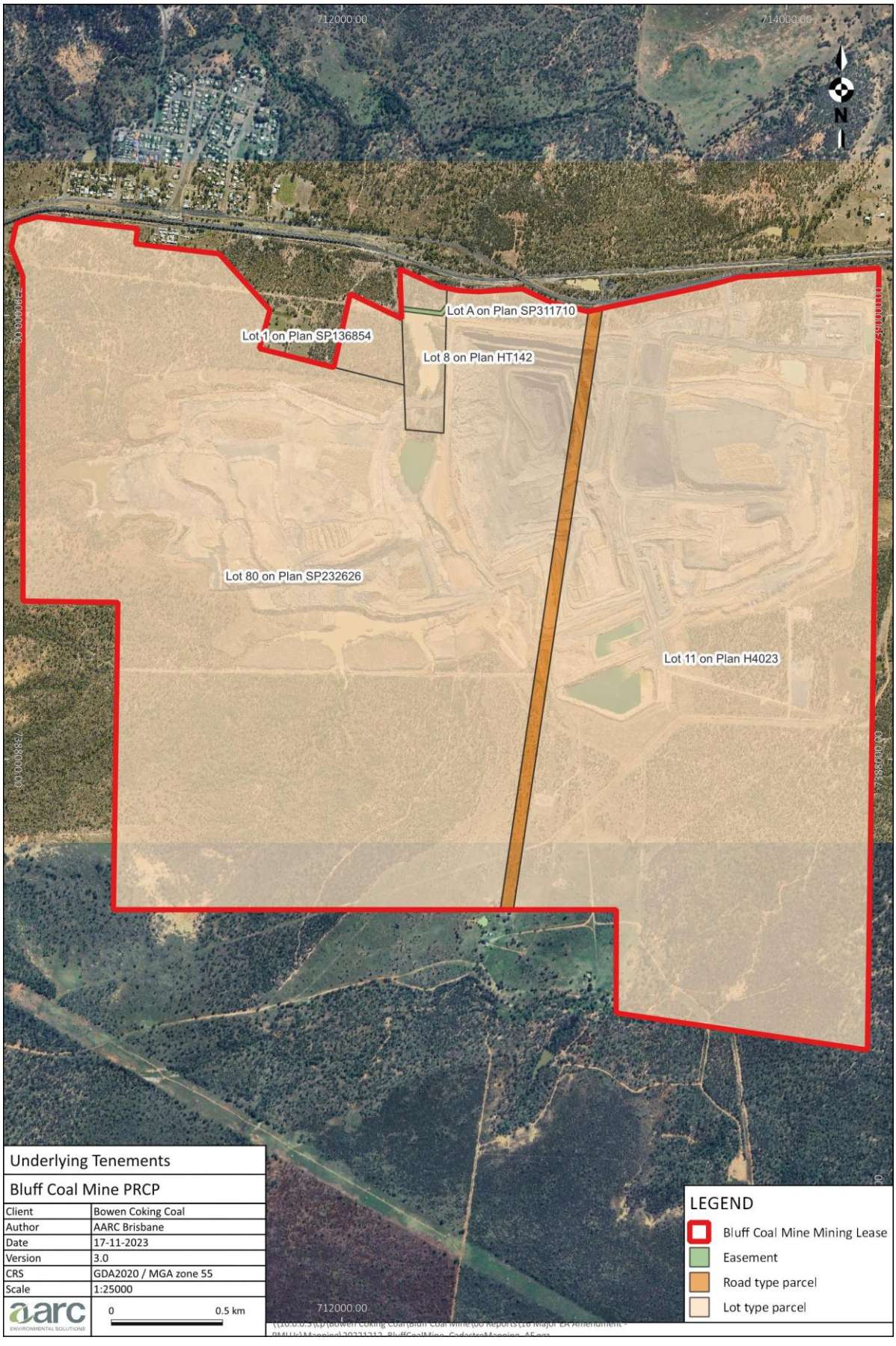

Figure 4: Underlying tenements

4 Project Planning: Baseline information

4.1 Climate

The climate data presented in Figure 5 has been drawn from SILO (Queensland Government 2022). The climate of the region is described as subtropical with warm wet summers and mild, dry conditions in winter. The warmest months are November to February. Average temperatures range from 22.3°C to 34.6°C in January to 9.1°C to 23.4°C in July (Emerald Airport ID 035264). Average annual rainfall for the area is 623 mm (SILO -24.21, 148.74) with a wet season that generally aligns with the November to March period and accounts for over 65% of the region's annual average rainfall.

Evaporation records available from SILO (-24.21, 148.74) estimate an annual average evaporation (Class A pan) of approximately 2,075 mm; approximately three to four times the average rainfall (Figure 5). Similarly, measured, monthly average potential evaporation is approximately three to four times higher than average rainfall.

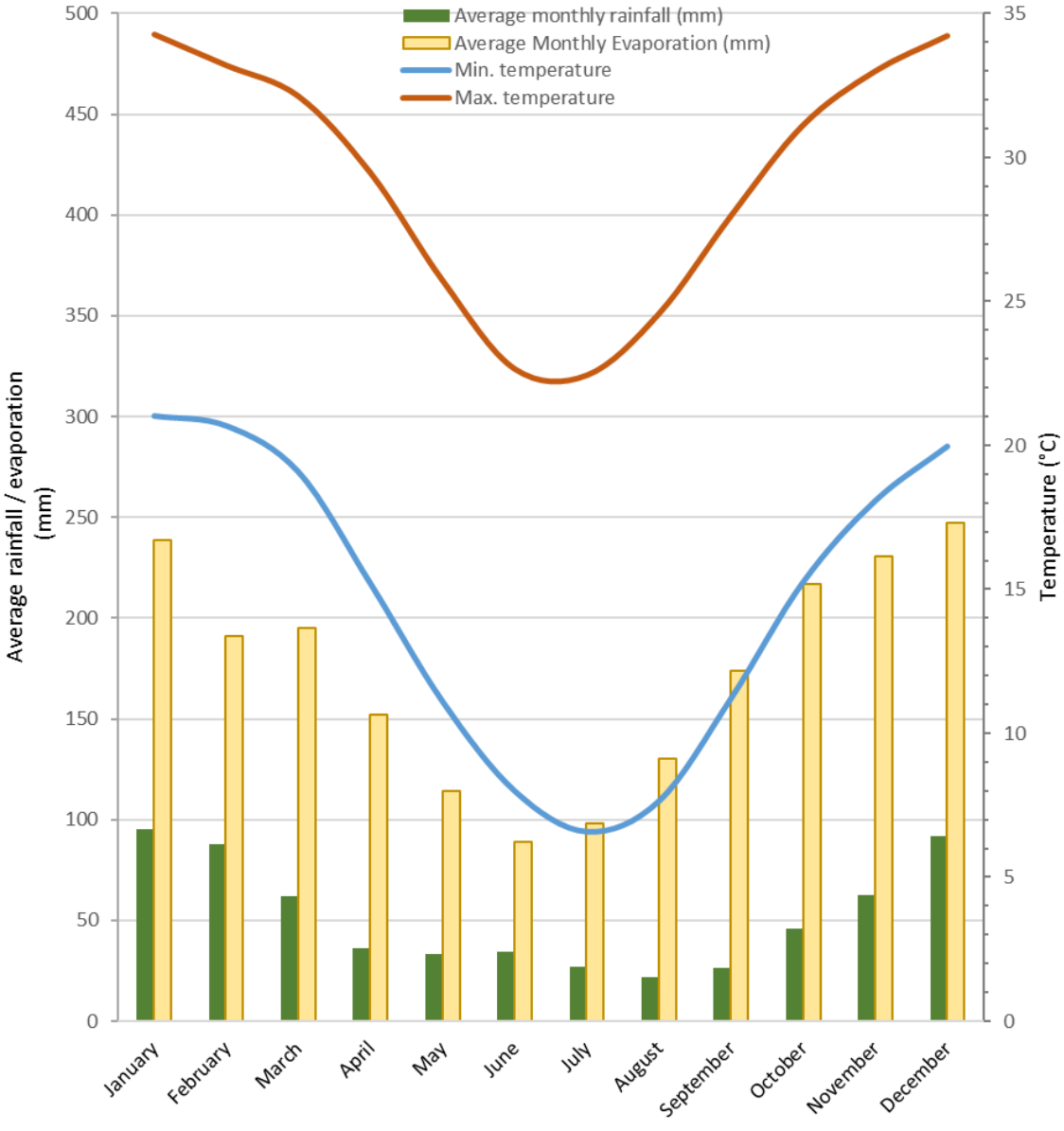

Figure 5: Project regional average monthly rainfall and evaporation

In Australia, climate change is generally expected to result in a shift towards more arid conditions, warmer temperatures, and reduced rainfall. According to the Queensland Government (2019), rainfall in central Queensland is predicted to decrease due to climate change. By 2050, median annual rainfall is projected to decrease by:

- 2% under a lower emissions scenario (with emissions reduced from 'business as usual'); and
- 8% under a high emission, or 'business as usual' scenario.

Long-term climate projections predict that conditions will become warmer, with hotter and more frequent hot days. Rainfall events are predicted to become more intense, and tropical cyclones are predicted to become less frequent but more intense.

4.2 Geological setting

Bluff Mine is situated within the Bluff and Yarrabee coal measures along the Mimosa syncline. The major geological units are comprised of the Burngrove Formation underlying the Rangal Coal measures (both from the later Permian Blackwater Group), and the overlaying Early Triassic Rewan formation (Figure 6 and Table 4). SLR (2013), in the Soils, Land and Overburden assessment for Bluff Mine, described the Rewan formation as consisting of lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate.

The local structural geology is complex and is comprised of folds, faults and thrusts running north-northwest to south-southeast within ML (AGE 2013) (Appendix C) (Figure 7). One major thrust fault (FL10) has been identified within the ML with distinctly different geological units on each side of the fault. The Rangal Coal Measures have been identified as running along the eastern side and the Rewan Formation on the western side of the fault (AGE 2013). There are five sub-parallel thrust faults further east of FL10 and include FL15, FL20, FL25, FL27, and FL30. An additional two tear faults (FL100 and FL200) have also been mapped within Bluff Mine area (Figure 7).

Table 4: Stratigraphy of Bluff Mine (AGE 2013)

Age	Unit	Lithology	Thickness (m)
Tertiary	Duringa Formation/ unnamed sediments	Mudstone, sandstone, conglomerate, siltstone, shale, lignite, basalt.	0—50
Triassic	Rewan Formation	Green-green claystone, siltstone, and sandstone with minor pebbly conglomeratic unit at its base.	0—250+
Permian	Rangal Coal Measures	Feldspathic and lithic sandstone, carbonaceous mudstone, siltstone, tuff, and coal seams. Main coal seams include: Aries; Castor; Pollux; Orion; and Pisces.	100+
	Burngrove Formation (Fort Copper Coal Measures)	Mudstone, siltstone, fine sandstone, tuff, and coal.	200+

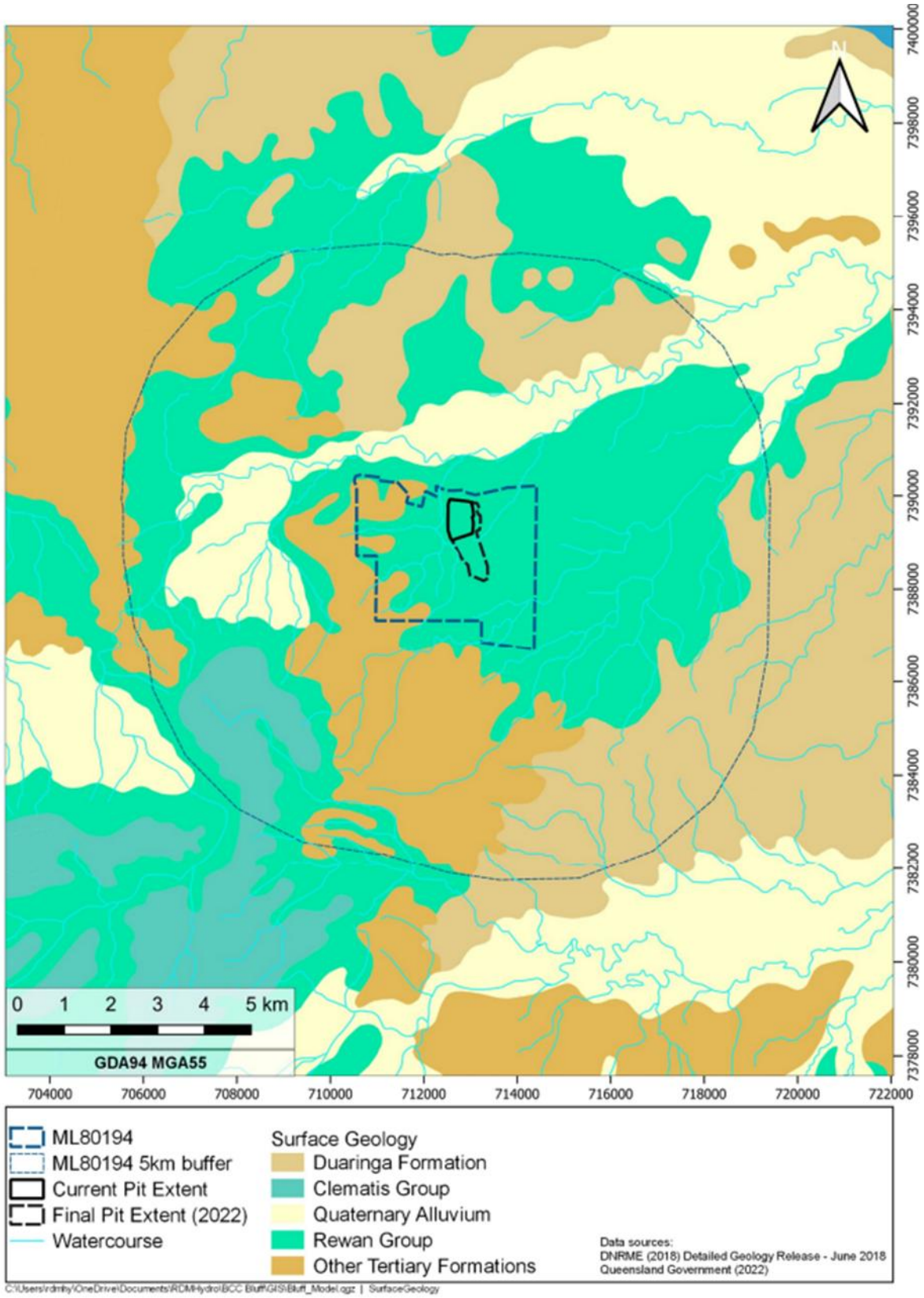

Figure 6: Geology of Bluff Mine site (RDM Hydro 2022)

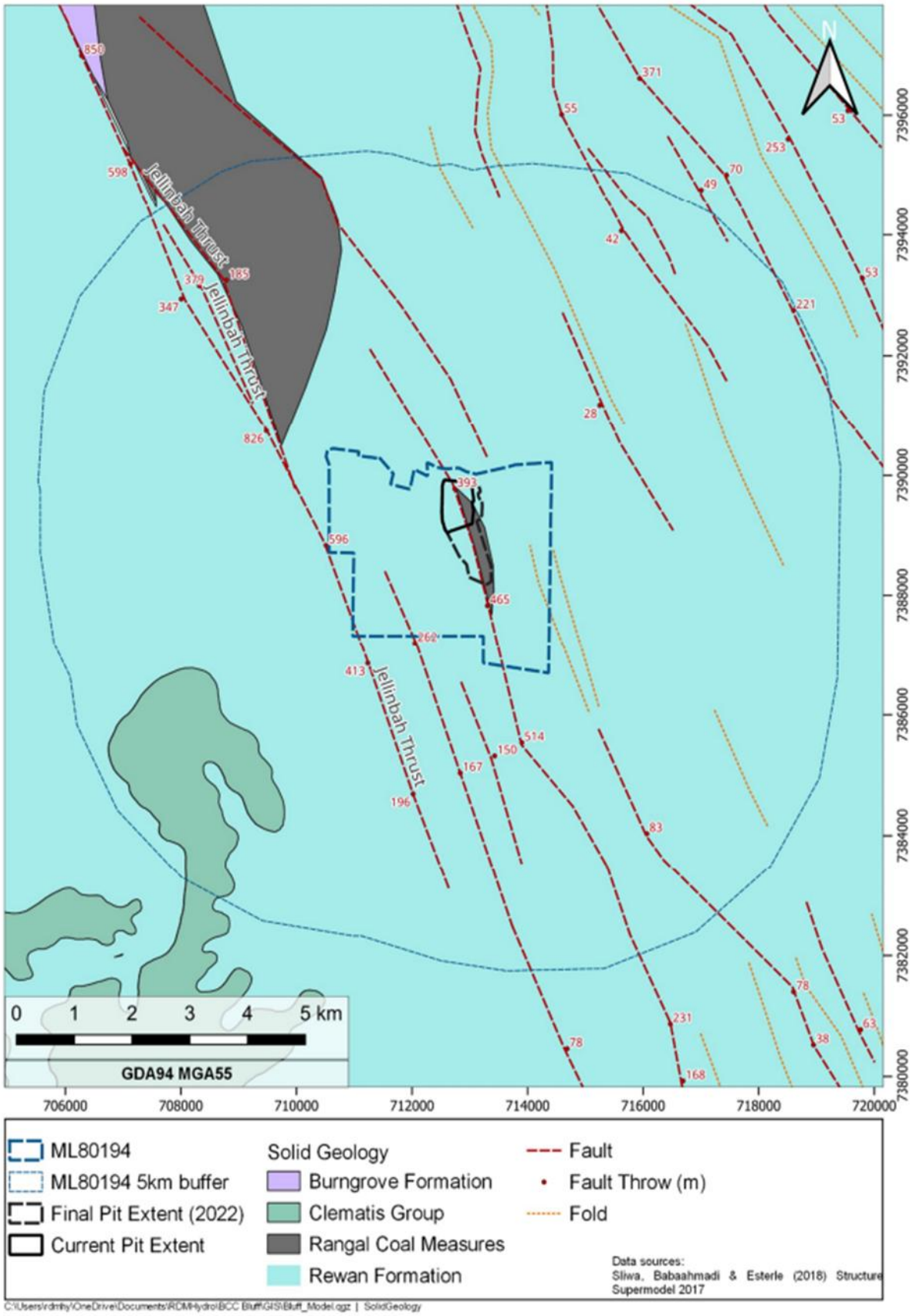

Figure 7: Faults across Bluff Mine site (SLR 2013)

4.3 Surface topography

The surface topography across Bluff Mine was detailed in the *2013 Soil, Land and Overburden assessment* (SLR 2013) (Appendix G). Bluff Mine area consists of gently undulating plains and low tablelands, with the Blackdown Tablelands National Park located approximately 2 km from the ML boundary. Bluff Mine and Blackdown Tablelands are approximately 230 m and 950 m above sea level, respectively.

On the western side of Bluff Mine area, the topography is dominated by moderate inclines (5—10%). The eastern region of Bluff Mine is dominated by gently inclined slopes (0—3%) with some areas of moderate inclines typically situated around drainage areas (5—10%). The elevation across the site varies with the west at approximately 230 m and decreasing towards the east to approximately 170 m (Figure 8).

4.4 Surface hydrology

Bluff Mine is situated within the Duckworth Creek catchment, within the Mackenzie River sub-basin, of central Queensland's Fitzroy River Basin. The Duckworth Creek Catchment has an area of approximately 2,500 km^2 (FRC Environmental 2013) (Appendix F). Several ephemeral waterways are in close proximity to Bluff Mine, including Duckworth Creek and its tributaries including Columba Creek, Rufus Creek, and Walton Creek (Figure 9). Columba Creek and Rufus Creek run through the active mining areas. The Department of Natural Resources and Mines (DNRM) has determined that within the mine area, Columba Creek and Rufus Creek are not watercourses under the *Water Act 2000*.

Columba Creek is the largest drainage feature to intersect the Bluff Mine lease boundary. Columba Creek is a second order ephemeral waterway and flows between the open cut pit and the western spoil dump. Rufus Creek is an ephemeral first order waterway which enters the Bluff Mine mining area from the south-west. Rufus Creek flows north-easterly from ML for 1.3 km before its confluence with Duckworth Creek (Bowen PCI 2022a).

Surrounding land use is predominantly cattle grazing within the Duckworth Creek catchment. Several State Government reserves are located near the ML, with Walton State Forest to the east, Arthurs Bluff State Forest to the south-west, and Taunton National Park (TNP) to the north-east. Riparian and floodplain vegetation is heavily cleared outside of the state reserves, especially along Duckworth Creek upstream of TNP (FRC Environmental 2019).

There is a water storage reservoir formed by an earth embankment with a concrete spillway on Columba Creek that was historically used for town water supply. A high rail embankment and the Capricorn Highway crosses Duckworth Creek and several tributaries including Columba and Rufus Creeks. There is no other known water infrastructure or riverine development along Duckworth Creek or its tributaries (FRC Environmental 2019).

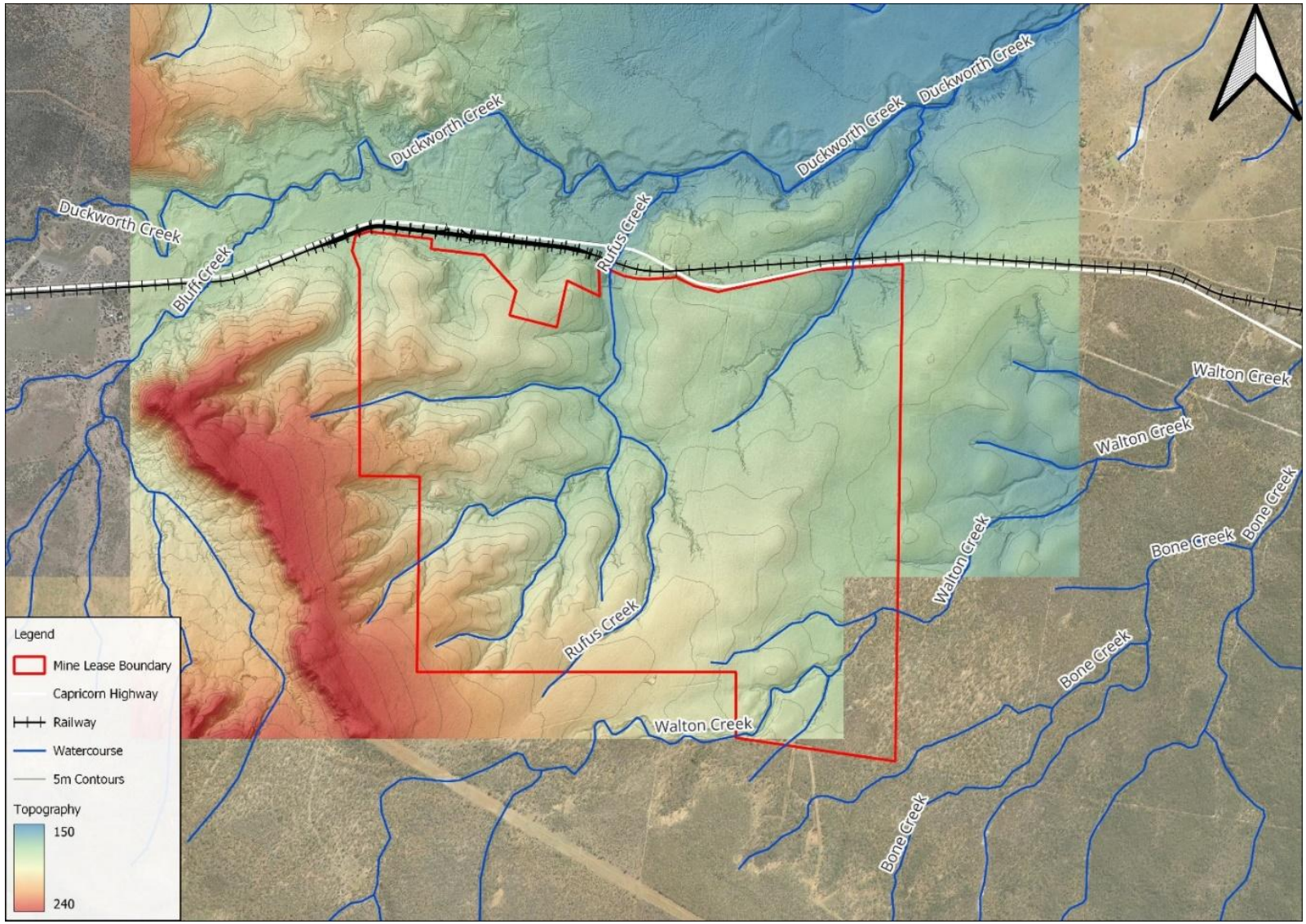

Figure 8: Elevation across Bluff Mine site

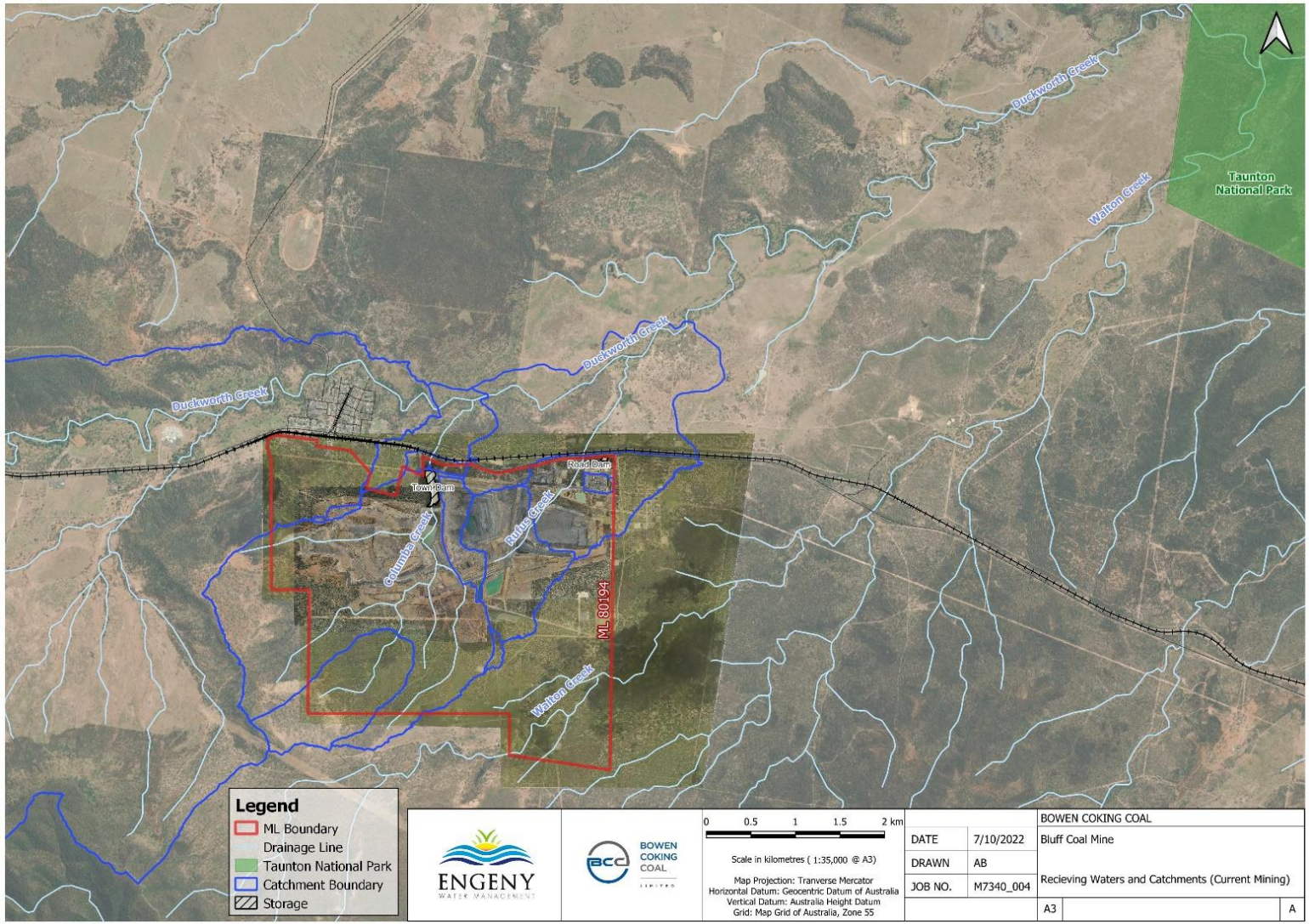

Figure 9: Surface hydrology (Engeny 2023)

4.4.1 Environmental values

The environmental values (EVs) and water quality objectives (WQOs) are defined under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (Qld) (Environmental Protection Policy (EPP) [Water and Wetland Biodiversity]) which is a subordinate legislation under the EP Act. The identified EVs and WQOs are included under Schedule 1 of the EPP (Water and Wetland Biodiversity). WQOs, where appropriate, are based on the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) (ANZECC and ARMCANZ 2000) for toxicants and the Queensland Water Quality Guidelines (QWQG) Central Coast regional water quality guidelines (DEHP 2013).

EVs describe the specific values of each waterway as determined by physical, biological, social, economic, and historical features of the waterway. EVs applicable to waterways within the Bluff Mine's receiving environment are scheduled in the Environmental Protection (Water) Policy 2009 Mackenzie River Sub-basin Environmental Values and WQOs Basin No. 130 (part), including all waters of the Mackenzie River Sub-basin September 2011 (DEHP 2011). The relevant water type is Mackenzie River southern tributaries—developed areas.

The identified EVs for surface waters within the Mackenzie River Sub-basin southern tributaries—developed areas are:

- aquatic ecosystem protection:
    - High Ecological Value in TNP
    - moderately disturbed waters elsewhere
- primary industries—the suitability of the water for:
    - stock watering—use of water for drinking by livestock
    - farm water supply—uses other than drinking water
- human consumers
- primary, secondary and visual recreation
- drinking water
- industrial use of water, and
- cultural and spiritual values—indigenous and non-indigenous cultural values.

Aquatic ecosystem protection, livestock water, farm water supply and cultural and spiritual values are considered the most relevant to the immediate downstream receiving environment.

4.4.2 Surface water quality

- Since the commencement of mining operations at Bluff Mine, background surface water quality data has been collected through the Bluff Mine Receiving Environment Monitoring Programme (REMP). This REMP identifies the receiving environment for Bluff Mine as the waters of Columba, Duckworth, and Rufus Creeks, along with connected or surrounding waterways within 10 km downstream of the release point, including TNP.
- Progressive REMP reports describe the region's flow regime as "unpredictable summer, highly intermittent" (Kennard *et al.* 2010). This means that flows are infrequent (i.e. the waterways are ephemeral), and their magnitude, duration, and timing are unpredictable, although they predominantly occur in summer. Isolated pools may persist for short periods after rainfall in these ephemeral waterways. Due to the unpredictable and intermittent nature of the waterways, a comprehensive background dataset for the site is still being compiled. The current dataset available for Duckworth Creek is presented in Table 5.
- The REMP requires monitoring at five sites:

  - One site upstream and one downstream of Columba Creek
  - One site upstream and one downstream of Duckworth Creek
  - One site downstream of Rufus Creek.
- Progressive REMP reporting on the receiving environment has found that surface water quality in the vicinity and downstream of Bluff Mine represents a moderately disturbed ecosystem (AARC 2024). Monitoring suggests that the waterways are primarily influenced by surrounding land uses (e.g. Capricorn Highway and railway line). However, water quality is considered consistent with baseline catchment conditions and aligned with the objectives for the receiving environment. The monitored water quality is deemed suitable for supporting the EVs of the waterways and poses a low toxicity risk to flora and fauna.

Table 5: Historical water quality data for Duckworth Creek Upstream

Statistic	**REMP Triggers**		**April 2013** (FRC, 2019)	**February 2020** (Bluff PCI Management Pty Ltd)	**April 2022** (REMP)	**March 2024** (REMP)	**January 2025** (REMP)
	WQO level	**EA Trigger level**					
Electrical Conductivity (µS/cm)	Baseflow: 310 High flow: 210	-	680	206	-	442	195.9
pH	6.5-8.5	6.5-9.0	6.37	7.41	7.45	7.01	7.33
Dissolved Oxygen (% Saturation)	85-100	-	36.1	-	-	34.1	94.2
Turbidity (NTU)	50	-	44.1	2100	-	338.5	538.7
Suspended Solids (mg/L)	110	-	-	258	56	218	556
Sulphate as SO4 (mg/L)	<10	-	-	5	4	3	3
Sodium (mg/L)	TBA	-	-	25	-	-	-
Fluoride (µg/L)	-	2000	-	-	<100	500	200
Ammonia	-	900			<10	1640	50
Nitrate	-	1100			30	<10	70
Temperature (°C)	Interpretational purposes only		-	-	-	23.5	24.9
Total Hardness CaCo3 (mg/L)			-	-	27	67	29
Total metal or metalloids							
Aluminium (mg/L)			-	33.0	2.42	6.91	16.2

Statistic	REMP Triggers		April 2013 (FRC, 2019)	February 2020 (Bluff PCI Management Pty Ltd)	April 2022 (REMP)	March 2024 (REMP)	January 2025 (REMP)
	WQO level	EA Trigger level					
Arsenic (mg/L)			-	0.004	0.001	0.002	0.002
Cadmium (mg/L)			-	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (mg/L)			-	0.034	0.003	0.01	0.019
Cobalt (mg/L)			-	0.015	0.002	0.005	0.008
Copper (mg/L)			-	0.033	0.007	0.009	0.019
Lead (mg/L)			-	0.017	0.002	0.004	0.008
Manganese (mg/L)			-	0.873	0.143	0.422	0.308
Molybdenum (mg/L)			-	<0.001	<0.001	<0.001	<0.001
Nickel (mg/L)			-	0.037	0.005	0.009	0.021
Selenium (mg/L)			-	<0.01	<0.01	<0.01	<0.01
Uranium (mg/L)			-	0.002	<0.001	<0.001	<0.001
Vanadium (mg/L)			-	0.07	<0.01	0.02	0.04
Boron (mg/L)			-	0.06	<0.05	0.21	0.11
Iron (mg/L)			-	34.5	2.47	8.93	18.4
Dissolved metal or metalloids							
Aluminium (µg/L)	55	55			260	<10	60
Arsenic (µg/L)	13	13			<1	2	<1

Statistic	REMP Triggers		April 2013 (FRC, 2019)	February 2020 (Bluff PCI Management Pty Ltd)	April 2022 (REMP)	March 2024 (REMP)	January 2025 (REMP)
	WQO level	EA Trigger level					
Boron (µg/L)	370	370			<50	200	100
Cadmium (µg/L)	0.2	0.2			<0.1	<0.1	<0.1
Chromium (µg/L)	1	1			<1	<1	<1
Cobalt (µg/L)	-	1.4			<1	<1	<1
Copper (µg/L)	2	2			4	<1	2
Iron (µg/L)	-	300			230	<50	160
Lead (µg/L)	3.4	4			<1	<1	<1
Manganese (µg/L)	1900	1900			78	119	2
Mercury (µg/L)	0.06	0.2			<0.1	<0.1	<0.1
Molybdenum (µg/L)	-	34			<1	1	1
Nickel (µg/L)	11	11			2	2	2
Selenium (µg/L)	5	10			<10	<10	<10
Silver (µg/L)	0.05	1			<1	<1	<1
Uranium (µg/L)	-	1			<1	<1	<1
Vanadium (µg/L)	-	10			<10	<10	<10
Zinc (µg/L)	8	8			<5	18	<5
C6—C9 Fraction (µg/L)	20				<20	<20	<20

Statistic	REMP Triggers		April 2013 (FRC, 2019)	February 2020 (Bluff PCI Management Pty Ltd)	April 2022 (REMP)	March 2024 (REMP)	January 2025 (REMP)
	WQO level	EA Trigger level					
C10—C36 Fraction (sum) (µg/L)	100				420	<50	<50

Note: 1. During REMP sampling in 2023, Duckworth Creek did not have enough sufficient water for sampling to be undertaken.
Orange = exceedance

4.5 Groundwater

4.5.1 Conceptual hydrogeological model

Groundwater modelling has been undertaken by RDM Hydro (2024) (Appendix C) in support of the development of this PRCP. RDM Hydro has determined that while the coal seams are relatively more permeable compared with the interburden, all lithologies are of low permeability. Fault planes provide the primary pathways for groundwater movement, however, not all faults are hydraulically conductive, as free water is not ubiquitously observed associated with faults in the pit. The hydraulic connectivity is likely to be highly horizontally anisotropic due to the presence of faulting and vertically anisotropic due to the discrete coal seams separated by low permeability interburden.

4.5.2 Groundwater levels and properties

The pre-mining groundwater levels within the coal seams range between 155—160 m (AHD) with groundwater flow nominally from southwest to northeast in the coal measures (RDM Hydro 2024). Prior to mining, the water table was greater than 15 m below ground level and is hydraulically disconnected from surface water features in the vicinity of the mine site. The Tertiary strata/regolith is believed to host the water table.

The groundwater quality of the site is typically highly saline between 9,620—26,200 mg/L total dissolved solids (TDS)) (RDM Hydro 2024). The monitoring bore located adjacent to the western wall of the mine open cut pit and near Columba Creek recorded the freshest water across the site. As the coal seems become deeper, generally to the south and west, the groundwater increases in salinity. The groundwater major ion chemistry is primarily sodium-bicarbonate with varying amounts of chloride and calcium. Areas closer to the interburden/overburden/faults are generally poorer in sodium content which may a result of greater groundwater flow relative to the coal seams.

4.5.2.1 Recharge and discharge

Measurements of the groundwater levels indicated that there is slow ground water recovery for the area which was deemed a result of the low sediment permeability. There is no evidence of rainfall recharge entering the coal seams and rainfall is more likely to run-off rather than infiltrate due to the low permeability of the surficial geology. However, there is some evidence of recharge to the Tertiary strata (RDM Hydro 2024). The only known source of discharge in the vicinity of the mine would be the extraction of associated water during mining (RDM Hydro 2024).

The groundwater flow typically mimics the surface topography and flows towards the east which indicated that the major recharging source for the aquifers is rainfall percolation on the eastern side of fault FL10.

4.5.2.2 Groundwater Quality

A program of groundwater sampling and analysis commenced in 2013 to determine background water qualities. Sampling was conducted from 13 monitoring bores located within both the Tertiary/regolith and Permian coal measure sequences. A review of the groundwater quality data collected across the Bluff Mine ML by RDM Hydro (2024) indicated that groundwater had the following characteristics:

- The groundwater is circum-neutral to slightly acidic, with an average pH of 7.6 and a median pH of 6.8.
- The groundwater is saline, with TDS with an average TDS of 20,512 mg/L and a medium of 21,808 mg/L. These are compared with the ANZECC (2000) livestock drinking water value for beef cattle where loss of production and decline in animal condition and health would be expected of 10,000 mg/L.
- The groundwater is dominated by the sodium as the cation and chloride as the anion.

- Boron, barium, and strontium are the metals/metalloids present at the highest concentrations which is reasonably typical of groundwaters associated with coal measures.

- Table 6 provides a statistical summary of the combine groundwater chemistry results the data collected.

Table 6: Groundwater Chemistry - Statistical Summary (2013-2023)

Parameter	Fraction	Units	ANZECC (2000) Livestock Drinking Water	Count	Average	Min	Max	P10	P50	P90
pH Value (Field)	T	pH Unit		43	7.6	2.9	12.5	6.3	6.8	11.5
pH Value (Laboratory)	T	pH Unit		62	7.4	6.6	8.1	7.1	7.4	7.8
Electrical Conductivity (Field)	T	µS/cm		43	30,229	1,,335	46,720	24,840	30,389	37,224
Electrical Conductivity @ 25°C	T	µS/cm		68	31,557	21,000	40,300	24,540	33,550	35,860
Total Dissolved Solids$_1$	T	mg/L	10,000$_1$	68	20,512	13,650	26,195	15,951	21,808	23,309
Sodium	T	mg/L		68	6,440	4,020	8,170	4,654	6,690	7,623
Potassium	T	mg/L		68	52	12	342	30	44	57
Calcium	T	mg/L	1,000	68	468	150	1,480	219	322	1,053
Magnesium	T	mg/L		68	607	171	1,070	300	621	918
Chloride	T	mg/L		68	10,912	5450	14,400	8714	11,300	12,830
Carbonate Alkalinity as CaCO3	T	mg/L		68	5	24	112	<LOR	<LOR	<LOR
Bicarbonate Alkalinity as CaCO3	T	mg/L		68	584	6	909	47	686	858
Sulfate as SO4	T	mg/L	1,000	68	785	1	1,300	8.7	861	1,220
Bromide	T	mg/L		16	28	13	54	17	26	42
Fluoride	T	mg/L	2	16	0.3	0.1	1.0	0.1	0.2	0.6
Aluminium	F	mg/L	5	68	0.16	0.01	0.82	0.05	0.05	0.50
Antimony	F	mg/L		58	0.005	0.002	0.012	0.001	0.005	0.005
Arsenic	F	mg/L	0.5	68	0.013	0.002	0.003	0.003	0.005	0.050
Barium	F	mg/L		57	4.31	0.05	88.20	0.05	0.09	2.39
Beryllium	F	mg/L		57	0.009	0.050	0.120	0.001	0.005	0.010

Parameter	Fraction	Units	ANZECC (2000) Livestock Drinking Water	Count	Average	Min	Max	P10	P50	P90
Boron	F	mg/L	5	57	2.57	0.06	5.10	0.34	2.70	4.77
Cadmium	F	mg/L	0.01	62	0.001	0.001	0.001	0	0.001	0.005
Chromium	F	mg/L	1	65	0.006	0.001	0.024	0.001	0.005	0.010
Cobalt	F	mg/L	1	57	0.008	0.001	0.033	0.005	0.005	0.010
Copper	F	mg/L	0.5	65	0.017	0.001	0.064	0.005	0.005	0.050
Iron	F	mg/L		68	3.3	0.1	21.3	0.1	1.4	14.6
Lead	F	mg/L	0.1	64	0.005	0.001	0.009	0.001	0.005	0.010
Manganese	F	mg/L		57	0.920	0.034	4.440	0.057	0.161	2.690
Mercury	F	mg/L	0.002	68	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
Molybdenum	F	mg/L	0.15	68	0.023	0.002	0.388	0.005	0.008	0.047
Nickel	F	mg/L	1	64	0.035	0.004	0.185	0.005	0.022	0.070
Selenium	F	mg/L	0.02	68	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
Silver	F	mg/L		59	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
Strontium	F	mg/L		53	42.2	10.4	173.0	13.2	37.2	115.8
Vanadium	F	mg/L		57	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
Zinc	F	mg/L	20	65	0.11	0.01	0.86	0.03	0.05	0.26
C6 - C9 Fraction	T	µg/L		12	15	30	50	<LOR	<LOR	50
C10 - C36 Fraction (sum)	T	µg/L		12	83	50	600	<LOR	<LOR	213
Sum of BTEX	T	µg/L		55	1.8	2.0	38.0	<LOR	<LOR	4.4
Naphthalene	T	µg/L		55	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR

T - Total; F - Filtered; LOR - Limit of Reporting; NA - Not available

1 Value for loss of production and decline in animal condition and health would be expected

4.5.3 Groundwater use

Groundwater aquifers impacted by the mining activity have been deemed unsuitable for humans and livestock due to the high salinity levels and elevated sulphate concentrations (AGE 2013). The groundwater bores located on site are used for assessment of water quality and water levels, no groundwater extraction occurs. There is also no known or identified cultural or spiritual values in relation to groundwater within Bluff Mine area (AGE 2013). The registered groundwater bores are shown in Figure 10.

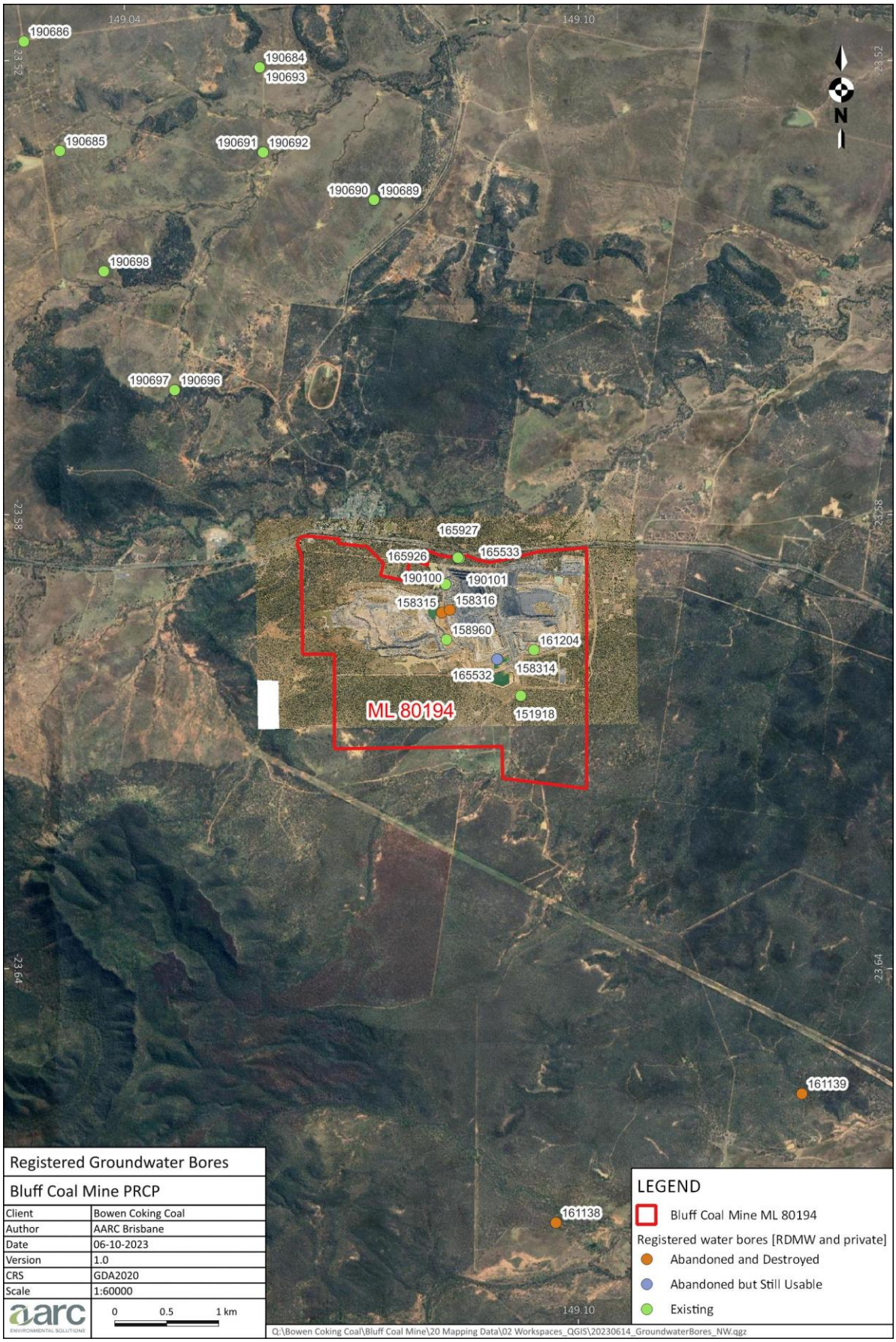

Figure 10: Registered groundwater bores

4.6 Land use

The Queensland Land Use Mapping (QLUM) provides classifications for various land uses within Bluff Mine area (ABARES, 2016). The predominant pre-mining land use classification underlying Bluff Mine area is grazing (Figure 11) on native vegetation which is described as:

> *Land uses based on grazing by domestic stock on native vegetation where there has been limited or no deliberate attempt at pasture modification.*

The major land use surrounding Bluff Mine is agriculture and mining. This has resulted in large areas of vegetation clearing along creeks and gullies in areas of existing remnant vegetation. A significant transport corridor is also present and comprises the Blackwater to Gladstone railway line and the Capricorn highway, located on the northern boundary of the ML. Several mines are located within the surrounding region with one underground coal mine (Excel Colliery, ML1774) approximately 2.5 km north of Bluff. The other closest operating mines to the Bluff Mine are:

- Jellinbah—approximately 22 km northwest;
- Curragh—approximately 21 km northwest; and
- Blackwater—approximately 25 km west.

Within the Bluff Mine area, a dam has been identified as “Class 6 Water” (ABARES 2016) and beef cattle grazing land suitability class 5 (refer Figure 11). This area is regarded as essential due to its importance for natural and agricultural resources, as well as being a reference point in the landscape.

The Bluff township and the Capricorn highway are classified as urban intensive uses. There are also several areas along the Capricorn highway and to the east and south of the ML boundary classified as rural residential and farm dam infrastructure.

Further information regarding land use is provided in section 6.

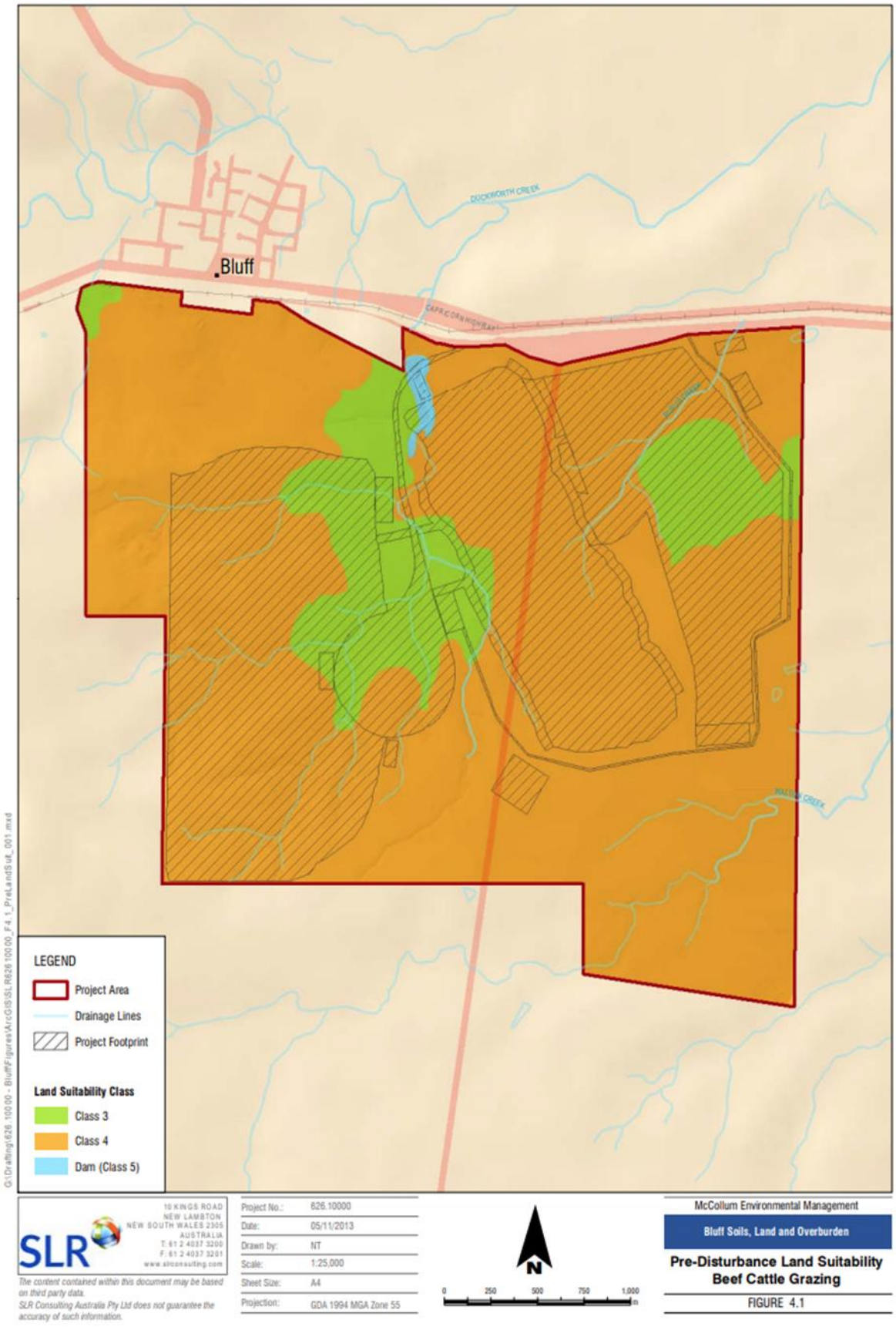

Figure 11: Beef cattle grazing pre-mining suitability classes.

4.6.1 Areas of regional interest

Areas of regional interest are defined in the *Regional Planning Interests Act 2014* and include Strategic Cropping Land, Priority Agricultural Areas, Priority Living Areas, and Strategic Environmental Areas.

There are no areas of regional interest mapped within the Bluff Mine ML. Land to the north of the ML, which is north of the Blackwater rail line and Capricorn Highway, is declared a Priority Living Area.

4.7 Soil landscape

4.7.1 Soil characteristics

Soil analysis was conducted for Bluff Mine and is detailed in the SLR (2013) Soils, Land and Overburden Assessment report (Appendix G). The Australian Soil Classification (ASC) system (Isbell, 1996) was used as the technical standard for naming soil units within Bluff Mine area. The results from field surveys identified five ASC orders including Chromosols, Dermosols, Kurosols, Kandosols and Sodosols (Figure 12). The dominant ASC orders were the Sodosols and Kursols, encompassing 48.0% and 46.2% of Bluff Mine area respectively. The other ASC orders encompassed the remaining Project area with Kandosol comprising 3.2%, Chromosol comprising 0.4% and Dermosol comprising 1.8%. The soil profiles and characteristics for each soil unit as determined by SLR (2013) are presented in Table 7.

Table 7: Soil units and characteristics

Soil unit	Horizon Depth (m)	pH	ESP[1] (%)	ECe (dS/m)	Cation exchange capacity (CEC) (cmol/kg)	K factor	EAT (class)	Soluble Potassium (mg/kg)	Total Sulphur (%)	Total Phosphorous (mg/kg)
1 - Mottled-Mesonatric Brown Sodosol (Type 1)	A1 (0—0.2)	6.5	3.4	0.3	2.9	0.052	8	20	0.03	69
	A2 (0.2—0.6)	6.1	8.3	0.2	1.2	0.054	3 (2)	<10	0.02	39
	B12 (0.6—1.0)	8.4	18.4	1.0	9.8	0.026	2 (2)	<10	<0.01	64
	B22 (1.0—1.3)	9.0	20.3	1.3	6.4	0.031	2 (2)	<10	0.03	63
2 - Mottled-Mesonatric Brown Sodosol (Type 2)	A1 (0—0.1)	6.4	-	0.4	2.2	0.055	8	20	0.01	78
	A2 (0.1—0.4)	6	-	0.1	1.1	0.055	3 (2)	<10	0.02	42
	Gravel (0.4—0.6)	Gravel layer separates the topsoil and subsoil								
	B12 (0.6—1.0)	6.8	19.4	1.2	9.8	0.027	2 (2)	<10	0.03	189
	B22 (1.0—1.3)	9.6	25.4	2.1	6.7	0.033	2 (2)	<10	0.03	81
3 - Mottled-Mesonatric Brown Sodosol (Type 3)	A1 (0—0.2)	6.5	0.8	0.8	6.5	0.044	7	20	0.03	128
	A2 (0.2—0.8)	6.7	-	0.4	0.7	0.052	3 (1)	<10	0.03	28
	B1 (0.8—1.0)	7.7	21.9	1.2	3.2	0.025	2 (1)	<10	0.02	111
	B2 (1.0—1.3)	8.6	26.7	0.7	4.5	0.022	2 (2)	<10	<0.01	86
4 -Dystrophic Red Kurosol (Type 1)	A1 (0—0.2)	5.7	-	0.2	1.3	0.043	8	10	0.03	124
	A2 (0.2—0.5)	5.5	-	0.1	1.0	0.042	3 (2)	<10	0.03	120
	B2 (0.5—1.0)	5.2	-	0.2	2.9	0.03	5	<10	0.03	395
	CB (1.0 +)	5.1	-	0.1	2.1	0.01	6	<10	0.03	213
5 - Dystrophic Red Chromosol	A1 (0—0.2)	6.2	-	0.4	2.3	0.037	8	20	0.03	139
	B1 (0.2—0.6)	6.5	-	0.1	2.1	0.036	5	<10	0.03	168

Soil unit	Horizon Depth (m)	pH	ESP[1] (%)	ECe (dS/m)	Cation exchange capacity (CEC) (cmol/kg)	K factor	EAT (class)	Soluble Potassium (mg/kg)	Total Sulphur (%)	Total Phosphorous (mg/kg)
	B2 (0.6—1.0)	6.6	-	0.1	2.9	0.032	5	<10	0.03	225
	B3 (1.0—1.2)	6.6	-	0.2	2.8	0.029	5	<10	0.03	291
6 - Dystrophic Red Kurosol (Type 2)	A1 (0—0.1)	5.1	-	0.3	1.4	0.042	8	20	0.04	118
	A2 (0.1—0.4)	5.3	-	0.2	0.7	0.048	3 (1)	<10	0.03	257
	B21 (0.4—1.0)	5.3	5.7	0.2	3.8	0.01	6	<10	0.03	125
	B22 (1.0—1.3)	5.3	8.3	0.2	4.8	0.036	5	<10	0.03	158
6 P1 - Brown Kurosol—Phase 1	A1 (0—0.2)	Same characteristics as soil unit 6—soil unit 6 P1 has a high percentage of gravel compared to soil unit 6								
	A2 (0.2—0.4)									
	B21 (0.4—0.5)									
	B22 (0.5—0.8 +)									
7 - Subnatric Brown Sodosol	A1 (0—0.2)	6.2	1.9	0.2	5.3	0.045	8	20	0.03	139
	B1 (0.2—0.5)	5.6+	5.4	0.2	3.7	0.042	5	<10	0.03	168
	B21 (0.5—1.0)	6.4	107	0.2	8.4	0.029	3 (3)	<10	0.03	225
	B22 (1.0—1.3)	8.1	17.6	1.6	6.8	0.032	2 (2)	<10	0.03	291
8 - Dystrophic Red Kandosol	A1 (0—0.2)	7.0	-	0.2	2.0	0.046	7	<10	0.02	110
	A2 (0.2—0.4)	-[2]	-	-[2]	2.3	0.046	3 (1)	<10	<0.01	95
	B2 (0.4 +)	No data provided—moderately to strongly acidic at depth								
9 - Brown Dermosol	A1 (0—0.2)	6.5	No data provided							
	B1 (0.2—0.4)	7.0								
	B2 (0.4—0.6)	7.0								

Soil unit	Horizon Depth (m)	pH	ESP[1] (%)	ECe (dS/m)	Cation exchange capacity (CEC) (cmol/kg)	K factor	EAT (class)	Soluble Potassium (mg/kg)	Total Sulphur (%)	Total Phosphorous (mg/kg)
	C (0.6 +)	-[2]								

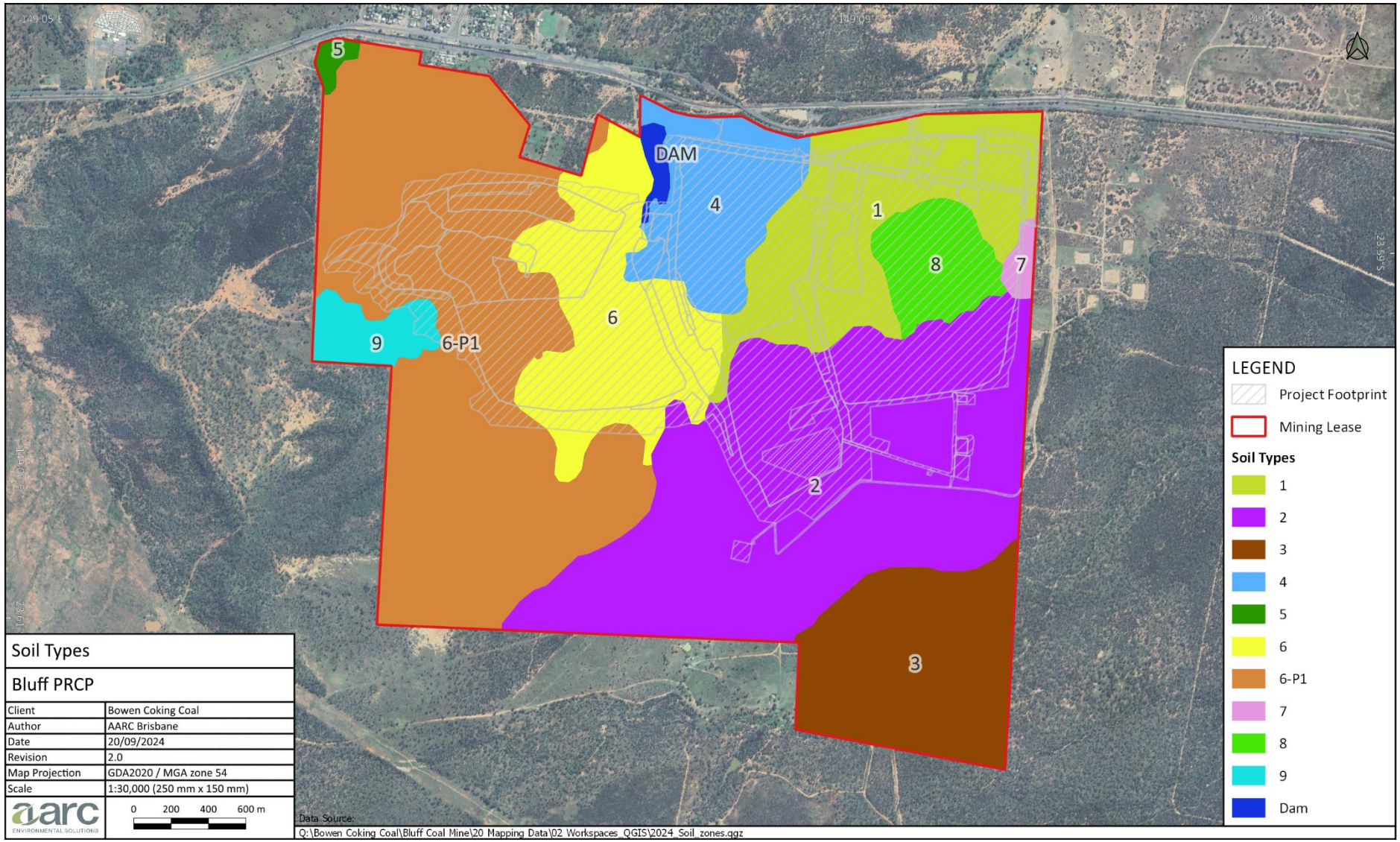

Figure 12: Soil types within Bluff Mine ML

4.7.2 Land suitability classes

Land suitability assessments was conducted by SLR (2013) (Appendix G) across the entire Bluff Mine ML (see Figure 11). This assessment determined the suitability of the underlying land for major agricultural enterprises including (1) rain-fed broad-acre cropping and (2) beef cattle grazing, and assigned a land suitability class, as outlined in the 'Technical Guidelines for Environmental Management of Exploration and Mining Queensland' (QDME 1995). The five-class system is based on physical and chemical limiting factors applied directly to specific uses.

This technical guideline has since been superseded by the 'Guidelines for Agricultural Land Evaluation in Queensland' (DSITI and DNRM 2015). The current five-class system is described in Table 8. The superseded classed have been reviewed and determined to align with the previous standard and therefore, no changes to the land suitability classes are noted.

Table 8: Land suitability classes description (DSITI and DNRM 2015)

Class	Suitability	Limitations	Description
1	Suitable	Negligible	Highly productive land requiring only simple management practices to maintain economic production.
2	Suitable	Minor	Land with limitations that either constrain production or require more than the simple management practices of class 1 land to maintain economic production.
3	Suitable	Moderate	Land with limitations that either further constrain production or require more than those management practices of class 2 land to maintain economic production.
4	Unsuitable	Severe	Currently unsuitable land. The limitations are so severe that the sustainable use of the land in the proposed manner is precluded. In some circumstances, the limitations may be surmountable with changes to knowledge, economics, or technology.
5	Unsuitable	Extreme	Land with extreme limitations that preclude any possibility of successful sustained use of the land in the proposed manner.

The land suitability ranking for each soil unit was determined by the most limiting factor of the soil which can include:

- water availability (m);
- nutrient deficiency;
- pH;
- physical characteristics and factors;
- soil workability;
- salinity;
- rockiness;
- microrelief;
- wetness;
- topography;
- erosion; and
- flooding.

The soils within Bluff Mine area, as described in section 4.7.1, were determined to be unsuitable for rain-fed broad-acre cropping and marginally to moderately suitable for beef cattle grazing (Table 9). Soil Units 1—4 were limited by water availability with the remaining soils limited by low fertility characteristics. Light grazing and a conservative land management approach is considered to be a sustainable agricultural enterprise shows the land suitability class across Bluff Mine site for beef cattle grazing.

The land suitability assessments determined that Bluff Mine area is largely suitable for marginal to moderate beef cattle grazing (Table 9) (SLR, 2013). Approximately 14% of Bluff Mine area is considered Class 3 and the remaining 85% is Class 4.

Table 9: Land suitability classification at Bluff Mine (SLR 2013)

Soil Units		**Land suitability classes**				
Number	**Name**	**Grain-fed broad-acre cropping**		**Beef cattle grazing**		**Agricultural land class**
		Class	**Main limitation (s)**	**Class**	**Main limitation (s) (LS code)**	**Class**
1	Mottled-Mesonatric Brown Sodosol (Type 1)	5	water availability	4*	water availability	C3
2	Mottled-Mesonatric Brown Sodosol (Type 2)	5	water availability	4*	water availability	C3
3	Mottled-Mesonatric Brown Sodosol (Type 3)	5	water availability	4*	water availability	C3
4	Dystrophic Red Kurosol (Type 1)	5	water availability	4*	water availability	C3
5	Dystrophic Red Chromosol	5	water availability	3^	nutrient deficiency	C2
6	Dystrophic Red Kurosol (Type 2)	5	water availability	3^	nutrient deficiency	C2
6 P1	Brown Kurosol—Phase 1	5	water availability	4	nutrient deficiency	C3
7	Subnatric Brown Sodosol	5	water erosion	3^	nutrient deficiency, water erosion	C2
8	Dystrophic Red Kandosol	5	water availability	3^	nutrient deficiency	C2
9	Brown Dermosol	5	water availability	4	rockiness, nutrient deficiency	C3

* Land suitability class was upgraded to Class 4 as field activities assessed the land as suitable for light grazing
^ ALC was upgraded to Class C3 as field surveys assessed the land as being suitable for moderate grazing

4.7.3 Stability

The Soil, Land and Overburden Assessment (SLR 2013) (Appendix G) details the stability across Bluff Mine. Soil erodibility is quantified using the soil erodibility factor known as the 'K factor.' Soil texture is the principal component affecting K factor; however, other factors such as soil structure, soil organic matter content and soil profile permeability also contribute to the soil's inherent erodibility. Bluff Mine contains highly erodible soils (high K factor). The soils have low inherent ability to store moisture (low PAWC) and dry soils erode easier than moist soils. The replenishment of soil moisture is also low (annual rainfall of 546 mm) with most of the rain falling in 10% of the year.

Areas that comprised a greater organic matter content will have an improved soil erodibility due to the addition of binding agents resulting from organic matter decomposition. The moderately inclined slopes (towards the west) of Bluff Mine area tend towards a higher erosion potential due to a greater exposure to gravity and subsequently erosive forces. The results for erosion rating assessments for each soil type within Bluff Mine area are presented in Table 10.

See section 8.8 for further information on soil and capping materials assessment.

Table 10: Soil erosion rating

Soil Unit	**K factor**		**Organic matter (Topsoil)**		**Dominant slope (%)**	**Erosion Rating**
Number	Value	Rating	%	Rating	Value	Rating
1	0.052	High	0.73	Moderate	1—3[2]	High
2	0.055	High	0.59	Very low	1—3[2]	High
3	0.044	High	0.8	Moderate	3—10[2]	Very High
4	0.043	High	0.92	Moderate	1—3 and 5—10	Very High
5	0.037	High	0.58	Very low	1—3	High
6	0.042	High	1.69	Moderate	3—10[2]	Very High
6 P1	0.040[1]	High	1.69	Moderate	5—10[2]	Very High
7	0.045	High	1.36	Moderate	0—3	High
8	0.046	High	0.49	Very low	1—3	High
9	0.025[1]	Moderate	-	Very low	3—5	Moderate

[1] Estimated based on soil texture (Hazelton and Murphy 2007)
[2] Slopes on drainage lines were 10—50%

4.8 Vegetation communities

In the EcoSM (2013) Terrestrial Fauna and Flora Impact Assessment (Appendix D), several vegetation communities were identified using desktop studies and validated through field assessments (Figure 13) (EcoSM, 2013). The vegetation communities were found to be mostly consistent with the desktop analysis, however, a greater remnant vegetation cover was observed in the field within the eastern portion of the study area. Table 11 details the vegetation communities recorded within Bluff Mine area with the current (2023) listings.

Table 11: Description of regional ecosystems

Regional Ecosystems	Short Description	VM Act Class[1]	Biodiversity Status[1]
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Least concern	Of concern
11.5.2	*Eucalyptus crebra, Corymbia spp*., with *E. moluccana* woodland on lower slopes of Cainozoic sand plains and/or remnant surfaces	Least concern	No concern at present
11.5.2a	*Allocasuarina luehmannii* low tree layer with or without emergent woodland.	Least concern	No concern at present
11.5.3	*Eucalyptus populnea +/- E. melanophloia +/- Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces	Least concern	No concern at present
11.7.2	*Acacia spp*. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	Least concern	No concern at present

[1] Status/listing as of October 2023

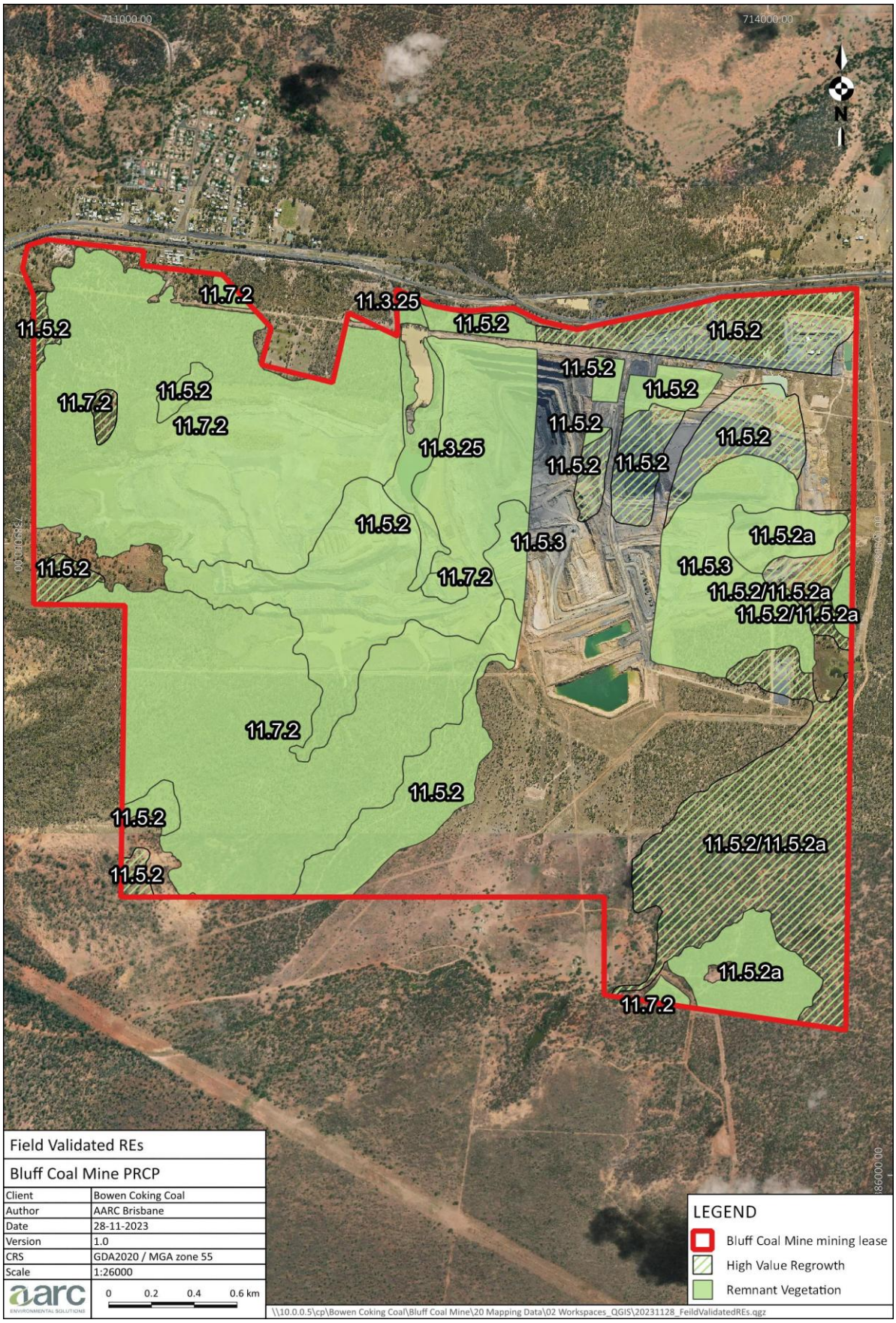

Figure 13: Field validated regional ecosystems within Bluff Mine Area

4.8.1 Terrestrial flora

Three *Nature Conservation Act 1992* (NC Act) listed species were identified or had a high likelihood of occurrence (Table 12). Two field surveys were conducted being post-wet season between the 7th—15th April and pre-wet season between 8th—17th September in 2013 (EcoSM 2013). Both the Native Frangipani and Large-leaved Trefoil were identified on site during field surveys. The *Lysiana filifolia* although determined to have a high likelihood of occurrence, was not identified during field surveys.

Several declared pest species were noted during field surveys and included Mother-of-Millions (*Bryophyllum delagoense*), Parthenium Weed (*Parthenium hysterophorus*), Prickly Pears (*Opuntia streptacantha, O. stricta, O. tomentosa*) and Harissia Cactus (*Eriocereus martinii*) (EcoSM 2013).

Table 12: NC Act listed species (EcoSM 2013)

Common Name	Scientific Name	Description	Previous Listing (2013)	Current listing as of 2023
Native Frangipani	*Cerbera dumicola*	Identified on site in field surveys	Near Threatened	Near Threatened
Large-leaved Trefoil	*Desmodium macrocarpum*		Near Threatened	Least concern
-	*Lysiana filifolia*	High likelihood of occurrence—not identified in field surveys	Near Threatened	Least concern

Groundwater dependent ecosystems (GDEs) of low confidence are associated with Columba Creek on the west of the void, Duckworth Creek, and Walton Creek (RDM Hydro 2024). No known GDEs or GDEs of moderate or high confidence are identified within 5 km of the ML. The dominant canopy species in the immediate area of Bluff Mine have an assumed maximum rooting depth of 15 m, which given the measured depth to groundwater at Bluff Mine, it is considered unlikely that vegetation utilises groundwater from the regional water table (RDM Hydro 2024).

Although not hydraulically connected to the groundwater table, there is the potential that vegetation utilises ephemeral perched aquifers, when present, in alluvial sediments associated with Duckworth Creek (RDM Hydro 2024). This is consistent with the conceptual model that identifies the aquifers associated with potential GDEs to be fluctuating with intermittent groundwater connectivity (DES 2022). Duckworth Creek is located approximately 700 m north of the ML boundary and is outside of the mining zone of influence.

4.8.2 Environmentally sensitive areas

A search of the DES Environmentally Sensitive Areas (ESAs) mapping tool for Category A, B, and C ESAs, as described in the Environmental Protection Regulation (2019). No ESAs were identified within the Bluff Mine ML, however, several state forests and national parks are within the vicinity of Bluff Mine (Figure 14). These include:

- Walton State Forest—approximately 5 km east of Bluff;
- Taunton National Park—approximately 10 km northeast of Bluff;
- Wallaby Lane Nature Refuge—approximately 6 km to the east of Bluff;
- Arthurs Bluff State Forest—approximately 5 km southwest of Bluff; and
- Blackdown Tablelands National Park—approximately 11 km south of Bluff.

4.8.3 Statewide corridors

Bluff Mine area supports large areas of remnant and high value regrowth vegetation, predominately through the north-west and southern extents. A large Statewide terrestrial corridor is located to the south/east of Bluff Mine area (Figure 14). This corridor is recognised through the Biodiversity Planning Assessment

Mapping and connects important flora and fauna refuges of Arthurs Bluff State Forest, Walton State Forest, Blackdown Tableland National Park, and TNP (refer Section 4.6).

The south-eastern portion of Bluff Mine area reinforces this corridor by widening its extent. In addition, Duckworth Creek is recognised as a state ecologically significant corridor. This riparian corridor is located to the north of Bluff Mine Area and connects to the larger terrestrial corridor to the north-east. Vegetation through the north-west of Bluff Mine area, and west of Bluff Mine, provides additional connectivity to this corridor, though this connectivity is interceded by the Capricorn highway and the Aurizon Bluff Operations Depot.

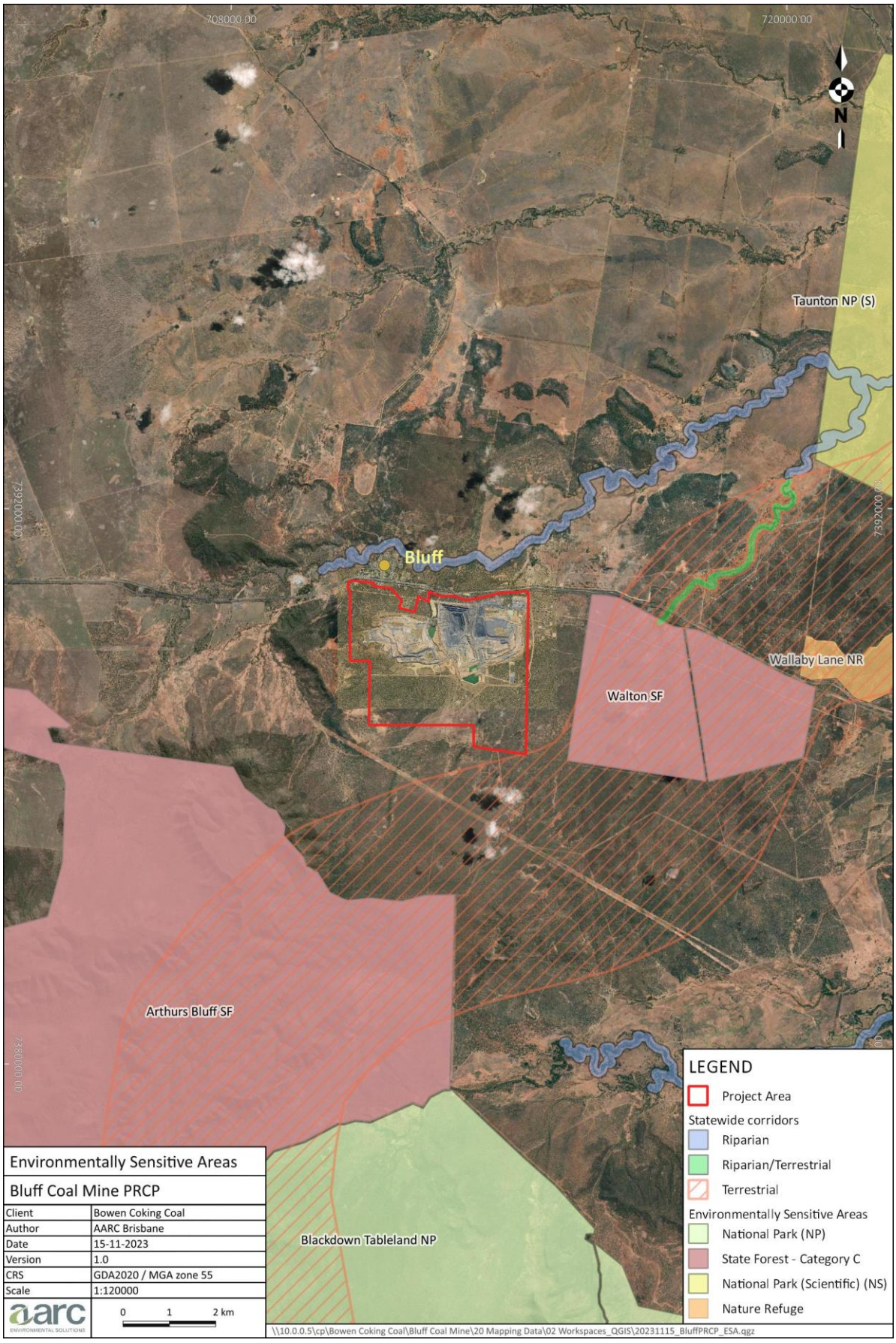

Figure 14: ESAs and statewide corridors surrounding Bluff Mine

4.9 Fauna

Two field surveys were conducted being post-wet season between the 7th—15th April and pre-wet season between 8th—17th September in 2013. 154 species of terrestrial vertebrate fauna were identified, including four introduced species (Cane Toad, European Fox, Feral Pig, European Rabbit) (EcoSM 2013). The species recorded across Bluff Mine consisted of 96 bird species, 6 amphibious species, 19 reptile species, and 35 mammal species.

Table 13 details the NC Act listed fauna species that were observed onsite during 2013 field surveys or had a high likelihood of occurrence (EcoSM 2013).

As the drainage features within the MLs are smaller, ephemeral, and generally only flowing for short periods after rain, the aquatic flora and fauna are not considered to be diverse or unique. Although macro invertebrates and fish may opportunistically move into the upstream drainages of ephemeral creeks to forage, the drainage lines within the MLs are considered poor habitat for macro invertebrates and are unlikely to harbour long-term fish populations.

No species were identified during the 2013 field surveys as being listed under the *Environment Protection Biodiversity and Conservation Act 1999 (*EPBC Act) or NC Act.

Table 13: NC Act listed fauna (EcoSM 2013)

Species	Common name	Sightings in 2013	NC Act Listing as of 2023
Chalinolobus picatus	Little Pied Bat	Identified on site during 2013 field surveys. Considered to potentially occur within all remnant and high value regrowth vegetation at Bluff Mine	Least concern
Strophurus taenicauda	Golden-Tailed Gecko	Two individuals of this species were identified at Bluff Mine during the dry season survey	Near threatened
Nettapus coromandelianus	Cotton Pygmy-goose	High likelihood of occurrence and has been recorded within 20 km of Bluff Mine	Least concern
Calyptorhynchus lathami	Glossy Black-cockatoo	Approximately 473 ha of potential habitat was considered to occur in the Bluff Mine ML and individuals have been recorded within 20 km of Bluff Mine	Vulnerable
Paradelma orientalis	Brigalow Scaly-foot	No individuals of this species were identified at Bluff Mine during field surveys and was unlikely to support an important population of this species	Least concern
Phascolarctos cinereus	Koala	No observations of koalas were recorded in 2013 field surveys, however, a recent (2023) ecology survey in the southern end of the ML identified Koalas.	Threatened
Rostratula australis	Australian Painted Snipe	The Australian Painted Snipe was not recorded at Bluff Mine during field surveys but is considered to have a moderate likelihood of occurring	Endangered
Chalinolobus dwyeri	Large-eared Pied Bat	This species has been recorded from the Blackdown Tableland National Park (approximately 7 km to the south of Bluff Mine) and may forage within areas of the Bluff Mine ML	Endangered
Tachyglossus aculeatus	Short-beaked echidna	The Echidna was not observed at Bluff Mine during field surveys however, was recorded from a scat in 2013.	Special least concern
Geophaps scripta	Squatter Pigeon	This species was recorded at a number of locations in the south-east of Bluff Mine during field surveys in 2013	Least Concern
Eremiascincus isolepis	Northern bar-lipped skink	This species was recorded at Bluff Mine during field surveys in 2013	Least concern

5 Community consultation

Legislative Requirement

Section 126C(1)(c)(iii) and (iv) of the EP Act*, "the rehabilitation planning part of the PRC plan must include a description of:*

- details of the consultation undertaken by the applicant in developing the proposed PRC plan; and
- details of how the applicant will undertake ongoing consultation in relation to the rehabilitation to be carried out under the plan."

The DES information sheet Community Consultation for PRCP (DES, 2019) (the Community Consultation Guideline) provides additional detail on identifying relevant parties and the nature of their interest.

The Community Consultation Guideline refers to engagement with stakeholders, where a relevant party is identified as having a genuine interest in:

- the land where the activity will occur;
- the land adjacent to where the activity will occur; and
- the land/amenities surrounding where the activity will occur that were likely to be impacted by the activities.

Bowen PCI has maintained open communications with stakeholders since acquiring Bluff Mine in 2021, including commencing regular community meetings and one-on-one engagement sessions with stakeholders who hold a genuine interest in the land to discuss environmental and operational performance, and outcomes. These consultation events enabled the local community to provide input into the intended post mining land outcomes at Bluff Mine. The information present in Table 14 consists of the consultation undertaken since mining 2022.

The outcomes of all stakeholder consultation are recorded in the Bluff Mine Stakeholder and Community Engagement register. This document is considered a stand-alone register. Should the PRCP schedule change in a way that may affect any interested stakeholders, consultation shall be undertaken, in accordance with the Section 5.1, regarding proposed changes with the outcomes detailed in this register.

This register will be updated as required, independent of this PRCP and will be considered prior to any future amendments to this PRCP.

Table 14: Community engagement register

Consultation Date	Community Member	Consultation Type	Information Provided	Issued raised by the community	How issues were considered	Decisions/ Outcomes	Commitments
4 May 2022	Bluff Community Reference Group	Community Reference Group Meeting	Presentation on the re-opening of Bluff Mine.	Nil applicable to rehabilitation.	N/A	N/A	Ongoing engagement with the Bluff Community Reference Group Meeting.
25 May 2022	DES	PMLU Pre-lodgement Meeting	Presentation highlighting poorly defined outcomes for the residual void within the existing EA.	DES agreed that an EA amendment was required to address and provide clarity on the pre-approved land outcome for the Bluff residual void.	Bowen PCI agreed to submit an EA Amendment.	Bowen PCI submitted an EA Amendment.	EA Amendment submitted.
24 November 2022	DES	PMLU Pre-lodgement Meeting	Pre -lodgement meeting regarding post mining land uses changes in the EA.	DES agreed that an EA amendment was required to address and provide clarity on the pre-approved land outcome for the Bluff residual void.	Continued progression of EA amendment to change site PMLU.	Continued progression of EA amendment to change site PMLU	EA Amendment submitted.
18 January 2023	DES	PMLU Pre-lodgement Meeting	Pre -lodgement meeting regarding post mining land uses changes in the EA.	DES agreed that an EA amendment was required to address and provide clarity on the pre-approved land outcome for the Bluff residual void	Continued progression of EA amendment to change site PMLU.	Continued progression of EA amendment to change site PMLU	EA Amendment submitted.

Consultation Date	Community Member	Consultation Type	Information Provided	Issued raised by the community	How issues were considered	Decisions/ Outcomes	Commitments
19 January 2023	Landholder surrounding Bluff	Private face to face meeting	Discussion regarding ongoing rehabilitation obligations including rehabilitation scheduling, and landform design requirements	Rehabilitation scheduling and sequence, and the potential noise and dust impacts	Bowen PCI reviewed the rehabilitation schedule in consideration of landholder concerns.	Rehabilitation areas in proximity to the township of Buff will be prioritised and schedule when impacts to surrounding landholders can be minimised	Prioritises rehabilitation in proximity to the Bluff township.
2 February 2023	Landholder surrounding Bluff	Private face to face meeting	Discussion regarding ongoing rehabilitation obligations including rehabilitation scheduling, and landform design requirements	Rehabilitation scheduling and sequence and the potential noise and dust impact to the surrounding landholder	Bowen PCI reviewed the rehabilitation schedule in consideration of landholder concerns.	Rehabilitation areas in proximity to the township of Buff will be prioritised and scheduled when impacts to surrounding landholders can be minimised	Ongoing commitments prioritises rehabilitation in proximity to the Bluff township.
16 February 2023	Underlying Landholder	Private face to face meeting	Discussed an EA amendment application to change the PMLU from nature ecosystem to low intensity grazing.	Nill issues raise. Underlying landholder was in support a low intensity grazing PMLU	Continued progression of EA amendment to change site PMLU	Continued progression of EA amendment to change site PMLU	Change site PMLUs from nature ecosystem to low intensity grazing.
11 April 2023	Landholder surrounding Bluff	Private face to face meeting	Discussion regarding ongoing rehabilitation obligations including rehabilitation scheduling, and landform design requirements	Rehabilitation scheduling and sequence and the potential noise and dust impact to the surrounding landholder	Bowen PCI reviewed the rehabilitation schedule in consideration of landholder concerns.	Rehabilitation areas in proximity to the township of Buff will be prioritised and scheduled when impacts to surrounding landholders can be minimised	Ongoing commitments prioritises rehabilitation in proximity to the Bluff township.

Consultation Date	Community Member	Consultation Type	Information Provided	Issued raised by the community	How issues were considered	Decisions/ Outcomes	Commitments
3 May 2023	Neighbouring Landholder	Face to face	Information on designs were provided regarding planned rehabilitation works of drainage features within the mining footprint.	Nil issues were identified.	Nil.	Planning rehabilitation works to proceed in accordance with provide designs	Ongoing engagement with Landholders regarding rehabilitation activities, when requested.
3 May 2023	Bluff Community Reference Group	Community Reference Group Meeting	An operational update on currently site activities (including planned rehabilitation of drainage works) and ongoing community engagement program.	Nil issues, applicable to rehabilitation activities onsite were raised.	N/A	N/A	Continued commitment to rehabilitation of Bluff Mine.
28 July 2023	Landholder surrounding Bluff	Private face to face meeting	Discussion regarding ongoing rehabilitation obligations including rehabilitation scheduling, and landform design requirements	Rehabilitation scheduling and sequence and the potential noise and dust impact to the surrounding landholder	Bowen PCI reviewed the rehabilitation schedule in consideration of landholder concerns.	Rehabilitation areas in proximity to the township of Buff will be prioritised and scheduled when impacts to surrounding landholders can be minimised	Ongoing commitments prioritises rehabilitation in proximity to the Bluff township.
3 August 2022	DES	DES Site Inspection	Site inspection following rainfall at Bluff Mine	Re-instatement of clean water drains to direct rainfall to suitable water storages	Bowen PCI to undertake works to re-instate the clean water drainage line	Re-instatement of drainage line	Continued commitment to ongoing monitoring and maintenance of infrastructure at Bluff Mine

Consultation Date	Community Member	Consultation Type	Information Provided	Issued raised by the community	How issues were considered	Decisions/ Outcomes	Commitments
15 November 2023	Bluff Community Reference Group	Community Reference Group Meeting	A presentation was provided on the sites upcoming care and maintenance period	Stakeholder raised concerns regarding the progressive timeline of rehabilitation onsite.	Bowen PCI has undertaken a critical review of the available land for rehabilitation to ensure effective scheduling.	N/A	Continued commitment to rehabilitation of Bluff Mine.

5.1 Stakeholder engagement plan

To meet the requirement of s126C(1)(iv) of the EP Act, and the PRCP guidelines, Bowen PCI has developed a community consultation and stakeholder engagement plan (SEP) that outlines how ongoing consultation will be undertaken with stakeholders who hold a genuine interest in relation to the rehabilitation to be carried out under this PRCP (Table 15).

The SEP is intended as a framework to facilitate engagement, consultation, and collaboration with stakeholders on, among other things, matters relating to rehabilitation and closure.

The key objective of the plan is to achieve the following:

- provide information about the timing and extent of planned rehabilitation and closure-related activities;
- provide information about the progress in implementing rehabilitation;
- receive community feedback on matters concerning rehabilitation; and
- provide timely responses to community feedback and enquiries relating to matters concerning rehabilitation.

This SEP will be continually reviewed and revised, where appropriate to allow for continual refinement.

Table 15: Stakeholder engagement plan

Objectives	Engagement type	Proposed consultation frequency	Released information	How feedback/comments are considered
Establish and maintain engagement practices that promote ongoing relationships with the community.	Community meetings	As required and prior to PRCP amendments	Updates on: • mine progression; • changes to operations; • rehabilitation (low intensity grazing PMLU); • final landform design	Include concerns raised in altering or adjusting project operations or rehabilitation where practicable
Build awareness and understanding of Bluff Mine operations, while managing community expectations of how the applicant would operate	Site tours	As required and prior to PRCP amendments	Provide information on ongoing operations and those of the future, including rehabilitation	Provide feedback to stakeholders for any concerns raised including potential resolution or outcomes where required
Provide the individuals with the opportunity to express their opinions and concerns in relation to Bluff Mine activities	Individual conversations with community members	As required and prior to PRCP amendments	Discuss the mine plan, current and future operations, including rehabilitation to a low intensity grazing PMLU	Preliminary report and findings will be forwarded to Bowen PCI Management for review and approval, response provided to external stakeholder to bring closure to the enquiry, comment, request for service or complaint
Provide a complaint mechanism to affected stakeholders to register enquiries and concerns	One-on-one meetings and site complaint hotline.	As required	-	Stakeholder Feedback Handling Procedure developed for Bluff Mine to provide a guideline for registering and responding to stakeholder enquiries and concerns

6 Post-mining land use

Legislative Requirement

Section 126C(1)(d) of the EP Act, *"the rehabilitation planning part of the PRC plan must state the extent to which each post-mining land use for land identified in the PRC PLAN schedule for the plan is consistent with:*

- the outcome of consultation with the community in developing the plan, and
- any strategies or plans for the land of a local government, the State or the Commonwealth."

In accordance with the legislative requirements outlined above, this section of the PRCP will describe and discuss the existing approved PMLUs for Bluff Mine, how the outcomes of consultation with the community has informed the PRCP, and strategies for the land of a local government, State, or the Commonwealth.

A PMLU is defined under section 112 of the EP Act as the purpose for which the land will be used after all relevant activities for the PRCP carried out on the land have ended. A PMLU must meet the definition of stable condition. Land is in a stable condition if:

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

The Environmental Protection Regulation (2019) requires that each PMLU:

- is viable, having regard to the use of land in the surrounding region; and
- satisfies at least one of the following:
    - the use is consistent with how the land was used before a mining activity was carried out on the land;
    - the use is consistent with a development approval relating to the land;
    - the use is consistent with a use of the land, other than a use that is mining, permitted under a State or Commonwealth Act, including, for example, a planning instrument under the Planning Act;
    - the use will deliver, or is aimed at delivering, a beneficial environmental outcome.

6.1 Pre-approved PMLUs

The EA is the only LOD for Bluff Mine, as it is considered to define the transitional land outcomes and is considered to satisfy the definition of an LOD as per section 750 of the EP Act.

The EA (EPML02090614) details the PMLUs within Attachment 2—Rehabilitation Requirements and Conditions of Schedule G (Land and Rehabilitation). The applicable sections of the EA have been reproduced below in Table 16. ..

Table 16: Approved Post Mining Land Use and Areas

Domain	Area (Ha)	Approved PMLU*
Mine Industrial Area and Infrastructure Areas	102.6	Low Intensity Grazing
Overburden Dumps (out-of-pit [east and west] overburden dumps and in-pit overburden dump)	351.5	Low Intensity Grazing
Water Management Infrastructure	12.4	Low Intensity Grazing
Residual void	48.8	NUMA
Total disturbance extent (including the Residual Void)	515.3	-

* PMLU as described in Attachment 2—Rehabilitation Requirements within EA (EPML02090614)

The majority of Bluff Mine is to be rehabilitated to low intensity grazing, with the residual void to be a NUMA (see section 7) (Figure 15). This PMLU is consistent with how the land was used before a mining activity was carried out and the outcomes of the land suitability assessments completed in support of the EA (EPML02090614) application. The PMLU is also consistent with the pre-mining land use of the site, which was grazing as described in Section 4.6. This PMLU outcome is underpinned by rehabilitation objectives that focus on achieving a safe, stable, sustainable, and non-polluting landform outlined further in Attachment 2—Rehabilitation Requirements of the EA and summarised in Section 6.2. The pre-approved PMLU aligns with the performance outcomes for the PMLU as defined in the EP Regulation (2019).

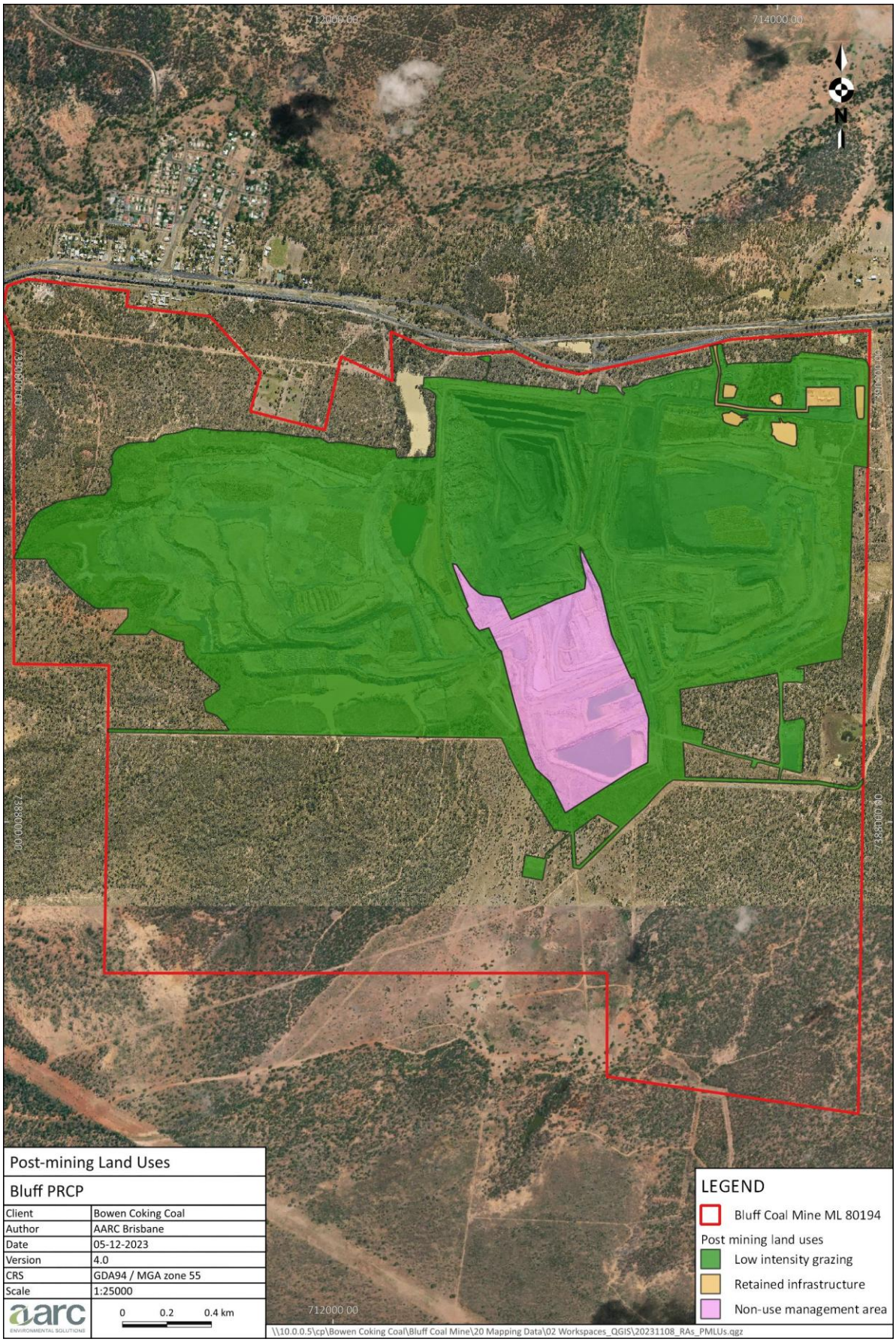

Figure 15: Approved Post Mining Land Uses

6.2 Closure criteria

The completion criteria for the grazing PMLU are defined in Attachment 2—Rehabilitation Requirements of the EA. The criteria have been isolated and their transition to a PRCP milestone has been described below in Table 17.

Table 17: PMLU completion criteria

Completion criteria as per the rehabilitation areas (RA)	Status	Comments	Milestone
All earthworks completed to final landform design and disturbed slopes are ≤10%.	Updated	Updated wording of the criteria to be SMART	RM3
Landform deemed safe by an appropriately qualified person (AQP) for the PMLU and that the constructed landform achieves a design criteria for geotechnical stability.	Updated	Updated wording of the criteria to be SMART	RM3
Local program of fire control and prescribed weeds and woody weeds control have been conducted.	Updated	Updated wording of the criteria to be SMART	RM6
Where risk mitigation measures include fencing and appropriate signage around a perimeter to restrict access, these have been erected in accordance with relevant guidelines and Australian Standards.	Updated	Updated wording	RM3
Topsoil must be tested for pH, electrical conductivity, and exchangeable sodium potential to ensure it is of a quality appropriate for achieving the PMLU and where required, ameliorants such as gypsum are added to improve soil quality characteristics at rates recommended by an AQP	Updated	Updated criteria to be SMART	RM4
Selective burial of hazardous materials tailings and rejects and covering of landforms with benign materials including topsoil has been conducted	Updated	Updated criteria to be more specific as to the remediation options for hazardous materials	RM2
Contaminated land assessment completed by a SQP[1] indicates that no contamination unsuitable for the PMLU remains or is occurring	Included		RM2
A Geotechnical study and assessment has been conducted by an AQP and shows that the elevated landforms are stable and safe	Updated	Updated wording	RM3
No evidence of erosion classified as 'moderate' or 'severe', significant active erosion features are not present and any initial erosion has been stabilised by vegetation cover	Updated	Erosion criteria has been maintained and erosion classification framework included to be SMART criteria.	RM7

Completion criteria as per the rehabilitation areas (RA)	Status	Comments	Milestone
Evidence that the reshaping of the upper surface of the elevated landforms has been to a stable gradient to direct runoff to the rock-lined waterway and prevent gully erosion	Updated	Updated criteria to be specific and measurable. Erosion and sediment control systems are designed by an AQP and fit for purpose. Included more specific criteria detailing the construction of drainage features and to ensure the landform is constructed to design specifications.	RM3
Slopes on elevated sections of the landform are geotechnically stable enough to maintain covers constructed for containment of hazardous material and for ecosystem support	Excluded	This is addressed within other criteria. The landform mut be assessed as geotechnically stable by an AQP and contaminated material assessments.	
Palatable pasture species have been established and vegetation groundcover is >70%	Updated	Updated criteria to separate out the achievement of groundcover and the achievement of pasture species.	RM6
Evidence of utilised revegetation techniques has been included in the Rehabilitation Report	Updated	Criteria updated to be specific and measurable and include seeding selection, minimum seeding rates and record keeping.	RM5
Revegetation seeding rate for grass seed mix at minimum rate of 10 kg/ha with a minimum of 4 palatable perennial pasture species present within the seed mix during revegetation	Updated/ Excluded	Criteria for seeding rates has been maintained A preliminary species list for the PMLU has been provided within *Table 29*. Making this specification redundant and no longer applicable.	RM5
Land suitability assessment by an AQP certifies that land has achieved a post-mine land suitability class similar to the pre-mining Class of 4 or better for low intensity grazing, as determined by the baseline study—Soil, Land and Overburden Assessment prepared by SLR Consulting	Updated	Updated criteria to be more specific and measurable	RM6
Weed presence, as defined in the Biosecurity Act 2014, is a maximum of 10% of total vegetative groundcover confirmed by an AQP in annual monitoring with weed management recommendations provided	Included		RM6
Environmental Audit has been conducted by an AQP to grade success of: • Erosion mitigation program; • Vegetation program; • Water monitoring program; • Weed management; • Establish progress towards a native ecosystem self-sustaining grazing PMLU; • Identify the Land Suitability Class; and • Establish adequacy and predicted long-term performance of safety barriers.	Excluded	AQP assessment has been included for erosion and sediment control systems, weed management, land suitability and retained water storage. The vegetation program has also been removed as the monitoring and maintenance program, described in Section 10, has been developed to measure and verify rehabilitation performance in accordance with this PRCP. Safety adequacy has been assessed in the risk assessment and controls implemented as discussed in Section 9.	

Completion criteria as per the rehabilitation areas (RA)	Status	Comments	Milestone
Contaminated land assessment completed by a SQP[1] indicates that no contamination unsuitable for the PMLU remains or is occurring	Excluded	This criterion is repeated and already included within RM2.	
Retained water storage water quality for quality characteristics are below the trigger values for livestock drinking water defined in Environmental Protection (Water) Policy 2009 Mackenzie River Sub-basin Environmental Values and WQOs Basin No. 130 (part), including all waters of the Mackenzie River Sub-basin, September 2011, or the most recent version	Updated	Updated wording	RM7
All retained water storages achieve geotechnical safety and stability as assessed and approved by an AQP	Included		RM7
No evidence of erosion on the retained dam banks classified as 'moderate' or 'severe' as defined by Attachment 3 - Erosion classification framework	Included		RM7
Dams to remain for landholder use are safe for stock access and have vegetated banks	Included		RM7

[1] SQP – Suitably Qualified Person

6.3 Community consultation

As described in section 5, since Bowen PCI commenced operation of Bluff Mine in 2021 ongoing consultation has been conducted with stakeholders who hold a genuine interest in the land with regards to environmental and operational performance, and outcomes. These have included, neighbouring landholders, the local community, key State and Commonwealth government agencies, and Central Highland Regional Council members.

The approved PMLUs are considered to be consistent with the outcomes of the community consultation undertaken to date as:

- No queries or issues with the PMLU have been raised by any community group to date.
- No queries or issues with PMLU have been raised by adjacent landholders or other members of the local community.

6.4 Land suitability

As described in section 4.7.2, SLR (2013) (Appendix G), determined that the Bluff Mine area, pre-mining, was largely suitable for marginal to moderate beef cattle grazing, with approximately 14% of the area considered to hold a Beef Cattle Grazing Land Suitability of Class 3 and the remaining 85% as Class 4.

This suitability assessment further considers the proposed final land outcomes of "stable, self-sustaining, and maintenance free" and assessed two potential final land use options, being:

- Return the land to pre-disturbance land suitability and/or land use; or
- Rehabilitate the land for another beneficial use, i.e., returned to an agreed alternative land suitability and/or land use.

In consideration of the conceptual final landform, proposed slope angles (≤10%), and existing soil resources the suitability assessment determined the gently inclined to flat land on the crests of the final landform are suitable for establishment of appropriate pasture species for grazing practices. Although the top of the final landform is flat and could potentially be used for moderate grazing, which is Beef Cattle Grazing Land Suitability Class 3, the available soil resources are marginal with inherent characteristics of acidity, sodicity and poor structure. Therefore, this flat to gently inclined land, in line with its pre-mining classification, is considered marginal land and best used for light grazing for fattening beef cattle.

The assessment summarises by concluding that post mining land suitability and land uses will be similar to pre-mining with a decrease in Land Beef Cattle Grazing Land Suitability Class 3 to 76.6 ha and an increase in Beef Cattle Grazing Land Suitability Class 4 land of 29.2 ha.

The PMLUs proposed within this PRCP have be determined in alignment with the outcomes of this Bluff Project Soils, Land and Overburden Assessment (SLR 2013) land suitability assessment.

6.5 Exploration

Exploration areas are not classified as a stand-alone mining domain due to all exploration areas being within the current overall mining footprint and incorporated within the existing mining domains. All exploration areas contained within the current mining domains will be rehabilitated in accordance with the provisions detailed in the Eligibility criteria and standard conditions for exploration and mineral development projects.

6.6 Landholder retained infrastructure

As per the written agreements included in Appendix K, some mining infrastructure will be retained by the underlying landholders. This includes roads, dams, pipelines, and storage sheds to assist in meeting ongoing land management requirements to maintain the low intensity grazing PMLU. Though important to facilitating other PMLUs, landholder retained infrastructure will be a minor component of rehabilitation at Bluff Mine and will not impede on the identified PMLUs. Landholder retained infrastructure are detailed further in Table 18.

Table 18: Landholder Retained Infrastructure

Infrastructure	Description
Pre-existing landholder dams	Two pre-existing landholder dams (including the Road Dam and a dam in the middle of Lot 11 on H4023) to be retained for stock watering. These dams are identified in Figure 16.
Sediment (Sed) and MIA dams	Five sediment and MIA dams are to be retained for stock watering purposes (specifically cattle). This includes the Run of Mine (ROM) pad Sump, MIA Dam, MIA Sed Dam 2 and 3 and ROM Sed Dam 1 identified in Figure 16.
Capricorn Highway Turnoff	The road providing access to the Capricorn Highway to be used for access to the property. This road access is identified in the Figure 16.
Access to existing workshops	The road providing access to the existing workshops to be used for access and for pastoral activities (including hay storage). This will allow cattle truck to access the workshops from the Capricorn Highway. This access road is identified in the Figure 16.
Existing workshops	For use for machinery and storage associated with pastoral activities. The workshops are identified in Figure 16.

Over the course of the life of Bluff Mine, further retained infrastructure agreements may be sought with the future underlying landholders. If so, all retained infrastructure provided to the signatories of these agreements will be in a condition that is safe to humans and wildlife, non-polluting, stable, and able to be sustained by the signatory of the agreement.

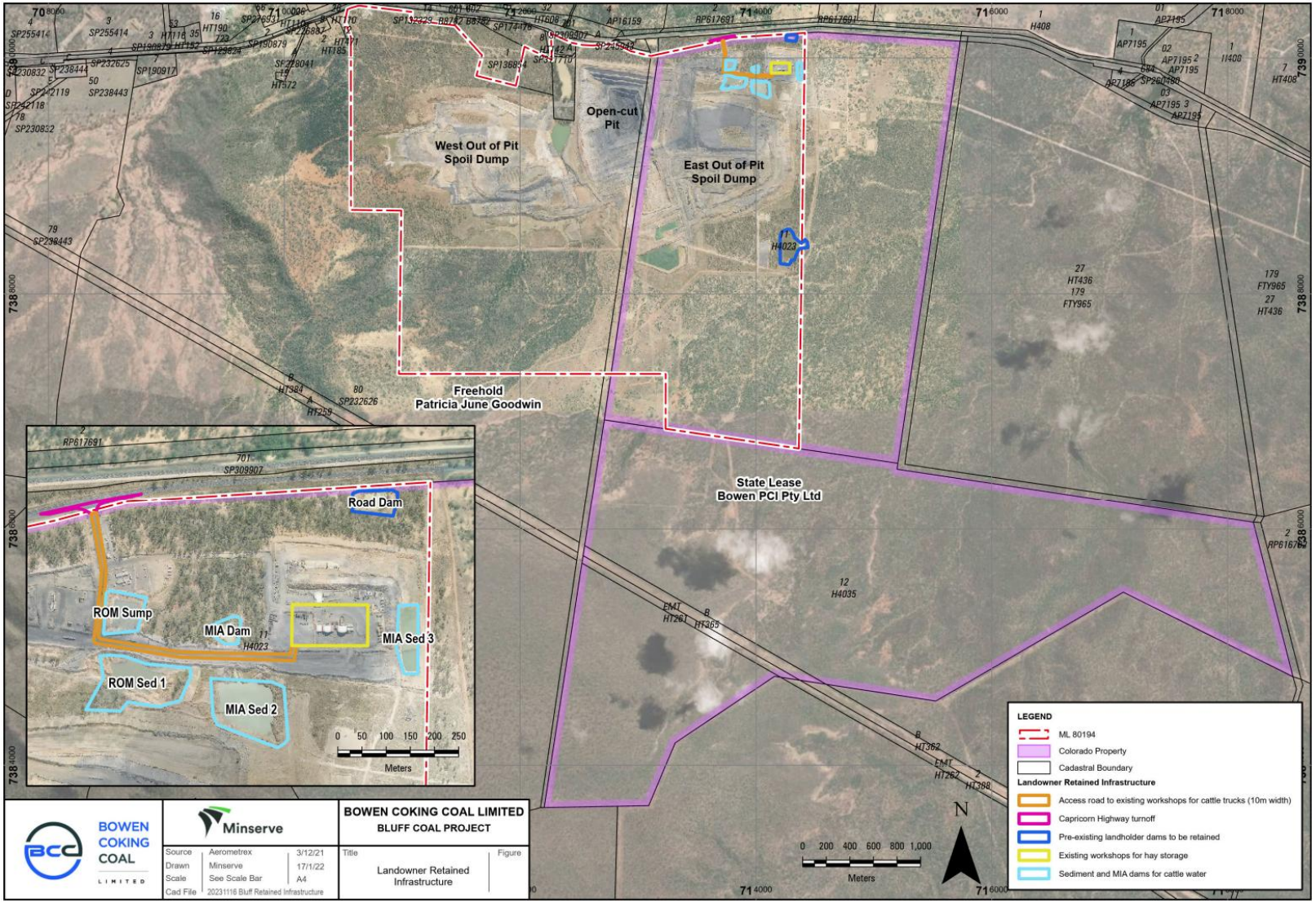

Figure 16: Retained Infrastructure

6.7 Relevant legislation

Section126C(1)(d) of the EP Act requires PMLUs to be consistent with any strategies or plans for the land of a local government, the State, or the Commonwealth. The local government, the State and the Commonwealth legislation and policies that have been considered in the PMLU selection process are defined below.

6.7.1 Local government

Bluff Mine is located in the Central Highlands Regional Local Government Area. The *Central Highlands Regional Council Planning Scheme 2016* identifies Bluff Mine area as being within the "Rural Zone." The purposes of the Rural Zone are defined as:

a) provide for rural uses including cropping, intensive horticulture, intensive animal industries, animal husbandry, animal keeping and other primary production activities;

b) provide opportunities for non-rural uses that are compatible with agriculture, the environmental features, and landscape character of the rural area where the uses do not compromise the long-term use of the land for rural purposes; and

c) protect or manage significant natural resources and processes to maintain the capacity for primary production.

The PMLU outcome of low intensity grazing is considered consistent with the planning scheme.

6.7.2 State government

The PMLU selection process considered relevant State legislation, prescribed guidelines and plans to ensure compliance and consistency. In addition to the EP Act and Regulation that guides the PRCP Process the following legislation and policies have been considered:

- *Aboriginal Cultural Heritage Act 2003* for the management of all cultural heritage finds and ensures closure activities do not disturb identified Aboriginal cultural heritage places and artefacts.
- *Environmental Protection Act 1994* and subordinate legislation—as described previously.
- *Land Act 1994* has been considered in relation to sustainability and community purpose, being grazing outcomes.
- *Nature Conservation Act 1992* has been considered for relevant species or communities within the mine area and considered in the rehabilitation methods.
- *Water Act 2000* for the regulation of surface water and groundwater at the Mine.

6.7.3 Commonwealth government

The PMLU selection process considered relevant Commonwealth legislation, prescribed guidelines and plans to ensure compliance and consistency. Key legislative considerations included:

- *Environmental Protection and Biodiversity Conservation Act 1999* - appropriate management of protected areas and mitigation of impacts.
- *Native Title Act 1993* - disturbance to be rehabilitated to the proposed final land use with consideration of the native title rights and interests of Traditional Owners.

7 Non-use management areas

Legislative Requirement

Section 126C(1)(d) (g) and (h) of the EP Act, *"for each proposed non-use management area, the rehabilitation planning part of the PRC plan must:*

- State the reasons the application considers the area cannot be rehabilitated to a stable condition
- Include copies of report or other evidence relied on by the applicant for each proposed non-use management area
- State the extent to which the proposed non-use management area is consistent with
  - the outcome of consultation with the community in developing the plan; and
  - any strategies or plans for the land of a local government, the State or the Commonwealth."

The EP Act defines a non-use management area as:

> *an area of land the subject of a PRC plan that cannot be rehabilitated to a stable condition after all relevant activities for the PRC plan carried out on the land have ended.*

The Bluff EA (EPML02090614) identified the 48.8 Ha of void remaining at the life of the mine as a NUMA within Attachment 2—Rehabilitation Requirements and the conditions of Schedule F (Land and Rehabilitation) (Figure 15). This determination was reached based on a groundwater assessment (RDM Hydro 2024) which demonstrates that the residual void will remain as a groundwater sink with long-term water modelling showing no risk of overtopping or seepage to the natural surface or groundwater. The groundwater quality was also determined to be highly saline (9620—25,200 mg/L) and unsuitable for stock or domestic purposes, constraining any potential for a PMLU for the residual void.

Under the relevant transitional provisions, as this void is a pre-approved NUMA described within a land outcome document, the Bowen PCI is not required to:

- justify the proposed NUMA;
- provide evidence to support the justification of the NUMA;
- go through the Public Interest Evaluation process; and
- comply with the prohibition of voids located within a flood plain having to be rehabilitated to a stable condition.

However, all NUMAs, regardless of whether they have been identified in a land outcome document, are required to be managed in way that achieves best practice management and minimise risks to the environment. The completion criteria outlined in Attached 2—Rehabilitation Requirements of the EA are provided below and described further in section 8.12. These sections demonstrate how the Bluff Residual Void will be managed to achieve best practice management and minimise any risk to the environment.

7.1 Completion criteria

The completion criteria for the NUMA is defined in Attachment 2—Rehabilitation Requirements of the EA and have been reproduced in Table 19.

Table 19: PMLU completion criteria

Completion criteria as per the RA	Status	Comments	Milestone
Geotechnical study has been completed within three (3) years prior to mine closure to confirm:			
that Highwall slopes are stable and safe;	Updated	Criteria updated to be SMART "Voids are assessed to be geotechnically stable by an appropriately qualified person"	MM1
the criteria of 33° (65%) for Lowwall and an average of 40° (84%) for Highwall slopes are achievable and sustainable over the long-term.	Updated	Updated wording	MM1
a safety assessment of Highwall slopes that are >30° and >5m in height has been conducted.	Included		MM2
risk assessment relative to safety of humans, stock and wildlife completed and risk mitigation measures have been implemented in accordance with relevant guidelines and Australian Standards such as ISO31000 Risk Management.	Excluded	Risk assessment mitigation measures are implemented under Section 9 of the PRCP	
Completion of a Rehabilitation Report by an appropriately qualified person (AQP) at the end of the mine life to ensure successful rehabilitation of the residual void and other landforms. This Rehabilitation Report has been completed in accordance with the relevant guidelines and Australian standards.	Updated	Updated wording	MM3
The identification of potential hazardous materials during mine life through water quality monitoring and material characterisation has been conducted.	Updated	Updated wording and criteria to be SMART to ensure that the water quality and potential hazardous materials in the void will not cause environmental harm to the surrounding environment.	MM3
During the 5 years prior to mine closure surface water monitoring and leaching tests have been undertaken in compliance with guidelines derived from ANZECC 2000.	Updated	Updated this criteria to be included under certification by an AQP to assess water quality will not cause environmental harm	MM3

Completion criteria as per the RA	Status	Comments	Milestone
Hydrological modelling has been conducted of the groundwater environment in the vicinity of the residual void to establish relationship between water in the residual void and the groundwater.	Updated	Updated wording of the criteria to be SMART	MM1
Evidence has been included in decommissioning records of elimination of any exposed carbonaceous material that may present a spontaneous combustion risk	Included		MM1
Evidence in decommissioning records that carbonaceous material has been encapsulated within an inert cover.	Included		MM1
Access to highwalls is restricted by a safety bund constructed to the following specifications: established from the slope crest at a distance outside the 'zone of void influence.' A minimum height of 2m; and A minimum base width of 5m.	Included		MM2
The boundary of the residual void area is fenced on the outside of the safety bund to specification (five strand barbed stock fencing).	Included	Updated wording	MM2
Safety signage designed in accordance with Australian Standard is erected at 100m intervals along the fence line.	Included	Updated wording	MM2
Residual void design ensures the void is PMF protected.	Updated	Updated wording to meet SMART criteria	MM3
A Geotechnical study has been completed and assessment that residual void slopes are stable and safe by appropriately qualified persons has been conducted.	Excluded	Addressed in other criteria	
Residual void assessed to be geotechnically stable by an AQP achieving a Factor of Safety (FoS) of ≥1.5 for the in situ pit walls.	Included		MM1
Safety assessment has been conducted of the residual void slopes that are <40° and >5m in height.	Included		MM2

Completion criteria as per the RA	Status	Comments	Milestone
Completion of an assessment report by a Registered Professional Engineer of Queensland (RPEQ) on the geotechnical issues and erosivity of the proposed final landforms, including residual voids, to demonstrate long-term landform stability. Reference has been made to the Queensland Mining Guidelines (or subsequent reprints) during the completion of this assessment.	Excluded	This is addressed under other criteria within MM3	
Absence of active rill/gully erosion.	Updated	Updated wording	MM2
Surface water monitoring has been conducted with water quality criteria derived from ANZG 2018 for 3 years post mining operation.	Included		MM3
Evidence that effective leachate prevention has been conducted through testing of mining waste and management in accordance with a documented Mine Waste Management Plan	Excluded	Addressed through the assessment of environmental harm to the surrounding environment	
Evidence from surface water monitoring that successful prevention measures have been implemented for poor quality leachate or discharge mobilisation from the void to watercourses.	Excluded	Addressed through the assessment of environmental harm to the surrounding environment	
A groundwater study has been conducted on the long-term groundwater levels and on the post-mining aquifer recovery (once the details of the final residual void for mine closure has been finalised).	Updated	Updated criteria to be SMART and uses Table E2—Groundwater quality limits from the EA as a reference for groundwater quality	MM3
Evidence that no significant difference in water quality has occurred relative to historic (background) groundwater quality.	Included	Incorporated into an existing criteria	MM3
Successful establishment of adequate drainage control between the Final Residual Void edge and location of bunds has been made to redirect any runoff away from the edge of the void.	Included		MM2
Evidence in the Rehabilitation Report that the void water levels have remained similar to modelled scenarios and the risk of void overflow have been maintained as minimal where appropriate.	Updated	Criteria updated to be SMART including the surface water level of 133mAHD	MM3

Completion criteria as per the RA	Status	Comments	Milestone
Predictive modelling undertaken by an AQP, confirming that the voids will remain as a groundwater sink and that there is no risk of contamination post mining.	Included		MM1
Evidence has been included in Rehabilitation Report that required waste management measures have been implemented.	Excluded	Not applicable to the NUMA in this case	
An audit of the hazardous materials register has been conducted to identify the location, use and disposal of potentially hazardous materials during the life of the mine.	Included		MM2

7.2 Community consultation

As described in section 5, since Bowen PCI commenced operation of Bluff Mine in 2021 ongoing consultation has been conducted with stakeholders who hold a genuine interest in the land with regards to environmental and operational performance, and outcomes. These have included, neighbouring landholders, the local community, key State and Commonwealth government agencies, and Central Highland Regional Council members.

The approved NUMA are considered to be consistent with the outcomes of the community consultation undertaken to date as:

- No queries or issues with the NUMA have been raised by any community group to date.
- No queries or issues with NUMA have been raised by adjacent landholders or other members of the local community.

7.3 Relevant legislation

7.3.1 Local government

The approved NUMA will be managed in such a way as to minimise any impacts on the outcomes outlined in the 'Central Highlands Regional Council Planning Scheme 2016,' in particular:

- The region's natural environment and native species habitats will be recognised, maintained, and enhanced, and the extent of weeds and pests impacting on the region will be minimised.
- The rehabilitated landform will be consistent with the region's character and amenity (e.g. agricultural land and the natural environment).
- The size of the NUMAs has been minimised to maximise the land to be returned to native ecosystem.

7.3.2 State and Commonwealth governments

The approved NUMAs are considered to be consistent with the relevant legislation identified in section 6.7.2 and 6.7.3. The void is not located within a floodplain and at the completion of mining the final landform will provide flood immunity up to the probable maximum flood (PMF).

7.4 Voids in a floodplain

Legislative Requirement

Section 126D(3) of the EP Act, if land the subject of the proposed PRCP schedule will contain a void situated wholly or partly in a flood plain, the schedule must provide for the rehabilitation of the land to a stable condition.

Section 126D(3) of the EP Act stipulates that 'if the land subject to a proposed PRCP schedule will contain a void situated wholly or partly in a floodplain, the PRCP schedule must provide for rehabilitation of the land to a stable condition.' The PRCP Guideline notes that Section 126D(3) of the EP Act does not apply where a NUMA has already been identified in a LOD and is transitioned into the PRCP schedule consistent with the LOD (DES 2021). As the Bluff Mine residual void has been previously identified and detailed in the LOD for Bluff Mine, evidence, and justification for the location of the residual void are not required to be provided in the PRCP.

Notwithstanding section 126D(3), the Bluff Mine Void is located outside the 0.1% AEP modelled flood extent and therefore does not represent a threat to the stability of the residual voids.

8 Rehabilitation management methodology

Legislative Requirement

Section 126C(1)(e) and (i), *"the rehabilitation planning part of the PRC plan must:*

- For each proposed post-mining land use for land, state the proposed methods or techniques for rehabilitating the land to a stable condition in a way that supports the rehabilitation milestones under the proposed PRCP schedule.
- For each proposed non-use management area, state the proposed methodology for achieving best practice management of the area to support the management milestones under the proposed PRCP schedule for the area."

8.1 Rehabilitation objectives

In Queensland, mine rehabilitation is required under the EP Act. Amendments to the EP Act in late 2018 implemented key elements of the State Government's Mined Land Rehabilitation Policy (Queensland Government 2018) which intends to ensure that, for land disturbed by mining activities:

- the land is safe and structurally stable;
- there is no environmental harm being caused by anything on or in the land; and
- the land can sustain a PMLU (section 111A of the EP Act).

These three objectives are the general rehabilitation goals for all areas disturbed by mining in Queensland.

8.2 Rehabilitation areas and improvement areas

To allow the development of a PRCP schedule that satisfies the requirements of the PRCP Guideline, discrete RAs and improvement areas (IAs) have been defined for Bluff Mine. As defined within the EP Regulation 2019:

- a rehabilitation area is "for land the subject of a post-mining land use, means an area of the land to which a rehabilitation milestone for the post-mining use relates"; and
- an improvement area is "for a non-use management area, means an area of land in the non-use management area to which a management milestone relates".

RAs and IAs have been nominated for areas of disturbance within Bluff Mine with consideration for the disturbance type and the proposed PMLU and are detailed in Table 20 shown in Figure 17.

Table 20: Identified RAs and IAs

Rehabilitation Area	Mining domain	Area (ha)	Description	PMLU designation
RA1	Mine infrastructure area	161	Buildings (including foundations) Workshop Roads Potable water storage facilities Chemical/fuel storages Laydown yard Access/coal haul road and infrastructure corridor ROM pad Pit access road Minor sediment dams associated water management infrastructure	Low intensity cattle grazing
RA2	Overburden dumps	301	in-pit waste rock emplacements out-of-pit waste rock emplacements (east and west) associated water management infrastructure	
RA3	Retained infrastructure	4.7	Retained infrastructure that forms part of the landholder agreement (i.e. relevant water storages, buildings, tracks/roads)	Retained infrastructure for low intensity grazing
IA1	Residual void	48.3	Residual void (including the Lowwall and Highwall)	Non-use management area

8.2.1 Rehabilitation area milestone criteria

Milestones have been developed for each PMLU rehabilitation area described in section 8.2. Rehabilitation milestones identify each significant event or step necessary to rehabilitate the land to a stable condition. Each milestone has been developed in consideration of best practice management, the environmental risk associated with each stage of rehabilitation and in a manner that align with the SMART (Specific, Measurable, Achievable, Reasonable, and Time Specific) principles.

The nominated rehabilitation milestones (RMs) and their applicability to the various RAs are shown in Figure 17, outlined in Table 21, and described in detail in sections 8.3 through 8.12.

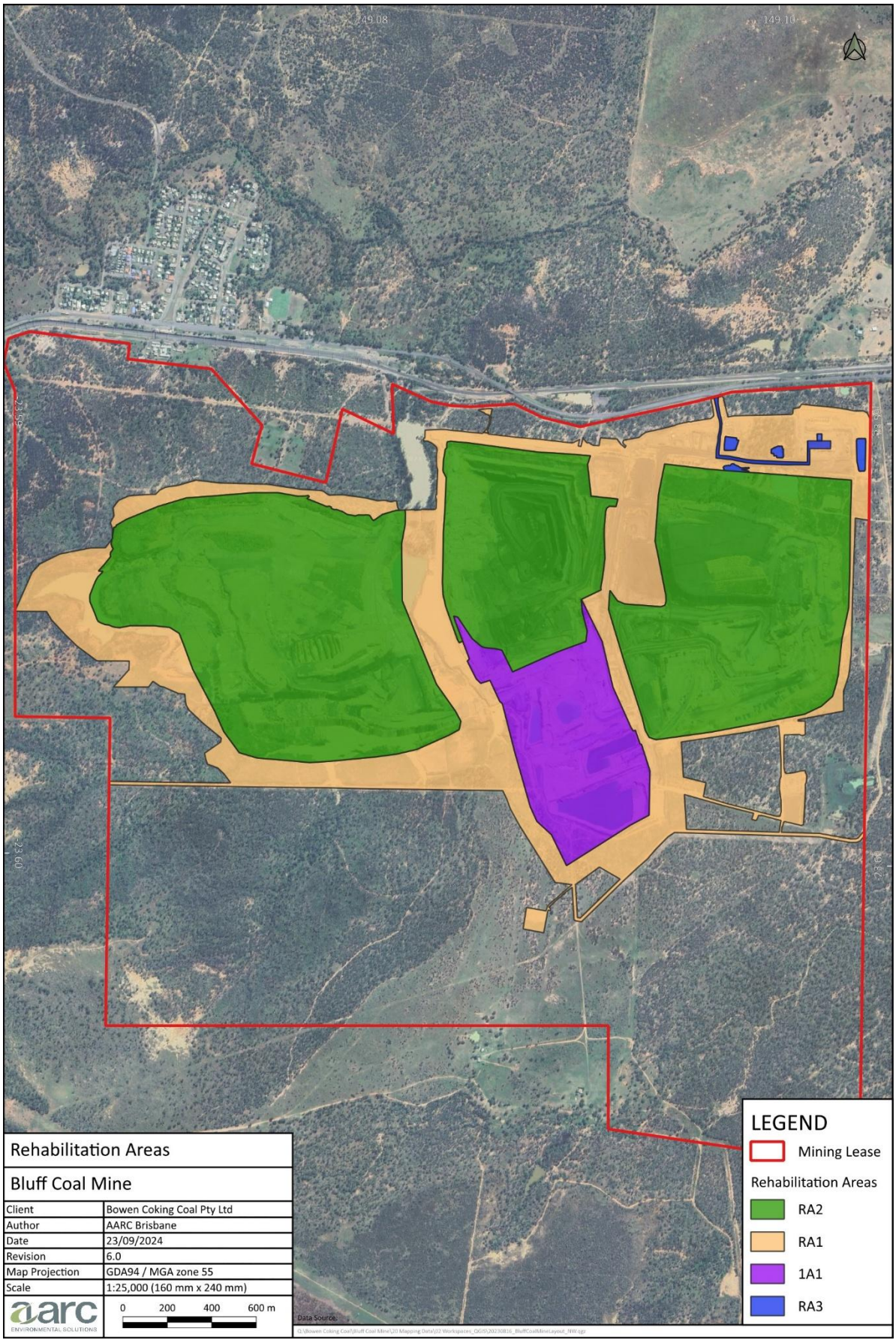

Figure 17: RAs and IAs

Table 21: Rehabilitation milestone criteria

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone completion criteria
RM1	Infrastructure decommissioning and removal	RA1 RA2 RA3	1.1 With the exception of any infrastructure to remain as part of the PMLU or for the purposes of rehabilitation or where infrastructure is agreed to be retained by the landholder as evidenced by a signed landholder agreement, the following are complete: (a) All services, such as water, electricity and gas, disconnected, terminated and removed; (b) All buildings and associated infrastructure dismantled and removed offsite; (c) All hardstand, concrete areas and roads (bitumen, blue metal, aggregate etc.) removed; (d) All fencing that is not part of PMLU requirements removed; (e) All pipelines drained and removed; (f) All waste removed; (g) All surface water drainage infrastructure removed; (h) All drillholes, bores, sediment ponds and sumps decommissioned; (i) All machinery and equipment removed from site; (j) All dams dewatered and desilted (where required); (k) Remove HV and LV power lines; and (l) Demolish and remove above ground
RM2	Management of contaminated land status	RA1 RA2 RA3	2.1 Contaminated land assessment undertaken by a SQP in accordance with the EP Act. If required, a site investigation report including a site management plan and/or validation report prepared and submitted in accordance with the provisions of Chapter 7, Part 8 of the EP Act. 2.2 All contaminated and hazardous materials are either: a) Remediated in situ; b) Removed/transported to an approved landfill for disposal and waste tracking information recorded and submitted; or c) Retained and managed under a site management plan (e.g. any associated and required seepage interception systems). 2.3 A site suitability statement from a SQP confirms the uses or activities for which the land is suitable, align to the approved PMLUs for the site.
RM3	Landform development (re-profiling / re shaping) of land affected by disturbance	RA1 RA2	3.1 Earthworks completed with an 'As constructed' survey plan showing the surveyed area and finished slopes conform to the designed landform and drainage for each sub-area including the landform design and report required by PRCP12. 3.2 All slopes achieve: a) Mine infrastructure area (RA1) - All slopes have been regraded to < 10%

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone completion criteria
			b) Overburden Dumps (RA2) - <5.7° and 10%, when measured from the toe of slope to the crest of the slope. 3.3 Prior to re-profiling, chemical testing for sodicity and dispersion potential is to be undertaken to a suitable sampling density as determined by an appropriately qualified person (AQP), for waste rock material that will make up the surface of the landform, where 'surface' is defined as the expected zone as determined through rehabilitation monitoring and AQP recommendation 3.4 AQP has certified that the landform geometry and drainage characteristics are appropriate to sustain the PMLU. 3.5 Landform shaped to be gently sloping characteristic of the natural landform and reinstates natural drainage lines and certified by an AQP. 3.6 AQP has certified that the 'As constructed' landform achieves long-term geotechnical stability with a Factor of Safety (FoS) ≥ 1.2. 3.7 Maximum vertical height is no more than 40 m above the original ground level. 3.8 All landforms are reshaped to be free-draining and water shedding. 3.9 An AQP has certified that environmentally problematic material is appropriately placed and located within the final landform. 3.10 All flood protection landforms provide final void immunity up to 0.1% AEP + 0.5 metres at a minimum, as confirmed by an AQP. 3.11 For Mine infrastructure area (RA1), the disturbed natural watercourse bed and banks must be returned to a profile similar to the pre-disturbance condition.
RM4	Surface preparation (topdressing, contour ripping, soil amelioration)	RA1 RA2	4.1 Assessment of growth media characteristics and the development of an amelioration and physical treatment plan is completed by an AQP, to ensure soil is suitable for targeted PMLU and the parameters in Table 22 are met for root zone 0—300mm, prior to each rehabilitation event. 4.2 Where the soil health and suitability assessment identify that the criteria in Table 22 are not met, ameliorants such as gypsum and fertiliser are added to improve growth medium characteristics at the rates recommended by an AQP. 4.3 Following amelioration as per criteria 4.1 and 4.2, an AQP certifies that the growth media has met the criteria listed in Table 22. 4.4 Following amelioration, the growth media characteristics are reviewed and endorsed by an AQP, to ensure growth media is suitable for target vegetation establishment, the PMLU and stability of the landform. 4.5 Records must be kept of ameliorants applied and incorporated into surface, as recommended by an AQP. 4.6 Deep ripping of compacted surfaces, at least 200 mm into soil/subsoil profile along contour of slopes.

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone completion criteria
RM5	Revegetation (seeding and / or planting)	RA1 RA2	5.1 Completed seeding of all surfaces in accordance with species list as described in Table 29. 5.2 Minimum total seeding rate of 10 kg/ha. 5.3 For a grazing PMLU the seed mix should include: a) a minimum of 25% (by weight) native species; b) four species of 3P pasture species; c) two legumes; and d) two shade tree species. 5.4 Records must be kept demonstrating species used, seeding rates, area sown, and germination certificate. 5.5 Stock exclusion fencing has been established to prevent stock from grazing newly seeded areas.
RM6	Achievement of surface requirements	RA1 RA2	6.1 total percentage of established, and self-sustaining vegetation ground cover is ≥70% 6.2 species used in revegetation remain present and showing evidence of natural recruitment. Evidence of flora recruitment from rehabilitation monition data. 6.3 AQP[3] certified that: a) there is not moderate or severe sheet, rill or gully erosion present as defined in the erosion classification framework[5]; b) mass movement and tunnel erosion are absent; c) all other erosion requiring intervention has been remediated and does not impact achieving the PMLU; and d) average erosion rate of 5 t/ha/yr is achieved, within a maximum erosion rate of 10t/ha/yr. 6.4 All contour banks and other temporary erosion and sediment control structures have been removed. 6.5 Proportion of Category 3 restricted invasive plant species[6] and Weeds of National Significance[7] is less than 10% of total vegetative groundcover and an AQP[3] has confirmed that appropriate weed management controls are being implemented. Weed management recommendations to be provided in annual reports. 6.6 Corrective action arising from the routine inspections program have been undertaken to include weed control, erosion repair and livestock management; 6.7 Surface water runoff has been collected across representative areas of rehabilitation when surface flows occur and is safe to do so. 6.8 Surface water runoff is non-polluting to receiving waters and complies with criteria presented below:

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone completion criteria
			• pH—6.5-8.5; • EC—310µS/cm; and • Sulfate—10mg/L
RM7	Achievement of target post-mining land use (Low Intensity Grazing PMLU)	RA1 RA2	7.1 Hazard and safety assessment completed by an AQP, demonstrates hazards are consistent with the type and severity of hazards typical of the adjacent equivalent land use. 7.2 Total percentage of established, and self-sustaining vegetative groundcover of species as listed in Table 29 and any 3P pasture species to be ≥70%. 7.3 Notwithstanding RM7.2, minimum composition of four species of 3P pasture species, two legumes, two shade tree species and at least two native pasture species, present per hectare (averaged). 7.4 Land suitability assessment by an AQP certifies that land has achieved a post-mine land suitability (DSITI & DNRM 2015) class of 4 or better for low intensity grazing. 7.5 Detailed flood modelling of drainage demonstrates that high-energy flows (greater than 2.5m/s) during a PMF event against the constructed landform) have been mitigated to ensure that the final landform is stable. 7.6 No evidence of scouring or destabilisation in or associated with drainage structures of the landform. 7.7 Final landform survey by an AQP confirms no built structures remain other than those that form part of a landholder agreement 7.8 Surface water demonstrates non-polluting landform: a) Surface water runoff is non-polluting to receiving waters and complies with Table 39. b) Surface water quality is monitored monthly during flow at, but not limited to, downstream locations specified in Table 40 must not exceed the limits in Table 39, for a minimum period of 5 consecutive years. c) Where the surface water quality at the downstream site exceeds the upstream site result as per RM7.8(a) and RM7.8(b), an AQP must complete an assessment of the cause of the exceedance and risk of rehabilitation not achieving a stable condition (RM7) within the schedule timeframe and: i) where there is low risk to achieving a stable condition from the mining tenure (ML80194), then no further action is to be taken; or ii) where there is a risk greater than low to achieve a stable condition, then an assessment of potential environment harm and any changes or rectification actions to rehabilitation activities must be determined and implemented.

Milestone reference	Rehabilitation milestone	Applicable RAs	Milestone completion criteria
			d) The assessment/s under RM7.8© must be completed and provide to the administering authority within 3 months of receiving the relevant sampling results. e) The 5-year timeframe under RM7.8(b) is reset by 4 occurrences of RM7.8(c)(i) and by a single occurrence of RM7.8(c)(ii) 7.9 Groundwater demonstrates non-polluting landform: a) Groundwater level is monitored at the locations specified in Figure 33 and all results must comply with level thresholds outlined in Table 43 for a minimum of 5 consecutive years. b) For a minimum of 5 consecutive years, groundwater quality must be monitored quarterly at but not limited to, the locations specified in Figure 33, for the quality characteristics listed in Table 42. c) Groundwater quality results must not exceed the limits in Table 42, for 3 consecutive results within a five year period
RM8	Achievement of target post-mining land use (Retained Infrastructure PMLU and Water Storage PMLU)	RA3	8.1 No infrastructure remaining other than those that form part of the landholder agreement. 8.2 Transfer of ownership agreements in place for all infrastructure to be retained. 8.3 Final landform survey confirms no built structures remain other than those that form part of a landholder agreement. 8.4 All retained water storages achieve geotechnical safety and stability as assessed and approved by an AQP. 8.5 No evidence of erosion on the retained dam banks classified as 'moderate' or 'severe' as defined by the Erosion classification framework5. 8.6 Retained dams are safe for stock access and have vegetated banks. 8.7 Water storages monitored quarterly must not exceed the limits in Table 39, for a minimum of 5 consecutive years

1. A Suitably Qualified Person (SQP) as per the EP Act Chapter 12, Part 3, 564.
(564) Suitably Qualified Person means for performing a regulatory function, means a person who—
(a) has qualification sand experience relevant to performing the function: and
(b) if a regulation prescribes an organisation for this paragraph—a member of the organisation

2. Site suitability statement retains its definition under the EP Act

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

4. 'Environmentally problematic material' means waste rock or processing materials that include one of the following characteristics: Potentially Acid Forming , saline, sodic, dispersive, high metal/metalloid concentrations and solubility.

5. Erosion classification framework:

Erosion classification	**Minor**	**Moderate**	**Severe**
Sheet erosion	Shallow soil deposits downslope	Partial exposure of roots; moderate soil deposits downslope	Loss of surface horizons, root exposure; moderate substantial soil deposits downslope
Rill erosion	<0.3m deep	<0.3m deep	>0.3m deep
	<15 rill/transect[1]	15 rills—30 rills/transect	>30 rills/transect
Gully erosion	Absent	>0.3m deep Gullies are linear, continuous, and restricted to primary or minor drainage lines	>0.3m deep Gullies are continuous or discontinuous, and either tend to branch away from primary drainage lines and on to foot slopes, or have multiple branches within drainage lines
Tunnel erosion	Absent	Absent	Present
Mass movement	Absent	Absent	Present

*the erosion classification framework is based on the 'Australian Soil and Land Survey Field Handbook' Third Edition. by the National Committee on Soil and Terrain (2009)

1. Transect linear 100 m across the contour (Source: Tongway, D. J. and Hindley, N. L. 2005. Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes. CSIRO Publishing, Canberra, Australia)

Table 22: Growth media criteria

Parameter	Unit	**Criteria**
pH	pH Units	6-8.4
ECe	dS/cm	<2
Exchangeable Sodium Percentage (ESP)	%	<6.0
Total Phosphorus	mg/kg	≥4

Total Organic Carbon	%	>1
Emerson Aggregate Test (EAT)	-	>3

6. Defined by the *Biosecurity Act 2014*.
7. Defined by *Invasive Plants and Animals Committee 2016, Australian Weeds Strategy 2017 to 2027,* Australian Government Department of Agriculture and Water Resources, Canberra.

8.2.1.1 Timeframes and land availability

RMs are required to be achieved as soon as practicable after land becomes available for rehabilitation. Section 126D (5) of the EA Act define land available as:

> *Land is available for rehabilitation if the land is not being mined, unless—*
>
> *(a) the land is being used for operating infrastructure or machinery for mining, including, for example, a dam or water storage facility; or*
>
> *(b) the land is identified in the proposed PRCP schedule or the application for an environmental authority for relevant activities to which the schedule relates as containing a probable or proved ore reserve that is to be mined within 10 years after the land would otherwise have become available for rehabilitation; or*
>
> *(ba) the land is required for the mining of a probable or proved ore reserve mentioned in paragraph (b); or*
>
> *(d) the land contains permanent infrastructure identified in the proposed PRCP schedule as remaining on the land for a post-mining land use*

As noted in section 1, on 30 November 2023 Bluff Mine entered a period of care and maintenance for an unforeseen duration. During this period no active mining activities will be undertaken within the mining leases, all mobile equipment will be removed from site with only water management infrastructure and building assets remaining.

On recommencement of operations, Bluff Mine has an estimated remaining life of mine of approximately 2 years to extract the proven ore reserves onsite. To enable the mining of this proven ore reserve Bowen PCI must place an estimated additional 3.0M m^3 of waste material across 331 Ha of the overburden dumps and require all current MIAs for ongoing management and maintenance of mobile equipment during operations. As these resources are required for the mining of a proven ore reserve this land does not currently meet the EP Act Section 126D(5) definition of land available and therefore rehabilitation activities for these areas have not been schedule for completion during this care and maintenance period.

As the duration of this care and maintenance period is unforeseen, and recommencement of mining operations is reliant on external factors outside the control of Bowen PCI (e.g. PCI coal price), rehabilitation of land currently unavailable has been scheduled in the PRCP Schedule (Appendix A) with consideration of the allowable maximum 10-year time frame in which mining of a proven ore reserve can be completed. Where land becomes available for rehabilitation earlier than the nominated 'Date area is available' or is able to commence earlier than the 'Commencement of first milestone' date, outlined in the PRCP Schedule (Appendix A), progressive rehabilitation for that land will commence as soon as practicable. Progressive rehabilitation commenced earlier than outlined in the PRCP Scheule will be carried out in accordance with the milestones and timeline as described in Table 21 and Table 23. Rehabilitation activities are expected to be begin within 2 years of mining operations recommencing at Bluff Mine.

Currently 25 Ha of overburden dumps meets the definition of land available. Rehabilitation of this areas is expected to commence in December 2025. This timing has been determined in consideration of works required to be completed by Bowen PCI to develop a health and safety management system for the care and maintenance period, in compliance with the *Queensland Health and Safety Act 1999* and Coal Mining Safety and Health Regulation 2017, and onboard contractors and equipment in accordance with this Health and Safety Management System.

No rehabilitation monitoring had occurred at the time of PRCP submission. As such, site-specific data relating to the timeframes required to achieve RMs was not available. Therefore, a conservative timeframe of 10 years for low intensity grazing areas has been proposed to achieve surface requirements. This timeframe takes into consideration unfavourable growing seasons and unforeseen extreme events such as droughts or storms that could negatively impact vegetation establishment.

The nominated rehabilitation timeframes considered for scheduling the RMs are shown Table 23.

Pre-construction landform design plan and report

Bowen PCI recognises the dynamic nature of the environment in which they operate. Accordingly, a pre-construction landform design plan and assessment report will be developed and certified by a third party AQP prior to the recommencement of coal extraction activities. This report will aim to validate the assessment outcomes presented within this PRCP, and will include:

- a landform stability analysis and model
- long-term geotechnical safety and stability assessment; and
- flood velocity analysis.

The landform stability analysis and model will be calibrated based on soil chemistry data collected from stockpiled and insitu topsoil just prior to recommencement of operations and intents to demonstrate that, based site specific soil chemistry, the final landform can achieve the criteria of the PRCP. The landform stability analysis and model will be undertaken in accordance with the latest version of the Queensland Government's 'Applying erosion and Landscape Evolution Models to assess post-mining landform stability: Technical paper' (Hancock 2025).

The long-term geotechnical safety and stability assessment will develop a geotechnical model of the entire site, that considers all credible potential instability mechanisms and include a stability analysis. The stability analysis will use quantitative methods such as probability of failure, strength reduction factor and FoS. A consequence assessment to evaluate the potential impacts of slope failure, considering the requirements and limitations and model uncertainties to validate the current stability criteria presented within the PRCP.

This flood velocity analysis will consider the requirements to implement control measures to mitigate potential impacts to the constructed landform from high-energy flow (≥2.5m/s).

Should any assessment within the pre-construction design plan and report indicate that there is a risk to achieving a stable condition of the final landform, an amendment to this PRCP and schedule will be submitted to the administering authority within 3 months of the risk being identified.

Table 23: Rehabilitation milestone timeframes justification

RMs	Applicable RAs	Summary rehabilitation methodology	Associated risks	Risk level assigned*	Nominated time frame (years)	Justification for assigned timeframe
RM1: Infrastructure decommissioning and removal	RA1 RA2 RA3	Infrastructure decommissioning and disposal	No risks were associated with infrastructure decommissioning	N/A	1	Some mine infrastructure (e.g. haul roads and tracks) will be required to facilitate rehabilitation activities and will therefore not become available for rehabilitation for several years post-closure. Decommissioning activities are considered 'Low' risk, therefore decommissioning is expected to take less than 1 year.
RM2: Management of contaminated land status	RA1 RA2 RA3	Remediation or removal of contaminated material (where applicable) Determination of contaminated land status by an SQP	Contaminated land Surface water impacts Groundwater impacts	Moderate	1	A contaminated land assessment will be undertaken by an SQP. If contaminated land is identified, remediation works will be undertaken promptly. Given the 'Moderate' risk classification associated with this activity, the timeframe assigned is 1 year.
RM3: Landform development (re-profiling / re shaping) of land affected by disturbance	RA1 RA2	Installation of drainage features Bulk earthworks re shaping Final re-profiling Geotechnical assessment of stability	Surface cracking Erosion Increased slope steepness	Moderate	1	As land becomes available, all bulk earthworks and installation of drainage features will be completed to design specifications and assessed as geotechnically stable by and AQP.

RMs	Applicable RAs	Summary rehabilitation methodology	Associated risks	Risk level assigned*	Nominated time frame (years)	Justification for assigned timeframe
						The timeframe assigned is 1 year. Due to the size of the fleet required to operate the Bluff Mine, rehabilitation activities of reshaping topsoiling and seeding are limited to a maximum of 60 hectares per year.
RM4: Surface preparation (topdressing, contour ripping, soil amelioration)	RA1 RA2	Surface preparation (e.g. topsoiling, contour ripping, soil amelioration activities as required)	Surface roughness in excess of that expected for the PMLU Erosion Insufficient density/diversity of vegetation	Moderate	1	Subsoil and topsoil amelioration and prompt vegetation establishment are key processes to minimise the identified risks. The timeframe assigned is 1 year. Due to the size of the fleet required to operate the Bluff Mine, rehabilitation activities of reshaping topsoiling and seeding are limited to a maximum of 60 hectares per year.
RM5: Revegetation (seeding and / or planting)	RA1 RA2	Revegetation with seed and / or tube stock consistent with the PMLU	Erosion Insufficient density/diversity of vegetation	Low	1	The seeding and / or planting of suitable target species is classified as 'Low' risk. The assigned timeframe of 1 year allows time for revegetation.

RMs	Applicable RAs	Summary rehabilitation methodology	Associated risks	Risk level assigned*	Nominated time frame (years)	Justification for assigned timeframe
RM6: surface requirements	RA1 RA2	Achievement of vegetation cover and species diversity. Erosion monitoring Removal of temporary erosion and sediment control structures Weed control. Surface water runoff is considered safe	Erosion. Failure to achieve vegetation cover and diversity Pests and weeds	Low	5	Achievement of target revegetation criteria is dependent on good climatic conditions and soil preparation. Allowance is made for poor growing seasons and extreme events such as droughts or storms that will negatively impact vegetation establishment, and consequent maintenance actions that may be required. Given these factors, five years has been assigned for these timeframes considering the time necessary for establishment of mature, self-sustaining vegetation.
RM7: Achievement of target post-mining land use (Low Intensity Grazing PMLU)	RA1 RA2	Pasture rehabilitation consistently similar milestone criteria Vegetation monitoring and maintenance as required Erosion monitoring	Insufficient density/diversity of vegetation Pests and weeds Erosion Vegetation failure (e.g. disease, drought).	High	5	
RM8: Achievement of target post-mining land use (Retained Infrastructure and water storage PMLU)	RA3	Confirmation that all non-retained infrastructure that does not form part of the landholder agreement has been removed. Water storages are safe, stable and consistent with the PMLU	Remaining infrastructure includes those that do not form part of the landholder agreement Water storages water quality exceeds limits	Low	1	Decommissioning activities are considered 'Low' risk, therefore decommissioning is expected to take less than 1 year.

* See section 9 for risk determination.

8.2.2 Management milestones

The nominated management milestones and timeframes for the NUMA in the final landform are outlined in Table 24. As there is only one IA at Bluff Mine, all the management milestones are applicable to it.

Table 24: Management milestones

Management milestone	Milestone criteria	Nominated time frame (years)	Management indicators
MM1 - Achievement of final landform design	1.1. Residual void designed with the following criteria: a) Highwall = 40° (84%) Low wall = 33° (65%) 1.2. Highwall landforms must: a) prevent surface or seepage flow of floodwater into the void b) be geotechnically stable when floodwater is against the creek-side batter; and c) not be constructed with dispersive material. 1.3. Certification by an AQP that: a) void highwalls, and low walls have been constructed as per the design criteria specified in 1.1 and 1.2; and the highwall, end wall and low wall achieve a FoS ≥1.5 within the NUMA extents. 1.4. Predictive modelling undertaken by an AQP, confirming that the voids will remain as a groundwater sink and that there is no risk of contaminant release to surface or groundwaters post-mining. 1.5. Residual voids must not overtop. 1.6. Voids are assessed to be geotechnically stable by an AQP. 1.7. Evidence has been included in decommissioning records of elimination of any exposed carbonaceous material that may present a spontaneous combustion risk. 1.8. Any carbonaceous material has been encapsulated within an inert cover.	1	Slope of void highwall and low wall Water level monitoring and modelling

Management milestone	Milestone criteria	Nominated time frame (years)	Management indicators
MM2 - Achievement of surface and safety requirements	2.1. safety assessments have been completed by an AQP for Highwall slopes 2.2. safety infrastructure established around the void, including: a) cattle exclusion zone to prevent cattle accessing the bunding; b) adequate bunding in place confirmed to be geotechnically stable by an AQP; c) perimeter fencing erected to prevent access to fauna and humans; and d) appropriate signage placed every 100 m of the perimeter of the void to clearly identify and convey the purpose (e.g. EP Act 1994 Non- Use Management Area No Entry). All signage has been erected in accordance with relevant guidelines and Australian Standards (AS1319:1994–Safety Signs for the Occupational Environment). 2.3. bunding constructed to the following design criteria: a) minimum base width of 5 m; a) a minimum height of 2 m; and b) located at least 10 m beyond the area potentially affected by any instability of the pit edge. 2.4. evidence has shown groundcover between the void crests and bunds as being >70% where groundcover is defined as any cover that assists in controlling erosion and may include live cover. 2.5. results have shown that, between the void crest and bund, significant active erosion features are not present and that any initial erosion has been stabilised by vegetation cover. 2.6. an audit of the hazardous materials register has been conducted to identify the location, use and disposal of potentially hazardous materials during the life of the mine 2.7. successful establishment of adequate drainage control between the Final Residual Void edge and location of bunds has been made to redirect any runoff away from the edge of the void.	1	Safety infrastructure established around the void. Safety assessments completed.
MM3 - Achievement of sufficient improvement	3.1. certification from an AQP that: a) no environmental harm will occur outside of the NUMA. b) the residual void is safe to humans and livestock c) the water quality and level in the void will not cause environmental harm to the surrounding environment, as demonstrated by long-term void and groundwater level and quality monitoring. d) the void acts as a groundwater sink to the receiving groundwater environment. e) maximum dimensions will not exceed surface water Level -133mAHD when monitored via LiDAR.	1	Geotechnical stability of void Geotechnical study completed by a SQP[1] assessing the FoS for all final landforms

Management milestone	Milestone criteria	Nominated time frame (years)	Management indicators
	i) the residual void has an adequate protection system to prevent inundation from a probable maximum flood (PMF) event, as confirmed by flood modelling undertaken by an AQP. ii) erosion of the landform within the NUMA area will not negatively impact on the stability of any adjacent rehabilitation areas, or their ability to sustain their PMLU. iii) Voids are assessed to be geotechnically stable, achieving: iv) a modelled FOS of ≥1.5 for the in situ pit walls before maximum in-pit water level is reached; v) a modelled FOS ≥1.5 for the in situ pit walls after maximum in-pit water level is reached; and vi) a FOS ≥1.5 for the spoil pit walls above the maximum in-pit water level 3.2. monitoring and maintenance of exclusion fences and bunds to be carried out to ensure they remain effective		

[1] A Suitably Qualified Person (SQP) as per the EP Act Chapter 12, Part 3, 564.
(564) Suitably Qualified Person means for performing a regulatory function, means a person who—
(a) has qualification sand experience relevant to performing the function: and
(b) if a regulation prescribes an organisation for this paragraph—a member of the organisation.

8.3 General rehabilitation practice

The rehabilitation practices used at any mining site inevitably evolve as a result of increasing knowledge gained from experience in the following areas:

- early rehabilitation successes and failures;
- weather, subsoils, soils, local flora and fauna and revegetation species; and
- site preparation, seeding practices, the maintenance and repair of previously rehabilitated areas and/or local agricultural practices.

For this reason, the rehabilitation practices outlined in the following subsections should not be interpreted as the precise method that will be used from this point on, but rather as a record of the current rehabilitation knowledge and intent at the time of writing; and with the expectation that rehabilitation practices will further evolve and develop from this point on.

While rehabilitation objectives, performance indicators and completion criteria for Bluff Mine are detailed at sections 8.1 and 8.2, from the perspective of operational rehabilitation planning and practice, the following overarching principles are considered key:

- Ensuring that reshaped areas proposed for rehabilitation meet the required landform design principles, that prepared areas meet the rehabilitation design specification for the area, and that local site drainage has been considered and surrounding areas graded to mitigate any rainfall run-off from adjacent areas to run-on to prepared RAs.
- Topdressing materials, final surface preparation methods and soil amelioration activities have the objective of supporting vegetative growth.

- Revegetation species selection, seeding and/or planting methods, and fertiliser applications target rapid vegetative ground cover effective at mitigating soil erosion, during the period of initial revegetation when areas are most at risk.
- Ongoing monitoring and maintenance are used both to assess rehabilitated area performance against completion criteria as well as to feedback to, and update rehabilitation practices; and to identify maintenance or modification requirements such that RAs are proceeding along a trajectory towards the designated PMLU.

There will be circumstances when rehabilitation practices outside of those discussed within this PRCP are utilised. For example, discrete areas of steeper slopes, rehabilitation failures or other scenarios that may necessitate more intensive rehabilitation practices. These circumstances will be identified, assessed and rehabilitation activities planned for as required.

8.4 Hydrogeology

The existing and pre-mining hydrogeological regime surrounding the Bluff Mine is detailed in section 4.5. To understand any potential impacts from the cessation of mining and the final landform, RDM Hydro undertook a predictive model assessment to review the post mining recovery rate for the groundwater regime 1000 years after mining ceases. The recovery of the system is illustrated in Figure 18 and Figure 19.

At the end of mining the extent of ≥ 5 m drawdown in the coal seam and ≥ 0.2 m in the Tertiary strata/regolith has a predicted range from the pit edge of 2.3 km and 860 m respectively. The sensitivity analysis indicated uncertainty that may extend 500 m in the coal seam under the base case predictions and 250 m in the Tertiary strata/regolith.

After 1000 years post mining the extent these drawdown extents are predicted range to increase from the pit edge of < 3 km and > 11 km respectively. The sensitivity analysis indicated uncertainty that may extend up to approximately 300 m to the east in the coal seam with predicted drawdown to the west limited by the presence of the fault. The expansion of the cone of depression post mining is due to the final void acting as a groundwater sink.

Although the predicted groundwater drawdown is expected to exceed the *Water Act 2000* trigger threshold for springs of 0.2 m (and as a proxy for terrestrial GDEs), there are no predicted impacts from groundwater drawdown as:

- there are no mapped springs within the predicted extent of drawdown exceeding 0.2 m;
- there are no mapped water course springs or wetlands within the predicted extent of drawdown exceeding 0.2 m, and
- GDEs are likely associated with the ephemeral perched aquifers in the alluvial sediments adjacent to the watercourse (Duckworth Creek) and are therefore not hydraulically connected to the water table and hence will not be affected by drawdown associated with mining.

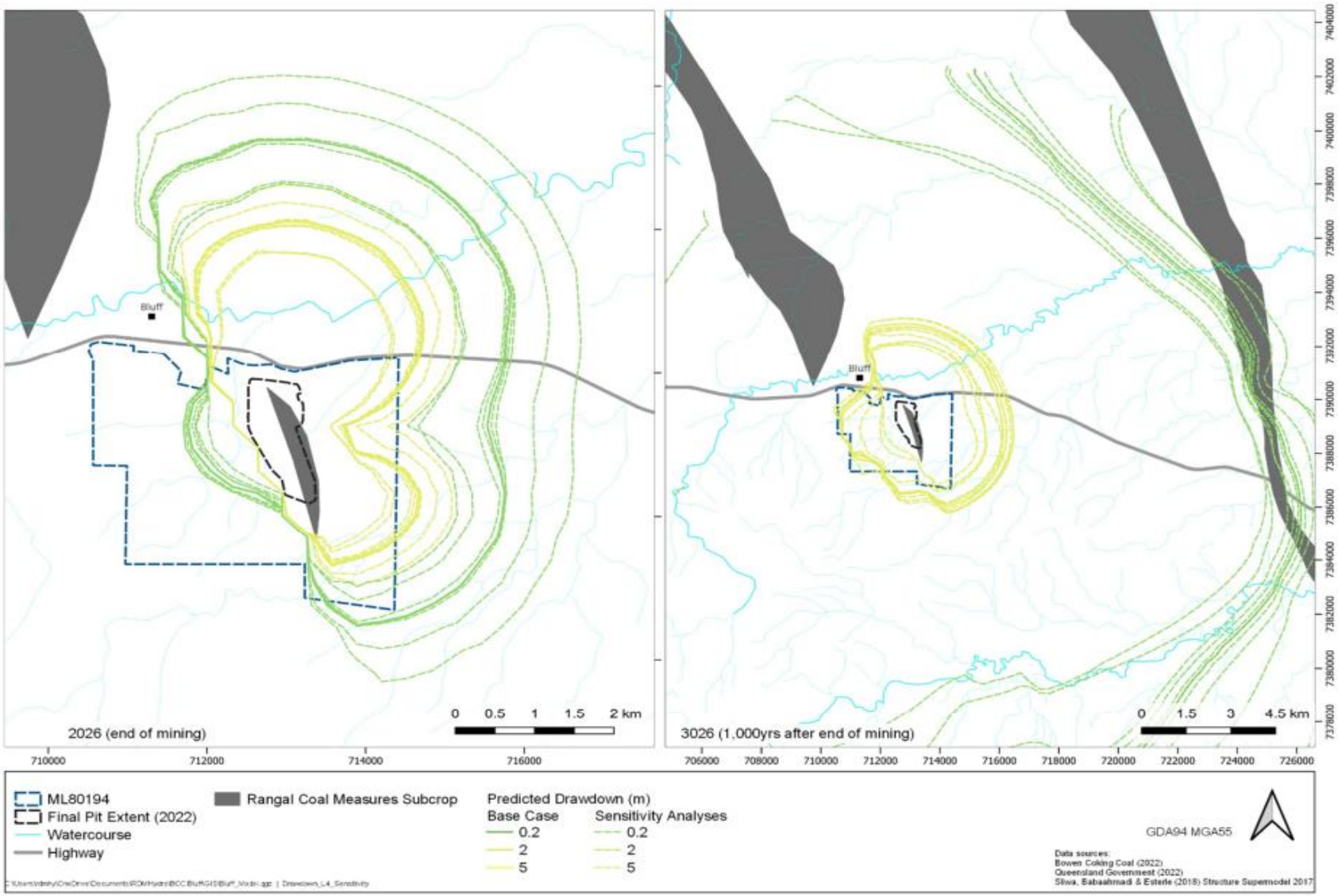

Figure 18: Predicted drawdown in the Coal Seams (RDM Hydro 2024)

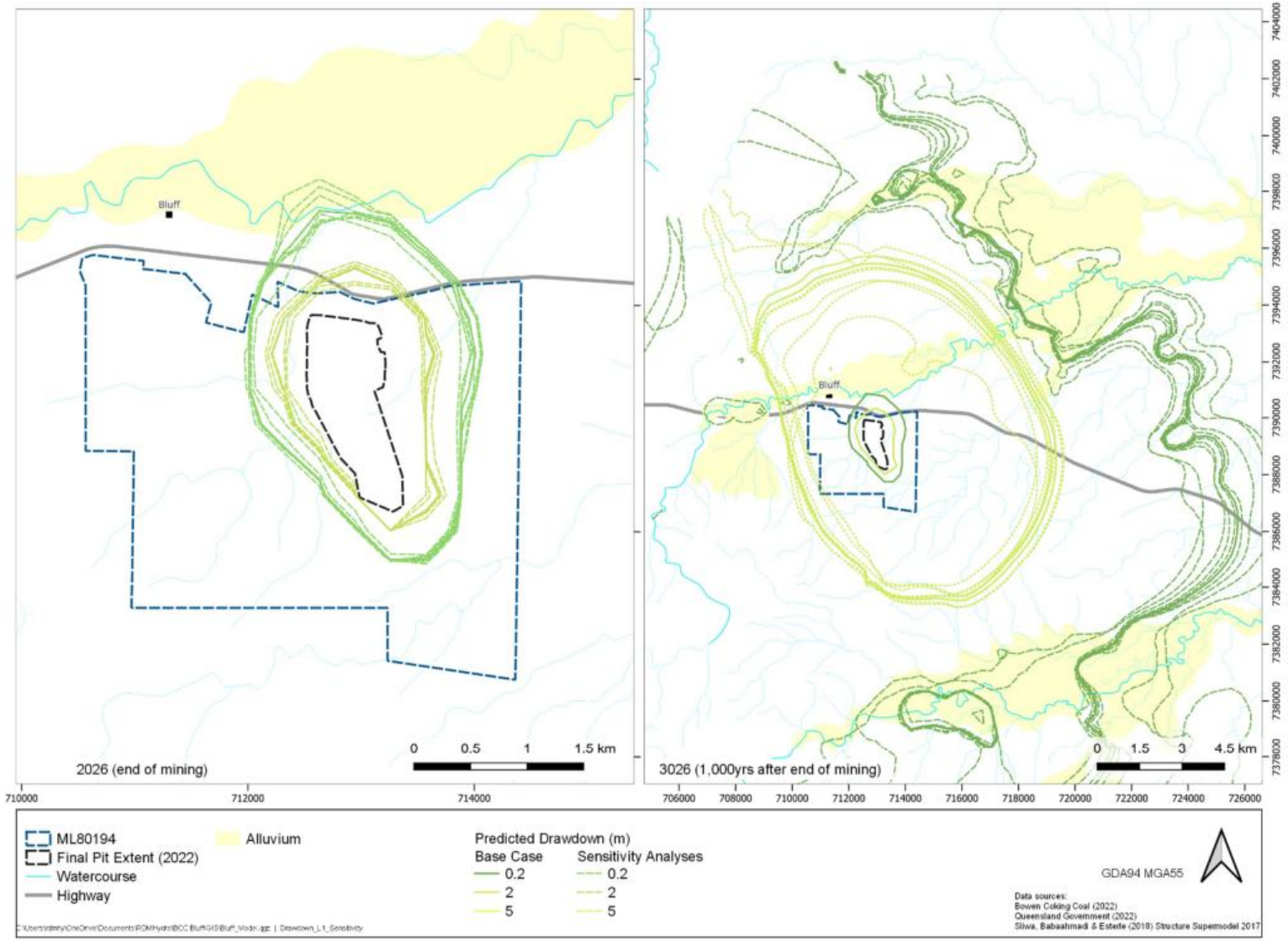

Figure 19: Predicted drawdown in the Tertiary/Regolith (RDM Hydro 2024)

8.5 Flooding

As noted in section 4.4.2, Bluff Mine is situated within the Duckworth Creek catchment, within the Mackenzie River sub-basin, of central Queensland's Fitzroy River Basin. Drainage lines of Duckworth Creek traverse the ML with the Duckworth Creek watercourse occurring 800 m—1.4 km downstream of the Bluff Mine. The approximate catchment area of Duckworth Creek is 2500 km^2 (FRC Environmental 2019).

Flood modelling has been undertaken by Engeny (2023) (Appendix E) to determine the final landform susceptibility to impacts from flooding. This assessment developed a Watershed Bounded Network Model to assess the design hydrology for the Bluff Mine final landform design (Engeny 2023). The model considered a catchment breakdown for Duckworth Creek and its associated catchments outside the mine lease, the pre-mining site based catchment delineation, and post closure landform catchment delineation. This study modelled six design events 0.1% Annual Exceedance Probability (AEP), 1% AEP, 2% AEP, 5% AEP, 10% AEP and 50% AER events and the PMF for the final landform.

The results from the flood model show runoff directed around the southern extent of the western overburden dump and between the residual void and western overburden dump.

The final landform design sufficiently manages runoff through the ML and minimised potential impacts to the final landform. Where interactions with rehabilitated dump surfaces, flood waters are generally contained by the drainage channels (Engeny 2023). The flood protection landforms implemented on the site will provide protection to the void up to AEP0.1% + 0.5m at a minimum.

The PMF flood events modelled for Duckworth Creek shows that the residual void is outside of the floodplain extent (Figure 20). With PMF levels more than 1 m below the lowest edge of the final void, providing a FoS for the event (Engeny 2023) (Figure 21).

Flood velocities were also modelled to determine potential impacts from runoff from the final landform. Results show that the velocities greater than 1.5 m/s are limited to the main drainage lines (i.e. Columba Creek) and is representative of velocities expected for natural waterways in the surrounding landscape (Engeny 2023). Flood velocities can be managed through vegetation establishment in drainage channels. As the 0.1% AEP and PMF flood events are considered very rare to extreme weather events, the erosional risk of the final landform as a result of flood has been determined as low (Engeny 2023).

However as discussed in Section 8.2.1.1, a pre-construction landform design plan and report will be completed prior to the recommencement of operations to consider the requirements to implement control measures to mitigate potential impacts to the constructed landform from high-energy flow (≥2.5m/s)

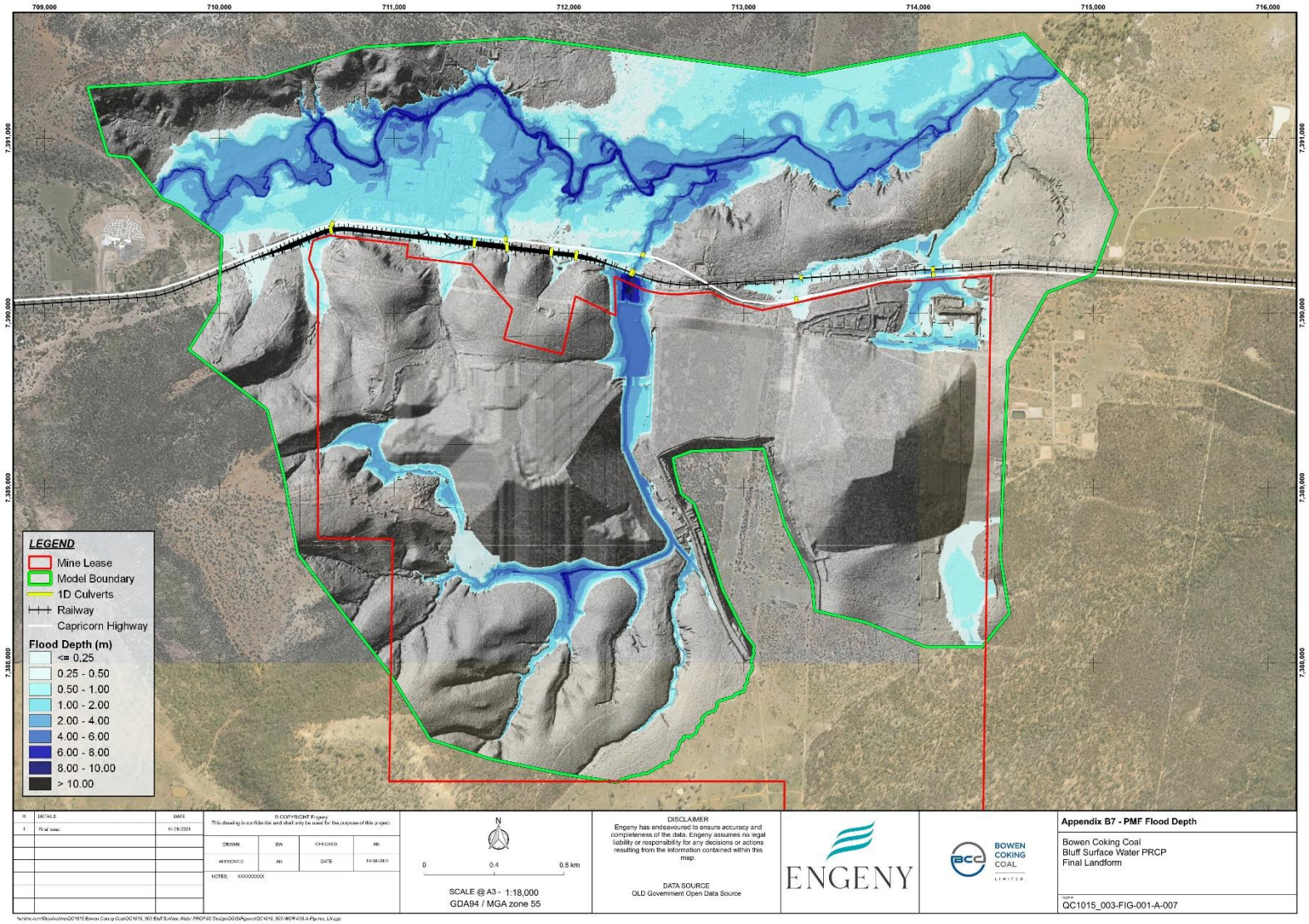

Figure 20: Bluff Mine PMF flood event (Engeny 2023)

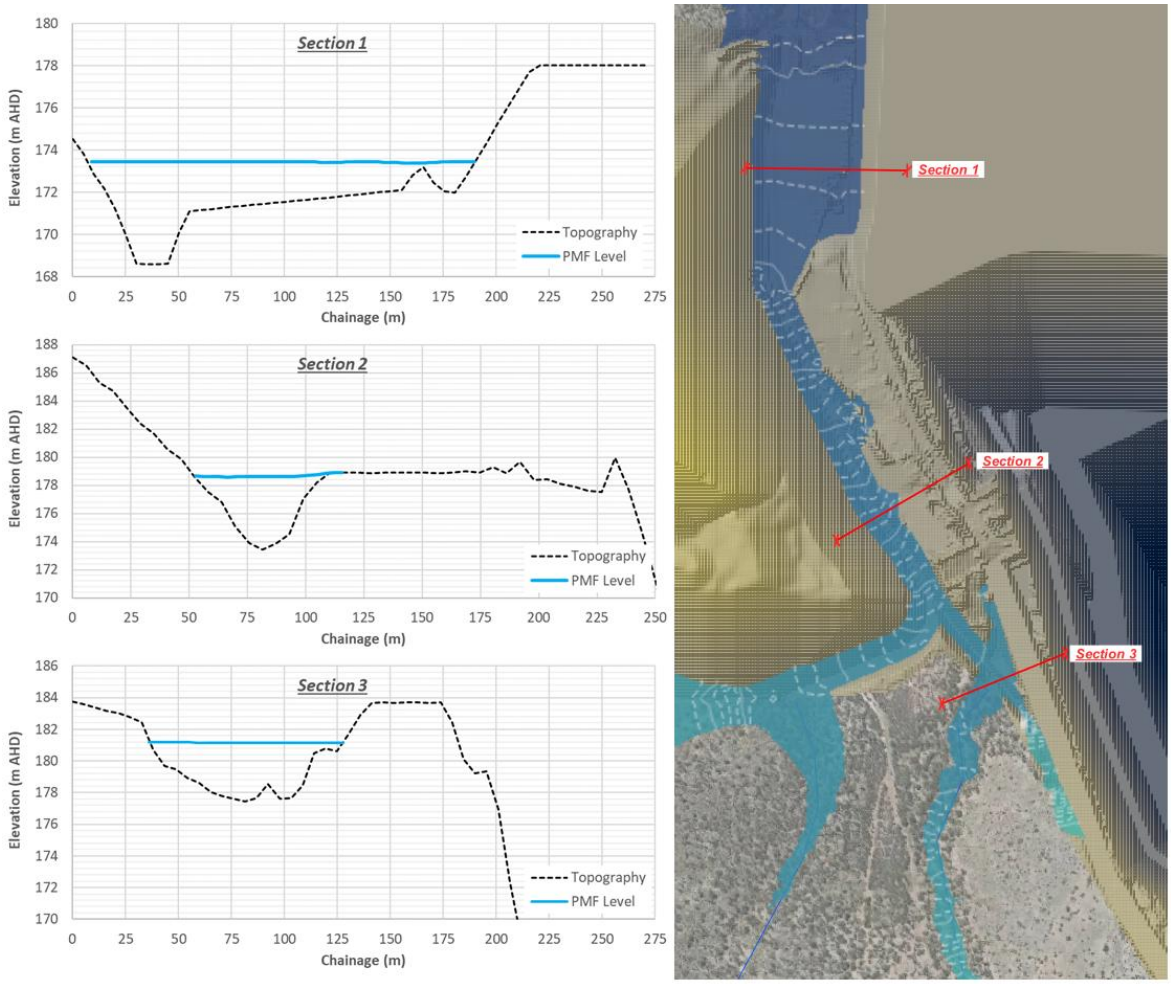

Figure 21: Columba Creek drainage line PMF level (Engeny 2023)

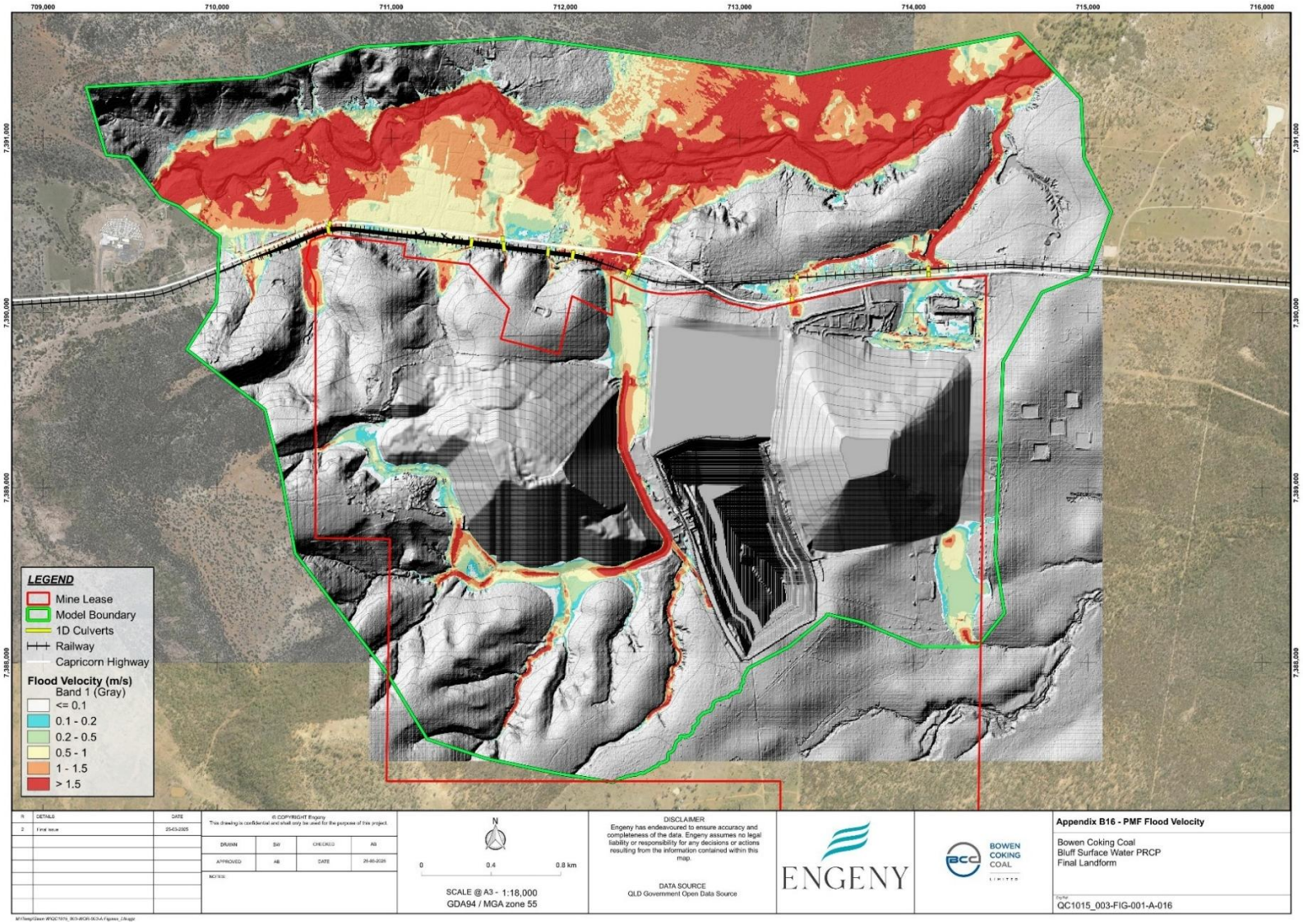

Figure 22: PMF Flood Velocity at Bluff Mine

8.6 Waste characteristics

Understanding of the geochemical characterisation of overburden materials has informed the selection of rehabilitation strategies, and appropriate PMLUs for Bluff Mine. Assessments of the overburden and coal reject materials has been conducted by O'Kane (2013), EGI (2018), and SMG (2020). These assessments identified and investigated the character of waste rock and coal units within Bluff Mine and highlighted any contaminants that pose a risk to the environment and the associated mitigation measures. Outcomes and recommendation from this assessment have been reproduced below for completeness.

8.6.1 Overburden and interburden geochemistry

A total of 58 samples were obtained within Bluff Mine from two drill holes. All collected samples tested had negative net acid producing potential and net acid generating pH values of greater than 4.5, indicating that materials were acid neutralising. The results from the assessment concluded that the overburden materials are likely to be non-acid forming (NAF) and unlikely to produce Acid rock drainage (ARD) (Appendix H). This outcome if supported by monitoring completed since mining operations commenced.

Total sulphur was also assessed to determine the capacity for acid generation (SMG 2020). Results showed that the majority of samples have values < 0.05% and approximately 11% of samples have total sulphur values of > 0.1%. Samples with higher sulphur values consisted of the coal sample, floor, and roof samples, which are unlikely to end up in the overburden dumps. The waste materials were assessed to have very limited potential for neutral mine drainage. Therefore, no special handling of overburden/interburden materials is required for ARD or neutral drainage control.

Field assessments indicated that arsenic, cadmium, and molybdenum were enriched in 8%, 13% and 0.6% of samples respectively (SMG 2020). Laboratory assessments of metal enrichment showed that arsenic was enriched in 3% of samples and all other elements had no enrichment. The metal and metalloid concentrations were generally low across all samples, with aluminium, boron and manganese slightly elevated in some samples. Seepage from the spoil dumps was determined to contain low concentrations of metals/metalloids.

Electrochemical Stability Index (ESI) results shows that 97% of samples have values < 0.05 indicating they are potentially dispersive with low structural stability (SMG 2020). Emerson aggregate classes were also used to predict the behaviour of samples, and results were consistent with the ESI results. This determines that samples had a moderate to high dispersion risk. Permian, fresh unweathered spoil is expected to be less dispersive than weathered spoil.

The overburden and interburden assessment conducted by EGI (2018) assessed the occurrence of pyrite and reactive carbonate. It was determined that the overburden/interburden is likely to have low ARD potential and overall excess buffering with minor observed pyrite and common occurrence of reactive carbonate throughout the samples. The findings presented were consistent with the previous geochemical test results by O'Kane (2013).

The potential for saline runoff and seepage was also assessed with $EC_{1:5}$ values ranging between 410 to 920 µS/cm (SMG 2020). The spoil salinity classification was therefore determined to be medium (SMG 2020) and therefore to ensure ongoing protection of downstream EVs, surface water monitoring criteria has been included in the milestone criteria outlined in Section 8.2.1.

8.6.1.1 Stability

Due to mineral waste generated at Bluff Mine having a potential to be sodic with a medium/high risk of dispersion, the proposed rehabilitated landform slopes have been limited to 10%. Furthermore, mining activities are scheduled so that fresh, unweathered Permian rock is placed on the outer batters of the slopes of the spoil dumps to limit dispersion and erosion. Weathered and tertiary rock, which recorded a higher propensity to dispersion, is placed deep in the spoil dump or in-pit. Rehandling of unweathered Permian rock is minimised to ensure stability of the landform. The GeoTek Solutions Pty Ltd (2013) Geotechnical Assessment for the Proposed Bluff Open Cut Coal Mine Project has accepted this management practice.

Furthermore, to ensure long-term stability, the maximum expected height for the out-of-pit overburden dumps is limited 30 m and are located a minimum of 50 m back from the pit crest to minimise loading on the pit wall. GeoTek Solutions 2013 recommended overall slope angle of 15% or 8.5° which is slightly higher than that proposed in Bluff Mine EA (≤10%).

8.6.2 Course reject geochemistry and stability

As described in section 3, coal is sent to an offsite coal handling and processing plan, and the rejects are sent back to site and incorporated into the dumps. Similarly, to weathered and tertiary rock, rejects materials are placed deep in the spoil dump or in-pit.

The 2013 (SLR) (Appendix G) assessed samples collected as representative of floor and roof of the coal seams as likely representative of course reject materials generated at Bluff Mine. Their assessment of these samples concluded that course rejects onsite will:

- not contain contaminants in levels that are a potential risk to human health from chronic exposure;
- majority of course reject material can be considered NAF; and
- total sulfate for reject material was considered low (range <100-710 mg/L) and are below the threshold where the potential for saline drainage typically occurs.

Nonetheless, similarly to weathered and tertiary rock, reject materials are placed deep within overburden dumps or within pit.

8.7 Final landform design

The landform design for Bluff Mine was created in consideration of the EA design criteria (Table 25), the targeted PMLU, surrounding topography of the land, relevant literature including regulatory publications, best practice guidelines, existing site documentation, historical data and rehabilitation and landform design insights from comparable mines in Central Queensland. The landform will be designed to be free-draining and water shedding.

The final landform has been designed to limit the size of the final footprint while maximising usage of areas already disturbed for the open cut pits.

Table 25: EA (EPML02090614) Landform Design Criteria

Disturbance Type	Slope Range (° degrees and %)
Residual Void—Low Wall	33° and 65%
Residual Void—Highwall	40° and 84%
Overburden dumps	≤ 5.7° and 10%

The approved Bluff Mine final landform consists of the following:

- In-pit and out-of-pit waste dumps.
- One residual void.
- Water storage/water management dams
- Rehabilitated infrastructure areas including mining infrastructure areas, roads and drainage lines.
- Retained infrastructure.

The final landform is presented on Figure 23 which includes surface elevation contours.

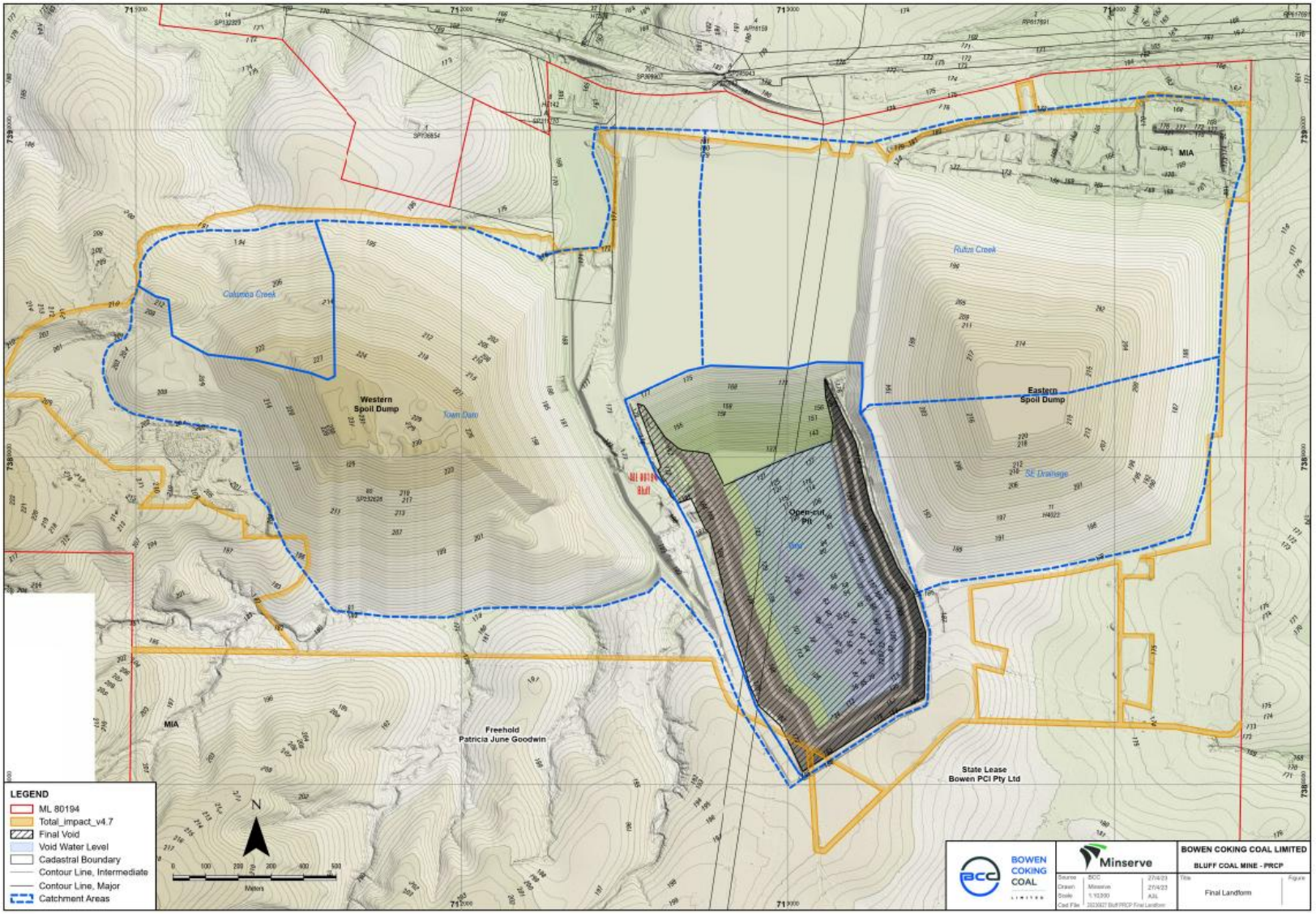

Figure 23: Final landform design

8.7.1 Long-term stability

The key environmental factors relevant to Bluff Mine, to ensure long-term stability, relates to the erosive potential of materials, and by extension, the erosive stability of the landforms. The long-term stability of the final landform was the principal consideration for the landform design concept, with a secondary consideration being the achievement of the PMLU of cattle grazing.

To verify the final landform suitably mitigates the erosive risks of the landform an erosion modelling through Water Erosion Prediction Project (WEPP) was conducted. WEPP modelling considers four key data points: climate information, soil profile, land use management and slope design.

Climate parameters were modelled from the area using CLIGEN 5.3, with input data sourced from SILO (daily rainfall, maximum and minimum temperature, solar radiation, and maximum relative humidity) and the Bureau of Meteorology (BOM) (pluviography data).

To develop soil profiles the eight (8) soil units identified in the SLR (2013) Soils, Land and Overburden Assessment report were grouped into the five (5) soil types for modelling, as follows:

- Mottled-Mesonatric Brown Sodosol;
- Dystrophic Red Kurosol;
- Dystrophic Red Chromosol;
- Subnatric Brown Sodosol; and
- Dystrophic Red Kandosol.

The model considered site-specific inputs including sand, clay and rock content (percent), organic matter (percent) and CEC (meq/100g), as determined within SLR (2013) and shown below in Table 26. The initial saturation was left at a default value of 75%, and interrill erodibility, rill erodibility, critical shear and effective hydraulic conductivity were calculated from the model for each soil profile based on the site-specific inputs. The site inputs for the WEPP within Table 26 were combined by soil group resulting in the five soil types as described above.

Table 26: WEPP site-specific inputs

Soil Unit	Soil Group	Sand	Clay	Organic matter	CEC (cmol/kg)	Rock
1	Mottled-Mesonatric Brown Sodosol (Type 1)	87	6	0.73	2.9	1
2	Mottled-Mesonatric Brown Sodosol (Type 2)	85	7	0.59	2.2	1
4	Dystrophic Red Kurosol (Type 1)	72	16	0.92	1.3	4
5	Dystrophic Red Chromosol	87	7	0.58	2.3	2
6	Dystrophic Red Kurosol (Type 2)	79	13	1.69	1.4	1
7	Subnatric Brown Sodosol	65	17	1.36	5.3	5
8	Dystrophic Red Kandosol	83	13	0.49	2	1

Wang *et al.* (2022) concludes that satisfactory predictions of runoff and soil loss can be made without laboratory testing. As such it is reasonable to conclude that site-specific data can be used to accurately provide baseline erodibility parameters for the site. These baseline parameters can then be considered sufficient for predicting runoff and soil loss.

In creating the land use management parameters for WEPP modelling, soil cover classes were established at 5% intervals ranging from 5% to 100%. Vegetation cover was fixed at these percentages throughout the WEPP simulations, ensuring consistent cover without growth or decay across the 100-year simulation period without growth or decay.

Slope design specifications were sourced from the proposed final landform design. Slopes were selected as representative of the maximum allowable slope of 10%, in accordance with the EA completion criteria, as shown in Figure 25. The selected slopes generally reflected an approximately height of 240 m RL (AHD), with the bottom of the slope approximately 193 m RL (AHD), giving a slope height of ~30 m. The slope is generally on a decline over ~475 m, with an approximate slope of 5.6 degrees or >10%.

A total of 560 WEPP iterations (100 years) were run, covering the range of soil samples and land use management profiles identified above. The maximum potential erosivity of the landforms was determined and expressed in tonnes per hectare per year (t/ha/yr), for each iteration and assessed against a target and maximum erosion rate. A target (or 'tolerable') erosion rate of 5 t/ha was adopted for assessing land suitability and erosivity risk (Landloch 2013; Howard and Loch 2019). A maximum tolerable erosion rate of 10 t/ha was adopted, as the rate was considered acceptable for mining rehabilitation purposes (Lu *et al.* 2001). The result of this analysis is presented in Figure 24.

The average base erosion (minimal vegetation cover, 5%) modelled for the representative final landform slopes is 10.17 t/ha/yr, with a maximum base erosion rate of 16.25 t/ha/yr.

The model results indicate the proposed 70% vegetation cover will provide an erosionally stable landform that is significantly below the maximum tolerable and target erosion rate threshold.

As described further in Section 8.2.1.1, ythe outcomes of the WEPP and Geotechnical assessments will be reviewed prior to the recommencement of mining activities

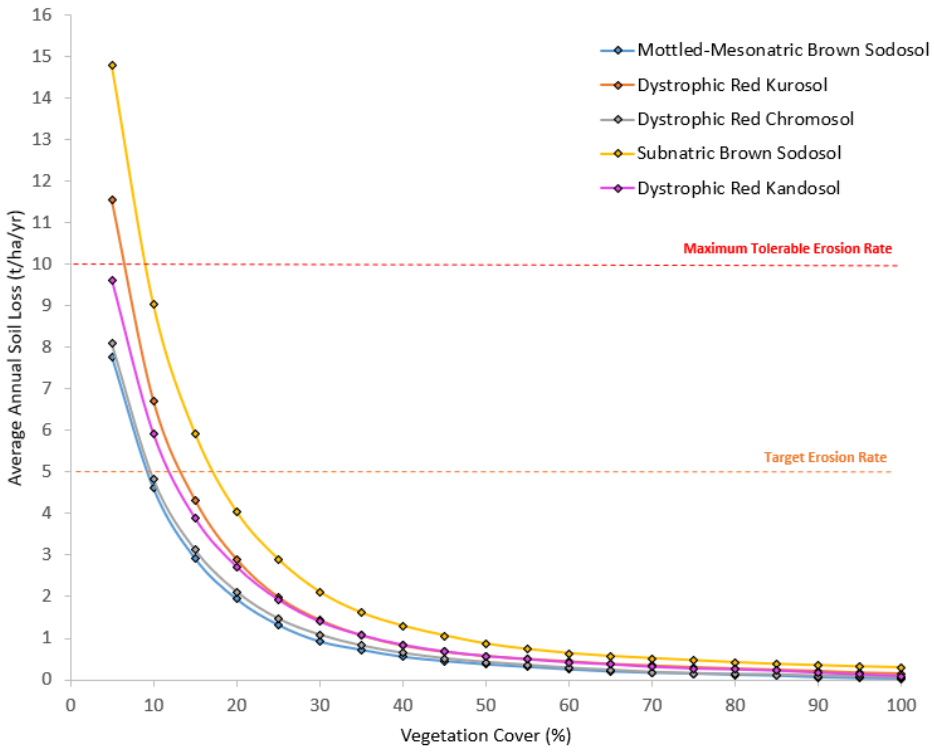

Figure 24: Average annual soil loss rates (t/ha/yr) as vegetation cover increases

Figure 25: Modelled slope locations

8.7.2 Method of construction

During the excavation of the box cuts, waste rock is loaded into haul trucks for hauling to overburden dumps. Once sufficient space is available behind the active face, waste rock material is placed in-pit behind the active workings to minimise surface disturbance associated with the overburden dumps. When the overburden dumps rock emplacements are no longer required (i.e. once in-pit emplacement resumes), progressive rehabilitation will be commenced to minimise the amount of time there is active disturbance associated with the overburden dumps.

The operational landforms (slope, height, size/footprint etc.) for overburden dumps are designed considering the size/footprint, height, and operational slopes of the final landform. In this way the overburden dumps at cessation of operation are as close as possible to the approved final landform design, reducing the bulk earthwork requirements to achieve the desired final landform. A cross -section of the proposed overburden dumps profile is provided in Figure 26.

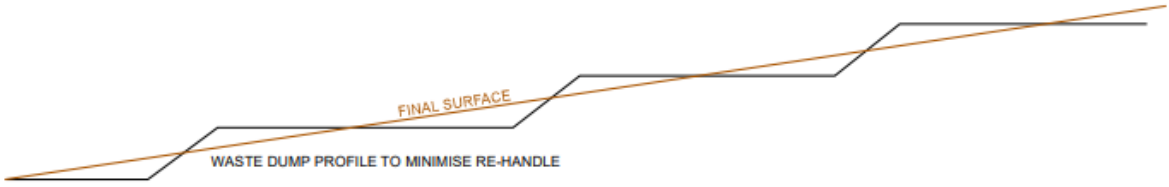

Figure 26: Out-of-pit overburden dump typical profile (GeoTek Solutions 2013)

8.7.3 Quality assurance/ quality control requirements

Key risks related to the construction of the final landform include deviations from the design plan, the use of materials that do not meet the required specifications, substandard construction quality, and the failure of QA/QC processes to detect any issues during construction. The management of final landform construction, along with technical oversight and QA/QC, will be undertaken by an AQP to ensure compliance with the design specifications. During construction and reshaping, Global Positioning System (GPS)-guided machinery will be utilised, with periodic monitoring conducted via LiDAR, aerial, or ground-based surveys to ensure alignment with the design.

Quality control during construction will be addressed through thorough mine planning and diligent field supervision. An AQP will prepare a QA/QC document to certify that the final landform design has been completed according to the plan and is stable.

8.7.4 Trial methodology

As rehabilitation has yet to commence at Bluff Mine, a series of trial are proposed within Section 9.5 to validate and, where possible improve, the rehabilitation methodologies proposed. Furthermore, as discussed in Section 10, rehabilitation progress is reviewed annually and where identified, modifications to rehabilitation practices will be implemented, as needed to improve rehabilitation outcomes.

8.7.5 Limitation and assumption of the landform.

The final landform design has certain constraints and limitations, including:

- the accuracy of soil availability and quality at the time of closure;
- the potential impacts of climate change on the intensity, duration, and frequency of future rainfall events;
- the characteristics of the final waste material;

- the materials tested are representative of the broader lithologies; and
- the waste material's nature remains consistent with current assessments.

8.8 Soil and capping material assessment

As discussed in 4.7, prior to mining SLR (2013) undertook a soil and land suitability assessment considering future rehabilitation and any additional amelioration requirements within Bluff Mine area (Appendix G). The main findings showed that:

- all soil units have low CEC;
- all soil units show poor fertility characteristics;
- most soil units presented with a typically poor soil structure in the second soil horizons making them unsuitable for rehabilitation;
- Sodosol soil units were sodic, however, the ESP values (<30%) indicated that this soil can be used is appropriately treated with gypsum or lime; and
- Kurosol soil units were strongly acidic and amelioration is required to improve the pH.

Due to subsoil's limiting factors, including acidity and salinity, the primary media described in Table 27, will be targeted for stripping for reuse within rehabilitated areas. Table 27 further describes the suitable soil stripping depths and amelioration requirements for each soil unit identified within Bluff Mine. However, as discussed further in Section 9.5, during progressive rehabilitation at Bluff Mine, ongoing soil sampling and analysis will be conducted to determine fertiliser and amelioration requirements to maximise revegetation success.

Topsoil stockpiles will be used for rehabilitation purposes. In accordance with Bowen PCI's Topsoil Management Procedure, topsoil locations are placed in areas away from mining activities and drainage lines to minimise erosion. To minimise rehandling of the soils, they have been placed near soon to be rehabilitated areas which also exclude cattle, machinery, and vehicles.

Table 27: Ameliorant requirements

Soil unit number	ASC order	Soil depth (m)		Ameliorant requirements
		Primary media	Secondary media	
1	Sodosol	0—0.2	0.6—1.0	Second topsoil horizon not suited due to structure and sodicity. Organic amendments and fertiliser to improve topsoil nutrient status. Gypsum to reduce ESP in subsoil. Lime or dolomite to improve subsoil pH
2	Sodosol	0 - 01	0.6—1.0	Second and third horizon not suited due to structure and/or gravel content. Last horizon not suited due to salinity. Organic amendments and fertiliser to improve topsoil nutrient status. Add gypsum to reduce ESP in subsoil.
3	Sodosol	0—0.2	1.0—1.3	Second horizon not suited due to structure. Third horizon not suited due to sodicity. Organic amendments and fertiliser to improve topsoil nutrient status. Gypsum to reduce ESP in subsoil.
4	Kurosol	0—0.2	0.5—1.0	Second topsoil horizon not suited due to structure. Organic amendments and fertiliser to improve topsoil nutrient status. Lime or dolomite to improve acidic pH in topsoil and subsoil.
5	Chromosol	0—0.1	0.2—1.2	Organic amendments and fertiliser to improve topsoil nutrient status.
6	Kurosol	0—0.1	0.4—1.3	Second horizon not suited due to structure. Organic amendments and fertiliser to improve topsoil nutrient status. Lime or dolomite to improve pH in topsoil and subsoil.
6 P1	Kurosol	0—0.2	0.4—0.8	Organic amendments and fertiliser to improve topsoil nutrient status. Lime or dolomite to improve pH in topsoil.
7	Sodosol	0—0.2	0.2—1.3	Organic amendments and fertiliser to improve topsoil nutrient status.
8	Kandosol	0—0.4	0.4—1.0	Organic amendments and fertiliser to improve topsoil nutrient status. Lime or dolomite to improve pH in topsoil.
9	Dermosol	none	0—0.6	Further testing required to determine ameliorant requirements prior to use in rehabilitation

8.8.1 Topsoil stockpile procedures

Topsoil management is described in the Bowen Coking Coal (BCC) Bluff Mine Topsoil Management Plan, which is reviewed every two years and are summarised below.

Topsoil stockpile management

Where stockpiling of topsoil is required, the following measures for soil management will be implemented where relevant and practicable, to reduce the risk of soil degradation and improve the chances of rehabilitation success:

- Topsoil stockpiles should be less than 2 m high and be contoured and positioned in a manner that encourages water drainage and discourages erosion. Grass germinating from the soil seed bank are to be maintained as a protective cover for stockpiles;
- If stockpiles fail to develop a natural grass cover, stockpile will be seeded with a fast-growing, non-invasive, commercially available sterile grass species;
- If there is a risk of a grass cover not establishing voluntarily, stockpiles will need to be ripped and seeded with a quick establishment pasture;
- Topsoil should be stockpiled for the minimum time practicable;
- Stockpiles are to be monitored annually for weeds and control measures implemented as appropriate; and
- Topsoil stockpiles are located in areas fenced from livestock.

Topsoil stockpile monitoring and maintenance

Topsoil stockpiles are to be monitored regularly to ensure that minimal loss of topsoil is incurred. Monitoring is recommended to be undertaken after major rainfall events, significant dust storms and in conjunction with bi-annual erosion and sediment control inspections.

To prevent erosion and soil loss stockpiles are seeded, where appropriate, to provide groundcover. Where stockpiles do not have adequate vegetation cover these stockpiles are 'turned' regularly to encourage the continued growth of microbacteria.

8.8.2 Materials balance

Topsoil resources currently stockpiled on site as of March 2024 totals 581,564m^3, the location of these topsoil stockpiles is shown below in Figure 27. The topsoil resources remaining to be stripped is detailed in Table 28. This consist of a total of 13,158m^3 topsoil and 52,632m^3 of subsoil. The estimated total volume of growth medium stockpiled and to be harvested on site is 647,354m^3. With the application of the 5% handling loss, the total volume available is 617,986m^3.

Bluff Mine has a total disturbance area requiring growth media application of 449.4ha. This allows for ~140mm of topsoil, from available stockpiles to be spread across mining disturbance.

Table 28: Remaining topsoil to be stripped for rehabilitation

Soil unit number	Stripping depth (m)		Stripping Area (ha)	Volume (m^3)	
				Topsoil	Subsoil
	Topsoil	Subsoil			
2	0.1	0.4	13.158	13,158	52,632
Total			**510.2**	**13,158**	**52,632**

To ensure an adequate rooting depth for plants is established onsite, a growth medium depth of 200mm will be applied to the site.

To address the gap between available topsoil and targeted rooting depth, and maximise the success of rehabilitation at Bluff Mine, Bowen PCI will commence the implementation of the rehabilitation trials described in 9.5. These trial aim to assess the suitability of the subsoil and spoil as a growth material, by testing different mixes of spoil, subsoil and topsoil with the addition of ameliorants. This will be achieved by demonstrating a successful revegetation outcome that meets the requirements of the PMLU.

Soil health and suitability assessments will be undertaken on all generated growth media. Where deficiencies are identified, ameliorants will be applied as necessary to the growth media to ensure it is fit for purpose.

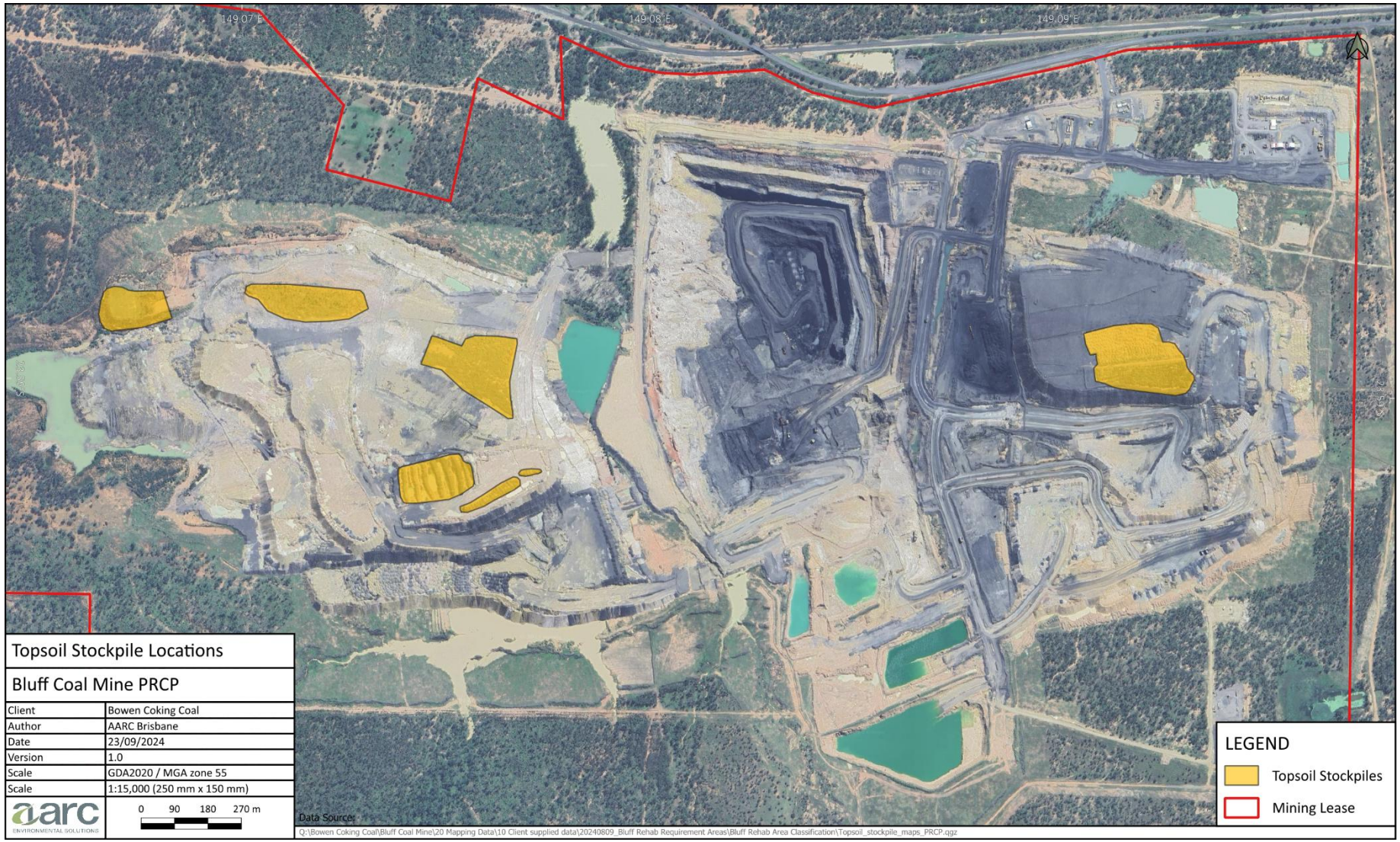

Figure 27: Topsoil Stockpile locations

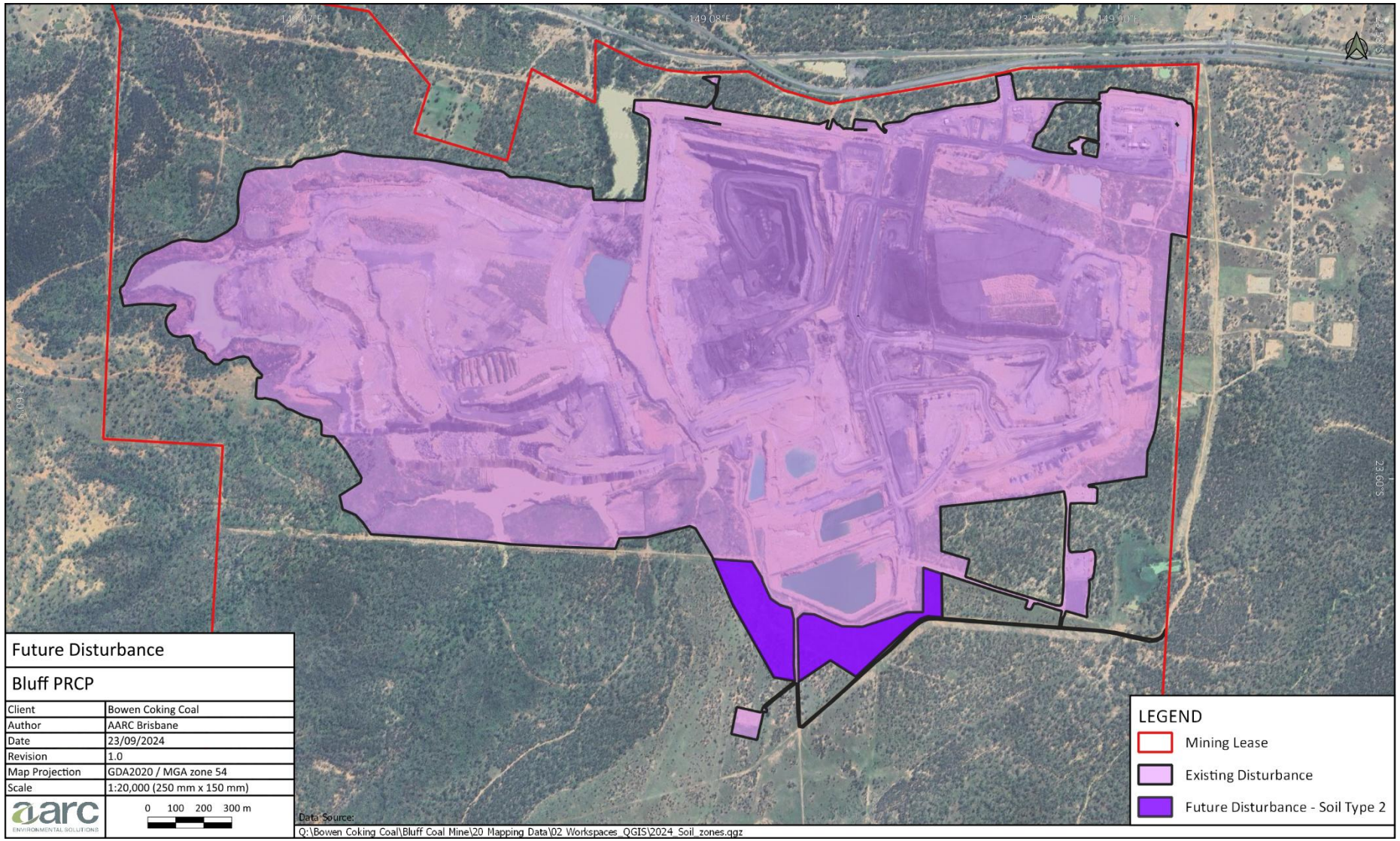

Figure 28: Future disturbance areas

8.9 Site preparation

The final landform will be reshaped and profiled according to the final landform design and specifications outlined in section 8.7. The approach to surface preparation will involve:

- Identification of the topsoil resource to be utilised for a given rehabilitation area, and the carrying out of composite soil sampling and agronomic laboratory analyses.
- Determination and procurement of type and quantity of ameliorants that would be beneficial for the topsoil resource (if needed).
- Where practicable, topsoil placement and seeding will occur in October-November, shortly before the commencement of the wet season.
- Topsoil should be placed by scraper or truck at the top of the profiled slope and pushed by a dozer or grader to achieve desired thickness of 100 mm (+/- 10 mm).
- Following fine spreading of topsoil, the dump surface will need to be ripped to break up any compaction and provide surface roughness. Ripping will be undertaken by a dozer or grader to a depth of between ~0.2- 0.5 m with a distance between rips of approximately 1 m, to encourage infiltration of water for plant growth.
- Seeding of topsoil to occur as soon as possible to encourage plant growth and prevent soil loss erosion.

Where needed, erosion mitigation measures will be constructed on slopes, including contour ripping swales will be placed every 220m, running both horizontally and vertically. Where necessary, mulch may be applied to mitigate erosion however, in the event where suitable mulch is not available, alternative measures will be investigated.

8.10 Revegetation

8.10.1 Seed selection

Bowen PCI will engage with technical rehabilitation specialists to determine the most appropriate seed mix selection to maximise rehabilitation success. A preliminary species list has been determined for Bluff Mine site and will be reviewed before and during rehabilitation. Table 29 includes suitable species for the grazing PMLU, based on the soil characteristics on site, as well as including species that are consistent with the surrounding landscape. However, all seed mixes must include a sterile grass (Shirohie millet, *Echinochola esculenta*) which will act as a cover crop. This will help to rapidly establish ground cover and minimise topsoil loss. This approach will also help to supress weeds and assist in restarting biological processes in the soil, creating a favourable micro-environment for the germination and emergence of the native seeds

The species listed in Table 29 are indicative only and are subject to change with season, availability, and following assessment of rehabilitation performance. All species listed are suited to the climate and site-specific environmental conditions that are experienced at Bluff Mine. At a minimum the low intensity grazing PMLU will have a seed mix which includes a minimum of 25% (by weight) native species, four 3P pasture species, two legumes and two shad tree species.

Sowing rates will be determined by and AQP, based on recommendations from the Department of Agriculture and Fisheries (2017), relevant guidelines (DAFF 2013; Australian Government 2017), and Future Beef (2022), beginning with a minimum of 10kg/ha. Ideally, sowing will take place within one week of topsoil placement and ripping. Newly seeded areas will be fenced appropriately to exclude stock from grazing to allow the highest change of germination and survival.

Monitoring of rehabilitated areas will commence at the wet season following rehabilitation works and will be carried out in conjunction with the Monitoring and Maintenance Program (Section 10).

When sourcing native seed stock, the use of local provenance native seed will be prioritised, being better adapted to Bluff Mines's edaphoclimatic conditions. A non-endemic option may exist where seed for the selected species is not available. Species selection will be planned sufficiently in advance to improve the ability to obtain commercial quantities.

Table 29: Preliminary species list for grazing PMLU

Common name	Scientific name	Classification
Pitted Bluegrass	*Bothriochloa decipiens var decipiens*	Grass
Forest Bluegrass	*Bothriochloa bladhii ssp. bladhii*	Grass
Queensland Bluegrass	*Dichanthium sericeum*	Grass
Bambatsi panic	*Panicum coloratum cvv. makarikariense*	Grass
Many-headed wiregrass	*Aristida caput-medusae*	Grass
Purple Wire Grass	*Aristida ramosa*	Grass
Purple pigeon	Setaria incrassata	Grass
Rhodes grass	*Chloris gayana cvv. Callide*	Grass
Rhodes grass	*Chloris gayana cvv. Katambora*	Grass
Bambatsi panic	*Panicum coloratum cvv. makarikariense*	Grass
Purple pigeon	*Setaria incrassata*	Grass
Bisset creeping blue grass	*Bothriochloa insculpta cvv. Bisset*	Grass
Caribbean stylo	*Stylosanthes hamata cvv. Verano or Amiga*	Legume
Roundleaf cassia	*Chamaecrista rotundifolia*	Legume
Caatinga stylo	*Stylosanthes seabrana cvv. caatinga*	Legume
Burgundy bean	*Macroptilium bracteatum*	Legume
Shirohie millet	*Echinochloa esculenta*	Cover crop

8.10.2 Weed control

Throughout rehabilitation works, weed management and controls will be implemented regularly across Bluff Mine to control declared weeds and those with the potential to impact revegetation success. Any areas that are currently undergoing rehabilitation will be restricted to avoid unnecessary disturbance and prevent the spread of weeds. Any vehicles or equipment travelling and used on rehabilitated areas will undergo a wash down prior to access.

8.11 Water management infrastructure

All newly rehabilitated areas are required to drain to erosion and sediment control (ESC) devices and will be maintained as a free drainage landform. With the following aspects were considered in the selection, installation, and management of the ESC devices on newly rehabilitated landforms:

- Sediment dams are to be designed in accordance with International Erosion Control Association guidelines;
- Additional erosion controls should be considered at inlet points and outlet spillways;

- Very small RAs may be able to be sufficiently controlled with temporary sumps, coir matting, or other ESC methods;
- All ESC structures should be inspected following significant storm events (>50mm of rain) to ensure their operation integrity is maintained;
- Sediment dams may require desilting to maintain their design operational capacity; and
- ESC structures are to be retained until RAs have been stabilised and run-off water quality meets WQOs.

Drainage channels will be constructed to divert water away from non-rehabilitated areas to maintain separation of non-mine affected and mine affected water and minimise the erosion potential in recently rehabilitated areas. Once a suitable protective groundwater is established, all drainage lines and channels, will be decommissioned and incorporated into the final landform design.

Prior to the recommencement of mining activities, a design plan and report will be completed. This will identify locations of high risk where high-flow velocities (≥2.5m/s) interact with the final landform. These areas will be assessed by an AQP to determine parameters that will reduce these risks. This is further discussed in Section 8.2.1.1.

8.12 Residual void

One residual void is approved at Bluff Mine. The residual void has been designed to not cause any serious or ongoing environmental harm to land, surface water or groundwater.

8.12.1 Final landform design

In accordance with the EA criteria, the residual void will be design in accordance with the criteria outlined in Table 30 to a FoS ≥ 1.5 (depicted in Figure 29).

Table 30: Residual void design

Highwall—competent rock average slope	Lowwall—competent rock average slope	Void maximum surface area (ha)
40° (84%)	33° (65%)	48.8

To ensure the safety of the residual void, the final highwall and lowwall slopes will be assessed by a suitably qualified geotechnical engineer. With the following factors considered:

- long-term residual void water levels;
- height and inclination of slope and number and spacing of intermediate benches (as may be required to achieve the final slope);
- shear strength of the lowwall and highwall soils and rock; and
- density and orientation of fractures, faults, bedding planes, and any other discontinuities, and the strength along them.

The residual void will be left in a safe condition by constructing safety bund walls, remediated waterways, fencing, and signage to limit human and animal access. The safety bund wall will be constructed as described in Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland (DME 1995). This guideline states that the bund wall should be of a minimum height of 2 m, with a minimum base width of 4 m, and be located at least 10 m beyond the area potentially affected by any instability of the pit edge.

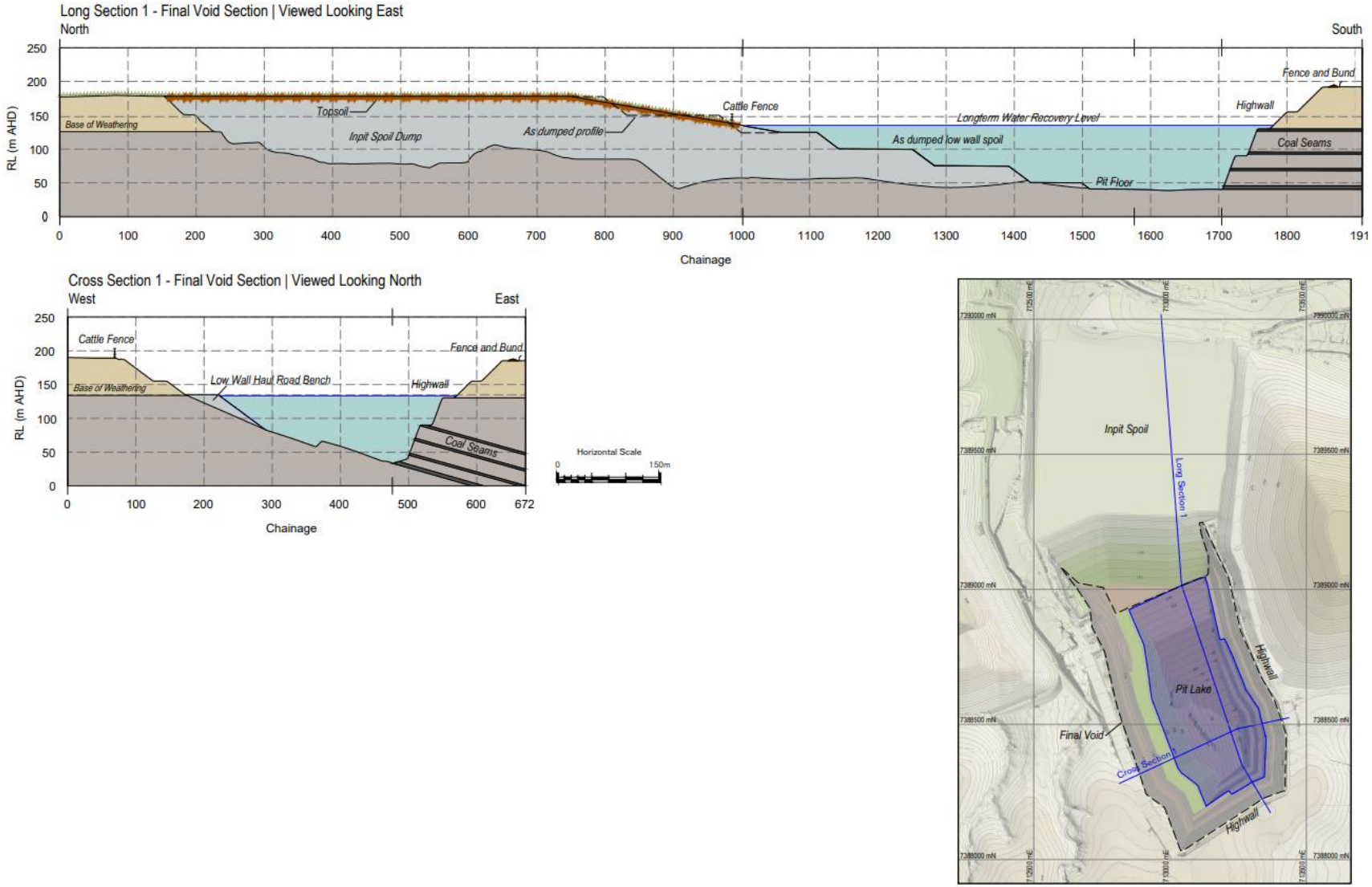

Figure 29: Residual void final landform design

8.12.1.1 Stability

The Geotechnical Assessment (GeoTek Solutions 2013, Appendix L) prepared for Bluff Mine details the pit slope stabilities for the eastern highwall, western low wall, and end walls of the residual void.

In accordance with GeoTek (2013) recommendation, at closure the pit floor will be treated (e.g. ripping, blasting, trenching) and good quality overburden will be placed to create a suitable and effective foundation. This is due to the steep floor dip and bedding plane shears.

The western low wall will be rehabilitated to a relatively flat overall slope (33°) due to the steep bedding dips, faults, and sheared rock mass. An overall slope of 33° will prevent the low wall sliding into the residual void. To achieve the overall slope angle of 33° the follow design parameters will be implemented.

- 30 m high batters cut to 45° with 20 m wide intermediate benches cut behind the coal floor; or
- 15 m high batters cut to 65° with 20 m wide intermediate benches cut behind the coal floor.

The steeper batter angles (65°) restrict the batter height to manage and prevent back-break and rock sliding out of the batters.

Furthermore, as outlined by GeoTek (2013), the following controlling geotechnical parameters will be met to ensure long-term stability of the low wall including, sheared bedding planes dipping at 30°, having shear strength parameters of $c' = 0$ kPa and $\phi' = 18°$, cut through by frequent imbricate faults, e.g. FL10, FL15, FL20 and FL25, which strike parallel with the western low wall.

The end walls will be rehabilitated to the same design criteria as the highwalls in accordance with GeoTek (2013) recommendation. GeoTek (2013) suggested that faulting which would likely cause damage and instability in the end walls, is not expected at closure as any major structures will be in an unfavourable orientation in the end wall.

The highwall has been designed to a slightly flatter slope angle to minimise the risk of instability. Therefore, as recommended by GeoTek (2013) highwall and end wall slopes will follow the following design criteria:

- 45° in Cenozoic soil/distinctly weathered Permian to a depth of approximately 20 m. A 15 m wide catch bench is required at the base of this horizon; and
- 65° batters in slightly weathered/fresh coal measures. A 15 m catch bench is required every 50 m.

The residual void has been designed to comply with the EA requirements (Table 30). However, as mining progresses and addition geotechnical information becomes available on the residual void geology, Bowen PCI will continue to review and update the residual void design slopes, in accordance with the milestone criteria of achieving a FoS ≥ 1.5.

8.12.2 Residual void water balance

Within the PRC Plan Groundwater Assessment completed by RDM Hydro (2024) (Appendix C) a water balance model was developed using GoldSim to assess the residual void water level and chemistry post mining. The Monte Carlo methodology was used to generate 100 daily timestep realisations from 2026 to 2126 (Figure 30). This assessment confirmed that the residual void water level is not expected to stabilise until approximately 2070 with a median (most likely) water level of RL 123.3 mAHD and a 90% probability that the water level will remain below RL 136.6 mAHD (RDM Hydro 2024). The maximum predicted water level determined from the 100 model realisations was RL 141.5 mAHD.

The predicted residual void long-term water level is well below the spill level of RL 177.8 mAHD. Due to the final landform design to shed water away from the residual void, the residual void will not overflow.

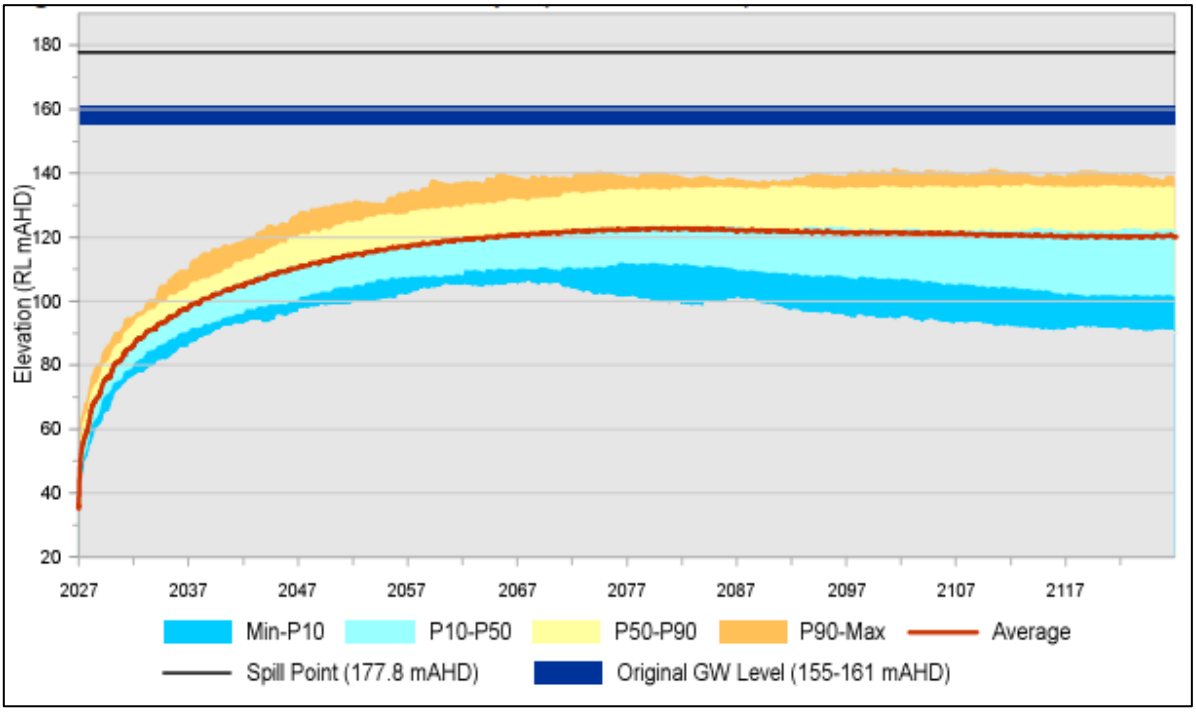

Figure 30: Modelled residual void water level (RDM Hydro 2024)

8.12.2.1 Residual void water quality

The PRC Plan Groundwater Assessment completed by RDM Hydro (2024) also modelled the residual void chemistry using a combination of rainfall chemistry, on site surface water monitoring data, and on-site groundwater data.

The water chemistry in the residual void was predicted using the mass balance approach from 100 model realisations for two scenarios including the best estimate and poor water quality. The water chemistry predictions indicated that:

- the residual void water body will increase in salinity and acidity over time, with increases in major ion (sulphate, sodium) and trace element concentrations;
- salinity levels are likely to exceed the livestock drinking water guideline value of 10,000mg/L TDS;
- there is a high likelihood that the salinity of the pit lake will exceed that of seawater (35,000 mg/L) within 100 years;
- acidity with increase from neutral to acidic however, potential buffering effects from carbonates present in the geology has not been accounted for in the modelling;
- sulphate concentrations will likely exceed the livestock drinking water guideline value (1000 mg/L);
- it is likely that fluoride concentrations, boron, and molybdenum will exceed the livestock drinking water guideline values; and
- it is possible that cadmium could exceed the livestock drinking water guideline value.

It should be noted that the potential stratification was not considered in the mass balance approach when modelling water chemistry in the residual void water body. If stratification does occur, is it likely that the salinity of the residual void lake would be greater at depth than as the surface.

8.13 Built Infrastructure

Minimal excavations and disturbance of infrastructure areas is proposed throughout mine life and therefore the MIA Infrastructure domain is expected to remain the least disturbed. The final landform design will be consistent with the local topography and returned to a suitability class for beef cattle grazing of 4 (see Section 8.2).

All built infrastructure associated with RA1 includes the following components:

- ROM pad, coal loading facility;
- buildings, relocatable offices, power generators;
- workshop, fuel dispensing and storage facilities, laydown yard, equipment storages, washdown pads;
- water management structures, dams, pipelines, draining channels, potable water tanks; and
- access roads, haul roads, service roads.

At the end of Bluff Mine life, any remaining infrastructure will be decommissioned and removed unless there is a specific request for the infrastructure to remain by the subsequent or underlying landholder. An agreement will be established to transfer ownership and liability associated with the infrastructure.

As discussed in Section 6.6, existing infrastructure currently identified within a landholder agreement (Appendix K) are contained within on Lot 11 on H4023 and will be transferred to the landholder at the end of mining , this infrastructure includes:

- pre-existing landholder dams (Road Dam and Dip Dam);
- five mine dams (sediment and MIA dams);
- Capricorn highway turnoff;
- access road to existing workshops; and
- existing workshops.

Rehabilitation and decommissioning of infrastructure will commence once processing of all ROM coal has finished, and all product coal removed from the site. Where notifiable activities have occurred or a risk of contamination exists by virtue of the activity undertaken, a contaminated land site investigation will be conducted by a SQP, and if contamination is identified, a remediation plan will be developed. Following remediation, a validation report will be prepared to verify that the remediation actions were adequate, and the site is suitable for the proposed PMLU.

Infrastructure areas will then be regraded to blend with the surrounding landscape and drainage lines reinstated to an acceptable profile and a capacity equivalent to that existing pre-mining. The final profile of any reconstructed drainage lines will comprise a flat base and sloped banks to allow for free drainage.

Apart from foundations associated with larger structures, which will be excavated to at least a depth of 1 m from the surface, disturbances associated with the majority of mine infrastructure are largely surficial. No steep slopes are anticipated to result from regrading of infrastructure areas. Surface preparation and revegetation will then be undertaken in accordance with the methods described in Section 8.7.1.

8.13.1 Buildings

In the absence of a continuing use for the buildings post relinquishment of the mining leases, all buildings and infrastructure (including footings and foundations) will be demolished and removed from site, or if materials constitute clean construction and demolition waste, it will be buried within the final in-pit spoil dump. All recoverable scrap steel will be sold and recycled, with the remaining non-recyclable wastes disposed of to an authorised landfill. Prior to disposal, all wastes will be assessed and classified in accordance with the Environmental Protection (Waste Management) Regulation 2000. A land contamination assessment

will be undertaken where potential contamination exists. Contaminated materials will either be remediated in situ or excavated and disposed of to an appropriately licensed facility.

Areas from which buildings and other infrastructure have been removed will be ripped, re-contoured and revegetated.

8.13.2 Roads

Roads that are not required post mining will be reshaped, topsoiled, and ripped and seeded. As discussed in section 8.13, the Capricorn highway turn off and access road to the workshop will be retained on site as beneficial infrastructure for future use by the landholders under a landholder agreement (see Section 6.6).

8.13.3 Workshops, chemical and fuel storages

All workshops, chemical and fuel infrastructure will be removed from site at completion of mining and sold, recycled, or appropriately disposed of to a facility authorised to accept such waste.

A land contamination assessment will be undertaken on all workshops and chemical/fuel storages. Contaminated materials will either be remediated in situ or excavated and disposed of to an appropriately licensed facility.

Following removal of infrastructure, land will be ripped, re-contoured and revegetated.

8.13.4 Powerlines

Rehabilitation of powerlines and other associated electrical infrastructure includes dismantling and removal from site. It is likely that power infrastructure may be retained on site as beneficial infrastructure for use by future landholders through agreements with local government and relevant power companies.

8.13.5 Water supply pipelines

There are three options associated with the decommissioning of the water supply pipelines:

- abandonment—where the pipeline is purged, physically disconnected from the point of supply, and sealed at both ends;
- removal—where the pipeline is purged from removed from its easement in entirety; or
- beneficial reuse—where sale or donation to a third party occurs which sees the pipelines continue to be beneficially used.

International best practice recognises that removal of the pipeline from the easement is rarely a commercially or environmentally viable option for decommissioning. Therefore, it is likely that pipelines will either be abandoned or re-used by a third party.

8.13.6 Water storage facilities

Bluff Mine operates under a water management system that focuses on distinct categories to separate water into:

- mine affected water—water which has interacted with mining activities and potentially contains elevated concentrations of contaminants or sediments;
- sediment water—water from rainfall run-off with the only contamination being dissolved or suspended solids;
- clean water—rainfall run-off not impacted by mining activities; and

- potable water—treated water suitable for human consumption/sanitation purposes.

Surface water runoff from mined landforms and disturbed areas can contain various contaminants. The potential contaminants and contamination sources are present in Table 31.

Table 31: Potential contaminants and sources

Source	Transport Mechanisms	Site Containment	Potential Contaminants	Key intervention and management strategy
ROM and Coal Stockpile Areas	Surface runoff	Pit void Water containment dams	Sediment, coal fines, soluble salts and pH altering materials.	adoption of appropriate landform design criteria to ensure stable land outcomes. adoption of water features to prevent sediment laden runoff. monitor WQ in receiving environment and manage if required. modelling has indicated the groundwater will act as a permanent sink due to presence of void. monitor for seepage and manage if required. monitor WQ in groundwater systems
Workshop Areas	Surface Runoff	Pit voids Water containment dams	Sediment, soluble salts, fuels, oils, grease (total petroleum hydrocarbons) and coal (coarse or fines).	
Haul Roads	Surface runoff	Water containment dams	Sediment and soluble salts	
Pit Void	Pumping of pit runoff to water containment dams	Pit void Water containment dams	Alkaline or sodic soils and heavy metals, coal fines and pH altering materials.	
Mine Affected Water Containment Sumps	Seepage through floor of dams. Pumping within mine water system. Overflows during heavy rainfall.	Pit void if containment dam capacity is limited.	Elevated pH, sediment, dissolved metals, coal fines, soluble salts, and hydrocarbons.	

All water storages on site at the end of mining operations are to be decommissioned, backfilled, reprofiled, topsoiled, ripped to create a seedbed, and seeded with a pasture seed mix suitable for grazing in accordance with their final PMLU.

Non-mine affected water dams will be rehabilitated similarly to clean water structures however, initially they will be allowed to dry through evaporation prior to being re-filled using embankment materials and re-contoured back to a level similar to that existing prior to mining.

Mine affected water structures will have linings removed (where applicable) and appropriately disposed of. Sediments will be either be buried onsite or removed from site to a licensed disposal facility.

9 Risk assessment

Legislative Requirement

Section 126C(1)(f) of the EP Act, the rehabilitation planning part of the PRC plan must identify the risks of a stable condition for land described as a post-mining land use not being achieved, and how the applicant intends to manage or minimise the risks.

9.1 Risk assessment requirements

Section 126C(1)(f) of the EP Act requires the PRCP to identify the risks, for each PMLU, of a stable condition not being achieved and how the applicant intends to manage or minimise the risk.

A risk assessment has been carried out in accordance with the following standards:

- AS/NZS ISO 31000:2018 Risk management - Guidelines; and
- HB203:2012 Managing environment-related risk.
- This risk assessment has informed the scope of the planning part of this PRCP, as well as the development of comprehensive rehabilitation success criteria. Where higher risks were identified for Bluff Mine, the scope of the PRCP was expanded to provide confidence in the rehabilitation methods to achieve the objectives and milestones proposed.

9.2 Risk assessment process

Any risk assessment needs to be undertaken with consideration of the scope, context, and criteria relevant to the assessment. For this risk assessment, the following scope and purpose was discussed and agreed to:

"The purpose of this risk analysis is to identify the risks of rehabilitation objectives not being achieved for the agreed PMLUs and NUMAs nominated and the approach to be taken by Bluff Mine to manage and minimise the risks identified."

For this risk assessment, risk scenarios (or 'threats') were identified and considered for each rehabilitation area and NUMA associated with Bluff Mine. The causes attributable to each risk scenario were documented as well as the potential impacts. Existing controls were noted, defined as those reasonably expected to be in place for a Project of this nature and having appropriate and contemporary management systems. Each risk scenario was then assessed with respect to health, safety, the environment, and compliance against the risk assessment schema outlined in Section 9.3.

9.3 Risk assessment schema

Risks specific to the rehabilitation of Bluff Mine were classified using the risk classification schema which is described below (Appendix J). The risk assessment schema used is comparable to those used widely within the mining industry and comprises the following components:

- a likelihood classification descriptors table (Table 33); and
- a consequence classification descriptors table (Table 32) intended to guide a consistent assessment of consequence.

Following a consensus determination of likelihood and consequence, the risk level was determined using the matrix shown in Table 33. For any risks classified as 'significant' or above, mitigation and management measures were identified and documented. Mitigation and management measures were also documented for some lower-level risks.

Table 32: Consequence classification descriptors

Loss Type	**Consequences**				
	Insignificant—1	**Minor—2**	**Moderate—3**	**Major—4**	**Catastrophic—5**
[P] People, Health & Safety	First aid case / medical treatment	Restricted work injury, temporary health impact	Lost time injury	Single fatality or permanent damage / disability	Multiple fatalities
[A] Asset or Equipment	Damage or loss <$10k	Damage or loss $10k-$100k	Damage or loss $100k- $1M	Damage or loss $1M-$10M	Damage or loss >$10M
[T] Time, Production, Cost, Quality, Business interruption	Easily addressed or rectified by immediate corrective action. Less than 1 day production impact	Minor or superficial damage or equipment / facilities. Loss of partial production for up to 1 week	Moderate damage or equipment / facilities. Loss of partial production 1 week up to 1 month	Major damage to equipment / facilities. Loss of majority of production 1 month up to 3 months	Major damage to equipment / facilities. Loss of total production > 3 months
[E] Environmental, Cultural Heritage	Limited damage to minimal area of low significance—no clean up required	Minor effects of biological or physical environment—minor clean up	Moderate short-term effects but not effecting the ecosystem function—moderate clean up	Significant environmental harm—reportable incident with adverse national publicity. Likely prosecution	Very serious, long-term, regional ecosystem damage. Loss of environmental authority to operate
[R] Reputation	No adverse publicity or attention. No shareholder actions.	Limited impact—some local public attention / concern. Minor shareholder enquiry	Adverse attention from state media or raise public concern. Moderate shareholder concern, release of statement.	Limited impact—some local public attention / concern. Minor shareholder enquiry	Adverse attention from state media or raise public concern. Moderate shareholder concern, release of statement.
[C] Legal Compliance	Low level legal issue	Minor legal issues, non-compliance, and breaches of regulations. Warning issues (mine record note issued)	Serious breach of regulation with investigation or report to authority with prosecution by authority and/or possible moderate fine	Major breach of regulation with prosecution by authority and/or potential major fine	Significant prosecution and fines. Very serious litigation including class actions.

Table 33: Risk level classification matrix

Likelihood		Consequence				
		Insignificant—1	**Minor—2**	**Moderate—3**	**Major—4**	**Catastrophic—5**
Almost Certain (A)	This event is expected to occur in most circumstances (once per month)	M (11)	H (16)	H (20)	E (23)	E (25)
Likely (B)	Will probably occur in most circumstances (once per year)	M (7)	M (12)	H (17)	E (21)	E (24)
Possible (C)	Might occur at some time (1-5 years)	L (4)	M (8)	H (13)	H (18)	E (22)
Unlikely (D)	Could occur at some time (5-10 years)	L (2)	L (5)	M (9)	H (14)	H (19)
Rare (E)	May occur only in unusual circumstances (10+ years)	L (1)	L (3)	L (6)	M (10)	H (15)

9.4 Risk assessment outcomes and management

Detailed risk assessment outcomes are provided in (Appendix J). For Bluff Mine, a total of 41 individual risk scenarios were identified resulting in:

- no risk scenarios classified as ‘extreme’;
- 4 risk scenarios classified as ‘high’;
- 19 risk scenarios classified as ‘moderate’; and
- 21 risk scenarios classified as ‘low.’

A summary of risk outcomes is shown in Table 34.

The four ‘high’ risks identified from the risk assessment can be grouped into the following categories:

- safety risks;
- erosional risks;
- non-polluting risks; and
- achievement of a sustainable PMLU.

The 19 ‘moderate’ risks identified span the same categories as the ‘high’ risk group, but with the addition of geotechnical risks.

Table 34: Risk assessment outcomes by rehabilitation and management areas

RA	Risk level				
	Low	**Moderate**	**High**	**Extreme**	**Total**
RAs					
MIA	5	3	1	0	**9**
Overburden dumps (in-pit and out-of-pit)	5	7	1	0	**13**
Water management infrastructure	6	5	0	0	**11**
Management area					
Residual void	1	4	2	0	**7**
Total	**17**	**19**	**4**	**0**	**40**

The first high risk was associated with MIAs and related to poor pasture productivity due to poor quality topsoil. This consequence considered the limited availability of good quality topsoil available within the Bluff Mine and as such could not be mitigated below a significant risk class in the assessment. However, ongoing soil analysis, amelioration and monitoring will ensure that topsoil placed within rehabilitated areas will be of a quality that promotes germination, with ongoing monitoring in place to detect germination failures early.

The second high risk was associated with erosion gullies on overburden dumps. This consequence considered the design of the final landform, the erosivity of the soil, and the potential failure of surface preparation activities, and as such could not be mitigated below a significant risk class in this assessment. However, monitoring efforts will ensure that any failed surface preparations will be detected and repaired.

The final two high risks were associated with groundwater and downstream water quality impacts. This risk has been addressed through downstream water quality monitoring and abated by groundwater modelling outcomes.

9.5 Rehabilitation trial

The risk assessment in Section 9 identified the lack of good quality topsoil as a risk to achieving successful rehabilitation of MIAs for a low intensity cattle grazing PMLU. Ensuring the appropriate soil structure and composition is crucial for the long-term sustainability of these rehabilitated areas. To mitigate this risk, a monitoring trial has been developed, as outlined in Table 35 in accordance with Section 3.7.1 of the PRCP Guidelines.

The trial will test a mixture of spoil, subsoil and topsoil as a growth media for its ability to effectively sustain a low intensity grazing PMLU. The outcome of this trial will guide the integration of the optimal mixture into the site's rehabilitation strategy, ensuring sustainable land use post-mining.

The pre-mining assessment of available soil resources highlighted that most of the site had a topsoil cover of 100mm and was able to sustain a grazing land use (Section 4.6) (SLR 2013). This minimal topsoil cover has contributed to the topsoil deficit faced by the site and the reason the trials of growth media are required.

A key focus of the trials is the incorporation of soil ameliorants, specifically gypsum, lime and organic matter, into the proposed growth media to improve its stability and quality. Gypsum is particularly beneficial for sodic soils, where it enhances soil structure by replacing sodium ions with calcium ions, thereby improving

soil particle binding. This results in better water infiltration, reduced surface crusting, and a lower risk of erosion. Lime, on the other hand, is effective in acidic soils, as it raises soil pH, making nutrients more available to plants and enhancing overall soil health. Both gypsum and lime promote stronger soil structure, improved root growth, and increased resilience to erosion. Furthermore, incorporating organic matter into degraded soils significantly enhances soil structure, fertility, and water retention, facilitating the re-establishment of vegetation. Organic matter serves as a reservoir of nutrients, releasing them slowly over time, which is essential for sustaining plant growth and health.

The results of the trial will determine a growth medium of spoil, subsoil, and topsoil amendments that is the most suitable for incorporation into the site's rehabilitation methodology, ensuring an appropriate growth media for rehabilitation and long-term success for the PMLU.

Table 35: Future rehabilitation trials for low intensity cattle grazing

Requirement	**Low intensity cattle grazing**
Objective	To develop and verify that spoil, subsoil and topsoil mixtures can be used as an appropriate growth media source to produce a successful vegetation outcome for the PMLU.
Trial design	Phase 1: Topsoil testing Location—Topsoil stockpiles Soil quality assessments of all existing topsoil stockpiles to assess any deficiencies to be considered during Phase 2. Phase 2: Growth media Location—within waste dumps Land characteristics: in-pit/out-of-pit pit spoil dump, comparison trial and substrate to consist of: Minimum 5m depth spoil material overlain with a topsoil/subsoil mixture with the addition of aglime and gypsum in rates as described by an AQP. Minimum 5m depth spoil material overlain with a topsoil/subsoil mixture with the addition of aglime and gypsum in rates as described by an AQP, and additionally a layer of organic matter. Potential issues: Establishment of minimum reasonable area required prior for a representative trial means that several years may lapse between seeding some areas and trial commencement (creating a risk of deterioration). Species suitability/ establishment under site-specific conditions.
Commencement	2026
Duration	Up to 5 years
Assessment for trial success	Pasture/vegetation cover is ≥70%; Surface water runoff is non-polluting to receiving waters and reflective of upstream qualities; Weed presence is a maximum of 10% total vegetative groundcover.; and Land suitability of a Class 4 or better.
Incorporation of results into rehabilitation strategies and milestones	Refinement/ verification of appropriate materials for growth media and ameliorants to achieve success criteria.
Previous trials	Not applicable

Relevant supporting documents	Review of techniques to address topsoil deficit in open cut coal mines under rehabilitation in Queensland (da Silva *et.al.* 2024).

10 Monitoring and maintenance program

To develop the PRC schedule, eight RMs have been determined as being applicable for the Bluff Mine. The PRCP Guideline (DES 2021) requires consideration of measures to be undertaken to demonstrate that milestones and milestone criteria have been achieved.

With respect to determining the achievement of RMs, a clear definition of milestone criteria have been developed for each rehabilitation milestone (Section 8.2.1). Assessment of RAs against completion criteria will be incorporated into the ongoing environmental management for the Bluff Mine. Assessment of RAs against the milestone criteria, that pertain to vegetation and achievement of post mining land uses, will be undertaken as part of the annual rehabilitation monitoring program (Section 10.1) that exists for the Bluff Mine. Monitoring of rehabilitation will commence following the completion of activities of the first rehabilitation milestone applicable to the relevant rehabilitation area.

The completion criteria for the PMLU will be used as the milestone criteria for the final milestone in the proposed schedule, which shows the achievement of the PMLU to a stable condition at surrender. When the final rehabilitation milestone applicable to the rehabilitation area is deemed to be satisfied, a final rehabilitation assessment will be undertaken before an application for progressive certification or ML surrender is made. Table 36 provides a summary of the monitoring measures to be undertaken to determine the achievement of each rehabilitation milestone. Determination of the boundary of an area reaching a given rehabilitation milestone at a given point in time will utilise standard survey techniques, including land based survey and airborne survey at an appropriate frequency—nominally annually—to achieve satisfactory geolocation of areas.

Table 36: Rehabilitation milestone and monitoring measures

Rehabilitation milestone	Description / criteria	Proposed management/ monitoring measure(s)
RM1: Infrastructure decommissioning and removal	Applicable to all infrastructure identified to be decommissioned/ removed from site. Considered to be met when the area can be transitioned to the next milestone.	Infrastructure decommissioned/ removed at closure will be subject to strict environment and safety planning requirements including completion inspections. A visual inspection(s) will be conducted to determine that no infrastructure remains that does not form part of a Landholder Agreement.
RM2: Management of contaminated land status	Applicable to all areas where notifiable activities have been carried out and, at a minimum, involves the completion of a Phase 1 contaminated land investigation undertaken by a AQP. Considered to be met when contaminated material has been placed removed from site, or remediated in situ, a site investigation report including a site management plan and/or validation report has been completed, and, if required, a site suitability statement has been prepared. Where required, remediation activities will be undertaken and recorded, and notifications completed.	A completed Phase 1 contaminated land investigation report, as well as any consequent reports where required. Visual inspection of potential sites or sources of contaminated material will be conducted, and samples collected as required. The contaminated site land investigation will determine the presence of any contaminants. Remediation activities will be undertaken if required following consultation on appropriate remediation activities. A site investigation report and/or validation report will detail the remediation of contaminated land and, if required, a site suitability statement prepared by a SQP that states that the land is suitable for use according to the nominated PMLU.
RM3: Landform development (re-profiling / re shaping) of land affected by disturbance	Applicable to all areas where bulk earthworks and other grading are required to achieve target landform shape and drainage characteristics. Considered to be met when graded banks are installed on waste rock dumps, final landform water storages are cleared, and natural drainage is established and all other applicable disturbance areas have been reprofiled to suit the surrounding landform. Additionally, a geotechnical assessment will be conducted to confirm that long-term geotechnical stability has been achieved.	Land based and/or remote sensing survey techniques will be employed to confirm that graded slopes meet design specifications. Additionally, visual inspections will be done to determine if any future maintenance/repair action is required. A geotechnical assessment will be conducted by an appropriately qualified person to confirm that long-term stability has been achieved for all relevant landforms.

Rehabilitation milestone	Description / criteria	Proposed management/ monitoring measure(s)
RM4: Surface preparation (topdressing, contour ripping, soil amelioration)	Applicable to all areas requiring revegetation. Includes final profiling and application of topsoil materials, soil testing, and soil amelioration. Considered to be met when surface preparation activities have been completed and soil condition is conducive to plant germination and growth.	A soil assessment will be conducted by an appropriately qualified person prior to each rehabilitation event to determine soil suitability, and recommendations made for ameliorants where required, to ensure a suitable root zone of 300mm is achieved. Records kept of ameliorants applied, including types, rates, and timing of applications. Monitoring of soil properties of the growth medium. Visual inspections and documentation of contour ripping, including depth, spacing and machinery used.
RM5: Revegetation (seeding and / or planting) - grazing	Applicable to all areas requiring revegetation. Includes seeding and/or planting of target revegetation species. Considered to be met when records demonstrate that seeding and/or planting of target species has been completed, with the understanding that remedial works such as reseeding or infill planting may be necessary to meet target vegetation completion criteria.	Records kept of species, seeding, area sown and germination Records of seeded and/or planted species consistent with the species listed in *Table 29*.
RM6: Achievement of surface requirement	Applicable to all areas requiring revegetation. Involves monitoring and remediation works if monitoring identifies risks to the final rehabilitation criteria being achieved. Considered to be met when all completion criteria have been achieved and land is safe, stable, does not cause environmental harm and can sustain the nominated PMLU.	Field surveys, drone, and satellite data analysis as part of the annual rehabilitation monitoring. Surface water runoff monitoring.
RM7: Achievement of target post-mining land use to safe and sustainable condition (Grazing PMLU)	Rehabilitated areas to be assessed against completion and milestone criteria. Considered to be met when land can be transitioned to progressive certification.	Field surveys, drone, and satellite data analysis as part of the annual rehabilitation monitoring. Landform survey by an AQP. Surface water quality monitoring. Groundwater quality and level monitoring.

Rehabilitation milestone	Description / criteria	Proposed management/ monitoring measure(s)
RM8: Achievement of target post-mining land use (Retained Infrastructure PMLU and Water Storage PMLU)	Applicable to all infrastructure to be retained to support the low intensity grazing PMLU. Considered to be met when all completion criteria have been achieved and land is safe, stable, does not cause environmental harm and can sustain the nominated PMLU.	A Hazard and Safety Assessment will be undertaken by an AQP. Field surveys, and water quality monitoring undertaken as part of the annual rehabilitation monitoring.

10.1 Rehabilitation monitoring program

Rehabilitation will be monitored on an annual basis, with the survey period occurring post wet season, as monitoring at this time allows for more accurate identification of the species present and a clearer understanding of species richness on site. Where sufficient data is acquired that demonstrates that rehabilitation is clearly on a trajectory to achieve milestone criteria, the frequency of monitoring may be reviewed and reduced as recommended by an appropriately qualified person.

The rehabilitation monitoring program aims to achieve data collection at sufficient spatial and temporal resolution to ensure statistically valid results. The following methods are employed at each monitoring site and described in detail in the following sections:

- permanent vegetation monitoring transects (ground cover monitoring and species richness);
- photographic monitoring;
- erosion monitoring; and
- topsoil characterisation (every 2–3 years).

In conjunction with walking between transects, RAs will be visually assessed to identify signs of fauna utilisation, noticeable issues such as erosion, vegetation cover deficiencies, or weed and / or pest infestations. Satellite imagery technology may also be employed. These observations are incorporated with the results of each rehabilitation progress report.

10.1.1 Permanent vegetation monitoring transects.

Monitoring permanent vegetation transects involves collecting quantitative data on ground cover composition, species richness, woody stem density, and canopy cover. Monitoring sites will be placed randomly within newly established rehabilitation polygons, at a density of approximately one site per 10 hectares. At each monitoring site, a 50 m tape will be run out to establish a transect and observations/measurements taken every five metres on either side of the transect, thereby representing a plot size of 50 m x 10 m. A star picket is installed at each end point of the transect, to identify consistently and precisely the permanent transect location. Photographic records and GPS locations for all monitoring sites and observed issues will be kept up to date in an appropriate database. To monitor revegetation progress, the data for each vegetation scenario will be averaged across monitoring sites established in similar timeframes and compared to the corresponding milestone and completion criteria.

Across each transect groundcover will be monitored. The survey methodologies outlined below have been adapted from the Queensland Herbarium survey technique (*Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Version 5.0)) (Neldner *et al.* 2019) and the *Method for the Establishment and Survey of Reference Sites for BioCondition* (Eyre *et al.* 2017).

10.1.2 Vegetation monitoring

Vegetation monitoring will involve the collection of quantitative data for:

- ground cover percentage;
- canopy cover;
- species richness;
- woody stem density;
- recruitment; and
- weeds.

Each monitoring site is demarcated by a 50 m long transect and observations/ measurements are taken at each 5 m interval on either side of the transect, thereby representing an effective plot size of 50 m by 10 m. A plastic delineator post guide will be installed at each end of the transect to ensure the exact location of the permanent transect can be identified, ensuring robust sampling repetition.

The survey methodology outlined has been adapted based on information contained within the *BioCondition Assessment Framework* (Eyre *et al.* 2015), the *Vegetation Assessment Guide* (DoE 2013), and the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al.* 2022).

10.1.2.1 Species richness

To measure species richness, all vascular plants occurring within 5 m of either side of the 50 m transect are recorded. Any species unable to be identified are collected for later identification. Species will be classified into one of the following six groups for reporting purposes:

- native pasture species;
- exotic pasture species;
- trees;
- shrubs;
- forbs; and
- noxious weeds.

This methodology is used to record species richness and the projective foliage cover on the transects to assess against milestone criteria. It should be noted that due to the pastoral nature of rehabilitation sites, the Projective foliage cover is inferred from the vegetation cover measured at each transect.

10.1.2.2 Ground cover

Ground cover monitoring involves the collection of quantitative data on average ground cover (percent) where the percentage of all types of ground cover within ten 1 m x 1 m quadrats is determined. Similar to the transect above, the quadrat shall be placed every 5 m on alternating sides of the transect, commencing at 0 m on the right and the final quadrat at 45 m. In each quadrat the total percentage ground foliage cover of each plant species and the percentage cover of bare soil, rock and organic litter is recorded.

Ground foliage cover incorporates native perennial grass cover, native annual grass cover, native forbs and other species, native shrubs (< 1m height), non-native grass, non-native forbs and shrubs, litter, rock, bare ground and cryptogams.

10.1.2.3 Recruitment

Recruitment is assessed using methodology adapted from Eyre *et al.* 2015 whereby recruitment is assessed over the 10 m x 50 m plot (5 m either side of each 50 m transect) (refer to Figure 31). Within this plot, the proportion of dominant species found to be regenerating are counted. A regenerating individual is identified as a woody stem species with a diameter at breast height of <5 cm. For each dominant canopy species present, at least one individual must be present as a sapling or seedling for the species to be considered as regenerating. The presence of all dominant species in the regenerative state would make up 100% recruitment.

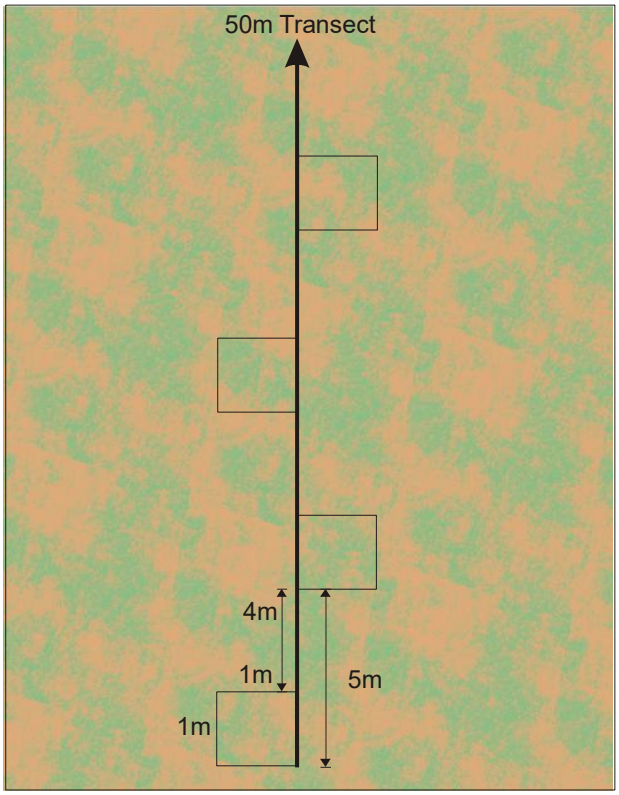

Figure 31: Ground cover percentage sampling

10.1.2.4 Pasture productivity

An assessment of pasture productivity will be undertaken to determine the achievement of the target PMLU. Pasture productivity within rehabilitated areas will be assessed using either manual measurements or satellite imagery. Measurements for pasture productivity should be undertaken at the end of the growing season. Manual measurements of pasture productivity will be undertaken in accordance with relevant industry guidelines. Pasture mass and height are common proxy measurement used for assessing pasture productivity.

To measure pasture mass:

1) A 30 x 30 cm quadrat will be established to measure sample sites.

2) A digital photograph is to be taken of the sample quadrat.

3) Pasture is then cut to ground level and placed in a paper bag.

4) The paper bag is placed on a wet/dry balance and the mass is recorded.

5) The process is then repeated for a minimum of 15 sites across the paddock and up to 20 sites if the paddock has significant variability in cover.

6) Data collected is then used below to calculate the average pasture mass in kilograms of dry matter per hectare (kg DM/ha).

To measure pasture height using the ruler/stick method (Meat and Livestock Australia 2019):

7) A 1 cm thick dowel, 30 cm long is marked 0.5 cm from the bottom, then every 1 cm along the stick. Note: readings between 0.5 cm and 1.5 cm will be recorded as 1 cm, readings between 1.5 cm and 2.5 cm as 2 cm etc.

8) To measure the pasture, place the stick vertically on the soil surface at the point where the base of the stick landed.

9) Slide a thumb down the stick until you touch a green leaf and record the cm.

10) Measure the height from at least 50 sites chosen at random as you traverse the paddock. The best way is to throw the stick as you walk across the paddock.

11) Pasture mass is then estimated in kg dry matter DM/ha using the approximate relationship between pasture height and a kg DM/ha chart.

Pending the outcomes of the advancement of the use of remote sensing / satellite imagery currently being undertaken, pasture productivity may be estimated from the use remote sensing or satellite imagery. For example, the CSIRO in partnership with the Western Australian Government has developed a '*Pastures from Space*' program which will utilise satellite imagery to provide real-time data on green pasture biomass and feed on offer. The use of satellite imagery is beneficial in providing a site-wide analysis.

10.1.3 Erosion monitoring

An erosion monitoring methodology has been developed with consideration to relevant guidelines and research (Neldner *et al.* 2019, Eyre *et al*. 2017 and DSITI 2015). Erosion monitoring is to be conducted across rehabilitation monitoring locations. RAs will be inspected to assess the extent of erosion features and an erosion rating for each site will be determined. Erosion features or indicators may include wind or sheet erosion, erosion rills, gullies or tunnels, or signs of slumping.

Erosion at the survey sites is monitored through visual assessment over time. Assessment is undertaken by traversing the 50 m transects described in Section 10.1.1, and recording the number and average depth of any erosion features or rill lines. Table 37 is used to record and classify these observations. The overall classification of the erosion on each transect is determined by the higher classification attributed to either the number of rills/gullies or the average depth. For example, a transect may present only one or two rills but if these are recorded as being 25 cm deep, the transect will be classified as presenting a Moderate erosion classification.

Obvious cases of localised settlement which are not causing any subsequent erosion are not counted as instances of erosion.

Table 37: Erosion classifications

Erosion classification	Minor	Moderate	Severe
Sheet erosion	Shallow soil deposits downslope	Partial exposure of roots; moderate soil deposits downslope	Loss of surface horizons, root exposure; moderate substantial soil deposits downslope
Rill erosion	<0.3m deep	<0.3m deep	>0.3m deep
	<15 rill/transect[1]	15 rills - 30 rills / transect	>30 rills/transect
Gully erosion	Absent	>0.3m deep Gullies are linear, continuous, and restricted to primary or minor drainage lines	>0.3m deep Gullies are continuous or discontinuous, and either tend to branch away from primary drainage lines and on to foot slopes, or have multiple branches within drainage lines
Tunnel erosion	Absent	Absent	Present
Mass movement	Absent	Absent	Present

*the erosion classification framework is based on the 'Australian Soil and Land Survey Field Handbook' Third Edition. by the National Committee on Soil and Terrain (2009)
1. Transect linear 100 m across the contour (Source: Tongway, D. J. and Hindley, N. L. 2005. Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes. CSIRO Publishing, Canberra, Australia)

It should be noted that the placement of the permanent transects may not be representative of the level of erosion across the entire rehabilitation area landforms. To compensate for this, general observations undertaken during the survey are also utilised in assessing rehabilitation performance. The location of any severe erosion outside the transect (i.e. tunnels, mass wasting, large gullies) is also recorded and marked with a handheld GPS.

The following information is recorded at each site:

- GPS reading of location;
- general description of type of erosion (gully [> 30 cm], rill line [<30 cm], circular failure, tunnelling etc.) and possible causes, refer to the glossary of terms for definitions of erosion types;
- depth of erosion;
- width of erosion;
- length of erosion;
- where eroded material is being deposited; and
- whether the erosion line is being stabilised by vegetation.

10.1.4 Growth medium monitoring

Growth media sampling will be undertaken at the commencement of rehabilitation monitoring to identify and address any deficiencies in the chemical composition or exceedances in the metal composition of the soil that may be detrimental to vegetation health, and every 5 years following to identify and address any deficiencies in chemical composition or exceedances in metal concentrations that could negatively impact

vegetation health. If annual rehabilitation monitoring indicates that the rehabilitation is not progressing towards the target PMLU, additional sampling will be carried out to identify the underlying cause.

Soil monitoring involves the collection of topsoil samples from a maximum depth of 10 cm to obtain quantitative data on the chemical and physical properties of soil. Soil sampling methodology has been adapted from Monitoring and Sampling Manual Environmental Protection (Water) Policy 2009 (DES 2018). Soil sampling is conducted by collecting approximately 200 g samples with a clean non-metallic shovel and bucket every 10 m along the 50 m transect. The first sample is collected at 0 m. These five samples are mixed in the bucket. The final 200 g soil sample is taken from the mix and placed into plastic sample bag. Samples are sent to a National Association of Testing Authorities (NATA) certified laboratory for analysis of indicators of soil nutrition and land contamination including:

- pH;
- electrical conductivity from a saturated extracted;
- soluble chloride;
- total phosphorous;
- moisture content;
- Emerson aggregate stability test;
- exchange acidity;
- exchangeable cations (calcium, magnesium, potassium, sodium and aluminium);
- CEC;
- calcium: magnesium ratio (Ca: Mg);
- ESP;
- total nitrogen, nitrite and nitrate;
- sulphate;
- extractable potassium and phosphorous (Colwell);
- total organic carbon and organic matter; and
- trace elements (arsenic, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel and zinc).

Soil moisture content shall be measured for interpretive purposes only and will not be assessed in determining rehabilitation performance.

Ideally, rehabilitation site data will be assessed in consideration of the trajectory to meet performance criteria outlined in Section 8.2.1 .

10.1.5 Photographic monitoring

Photographic monitoring provides a visual record of the vegetation, ground cover, erosion and general appearance of each rehabilitation site, allowing these sites to be compared over time (Eyre *et al.* 2015). A digital camera is used to take the photos so that a permanent record can be kept for each site. The process of taking the monitoring photos is as follows:

1) The person taking the photograph stands at the star picket which marks the beginning of the 50 m.

2) The camera is then aimed directly towards the end of the 50 m transect and a single photograph is taken.

3) The person then stands at the star picket which marks the end of the 50 m transect.

4) The camera is then aimed directly towards the start of the 50 m transect and a single photograph is taken.

5) Steps 1—6 are repeated for all terrestrial monitoring sites.

6) The digital photographs are then downloaded and stored for future reference.

10.1.6 Fauna observations

Observations of any fauna species or indicators of fauna presence (e.g., scats, tracks, or other signs of fauna activity) within or in the vicinity of the RAs will be noted as part of rehabilitation monitoring.

10.1.7 Water quality monitoring

10.1.7.1 Surface water monitoring

Surface water monitoring will be undertaken upon the completion of rehabilitation to demonstrate the achievement of the PMLU landform to a stable condition. This will include the monitoring of surface water runoff from the landform, opportunistically, and downstream receiving waters at regular intervals as described below.

Runoff water sampling

Sampling of direct runoff from the landform will be undertaken opportunistically during rain events. The selection of the monitoring location(s) will consider a range of factors including the timing of rehabilitation; PMLU; underlying material type; and surface treatment. The objective of the rehabilitation area surface water sampling is to demonstrate that a stable condition is being achieved. The selected RAs will be designed and constructed to allow the capture of surface water flows for sampling from the rehabilitated area's surface, without significant influence from surrounding operational areas. Depending on the nature of the rehabilitation area, the method and frequency of the surface water collection may vary from area to area. Runoff samples from the selected RAs will be collected and analysed. Analysis will be limited to the major contaminants of concern (CoCs) identified in Section 4.4.2 and Table 5. These are described below in Table 38. These limits are derived from the previous approved EA release limits which stem from ANZECC & ARMCANZ (2000) .

Table 38: Surface water runoff quality limits

Quality characteristic	Units	Limit[1]
pH	pH units	6.5-8.5
Electrical Conductivity	µS/cm	310
Sulfate	mg/L	10

1.Limits are derived form ANZECC & ARMCANZ (2000)

Receiving water monitoring

Additional receiving water monitoring will be undertaken using an adapted version of the REMP for the Bluff Mine (Appendix B). The REMP has been designed to monitor potential impacts to surface water EVs and quality and is therefore has required only minor adjustments to be sufficient in purpose for rehabilitation monitoring.

The trigger levels have been derived from WQO derived from Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018; ANZECC and ARMCANZ 2000) and from EA contaminant trigger investigation levels (Appendix B). The REMP and EA trigger levels are described in Section 4.4.2 and Table 5.

The REMP suitably monitors the following CoCs identified in Section 8.13.6, Table 31. The limits monitored by the REMP have been adapted to suit the post-mining landform.

Table 39: Surface water receiving water quality limits

Quality characteristic	Units	Limit	Comment on limit
pH	pH Units	6.5-8.5	WQO
Electrical Conductivity	µS/cm	310	Baseflow WQO
Turbidity	NTU	50	WQO
Sulfate	mg/L	10	WQO
Aluminium - dissolved	µg/L	55	ANZG 2018
Antimony - dissolved	µg/L	9	ANZG 2018
Arsenic - dissolved	µg/L	13	ANZG 2018
Boron - dissolved	µg/L	370	ANZG 2018
Cadmium - dissolved	µg/L	0.2	ANZG 2018
Cobalt - dissolved	µg/L	1.4	ANZG 2018
Chromium - dissolved	µg/L	1	ANZG 2018
Copper - dissolved	µg/L	1.4	ANZG 2018
Iron - dissolved	µg/L	300	
Lead - dissolved	µg/L	3.4	ANZG 2018
Manganese - dissolved	µg/L	1900	ANZG 2018
Mercury - dissolved	µg/L	0.06	ANZG 2018
Molybdenum - dissolved	µg/L	34	ANZG 2018
Nickel - dissolved	µg/L	11	ANZG 2018
Selenium - dissolved	µg/L	5	ANZG 2018
Silver - dissolved	µg/L	0.05	ANZG 2018
Uranium - dissolved	µg/L	0.5	ANZG 2018
Vanadium - dissolved	µg/L	6	ANZG 2018
Zinc - dissolved	µg/L	8	ANZG 2018
Fluoride	mg/L	2	Protection of livestock and short-term irrigation guideline
Ammonia	mg/L	0.9	ANZG 2018
Nitrate	mg/L	1.1	WQO
Total recoverable hydrocarbons (C6-C9)	µg/L	20	LOR
Total recoverable hydrocarbons (C10-C36)	µg/L	100	LOR

Major ions Calcium, chloride, potassium, magnesium, sodium, bicarbonate, carbonate	mg/L	For interpretation purposes only	
Hardness	mg/L	For interpretation purposes only	

All sampling will be undertaken in accordance with the Queensland Monitoring and Sampling Manual (DES 2018) methodology and the Australian Standard (AS) AS5667 Water Quality Sampling. Field readings of pH, dissolved oxygen, electrical conductivity (EC) and temperature will be recorded. In situ measurements will be collected using a multi-parameter water quality meter that is laboratory calibrated to the manufacturers' specifications.

Grab samples will be collected at a depth of 10 to 20 cm where sufficient water is available. Two water metals samples, one total (unfiltered) and one dissolved (field filtered) will be collected at each site. Samples will be collected in the laboratory-provided sample collection bottles with preservative added where required. All water samples will be kept on ice or refrigerated during storage and transport to a NATA accredited laboratory for analysis.

Monitoring will occur on a monthly basis during flow for a minimum of five consecutive years at the sites are detailed in Table 40 and shown in Figure 32. These sites consist of two reference sites, located upstream of the ML and are outside the immediate zone of influence from Bluff Mine. Three impact sites are located downstream of the Bluff Mine within the receiving environment (Appendix B).

Table 40: Receiving water monitoring locations

Sites	**Description**	**Monitoring Locations (GDA 2020)**		**Monitoring frequency**
		Latitude	**Longitude**	
Upstream[a] (Reference) Background Monitoring Points				Monthly during a flow event (five consecutive years)
CCU	Columba Creek	-23.603	149.078	
DCU[c]	Duckworth Creek	-23.580	149.082	
Downstream[b] (Receiving / Impact) Monitoring Points				
CCD	Columba Creek	-23.585	149.081	
DCD	Duckworth Creek	-23.578	149.087	
RCD[d]	Rufus Creek	-23.585	149.098	

Notes:
a. Located upstream of the ML and are not subject to the release of MAW from the Bluff Mine.
b. Located downstream of the ML and within the receiving environment.
c. Surface water for reference site DCU was sampled approximately 100 m south of the survey location, at GDA 94 coordinates 712497 (Easting) and 7390724 (Northing).
d. Macroinvertebrates and water probe results for RCD were sampled approximately 30 m north of the survey location, at GDA 94 coordinates 714084 (Easting) and 7390234 (Northing).

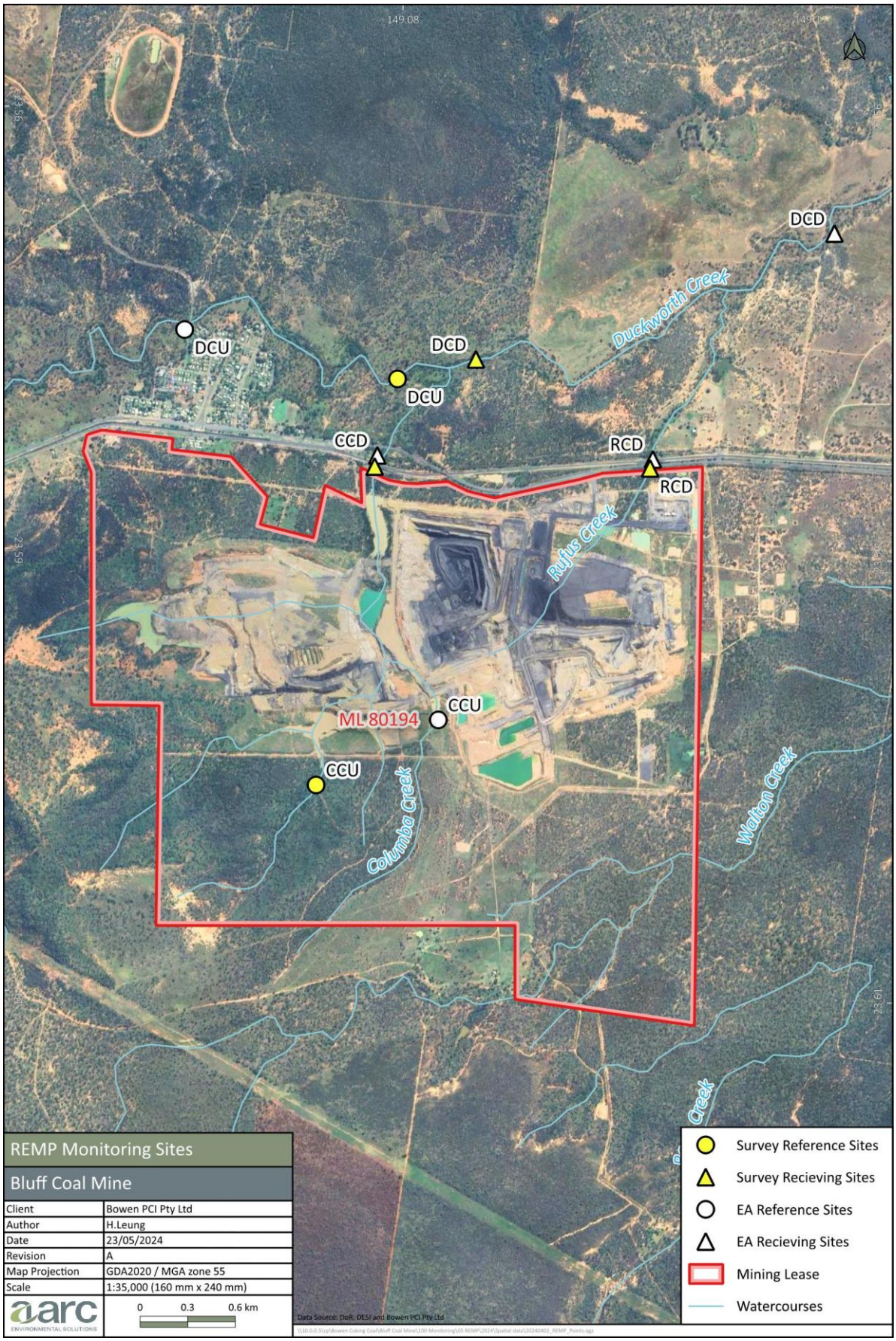

Figure 32: REMP monitoring points

10.1.7.2 Groundwater monitoring

The RDM Hydro (2024) water balance model , as described further in section 8.4, predicts that that the pit will function as a perpetual groundwater sink and, as such the risk of pit water or other contaminants migrating from the final void is considered low (Appendix J). In accordance with the RDM Hydro (2024) recommendation, the post closure groundwater monitoring program has been developed to ensure the continued verification of the modelling outcomes and will be incorporated into the Bluff Groundwater Monitoring Program (GWMP) during rehabilitation and closure activities. This program will incorporate both groundwater level and quality monitoring.

As determined by RDM Hydro (2024), the post closure monitoring program will encompass the existing network of groundwater monitoring bores, listed in Table 41 and shown in Figure 33.

Table 41: Groundwater monitoring locations

Monitoring point	Location[1] GDA2020 UTM Zone 55		Reference point elevation (mAHD) [1]	Screen depth (mRP)	Aquifer	Monitoring Frequency
	Latitude	Longitude				
MB05	-23.604	149.092	188.5	87-93	Aries Seam	Quarterly
MB08	-23.586	149.084	180.0	70.1-73.1	Aries Seam	
MB09	-23.586	149.084	180.2	37.2-40.2	Regolith	
MB12	-23.606	149.087	197.1	51.8-54.8	Overburden	
MB13	-23.602	149.096	177.8	271.3-274.3	Aries Seam	
MB14	-23.587	149.089	177.7	176.2-179.2	Aries Seam	
VWP2	-23.60	149.089	154.2 148.0 - 147.3 151.0	81 97 - 161.5 202	Aries Seam	

[1] Top of bore casing

mRP = metres below reference point

There is a low permeability of the coal seam (therefore slow rates of movement) and it is therefore likely that groundwater movement will be towards the void, rather than away (RDM Hydro 2024). Quarterly groundwater level and quality monitoring will be undertaken through this post closure GWMP. Groundwater level results must comply with Table 43 for a minimum of ten consecutive years. Groundwater quality must be monitored for a minimum of five consecutive years and must not exceed the limits specified in Table 42 for three consecutive years within a five year period.

All groundwater monitoring will be undertaken by a competent person and will be in accordance with the latest edition of the Queensland Governments Monitoring and Sampling Manual (2018).

The groundwater trigger values from the EA (Table 2) are based on baseline groundwater quality at the site and applicable WQOs (RDM Hydro 2024). These values were determined in line with DES (2021) guidelines on using monitoring data to assess groundwater quality and potential environmental impacts (RDM Hydro, 2024).

The methodology undertaken by Bowen PCI to develop groundwater triggers, as per the specified DES (2021), are as follows:

- Adopt a single contaminant trigger based on a combination of ecosystem protection WQOs and bore-specific derived percentile values.
- The limit is exceeded when the trigger value is exceeded on three consecutive occasions.
- For the bore-derived value, in the first instance this is the 80th percentile however, if a review of the percentile against historical data would result in an exceedance of the limit, the 95th percentile is adopted.
- If there are insufficient samples to establish bore-specific trigger values, then the site-wide statistical value is adopted for that parameter as an interim trigger.
- Where the limit of reporting is greater than the WQO, then the limit of reporting is adopted.

The trigger thresholds presented in the EA and RDM Hydro (2024) are designed to monitor the natural response of groundwater aquifers to mining activities and therefore have been transitioned in the post closure GWMP. However, as per the EA, once interim limits are finalised triggers presented in Table 42 will be reviewed.

TDS is not necessary to be monitored, whilst mercury, selenium, silver, and Total Petroleum Hydrocarbons (TPH) have been excluded due to their consistent non-detection as trace elements and the absence of a source for hydrocarbons (RDM Hydro 2024).

Parameters and triggers for the monitoring of groundwater levels can be found in Table 43.

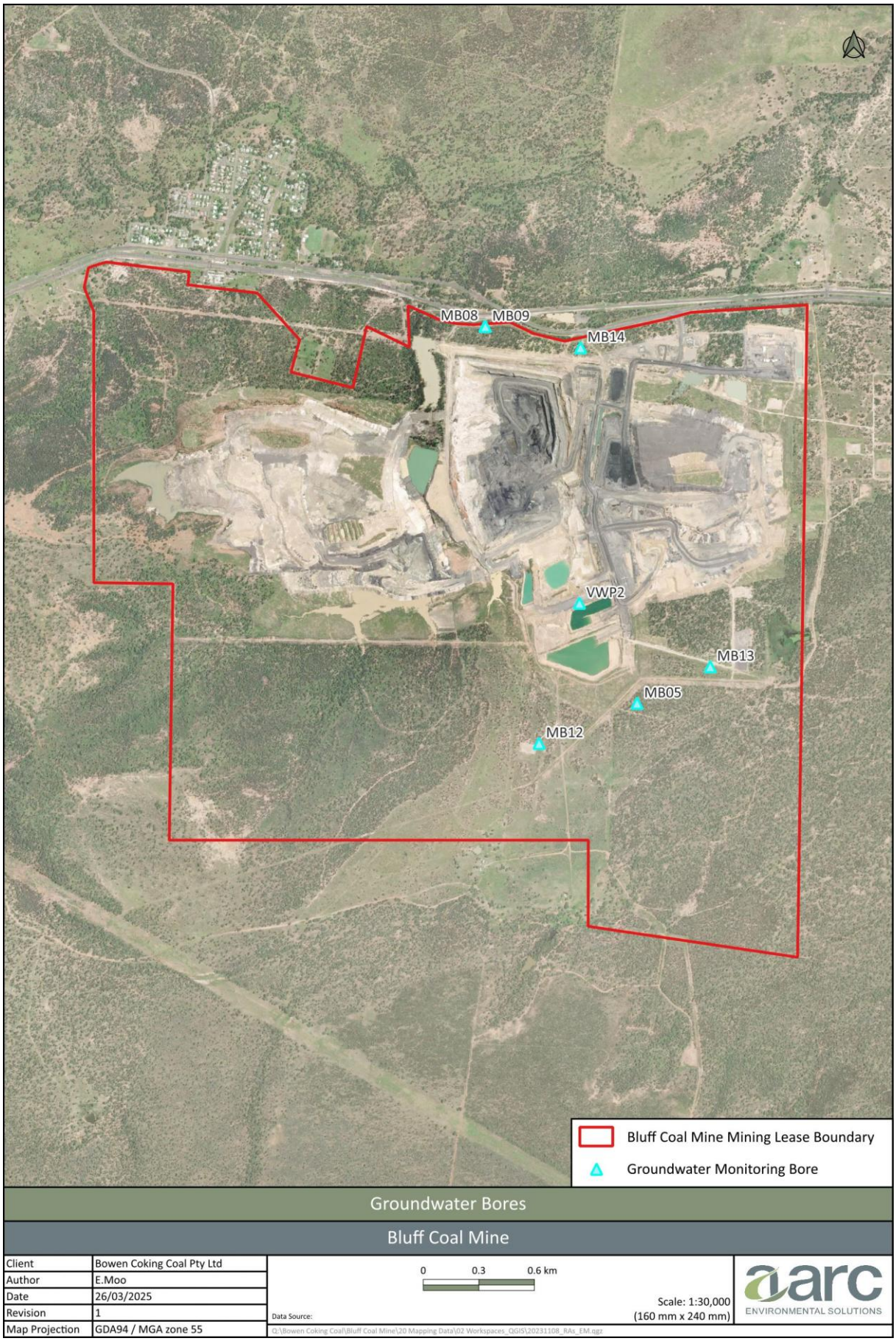

Figure 33: Groundwater monitoring locations

*Table 42: Post-closure Groundwater Quality Monitoring Parameters and Trigger Values**

Quality Characteristics (unit)[1]	**Limit**	**Limit[2]**	**Source[3,4]**
EC (µS/cm)	MB05	35,600	Site-specific
EC (µS/cm)	All bores, except MB05	35,700	Site-specific
pH (pH units)	All bores	7.0-8.0	Site-specific
Sulphate as SO4 (mg/L)	MB05	1250	Site-specific
Sulphate as SO4 (mg/L)	All bores, except MB05	840	Site-specific
Aluminium—dissolved (µg/L)	All bores	55	ANZG 2018
Antimony—dissolved (µg/L)	All bores	9	ANZG 2018
Arsenic—dissolved (µg/L)	All bores	13	ANZG 2018
Boron—dissolved (µg/L)	All bores	940	ANZG 2018
Cadmium—dissolved (µg/L)	All bores	0.2	ANZG 2018
Cobalt—dissolved (µg/L)	All bores	1.4	ANZG 2018
Chromium—dissolved (µg/L)	All bores	1	ANZG 2018
Iron—dissolved (µg/L)	All bores	2500	ANZG 2018
Lead—dissolved (µg/L)	All bores	3.4	ANZG 2018
Manganese—dissolved (µg/L)	All bores	1,900	ANZG 2018
Mercury - dissolved (µg/L)	All bores	0.06	ANZG 2018
Molybdenum dissolved (µg/L)	All bores	34	ANZG 2018
Nickel - dissolved (µg/L)	All bores	11	ANZG 2018
Selenium - dissolved (µg/L)	All bores	5	ANZG 2018
Silver - dissolved (µg/L)	All bores	0.05	ANZG 2018
Uranium - dissolved (µg/L)	All bores	0.5	ANZG 2018
Vanadium - dissolved (µg/L)	All bores	6	ANZG 2018
Zinc - dissolved (µg/L)	All bores	90	Site-specific
Fluoride (mg/L)	All bores	2	Protection of livestock and short-term irrigation guideline
Ammonia (mg/L)	All bores	0.9	ANZG 2018
Nitrate (mg/L)	All bores	1.1	WQO
TPH C6-C9 Fraction (µg/L)	All bores	20	Typical LOR. Laboratory analytical method must be suitable to achieve LOR

TPH C10—C36 (Sum of total) (lab reported) (µg/L)	All bores	50	Typical LOR. Laboratory analytical method must be suitable to achieve LOR
Major ions (mg/L) Calcium, chloride, potassium, magnesium, sodium, bicarbonate, carbonate		For interpretation purposes only	-

Notes:

1. All metals and metalloids must be measured as 'dissolved' fractions (from analysis of a field filtered sample).
2. Limits apply to dissolved fractions
3. ANZG 2018: for aquatic ecosystem protection, based on Australia and New Zealand Guidelines for Fresh and Marine Water Quality
4. WQO: Environmental Protection (Water) Policy 2009: Issac River Sub-Basin Environmental Values and Water Quality Objectives

Table 43: Post-closure Groundwater Level Thresholds

Bore ID	Monitoring Unit	Screen Interval (mRP)	Surface RL (mAHD)	Standing water level pre-mining (mRP)	Modelled maximum drawdown (m)[1]	Water level at maximum drawdown (mRP)	Bore dry at maximum drawdown	Trigger threshold (mAHD)[2]	Trigger threshold (mRP)[3]
MB05	Aries Seam	87.0-93.0	188.5	31.3	61.9	93.2	Yes	95.5	93.0
MB08	Aries Seam	70.1-73 1	180.0	27.0	83.2	110.2	Yes	106.9	73.1
MB09	Regolith	37.2-40.2	180.2	25.4[2]	16.4	41.6	Yes	140.0	40.2
MB12	Overburden	51.8-54.8	197.1	31.1[2]	7.4	38.5	No	158.6	38.5
MB13	Aries Seam	271.3-274.3	177.8	16.7[2]	25.8	42.5	No	135.3	42.5
MB14	Aries Seam	176.2-179.2	177.7	22.8[2]	91.1	113.9	No	63.8	113.9
VWP2	Aries Seam	81.0	152.5	27.0	83.2	110.2	Yes	98.5	4

[1] Numerical model did not include discrete coal seams. Modelled maximum drawdown is driven by the maximum pit depth and therefore may exceed the actual seam depth
[2] Estimated from pre-mining potentiometric surface
[3] If the bore is predicted to be dry at maximum drawdown the trigger threshold is the bottom of the screen interval, otherwise it is the calculated water level at maximum predicted drawdown
4 The VWP data is automatically calculated in mAHD and cannot be physically measured

10.1.7.3 Groundwater and water balance model

The groundwater and water balance model is to be maintained and rerun every five years. The first update to both off these models is to be undertaken on the 31 December 2028. The predictions of each model are to be rerun, with the incorporation of updated data. A final rerun of both models are to be undertaken within a year of any surrender.

10.2 Data analysis, interpretation and reporting

10.2.1 Laboratory analysis

All soil samples collected during rehabilitation monitoring will be sent to a NATA certified laboratory for analysis of the recommended parameters.

In the event that, any plants cannot be identified in the field, samples will be sent to the Queensland herbarium for identification.

10.2.2 Progress reporting

Annual rehabilitation reports will be prepared following the collection of monitoring data to provide a detailed analysis of monitoring results and evaluate rehabilitation progress towards completion criteria. This ongoing evaluation will enable the early detection of unfavourable trends in measured indicators and identify any requirements for adaptive management practices to ensure rehabilitation success and certification in the long-term.

10.2.2.1 Interpretation

Rehabilitation monitoring results will be analysed both categorically and temporally. Results obtained from rehabilitation sites will be compared rehabilitation milestone criteria. Rehabilitation monitoring results will also be compared with historical data where possible to detect any trends over time. Common variables such as climatic conditions, seasonal variation and other event specific circumstances will also be considered in the analysis of rehabilitation data.

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Appendix A.	**PRCP Schedule**
Appendix B.	**Receiving Environment Monitoring Program**
Appendix C.	**Groundwater Impact Assessment Report for the Bluff Coal Project**
Appendix D.	**Bluff Terrestrial Flora and Fauna—Impact Assessment**
Appendix E.	**Mine Closure Drainage and Floodplain Modelling Report**
Appendix F.	**Aquatic Ecology Impact Assessment**
Appendix G.	**BCM Soil, Land and Overburden Assessment**
Appendix H.	**Geochemistry Assessment**
Appendix I.	**Bluff Coal Project Surface Water Assessment**
Appendix J.	**Rehabilitation Risk Assessment**
Appendix K.	**Landholder Agreement**
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