



**Red Mountain
Infrastructure RMI
Progressive
Rehabilitation and
Closure Plan**



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TERMS AND DEFINITIONS

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

3P grasses	Perennial, productive and palatable
AEP	Annual exceedance probability
AMD	Acid and Metalliferous Drainage (AMD). Includes acid/acidic drainage (AD), pH-neutral metalliferous drainage (NMD) and sulphide-derived saline drainage (SD) – and/or any combination of these
AMWU	Australian Manufacturing Workers' Union
ANC	Acid neutralising capacity
ASC	Australian Soil Classification
BCM	Bank cubic meter. One cubic meter of material as it lies in the natural bank state
Biodiversity Act	Biodiversity Act 2004 (Queensland)
BMA	SMC Billiton Mitsubishi Alliance
BOM	Bureau of Meteorology
CCP	Community Consultation Plan
CEC	Cation exchange capacity
CHPP	Coal handling and preparation plant
C-RES	SMC cost-neutral organization. (SMC's community-related Local Buying Program is delivered in a strategic partnership between SMC and C-RES)
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
CSM	Conceptual site model
DAWE	Department of Agriculture, Water and Environment (Australia)
DEM	Digital elevation model
DES	Department of Environment and Science (Queensland) (The Adminstrating Authority)
DM	Dry matter (with reference to vegetation)
DoR	Department of Resources (Queensland) (previously referred to as the Department of Natural Resources, Mines and Energy)
DSI	Detailed site investigation
DSITI	Department of Science, Information Technology and Innovation (Queensland)
DTMR	Department of Transport and Main Roads (Queensland)
EA	Environmental Authority (in terms of the Environmental Protection Act 1994, Queensland)
EC	Electrical conductivity
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EP Act	Environmental Protection Act 1994 (Queensland)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Queensland)

ERA	Environmentally relevant activities
ESA	Environmentally sensitive area
ESP	Exchangeable sodium percentage
FCCM	Fort Cooper Coal Measures
FOS	Factor of safety
Interburden	Non-carbonaceous or carbonaceous mine waste located between coal seams. In this report the term 'overburden' shall be used to define overburden and interburden.
IRC	Isaac Regional Council
lcm	Loose cubic meter. One cubic meter of material which has been disturbed and has swelled as a result of movement
LGA	Local Government Area
LOA	Life-of-asset
LOD	Land outcomes document
LOM	Life-of-mine
LSA	Land suitability assessment
MIBC	Methyl Isobutyl Carbinol
MEP EIS	Millennium Expansion Project Environmental Impact Statement
MERFP Act	Mineral and Energy Resources (Financial Provisioning) Act 2018 (Queensland)
Mine waste	Material comprising overburden, ± coarse/fine reject (dewatered), ± waste coal. Sometimes called 'mineral waste' or 'mining waste'
ML	Mining Lease
MLES	Matter of local environmental significance
MNES	Matter of national environment significance
MCM	Moranbah Coal Measures
MSES	Matter of state environmental significance
NAF	Non-acid forming
NC Act	Nature Conservation Act 1992 (Queensland)
NEPM	National environment protection measure
NNTT	National Native Title Tribunal - an independent body established under the Native Title Act 1993 in Australia as a special measure for the advancement and protection of Aboriginal and Torres Strait Islander peoples.
NUMA	Non-use management area
Overburden	Non-carbonaceous or carbonaceous mineral waste located above (overburden proper) or between (interburden) coal seams. Carbonaceous overburden is generated during mining of non-ore material and may be represented by sedimentary units (non-coal) rich in organic carbon. Carbonaceous overburden does not include coarse reject, seam floor, seam roof or coal partings. Overburden reports to spoils dumps.
PAF	Potentially acid forming
PAWC	Plant available water capacity
PMLU	Post-mining land use

PRC Plan	Progressive Rehabilitation and Closure Plan (in terms of the Environmental Protection Act 1994 (Queensland))
PRCP Guideline	Progressive Rehabilitation and Closure Plan Guideline (November 2019) (DES, Queensland)
PSI	Preliminary site investigation
QLD	Queensland
RA	Rehabilitation Area. As defined in the PRCP Guideline: a rehabilitation area, for a post-mine land use, means an area of land in the post-mine land use to which a rehabilitation milestone for the post-mining use relates
RE	Regional ecosystems
Reject	Waste material produced during coal washing, separated from run-of-mine (ROM) coal in the coal handling and preparation plant (CHPP). Can be separated and disposed as fine rejects (tailings) and coarse reject, or co-disposed as mixed plant reject which is a mixture of coarse reject and 'dewatered' fine reject
Remnant coal	In-situ coal that remains exposed on the pit walls (highwall) and/or pit floor. Remnant coal can be ore grade or waste coal. Remnant coal can be fresh, oxidized or coked (heat affected).
ROM	Run-of-mine
RM	Rehabilitation Milestone. As defined in the PRCP Guideline: a rehabilitation milestone, for the rehabilitated land, means each significant event or step necessary to rehabilitate the land to a stable condition (section 115 of the EP Act)
RMI	Red Mountain Infrastructure
RMJV	Red Mountain Joint Venture
RRR	Residual risk rating (with reference to the risk assessment)
SEVT	Semi-evergreen vine thicket
SMART	Specific, measurable, achievable, reasonable/relevant, time-specific
SMC	Stanmore Mitsui Coal
SMP	Site Management Plan
SMU	Soil mapping unit
Spoil	Mine waste comprising non-ore (non-ROM) material such as overburden and waste coal. Within this report, unless stated otherwise, spoil is assessed as a whole (bulk material) with no distinction made between carbonaceous and non-carbonaceous overburden
SPR	Source-pathway-receptor
TDS	Total dissolved solids
TEC	Threatened ecological communities
TLO	Train load-out
Waste coal	Sub-economical coal that reports to the spoil dumps as waste. Waste coal can be fresh or oxidised. All oxidised and coked (cindered) coal is waste

INTRODUCTION

This transitional Progressive Rehabilitation and Closure Plan (PRC Plan) has been prepared for Red Mountain Infrastructure (RMI) in accordance with the requirements of the Mineral and Energy Resources (Financial Provisioning) Act 2018 (MERFP Act). This PRC Plan has been developed to meet the requirements of the *Environmental Protection Act 1994* (EP Act) and the Progressive Rehabilitation and Closure Plan Guideline (PRCP Guideline) (DES, 2021).

Environmental Authority Holder:	Stanmore (SMC)
Environmental Authority Number:	EPML00819113 (14 June 2022)
Land Description:	ML70312

Environmentally relevant activities at RMI are limited to mineral processing and resource recovery, and a transfer facility. They are undertaken under the conditions of the site's Environment Authority (EA) EPML00819113 (Appendix 1). This EA is the land outcome document (LOD) for this transitional PRC Plan.

This PRC Plan comprises two parts:

- **Section A: Rehabilitation Planning** - providing information about the site, the rehabilitation plans, and evidence and justification to support the development of the proposed PRCP Schedule.
- **Section B: PRCP Schedule** - including maps of rehabilitation and closure outcomes for the site, and tables of time-based rehabilitation milestones.

This PRC Plan also includes separate Appendices, providing key information and specialist studies used to support development of this plan.

Transitional Provisions

Part 27, Chapter 13 of the EP Act sets out the transitional provisions following the commencement of the MERFP Act. In particular, SMC is a 'mining EA holder' for the purposes of the transitional provisions on the basis that, on commencement of the MERFP Act, Stanmore SMC was "the holder of an environmental authority (EPPR00668513) for a mining activity relating to a mining lease authorising operations" at RMI (section 750, EP Act). Furthermore, Section 6 of the PRCP Guideline makes provision for "existing EA holders who must transition into the new PRC Plan framework" (DES, 2021). As RMI has an approved EA, the site falls under the ambit of the requirements of a transitional PRC Plan. Based on the requirements of Section 6 of the PRCP Guideline, the following underpin this PRC Plan:

- A Transition Notice for RMI was issued to the former EA holder BHP Mitsui Coal Pty Limited (BMC) by the Adminstrating Authority, dated 3 December 2020 (Appendix 2). This Transitional Notice required submission of the RMI PRC Plan and PRCP Schedule by 1 December 2021.
- The site's Transitional Notice was issued on 3 December 2020 following two pre-notification meetings held between the Adminstrating Authority and BMC – the first on 26 April 2020, with a follow-up on 26 November 2020. This PRC Plan is based on the key aspects agreed upon by BMC and the Adminstrating Authority during these meetings and as documented in the memo provided in Appendix 3. Introduction
- In accordance with transitional provisions (Section 750, EP Act), the RMI EA is an approved LOD.
- Prior to the PRC Plan submission, a pre-lodgement meeting between the Adminstrating Authority and BMC was held on 27 October 2021. This was arranged to discuss the key content of the site's draft plan, aimed at identifying any notable gaps or refinements needing to be addressed prior to the final submission.

Aligned to the above, and the PRCP Guideline requirements¹, the following process for transitioning rehabilitation and closure outcomes from the RMI EA into the site's PRCP Schedule has been followed:

¹ As per Section 6.4 (Transitioning Rehabilitation and Closure Outcomes into PRCP Schedule) of the PRCP Guideline

1. Identifying rehabilitation and closure outcomes in the LOD (EA EPML00819113).
2. Identifying post-mine land uses (PMLUs) (non-use management areas are not planned for RMI).
3. Defining rehabilitation areas within the PMLUs.
4. Identifying milestones.
5. Identifying milestone criteria.
6. Identifying when the first milestone must commence and completion dates for the milestones.

On 14/02/2022, the Department of Environment and Science (DES, the department) issued an information request to the former EA holder (BMC). The information response was due on the 30/11/2021. On 10/11/2022, Stanmore SMC requested an extension to the information response. On 11/11/2022 DES approved the information request period to 06/01/2023. The PRC Plan and Schedule provided in this application has been revised to include further information requested by DES.

A. REHABILITATION PLANNING

1 PROJECT PLANNING

Legislative Requirement

In accordance with 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.

PRCP Guideline

The following spatial information must be submitted as part of the PRC Plan:

- The location and maximum extent of disturbance footprint for the mine life;
- The PMLUs and NUMAs for the area within the resource tenures;
- Any sensitive receptors.

In addition to the list above, the PRC Plan must include spatial information outlining the rehabilitation and improvement areas that correspond to the proposed PRCP Schedule. The spatial information must show the locations of the rehabilitation and improvement areas for a 10-year period (minimum).

All spatial information must be prepared and submitted in accordance with the guideline 'Spatial Information Submission' (ESR/2018/4337).

1.1 Project Description

1.1.1 Geographic Location

RMI is a coal handling and preparation plant (CHPP) constructed entirely on Mining Lease (ML) ML70312. It is located approximately 140km south-west of the city of Mackay, in Central Queensland. The nearest regional centre is Moranbah, which is located approximately 20km to the west. The RMI ML70312 covers approximately 291 hectares (ha).

The CHPP began construction in 2005, with first coal washed in October 2006. The project was initially a joint venture between Peabody and BMC - this formally commenced in December 2007 with Peabody transferring a 50% interest in ML70312 to BMC, and the EA was amended to split ML70312 into its own project EA. In October 2007 BMC bought Peabody's remaining 50% interest. On 3 May 2022, SMC Stanmore (SMC) acquired an 80% share in the BMC portfolio which included RMI. With the change in ownership RMI is a joint venture between Stanmore Resources Limited (80%) and Mitsui Coal Limited (20%).

The CHPP has been designed to process and handle coal from multiple projects and has road access and coal stockpiling facilities to facilitate multiple coal sources. The CHPP currently washes coal from the adjoining SMC Poitrel Mine (to the south of RMI), and Millennium Mine, which is 50:50 joint venture between MetRes and Stanmore Resources (to the north and west).

Raw coal is transported from the mines to RMI, where it is stockpiled on run-of-mine (ROM) coal stockpiles. Coal is crushed and then beneficiated through the CHPP, stockpiled on product stockpiles and loaded onto trains to the Dalrymple Bay Coal Terminal. The rail loading facilities are also used by the neighbouring Daunia Mine which is owned and operated by BHP Billiton Mitsubishi Alliance (BMA) (to the south-east of RMI) (Figure 1).

The spur line for the CHPP rail loop diverges from the Norwich Park branch of the Aurizon rail network. The spur line crosses New Chum Creek between the Norwich Park Branch and the rail loop. The land for the spur line is leased by Queensland Rail.



1.1.2 Mining Tenements

The RMI mining tenure is ML70312 (Table 1 and Figure 2).

Table 1: RMI Tenements.

Lease Number	Name	Date Granted	Land Tenures - Landholder	Area (ha)
ML70312	Millennium East (Red Mountain CHPP)	16/12/2004	Lot 4 on SP 190266	290.9

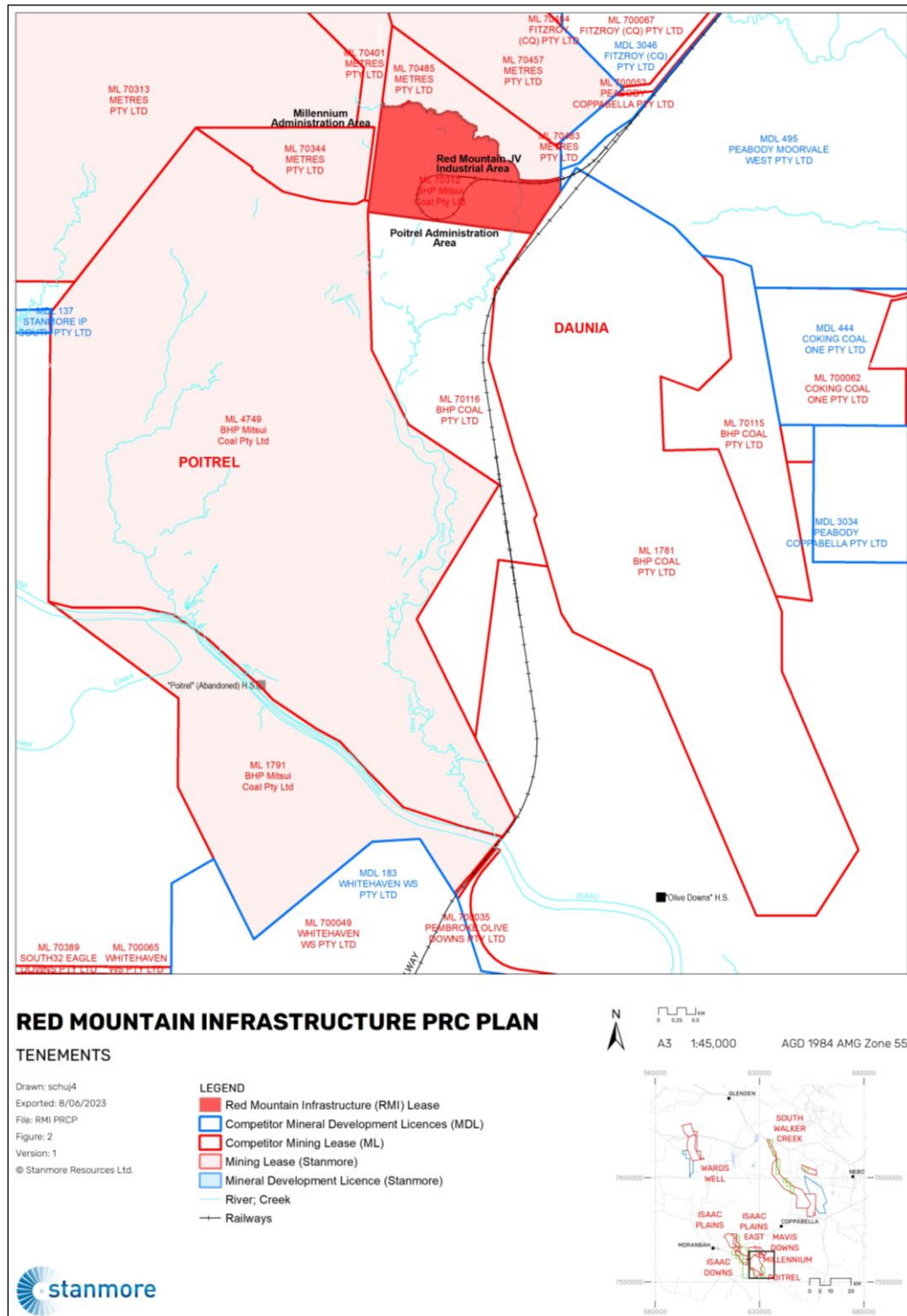


Figure 2: RMI Tenements.

Table 2: Primary Mine Features and Infrastructure at RMI.

Mine Domain	Mine Feature Name
Processing Infrastructure	• CHPP • Conveyors • Stackers • Hoppers and bins • Reclaim tunnel
Processing Disturbance	• Tailings drying cells
General Disturbance	• Laydown areas • Access roads • Haul roads • Drains • Topsoil stockpiles
Stockpiles	• ROM coal stockpile • Product coal stockpile • Temporary coarse reject stockpile
Dams	• Process water dam • Environment dam
Rail	• Rail loop and spur • Loading bin and facilities • Conveyors
General Infrastructure	• Administration and crib buildings • Workshop • Coal testing lab • Fuel, oil and chemical storage • Fuel and wash bays • Pipes and pumps • Power lines • Switchyard and substations • Communications towers • Fences

1.1.3 Primary Mine Features and Infrastructure On-Site

The main features and infrastructure approved within the EA for RMI are mining support activities, as summarised in Table 2. A site map is also shown in Figure 3.

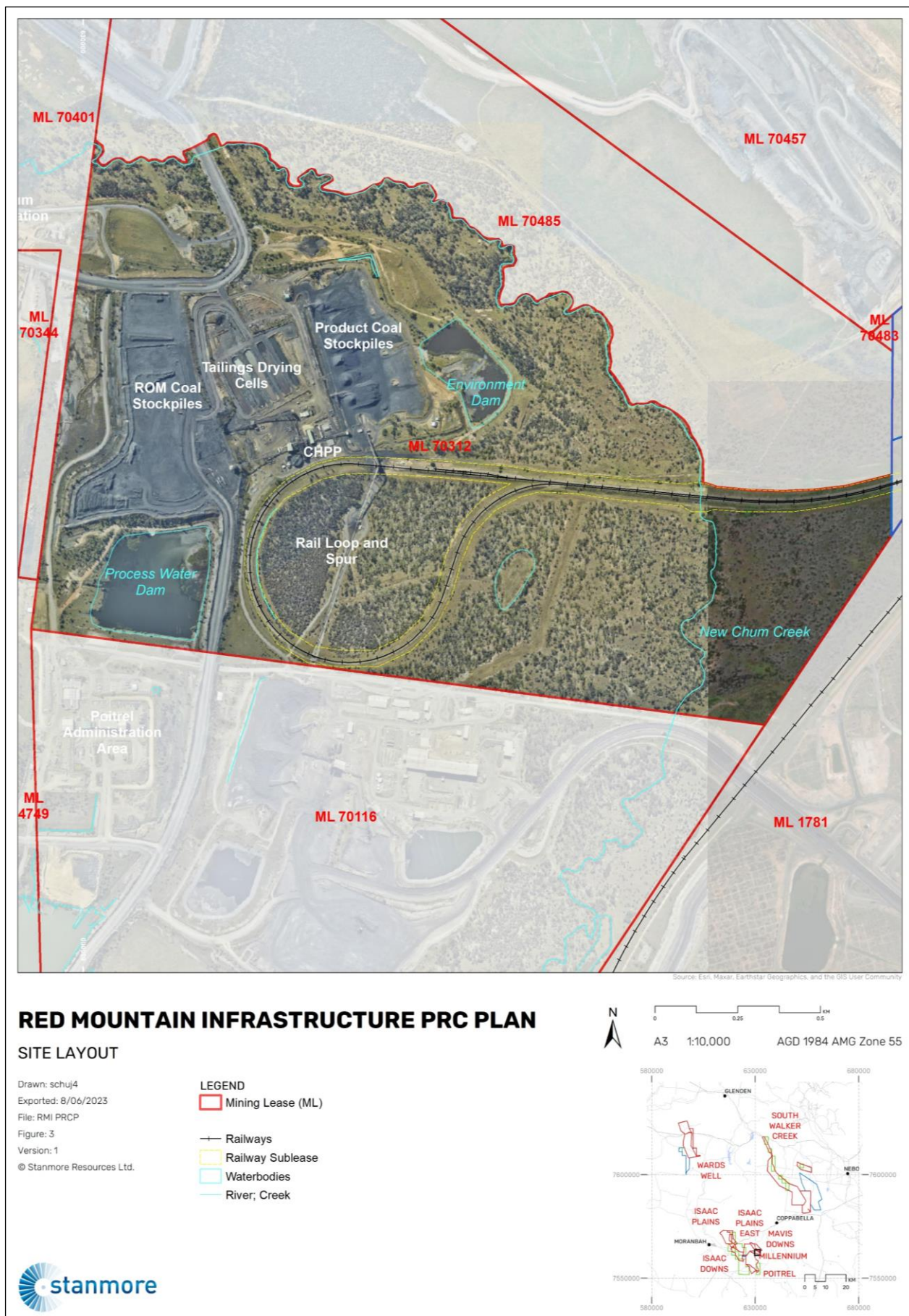


Figure 3: RMI Site Map.

1.1.4 Type of Mining Operation

RMI consists of a CHPP and associated infrastructure to process and rail coal from the adjacent coal mining operations. No mining is approved on the tenure.

1.1.5 Proposed Duration

The RMI processing infrastructure services the neighbouring SMC owned and operated Poitrel Mine - which is currently planned to operate until 2036. Millennium Mine, which is operated by MetRes, has a contract with RMI to process coal until September 2026 although this can be extended at any time.

The rail loading facilities and rail line also service the BMA Daunia Mine, which is currently planned to operate until 2051.

1.2 Baseline Information

PRCP Guideline (Section 3.1)

In addition to the legislative requirements, the following information about the site, where relevant, is considered necessary by the administering authority (as per section 126C(1)(j) of the EP Act) to decide whether to approve the PRCP Schedule:

- Site topography (locally and regionally);
- Climate (general and specific (rain, evaporation, temperatures)) including long-term projections;
- Geological setting;
- Site hydrology and fluvial networks;
- Groundwater levels and properties;
- Soil types, properties, and productivity;
- Land stability (pre-existing land degradation/erosion and predisposition to ongoing stability issues);
- Vegetation communities and ecological data (including existing regional ecosystem mapping);
- Fauna presence and populations;
- Pre-mining land use;
- Identification of underlying landholders.

Transitional PRC Plans must include any baseline information collected as part of an EIS process or original EA application. If this information is unavailable, the reasons should be explained in this section of the rehabilitation planning part. Transitional PRC Plans are not required to demonstrate how aspects of the mine site have been designed for closure for existing or approved disturbance. However, any expansion to an existing site must demonstrate how it has been designed for closure. The rehabilitation/improvement planning must include data from when mining first commenced up until planned surrender. The transitional provisions of the EP Act include an exceptional circumstance for when land is available for rehabilitation.

1.2.1 Site Topography

The regional topography of the Bowen Basin is dominated by flat to gently sloping landforms and low rolling hills. The site's pre-mining topography was generally low relief, dominated by a gently sloping landscape towards the south-east. The pre-mining average slope across the site was 1.5 % with an average elevation of 230RL. The site is influenced by the topography of the surrounding coal operations with Millennium Mine's spoil dumps directly to the north and the west, and Poitrel Mine's spoil dumps to the south-west.

1.2.2 Climate

RMI is located in a semi-arid climatic zone, which is characterised by high summer temperatures, warm dry winters and a distinct wet and dry season. Weather data was collected at the Moranbah Water Treatment Plant (Station No. 034038) between 1972 and 2012; and since 2012 it has been collected at the Moranbah Airport (Station No. 034035). The Moranbah weather stations are located approximately 20 km west of RMI.

1.2.2.1 Temperature

Maximum average temperatures range from 24°C in June/July to 35°C in December/January, with minimum average temperatures ranging from 9°C in July to 22°C in January.

1.2.2.2 Rainfall

Although rainfall occurs throughout the year, it is more prevalent in the summer months (December, January and February) (Table 3).

Table 3: Moranbah Monthly Average Rainfall.

Month	Station No. 034038 (mm)	Station No. 034035 (mm)
January	103.8	88.0
February	100.7	100.5
March	55.4	92.6
April	36.4	23.8
May	34.5	30.1
June	22.1	16.7
July	18	28.0
August	25	9.0
September	9.1	8.3
October	35.7	24.0
November	69.3	38.3
December	103.9	55.3
Annual	614.2	514.6

1.2.2.3 Evaporation

The evaporation rate is highest in the summer months with mean daily rate of 8.2 mm in January. The evaporation rate is the lowest in June (mean daily rate of 3.6 mm). The annual average rate of evaporation is 2,372.5 mm, which greatly exceeds the annual rainfall, a characteristic of semi- arid environments.

1.2.2.4 Wind

Wind records for Moranbah for January-April show an easterly predominance of moderate strength (1-20 km/h), with easterlies dominating in May-July with some south-easterly influence. Easterly winds predominate for August-December which tends north to north-easterly from October to December.

1.2.2.5 Long-Term Climate Projections

To undertake impact assessment of future climate on closure, PRC Plans and other hydrologic applications, the Guideline for Climate Change Adaptation in Mine Water Planning and Hydrologic Assessment was developed (BMC, 2020). This Guideline will assist site practitioner's understand key aspects of the associated quantitative impact assessment towards facilitating design and business decision making. This Guideline was developed based on the latest research and projects completed by CSIRO, Bureau of Meteorology (BOM) and the Queensland Government and is aligned with the latest published projection database and methods including CCS and High-Resolution Projection Data.

1.2.3 Geological Setting

RMI is within the Bowen Basin and geologically is located on the western margins of the Taroom Trough. The site is situated within the Fort Cooper Coal Measures (FCCM). The FCCM underlie the Rangal Coal Measures, which are the coal measures being mined at neighbouring Daunia, Poitrel and Millennium mines.

The stratigraphy within the site ranges from:

- Later tertiary-quaternary alluvium, characterised as locally red-brown mottled, poorly consolidated sand, silt, clay, minor gravel and high-level alluvial deposits (generally related to present stream valleys but commonly dissected),
- Early Triassic-middle Triassic arenite-mudrock, characterised as lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanolithic pebble conglomerate [at base],
- Late Permian sedimentary rock, characterised as lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff and tuffaceous (cherty) mudstone.
- Late Permian arenite-mudrock, characterised as calcareous sandstone and shale, mudstone, coal and concretionary limestone).

The upper 10-15m (approximately) material is weathered. A fault is present within the south-western corner of the lot boundary and several more can be found within 1 km of the site.

1.2.4 Site Hydrology and Fluvial Networks

The RMI lease (ML70312) is located within the catchment of New Chum Creek, which covers an area of approximately 51 km². Also located within the New Chum Creek catchment is the Millennium, Daunia and Poitrel Mines, which include open cut voids, spoil dumps and creek diversions. RMI's lease (~3.2 km²) covers approximately 6% of the New Chum Creek catchment.

New Chum Creek enters the RMI lease from the north-west after running through the Millennium Mine (Figure 4). The northern bank of New Chum Creek forms the approximate alignment of the northern RMI lease boundary with the Millennium Mine, before the creek turns more southerly, crossing the RMI lease to the east of the CHPP and rail loop. In accordance with the EA requirements, a 100 m vegetated buffer has been maintained on the RMI side of New Chum Creek, with the approved exceptions of the Millennium Mine haul road and the rail line, which cross the creek using culverts.

New Chum Creek in the proximity of RMI, is classified as a non-perennial minor watercourse with Strahler Stream Orders of 2 and 3. The Stream Order of New Chum Creek increases from 2 to 3 at the convergence of a former un-named tributary from the north, which has been covered by the Millennium Mine spoil dump and no longer provides inflows. New Chum Creek remains a Stream Order 3 Waterway until it enters the Isaac River (Strahler Stream Order 6) approximately 8 km to the south of RMI. There are no Stream Order 4 or above waterways within or immediately surrounding RMI. There are also no creek diversions within the RMI lease.

Upon crossing the southern RMI lease boundary, New Chum Creek flows in a southerly direction through the Poitrel mining leases ML70116 and ML4749 before entering the Isaac River. As part of the Poitrel mining operations, New Chum Creek has been diverted to the east from its original alignment to allow for the open cut operations.

New Chum Creek forms part of the Isaac Northern Tributaries Catchment within the Fitzroy Basin. This area is covered by the environmental values and water quality objectives established for the Fitzroy Basins under the *Queensland Environment Protection (Water and Wetland Biodiversity) Policy (2019)* within the Isaac River Sub- basin Environmental Values and Water Quality Objectives Basin No. 130 (Part).

1.2.5 Groundwater Levels and Properties

A hydrogeological assessment and development of pre- and post-mining hydrogeological conceptual models (CDM Smith, 2021) has been undertaken to support the PRC Plan and is contained in **Error! Reference source not found.** The hydrogeological information summarised within this PRC Plan is sourced from this assessment.

There are two primary hydrostratigraphic units inferred as occurring within or near the RMI site:

- **Alluvial Aquifer** – associated with New Chum Creek and comprised of relatively coarse (i.e., sandy) alluvium derived from re-worked bedrock material. The alluvial aquifer is not monitored as part of the RMI operations and as such the presence of this aquifer is only inferred based on the topography and geology of the site. It is unknown if the alluvial aquifer is a perched system or is connected to the regional water table where the regional groundwater system is shallower further to the south (i.e., off-site).
- **Fort Cooper Coal Measure Aquifer (FCCMA)** – comprises interbedded siltstones, sandstones, minor mudstones, shales and coal measures. It is likely to be a fractured rock aquifer with relatively low primary porosity with the exception of coal measures, which may have a relatively higher primary porosity. The permeability of this aquifer is dependent on the aperture and connectedness of the fracture network. Groundwater flow through the deeper coal seam sections of the aquifer may be dominated by primary porosity in addition to pathways through fractures (secondary porosity). The dual porosity of the FCCMA means that groundwater flow paths are likely to be heterogeneous and may be difficult to accurately predict.

The RMI site is located within the Isaac Groundwater Catchment within the Fitzroy Basin. The RMI site is also located within the Isaac Connors Groundwater Management Area, which is prescribed under the Water Act (2000) Water Plan (Fitzroy Basin) 2011. The Water Plan's objectives for groundwaters within the management area are for sustainable management to maintain ecological values and enable maintenance and ongoing use of the resource through water allocations and licensing.

Groundwater levels in the proximity of RMI are influenced by surrounding mining operations, which include open cut and underground coal mining operations. As operations at RMI do not extract groundwater or include excavations that interact with groundwater, the predominant influence on groundwater levels from RMI operations would be seepage from the operational dams.

Assessment of groundwater levels during the fieldwork undertaken as part of the preparation of this PRC Plan (21 April 2021), recorded the following groundwater levels and changes in groundwater heights since 2015:

- MB3A 218.2 m AHD – decline of around 12 m since 2015;
- MB3B 219.6 m AHD – decline of around 5 m since 2015;
- MB4 215.4 m AHD – decline of around 2 m since 2015;
- MB11A 209.0 m AHD – decline of around 8 m since 2015;
- MB11B 211.4 m AHD – decline of around 8 m since 2015.

Figure 22 (Section 8.2.7) shows the location of the existing groundwater monitoring bore network.

Due to the lack of groundwater extraction at RMI, decreases in groundwater heights at RMI are not a result of on-site operations.

Registered groundwater bores within 2 km of the site are predominantly associated with 'mine monitoring' with only five existing registered bores classified as 'water supply' and two existing bores as 'unknown' use. Based on the location of the bores and the surrounding mines site landforms, it is anticipated the off-site water supply bores may have been decommissioned/lost as part of surrounding mining operations.

Groundwater quality within the FCCMA, measured through the on-site monitoring bores, indicates the following:

- Average salinity of 1700 – 3700 mg/L.

- Slightly basic pH averaging from 7.8 to 8.3.

The water quality of the FCCMA is considered suitable for the nominated PMLUs including stock watering of beef cattle, sheep and horses.

1.2.6 Soil Types, Properties and Productivity

1.2.6.1 Soil Context

A soil, capping and land suitability assessment for RMI was commissioned by BMC in 2021, including a sampling program of stockpiled topsoil (GTE, 2021 – Appendix 5). A desktop review of available information from the Daunia Mine Environmental Impact Statement (EIS) (BMA, 2008), Millennium Mine EIS (Peabody, 2008) and Poitrel Mine EIS (SKM, 2004) was also undertaken to understand baseline soil types. Soil types have been identified by soil mapping unit (SMU) and Australian Soil Classification System (ASC), as detailed in Table 4, and shown in Figure 5.

Table 4: Soil Mapping Units (SMUs) and Australian Soil Classification (ASC) of Soils at RMI.

SMU Code	Australian Soil Classification	SMU Concept	Area (ha) on Project Site	Additional Notes
A2	Brown Sodosol	Alluvial, sandy hard duplex	186	Hard setting sandy loam duplex soils alongside New Chum Creek often with bleached A2 over hard coarse structured medium yellow clay often heavily mottled. Poplar Box mixed woodlands with associated Brigalow and Blackbutt.
DB4	Brown Vertosol*	Moderately well-structured grey, brown cracking clays	24	Little or no gilgai.
B4	Black Vertosol	Friable Brigalow scrub soil, black cracking clay	76	Deep well-structured black cracking clay with granular surface mulch.
B4v	Black Vertosol	Variant to B4	1	Fine granular non-cracking red / brown Brigalow scrub soil.
DB2	Brown Vertosol	Linear gilgai on dark grey, brown clays	4	Cracking and non-cracking clays. Brigalow, Bauhinia, Poplar Box and Dawson Gum.

* Australian Soil Classification not available for the SMU codes on review. Assessed by GTE based on SMU Code Description and available information.

Disturbance at RMI has occurred in the A2, B4 and B4v SMUs. Topsoil has been stockpiled at five locations, as shown in Figure 5. Three topsoil stockpiles have been sampled (samples RMI1 – RMI4), along with two undisturbed sites (samples RMI5 and RMI6) to the north of New Chum Creek at Millennium Mine. (Stockpiles 4 and 5 were not sampled due to the minimal volumes).

The main properties and productivity data for the sampled topsoils are summarised in Table 5 and Figure 5. Detailed results of the topsoil quality are included in Section 6.1.4 and Appendix 5. The properties of stockpiled topsoils indicate that exchangeable sodium percentage (ESP) is low and potential for dispersion when undisturbed is also low. However, instability may be an issue when topsoil is disturbed and saturated. These same observations were noted in the undisturbed topsoil sample sites. Some minor limitations are also present with nutrient levels in stockpiled soil; however these are also not dissimilar to the undisturbed site samples. This indicates with appropriate management topsoils will be suitable for rehabilitation at RMI.

Table 5: Chemical Properties and Productivity Potential of Soil Types Found Within The RMI Area.

Analysis (Unit)	Soil Samples and Associated Sampling Locations					
	Stockpile 3	Stockpile 2		Stockpile 1	Undisturbed Sites	
	RMI1	RMI2	RMI3	RMI4	RMI5	RMI6
Soil pH (H2O)	8.07	7.46	6.79	6.36	7.47	6.10
Soil EC (dS/m)	0.174	0.083	0.183	0.096	0.103	0.034
PAWC (mm)	48 - 60	36 – 60		36 - 60	N/A	N/A
Tot Organic Carbon (%)	1.1	0.85	1.3	1.9	4.2	2.2
CEC (meq/100g)	16	8.7	10	7.4	30	8.1
ESP (%Na/CEC)	0.31	0.30	0.87	0.35	0.54	0.11
Ca/Mg (ratio)	3.2	2.1	3.6	2.7	4.3	3.5
Productivity	Soil properties sufficient to support grasses and native trees					

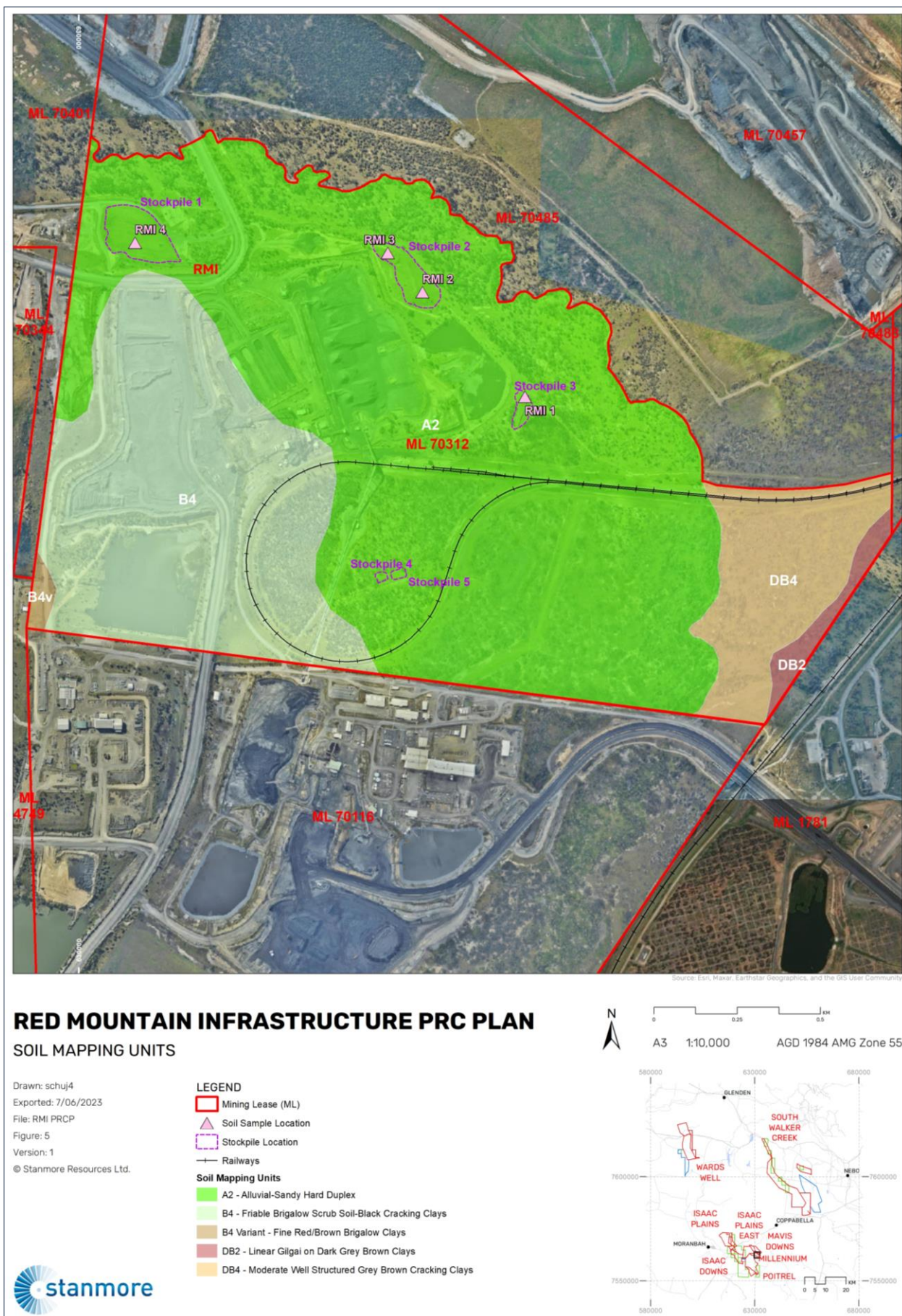


Figure 5: RMI Soils Map Showing Soil Mapping Units within the Mining Lease.

1.2.6.2 Pre-Mining Land Suitability Cattle Grazing

A desktop assessment was undertaken to determine the pre-mining land suitability classes, according to the DSITI & DNRM (2015) Guidelines for Agricultural Land Evaluation in Queensland, for cattle grazing at RMI (GTE, 2021). The pre-mining land suitability assessment for cattle grazing on RMI, based on the site-specific SMUs (refer to Section 1.2.6.1) is shown in Table 6. The results of the desktop assessment indicated the pre-mining land suitability class for the A2 SMU was 4. All remaining SMUs scored a land suitability class of 2 using the combination of methods where information was available (i.e., SMU B4 only).

Table 6: Pre-Mining Land Suitability of SMUs for Cattle Grazing at RMI (DSITI and DNRM, 2015).

SMU Code	SMU Concept	Land Suitability Class (Beef Cattle Grazing)
A2	Alluvial, sandy hard duplex	4
DB4	Moderately well-structured grey, brown cracking clays	2
B4	Friable Brigalow scrub soil, black cracking clay	2
B4v	Variant to B4	2
DB2	Linear gilgai on dark grey, brown clays	2

1.2.7 Land Stability

The pre-mining topography is defined by gently undulating plains that drain to the east and south. Pre-mining surface erosion was associated with grazing activities and historically cleared areas. Materials exposed through disturbance and placement in engineered landforms (ROM pad, bunds, etc.) have a propensity to be unstable if not rehabilitated.

1.2.8 Vegetation Communities and Ecological Data

1.2.8.1 Vegetation Communities and Regional Ecosystems

The vegetation communities and regional ecosystems (REs) occurring on RMI have been assessed based on a desktop review of the following databases and previous studies, as well as a rapid field-based vegetation assessment undertaken by BMC in April 2021 (RMI vegetation assessment).

The Queensland Government mapping databases include:

- Regional ecosystem mapping ML 70312 (Regional ecosystem mapping: [Regional Ecosystem Mapping](#))
- Matters of State Environmental Significance (MSES) ML 70312 (Matter of state significance (MSES): [MSES Online Reports](#))
- Maps of environmentally sensitive areas ML 70312 (Maps of environmentally sensitive areas: [Maps of Environmentally Sensitive Areas](#))

Results of desktop searches of government databases are provided in Appendix 6. Other documents referred to include:

- Historical aerial photography (Figure 8).
- Millennium Expansion Project Environmental Impact Statement (MEP EIS) Chapter 13: Nature Conservation (Peabody, 2011).
- Red Mountain Joint Venture Environment Management Plan ML70312 (RMJV EM Plan) (SMC/Peabody, 2014).

Observations from the Desktop Review include:

- The State mapping is undertaken at a coarser scale and has some inaccuracies. However, it has been reviewed and deemed adequate for the purpose of illustrating the broad extent of regional ecosystems (REs), matters of state significance (MSES) and environmentally sensitive areas (ESAs) on RMI.
- The review of RE mapping in the MEP EIS is of limited value to the RMI PRCP as they were undertaken more than 10 years ago (in 2010), and reduced accuracy associated with coarse-scale mapping of the area associated with RMI.
- The RMJV EM Plan refers to historical flora and fauna surveys being undertaken by Ansar Environmental in 2003. The results of the REs recorded during this assessment listed in the RMJV EM Plan have been considered as part of the desktop assessment, however the historical nature of the survey and the degree of disturbance at RMI since 2003 means this survey is of limited value to the RMI PRCP.

A rapid field-based vegetation assessment was undertaken by BMC in April 2021 (RMI vegetation assessment) to verify the regional ecosystems and vegetation communities occurring in the existing vegetation on ML70312 surrounding the disturbed area on RMI.

The RMI vegetation assessment was undertaken in accordance with the *Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland, Version 5.1* (Neldner et al, 2020).

Table 7 lists the REs and associated vegetation communities that were recorded in the RMI vegetation assessment as well as those REs referred to within the MEP EIS and/or the RMJV EM Plan.

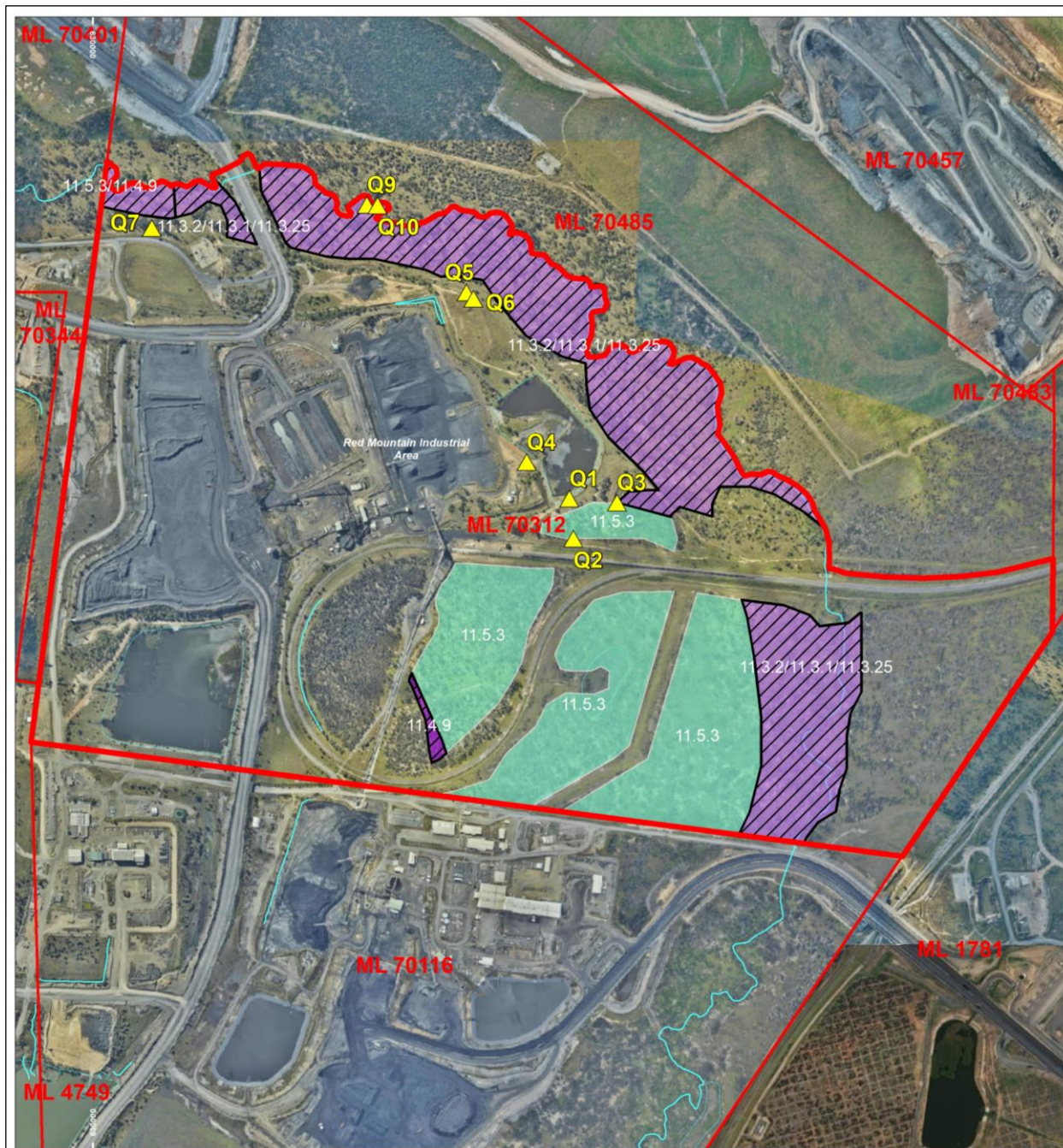
The vegetation communities recorded during the RMI vegetation assessment are described in more detail in Table 8 to Table 11.

Despite the historical disturbance to vegetation on RMI, a mosaic of vegetation communities remain predominantly associated with the riparian corridor of New Chum Creek and associated Quaternary alluvial and Tertiary plains. Figure 6 illustrates the current Queensland government regional ecosystem mapping and the location of the Quaternary vegetation sites surveyed during the RMI vegetation assessment.

Table 7: Regional Ecosystems Mapped and/or Recorded on RMI.

Regional Ecosystem Descriptions	RE Code	RE VM Status	RE BIOD Status	RE Map	Field RE	MEP EIS	RMJV EM Plan
<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	11.3.1	E	E	✓	✓	-	-
<i>Eucalyptus populnea</i> woodland on alluvial plains	11.3.2	OC	OC	✓	-	✓	-
<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	11.3.25	LC	OC	✓	-	✓	-
<i>Eucalyptus-Corymbia</i> grassy or shrubby woodland on Cainozoic clay plains	11.4.2	OC	OC	-	-	-	✓
<i>Dichanthium</i> spp., <i>Astrelba</i> spp. grassland on Cainozoic clay plains	11.4.4	LC	OC	-	-	-	✓
<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains	11.4.9	E	E	✓	-	✓	✓
<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	11.4.8	E	E	✓	✓	-	-
<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i>	11.5.3	LC	NC	✓	✓	-	✓

Regional Ecosystem Descriptions	RE Code	RE VM Status	RE BIOD Status	RE Map	Field RE	MEP EIS	RMJV EM Plan
+/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces							
<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> and <i>Corymbia</i> spp. woodland on Cainozoic sand plains/remnant surfaces. Plateaux and broad crests with deep red loams	11.5.9	LC	NC	-	✓	-	✓
<i>Corymbia clarksoniana</i> woodland and other <i>Corymbia</i> , <i>Eucalyptus</i> species on Cainozoic sand plains/remnant surfaces.	11.5.12	LC	NC	-	-	-	✓
<i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains/remnant surfaces.	11.5.18	OC	OC	-	-	-	✓
<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> and <i>Eucalyptus thozetiana</i> or <i>E. microcarpa</i> woodland on lower scarp slopes on Cainozoic lateritic duricrust.	11.7.1	LC	OC	-	-	-	-
<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	11.7.2	LC	NC	-	-	-	✓
Non-remnant cleared	-	-	-	✓	✓	✓	✓



RED MOUNTAIN INFRASTRUCTURE PRC PLAN

REMNANT REGIONAL ECOSYSTEMS & ENVIRONMENTALLY SENSITIVE AREAS

Drawn: schuj4
Exported: 7/06/2023
File: RMI PRCP
Figure: 6
Version: 1
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LEGEND

- ▲ RMI Vegetation Survey Sites
- Mining Lease (ML)
- Environmentally Sensitive Areas**
- Category B - Endangered Regional Ecosystem
- State Regional Ecosystems (Biodiversity)**
- Endangered - Dominant
- Endangered - Sub-Dominant
- No Concern at Present
- River; Creek
- Waterbodies



0 0.25 0.5 km
A3 1:10,000 AGD 1984 AMG Zone 55

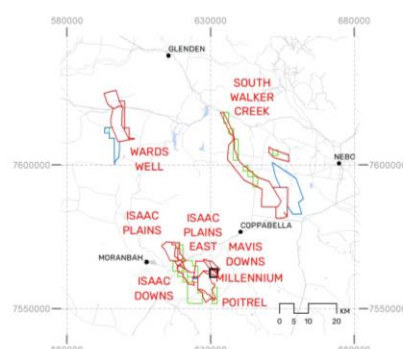


Figure 6: State Regional Ecosystems and Environmentally Sensitive Area Mapping ML70312, Including Sampling Location of RMI's 2021 Vegetation Assessment.

Table 8: Non-Remnant Cleared Vegetation.

	Vegetation Community Description Non-remnant cleared mixed exotic pastures and scattered regrowth with <i>Chloris Gayana</i> , <i>Eucalyptus populnea</i> , <i>Acacia salicina</i> on Tertiary clay plains surrounding infrastructure and dams.
	RE and Status Non-remnant cleared
	Ecological Dominant Layer (EDL) Ground
	EDL Median Height (Range) (m) 1m (0.5 – 1.5m)
	EDL Estimated Cover (%) 80%
	Dominant Species Tree 1 (T1) and Tree 2 (T2) <i>E. populnea</i> , <i>A. salicina</i>
	Dominant Species Shrub (S1 and S2) <i>Acacia salicina</i>
	Dominant Species Ground <i>Chloris gayana</i> *, <i>Cenchrus ciliaris</i> *, <i>Megathyrsus maximus</i> *
	Survey Sites Q1, Q4, Q5, Q8

Table 9: Remnant RE 11.5.3.

	Vegetation Community Description Remnant RE 11.5.3 <i>Eucalyptus populnea</i> mixed with open forest with <i>Lysiphyllum hookeri</i> , <i>Acacia excelsa</i> , <i>Eremophila mitchellii</i> , <i>Ehretia membranifolia</i> and <i>A. salicina</i> on loamy Tertiary plains.
	RE and Status RE 11.5.3 remnant
	Ecological Dominant Layer (EDL) Tree 1
	EDL Median Height (Range) (m) 16m (10-20m)
	EDL Estimated Cover (%) 35%
	Dominant Species Tree 1 (T1) and Tree 2 (T2) <i>Eucalyptus populnea</i> , <i>Lysiphyllum hookeri</i> , <i>Acacia excelsa</i> , <i>Eremophila mitchellii</i> , <i>Ehretia membranifolia</i> and <i>A. salicina</i>
	Dominant Species Shrub (S1 and S2) <i>Alectryon diversifolius</i> , <i>Breynia oblongifolia</i>
	Dominant Species Ground <i>Chrysopogon fallax</i> , <i>Styosnthes scabra</i> *, <i>Cenchrus ciliaris</i> *, <i>Urochloa mosambicensis</i> *, <i>Harrisia martini</i> ***, <i>Megathyrsus maximus</i> *
	Survey Sites Q2

* Indicates species is exotic

** Indicates a species is listed invasive under the *Queensland Biosecurity Act 2014*

Table 10: High Value Re-Growth RE 11.4.8.

	Vegetation Community Description High Value Regrowth RE 11.4.8, <i>Eucalyptus cambageana</i> forest on the Tertiary clay plains
	RE and Status RE 11.4.8 High Value Regrowth >15 years
	Ecological Dominant Layer Tree 1
	EDL Median Height (Range) (m) 11m (6 – 12m)
	EDL Estimated Cover (%) 70%
	Dominant Species Tree 1 (T1) and Tree 2 (T2) <i>Eucalyptus cambageana</i> , <i>Acacia harpophylla</i>
	Dominant Species Shrub (S1 and S2) <i>Cassia brewsteri</i> , <i>Alectryon diversifolius</i> , <i>Ehretia membranifolia</i> , <i>Enchylaena tomentosa</i>
	Dominant Species Ground 80% litter, Scattered <i>Cenchrus ciliaris</i> *
Survey Sites Q3, Q6, Q7	

Table 11: High Value Re-Growth RE 11.3.1.

	Vegetation Community Description High Value Regrowth RE 11.3.1 Mixed <i>Acacia harpophylla</i> forest on Quaternary alluvium and along drainage lines with or without emergent
	RE and Status RE 11.3.1 High Value Regrowth >15 years
	Ecological Dominant Layer Tree 2
	EDL Median Height (Range) (m) 8m (3 – 10m)
	EDL Estimated Cover (%) 30 – 40%
	Dominant Species Tree 1 (T1) and Tree 2 (T2) <i>Eucalyptus cambageana</i> , <i>Acacia harpophylla</i> , <i>Lysiphyllum hookeri</i> , <i>Cassia brewsteri</i>
	Dominant Species Shrub (S1 and S2) <i>Citis glauca</i> , <i>Carrisa ovata</i>
	Dominant Species Ground <i>Megathyrsus maximus</i> *, <i>Aristida sp.</i>
Survey Sites Q9, Q10	

* Indicates species is exotic

** Indicates a species is listed invasive under the *Queensland Biosecurity Act 2014*

1.2.8.2 Environmentally Sensitive Areas

The desktop review indicated the presence of Category B ESAs on RMI (Figure 6 and **Error! Reference source not found.**). These ESAs are associated with the following mapped regional ecosystems with an Endangered Biodiversity status:

- RE 11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains;
- RE 11.4.8 *Eucalyptus cambageana* open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains;
- RE 11.4.9 *Acacia harpophylla* shrubby open forest with *Terminalia oblongata* on Cainozoic clay plains.

1.2.8.3 Threatened Ecological Communities

The desktop review of the Australian Government *EPBC Act Protected Matters Search Tool* for RMI (Appendix 6) indicated the likely occurrence of the following Endangered Threatened Ecological Communities (TECs) within 1km of RMI:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) Endangered Community (Brigalow TEC);
- Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin (Natural Grassland TEC);
- Poplar Box Grassy Woodland on Alluvial Plains (Poplar Box Grassy Woodland TEC).

Brigalow TEC

The MEP EIS recorded approximately 85.7 ha of the Brigalow TEC across the entire survey area though did not record the Brigalow TEC on the RMI ML70312. The RMJV EM Plan indicates the Brigalow TEC was observed on RMI in association with RE 11.4.8 and 11.4.9.

The RMI vegetation assessment indicated that the majority of the area mapped by the State as containing remnant REs (Figure 6) was observed to be comprised of high value regrowth in association with Endangered Brigalow REs 11.4.8 (Table 10) and RE 11.3.1 (Table 11). Based on the results of the RMI vegetation assessment, the Brigalow TEC is likely to occur on RMI in association with the high value regrowth RE 11.3.1 along New Chum Creek and is moderately likely to be associated with the high value regrowth RE 11.4.8 due to the dominance of *E. cambageana* in these areas.

Natural Grassland TEC

The MEP EIS indicates that REs associated with potential Natural Grassland TEC were recorded in association with RE 11.9.3; however, it stipulates these areas did not meet the condition thresholds to be considered the community under the EPBC Act. The RMJV EM Plan mentions the potential presence of RE 11.4.4 listed as a constituent RE for the Natural Grasslands TEC; however, this RE 11.4.4 is not mapped on RMI, nor was it recorded during the MEP EIS or the RMI vegetation assessment in 2021.

Given the lack of mapping or records of the constituent grassland REs on RMI, the degree of historical disturbance, as well as the presence of exotic pasture grasses, including but not limited to Buffell grass (*Cenchrus ciliaris*), it is unlikely that the Natural Grassland TEC is present on RMI.

Poplar Box Grassy Woodland TEC

The Poplar Box Grassy Woodland TEC was listed as a TEC under the EPBC Act by the Department of the Environment and Energy in 2019 (DoEE, 2019), after the MEP EIS and RMJV EM Plan were undertaken. The Poplar Box Grassy Woodland TEC is associated with RE 11.3.2 that has been mapped and previously recorded on RMI for the MEP EIS and RMJV EM Plan. To meet the Poplar Box Grassy Woodland TEC, an area of RE11.3.2 is required to meet additional key diagnostic characteristics associated with tree canopy cover >10%, tree canopy height >10m, dominance of *Eucalyptus populnea* (Poplar Box) in the canopy, as well having either a <50% perennial vegetation cover in ground layer or ≥ 20 native plant species per patch in the ground layer (DoEE, 2019). Given the high historical disturbance of the vegetation on RMI there is only a moderate chance of the Poplar Box Grassy Woodland TEC occurring.

The likelihood of occurrence of TECs on RMI has been listed in Table 12, based on the results of the desktop assessment and RMI vegetation assessment.

Table 12: Threatened Ecological Community Likelihood of Occurrence on RMI.

Threatened Ecological Community	RE Code	RE Map	Field RE	MEP EIS	RMJV EM Plan	Likelihood of Occurrence on RMI
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) Endangered Community (Brigalow TEC)	11.3.1 11.4.9 11.4.8	✓	✓	-	✓	Likely
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin (Natural Grassland TEC)	11.4.4	-	-	-	✓	Unlikely
Poplar Box Grassy Woodland on Alluvial Plains (Poplar Box Grassy Woodland TEC)	11.3.2	✓	-	✓	✓	Moderate

1.2.8.4 Conservation Significant Flora Species

No conservation significant flora species records were returned from the Queensland Government online wildlife records searches (**Error! Reference source not found.**).

No threatened flora species listed under the EPBC Act were observed within the MEP area during the MEP EIS. The RMJV EM Plan states that a flora survey identified one listed species, the *Cerbera dumicola*, shrub or small tree growing to 4m high, classified as Near threatened under the *Nature Conservation (Wildlife) Regulation 1994*. Despite the previous record of *Cerbera dumicola*, there are no requirements for consideration of its inclusion in the rehabilitation requirements for RMI as per the EA and/or RMJV EM Plan.

1.2.9 Fauna Habitats

1.2.9.1 Fauna Species and Habitats

The fauna habitat types within the undisturbed area of RMI include the waterway habitat associated with the riparian vegetation along New Chum Creek, as well as adjacent areas of eucalypt woodlands associated with *Eucalyptus populnea* dominated woodlands and/or *Eucalyptus cambageana* regrowth as well as Brigalow (*Acacia harpophylla*) regrowth woodlands. The broad fauna habitats on RMI can be classed as:

- Mixed riparian woodlands;
- Eucalypt woodlands with exotic grasses;
- Brigalow woodlands with exotic grasses;
- Cleared exotic grasslands.

The vegetation in areas undisturbed by mining along New Chum Creek and the adjacent plains have been mapped by the Queensland Government as containing core habitat for threatened (Endangered or Vulnerable) wildlife and special least concern animals including, ornamental snake (*Denisonia maculata*) (Vulnerable EPBC Act and NC Act) and essential habitat for the short-beaked echidna (*Tachyglossus aculeatus*) (**Error! Reference source not found.** and Figure 7).

No conservation significant fauna species records were returned from the Queensland Government online wildlife records (**Error! Reference source not found.**). There are no requirements for inclusion of specific fauna habitats attributes in rehabilitation planning for RMI listed in the EA.

The vegetation on RMI associated with the mapped fauna habitat containing habitat for threatened (Endangered or Vulnerable) wildlife and special least concern animals (**Error! Reference source not found.** and Figure 7) has, however, been considered in PMLU planning and will be maintained as woodland habitat or watercourse vegetation (Section 3.1).

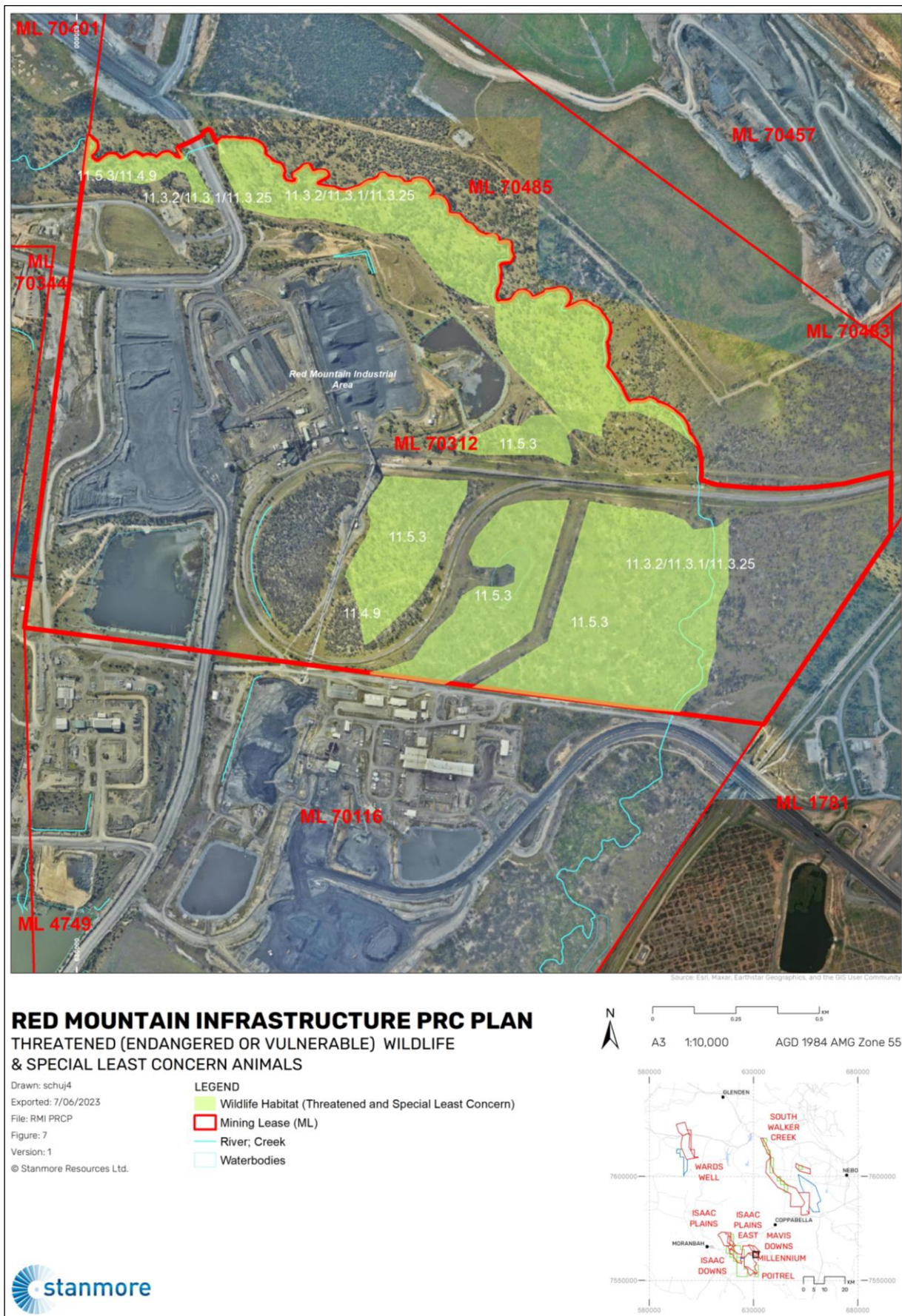


Figure 7: RMI Threatened (Endangered or Vulnerable) Wildlife and Special Least Concern Animals.

1.2.9.2 Fauna Corridors and Connectivity

At a regional level the landscape is characterised by a mosaic of cleared land for pastoral uses and mining, natural grasslands and native woodlands. Landscape connectivity in the region is predominantly provided by extant vegetation occurring along riparian corridors of waterway and river systems, providing wildlife movement opportunities.

No state or regional corridors have been mapped on RMI (**Error! Reference source not found.**).

Despite the lack of mapping of State or regional corridors, Condition E6 of the RMI EA recognises the importance of the habitat associated with New Chum Creek by conditioning that *a buffer distance of not less than one hundred (100) metres must be retained on either side of the vegetation along New Chum Creek within Mining Lease 70312 to minimise environmental impacts to regional ecosystems*. Accordingly, the vegetation along New Chum Creek and associated 100 m buffer zone has been maintained as a watercourse PMLU along New Chum Creek and woodland habitat within the 100 m buffer zone. Areas of disturbance within these areas will be rehabilitated to a watercourse or woodland habitat PMLU (Section 3.1.3 and Section 3.1.2).

1.2.10 Pre-mining Land Use

The predominant pre-mining and historical land use within and surrounding RMI is associated with cattle grazing (SMC/Peabody, 2014). This has resulted in significant disturbance of native vegetation communities within and surrounding RMI.

Figure 8 depicts a historical pre-mining aerial image of RMI and surrounding areas from 1957. The image illustrates the degree of disturbance to vegetation within and surrounding RMI from historical grazingland management prior to mining.

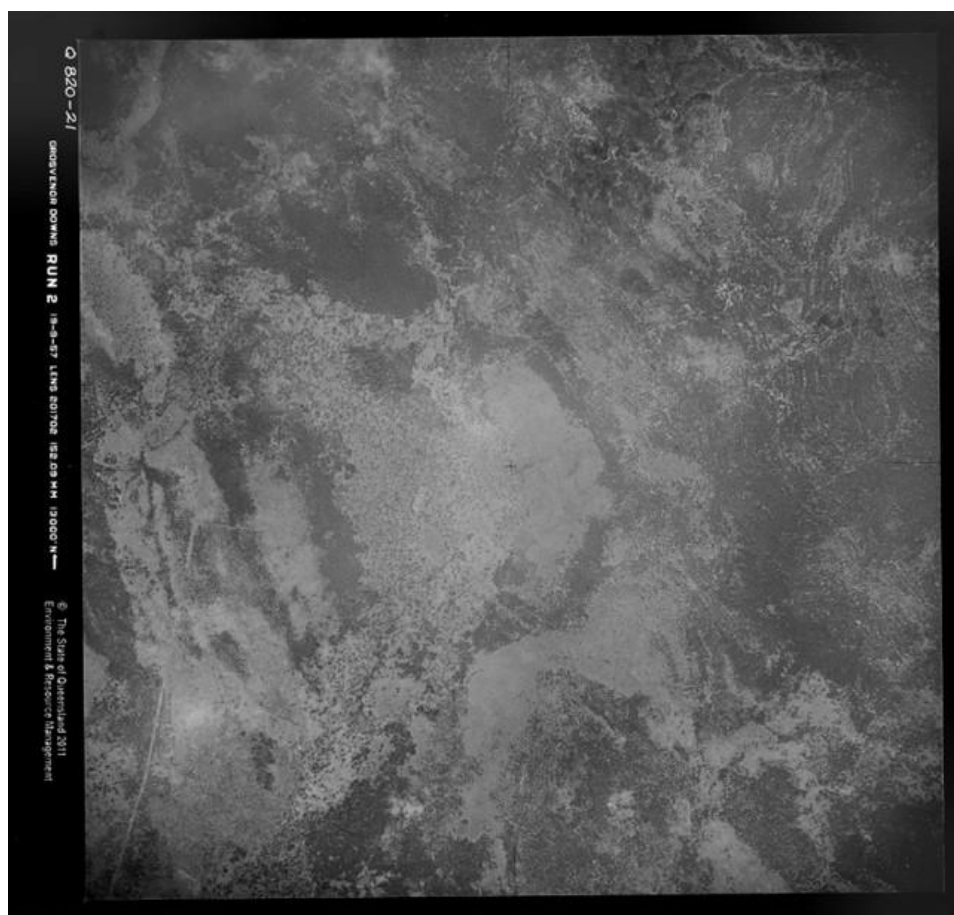


Figure 8: Pre-Mining Historical Aerial Image of RMI and Surrounding Areas-1957 (Grosvenor Downs 1:40,500).

1.2.11 Underlying Landholders

The underlying landholder is SMC Stanmore Pty Limited.

1.3 Design for Closure

This PRC Plan has been developed to proactively manage progressive rehabilitation of the RMI site to a stable post-mining land use, aiming to minimise long-term management requirements as well as associated closure costs. Importantly, a focused design for closure underpins all sections of this plan, including:

- Engagement with relevant stakeholders to define suitable PMLUs;
- Defining and implementing rehabilitation practices to identify risks that could influence achievement of milestone criteria;
- Demonstrating successful rehabilitation through defined site monitoring to develop a feasible PRCP Schedule.

1.4 Rehabilitation and Improvement Planning

Legislative Requirement

In accordance with sections 126C(1)(b) and (c)(ii) of the EP Act, the rehabilitation planning part must include:

- Identification of all relevant activities on the mine site.
- The predicted duration of each of the relevant activities proposed for the mine site.
- The size/extent of the relevant activities.
- Whether the different relevant activities can be progressively rehabilitated.

PRC Plan Guideline (Section 3.1)

Under section 126C(1)(j) of the EP Act, transitional PRC Plans must also include the following details about any existing rehabilitation already completed at the time of submission of the proposed PRC Plan:

- A description of the rehabilitation works previously carried out.
- When the rehabilitation works commenced and were completed.
- Whether the rehabilitation has been applied for or approved as progressively certified under the EP Act.

1.4.1 Relevant Activities Requiring Rehabilitation

The relevant activities at RMI that will require rehabilitation - including predicted duration and availability for progressive rehabilitation, are provided in Table 13.

Progressive rehabilitation is limited until processing of coal from neighbouring mines is complete. This timing is aligned with the planned completion of coal processing at Poitrel Mine in the PRCP Schedule, with rail and train load-out areas available once train loading of Daunia coal is complete (refer to Section 1.1.5).

Currently there are no agreements in place to retain any infrastructure, but these may be sought in the future if the infrastructure may benefit the PMLU.

Table 13: Relevant Activities Requiring Rehabilitation at RMI.

Relevant Activity	Predicted Duration	Size (ha)	Availability for Progressive Rehabilitation
CHPP and associated infrastructure.	2021-2036	57	Available once RMI coal processing is complete.
Administration, crib and general buildings; workshop; fuel, oil and chemical storage.	2021-2039		Required for the rehabilitation operations until the majority of the rehabilitation of the processing areas is complete.
Laydown and general areas.	2021-2036		Available once RMI coal processing is complete.
Roads.	2021-2036	17	Available once RMI coal processing is complete.
ROM coal stockpile; product coal stockpile.	2021-2036	44	Available once RMI coal processing is complete.
Tailings drying cells.	2021-2036	3	Available once drying is complete.
Process water dam, Environment dam, drains.	2021-2049	24	Required for water management until rehabilitation of the processing areas is tracking towards achieving surface requirements.
Train load-out and associated infrastructure.	2021-2051	33	Area associated with RMI coal processing will be available once RMI coal loading is complete, with remaining area available once Daunia coal loading is complete.
Rail area.	2021-2051		Available once Daunia coal loading is complete.
Topsoil stockpiles.	2021-2051	5	Areas to be progressively rehabilitated as topsoil is used in other rehabilitation activities.

1.4.2 Rehabilitation Areas and Milestones

The rehabilitation areas (RA) and rehabilitation milestones (RM) included in the PRCP Schedule for RMI are referred to throughout this PRC Plan.

A RA is defined in the PRCP Guideline (DES, 2021) as an area of land in the post-mine land use to which a rehabilitation milestone for the post-mining use relates, and a RM is each significant event or step necessary to rehabilitate the land to a stable condition (section 112 of the EP Act).

The RMI RAs, as well as the relevant activities associated with each RA, are detailed in Table 14 (and Figure 9).

Table 14: Rehabilitation Areas (RAs), Associated PMLUs and Relevant Activities for RMI.

Rehabilitation Area (RA)	PMLU	Relevant activity
RA1	Cattle Grazing	- CHPP and associated infrastructure. - Administration, crib and general buildings. - Workshop, fuel, oil and chemical storage. - Laydown and general areas. - Roads. - Product coal stockpile. - Tailings drying cells. - Process water dam, Environment dam, drains.

Rehabilitation Area (RA)	PMLU	Relevant activity
		• Rail area. • Train load-out and associated infrastructure. • Topsoil stockpiles.
RA2	Woodland Habitat	• ROM pad.
RA3	Woodland Habitat	• Road. • Rail area. • Train load-out and associated infrastructure. • Topsoil stockpiles.
RA4	Watercourse	• Road. • Rail area.

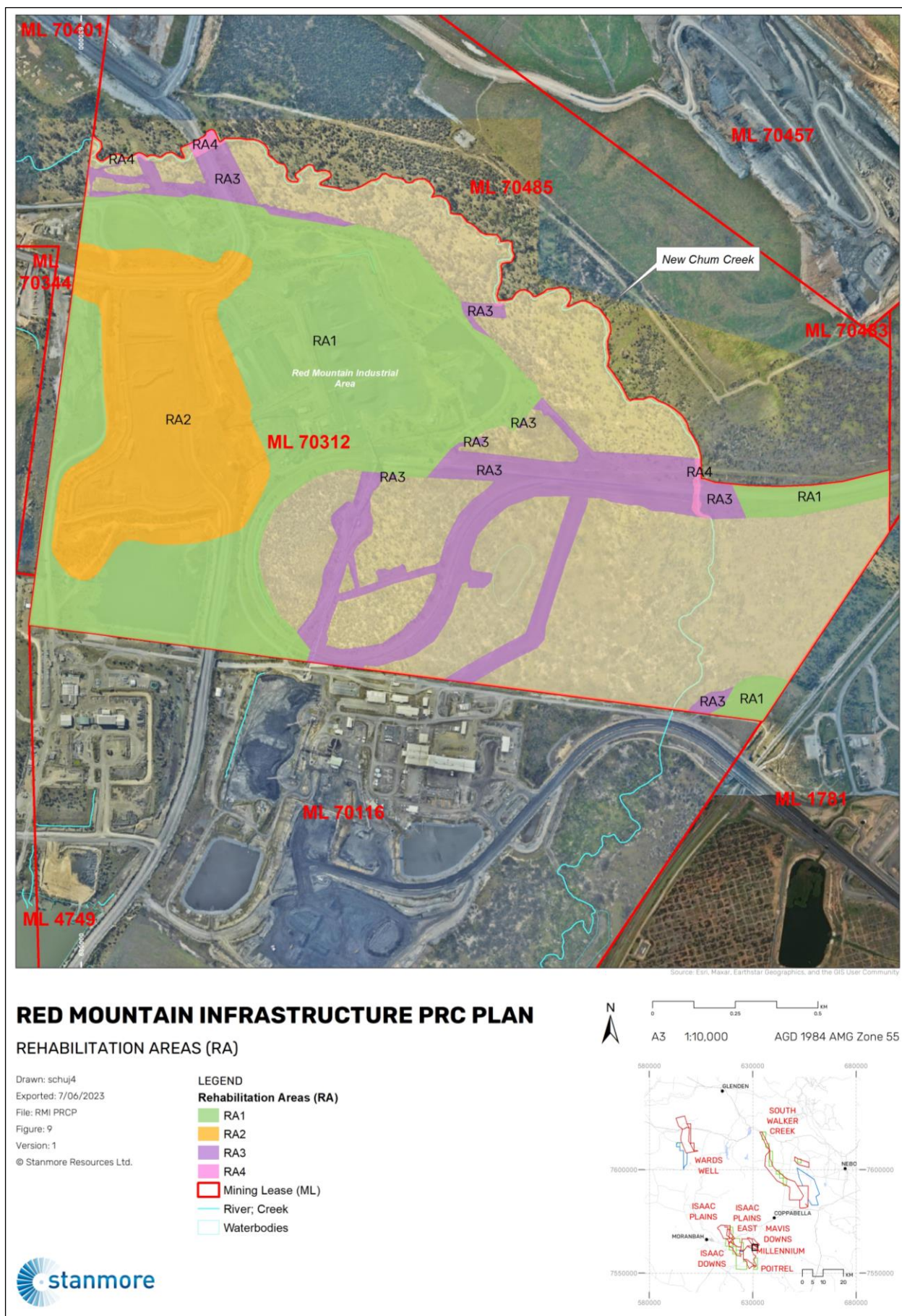


Figure 9: RMI's Rehabilitation Areas.

The RMs for RMI are detailed in Table 15.

Table 15: Rehabilitation Milestones for RMI.

Rehabilitation Milestone (RM)	
RM1	Infrastructure decommissioning and removal.
RM2	Remediation of contaminated land.
RM3	Landform development and reshaping.
RM4	Surface preparation (cattle grazing).
RM5	Surface preparation (woodland habitat).
RM6	Surface preparation (watercourse).
RM7	Revegetation (cattle grazing).
RM8	Revegetation (woodland habitat).
RM9	Revegetation (watercourse).
RM10	Achievement of surface requirements (cattle grazing).
RM11	Achievement of surface requirements (woodland habitat).
RM12	Achievement of surface requirements (watercourse).
RM13	Achievement of post-mining land use to a stable condition (cattle grazing).
RM14	Achievement of post-mining land use to a stable condition (woodland habitat).
RM15	Achievement of post-mining land use to a stable condition (watercourse).

1.4.3 Existing Rehabilitation

There is no rehabilitation on-site as all disturbance is associated with the ongoing coal washing and train load-out activities.

2 COMMUNITY CONSULTATION

Legislative Requirement

In accordance with section 126C(1)(c)(iii) and (iv) of the EP Act, the rehabilitation planning part of the PRC Plan must include:

- 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.

PRCP Guideline (Section 3.5)

- In developing the proposed PRC Plan, the community should at least be engaged on the plan for the mine, PMLUs or NUMAs, areas of disturbance, rehabilitation and management methods, progressive rehabilitation, and closure timeframes. Ongoing community consultation should continue throughout the stages of the mine life so that progressive rehabilitation and the socio-economic and environmental impacts related to mine closure can be discussed with the community.
- Community consultation carried out through different processes (such as an EIS) may be used to address the requirements in section 126C(1)(c) of the EP Act. The details of this consultation must be provided in the rehabilitation planning part of the proposed PRC Plan).

Transitional PRC Plans are still required to meet the legislative requirements in section 126C(1)(c) of the EP Act. All proposed PRC Plans must contain a community consultation plan regardless of whether the site has an existing EA.

2.1 Consultation to Date

BMC (the previous EA holder) engaged with DES regarding PMLUs as part of RMI's EA application process in 2019.

Engagement with affected landowners for Daunia and Poitrel Mines was undertaken to develop compensation, leasing and agistment agreements, based on the assumption that land disturbed for mining will be rehabilitated to be suitable for its previous use (grazing) after SMC's use of the land has ceased. SMC continues to engage with underlying and neighbouring landholders regularly on land management including lease/license issues; and on operational matters (such as air quality monitoring) as required.

BMC provided two PRC Planning briefings to Isaac Regional Council (IRC) to date (December 2020 and April 2021).

Consultation undertaken by BMC as part of PRC Plan preparation for RMI included:

- A phone call to the IRC CEO, a letter to IRC regarding the RMI PRC Plan, and an invitation for further discussion with Council about their involvement in PRC Plan consultations;
- Letters to two landowners whose properties are adjacent to RMI, one landowner whose property is not adjacent but accommodates the access road to RMI and two landholders who are affected by or adjacent to Daunia or Poitrel Mines;
- A letter to utility owners/operators and the owners of overlapping tenures (gas exploration) within and adjacent to ML 70312, including Aurizon, Queensland Rail, Powerlink and Arrow Energy;
- A letter to the owners of adjacent mining operations which include MetRes (Millennium), Poitrel Mine (BMC), Daunia Mine (BMA), Whitehaven Coal, Stanmore Resources and Pembroke Resources; and
- A letter to the Department of Natural Resources Mines and Energy (DNRME) Deputy Director-General Georesources and Manager Native Title Services and Coal Hub.

2.2 Community Consultation Register

A community consultation register has been provided as part of the PRC Plan in compliance with section 126C(1)(c)(iii) of the EP Act and includes:

- Identification of each community member/stakeholder;
- Previous engagements with the community;
- Consultation date(s);
- Description of consultation type;
- Information provided to the community;
- Issues raised/discussed by the community;
- How issues have been considered;
- Decisions/ outcomes of engagement; and
- Commitments made by BMC (now SMC)

The stakeholders identified as part of this register are considered as having a genuine, demonstrable and legitimate interest in RMI's ongoing rehabilitation and closure planning.

The community consultation register (Table 16) will be a live instrument for recording future consultation on RMI's PRC Plan. The complete register is provided in **Error! Reference source not found..**

Table 16: RMI Community Consultation Register.

Stakeholders	Details	Interests
Affected Stakeholders		
Traditional Owners	Barada Barna people were engaged in the management of Aboriginal cultural heritage through a Cultural Heritage Management Plan for RMI, originally developed by the Millennium Coal Mine to achieve its duty of care obligation under the Aboriginal Cultural Heritage Act 2003. Barada Barna people's native title to areas of land within the Isaac, Central Highlands and Mackay LGAs was determined by the Native Title Tribunal in June 2016. Barada Barna People are represented by BBAC. SMC is in regular communication with BBAC.	• Cultural heritage impacts. • Impacts on Native Title (e.g., within stock routes or associated with the Isaac River). • Post-mining land use and landform/landscape. • Future access to and ownership of land. • Environmental management/stewardship. • Employment and business opportunities in exploration, environmental management and monitoring, rehabilitation.
Adjacent and Affected Property Owners - RMI	There are two landowners whose properties are adjacent to RMI, and one landholder whose property is not adjacent but accommodates the access road to RMI, Daunia Mine and Poitrel Mine. Mavis Downs is located to the east of RMI (and Daunia Mine) and Poitrel Mine is located to the west. The access road to RMI is on a property called Wotonga. SMC has constructive working relationships with all underlying and adjacent landowners.	• Water access – underground and surface water allocations. • Environmental management/stewardship. • Post-mining land use and landform/landscape. • Rehabilitation schedule. • Future access to and ownership of land.
Underlying and Adjacent Property Owners – Daunia and Poitrel Mines	Poitrel Mine and Daunia Mine have compensation agreements with two landowners whose properties are affected by mining. The two properties are Winchester Downs and Olive Downs. Adjacent landholders to Poitrel Mine and Daunia Mine include the owner of Mavis Downs and the former owners of Daunia Mine.	
Utility Owners	Aurizon operates the TLO and rail loop which are owned by Queensland Rail and are located on land leased from SMC. Powerlink owns the Daunia overhead and underground power lines. IRC has a road reserve (an unused 'paper road') within the southern part of Daunia Mine. SMC engages with utility owners as required, i.e., issue-specific or transactional engagement.	• Impact on assets/asset value. • Rehabilitation of impacts on assets. • Service disruptions and mitigations. • Crossing/interface agreements.

Stakeholders	Details	Interests
Adjacent SMC Mine Managers and Key Stakeholders	Poitrel Mine is adjacent to RMI to the south-west and utilises infrastructure at RMI. Daunia Mine is also adjacent to RMI to the south-east and utilizes the TLO and rail loop.	- Any impacts on the use of land within overlapping tenures. - Water access. - CHPP access. - TLO and rail loop access. - Stakeholder (including employee/contractor) perceptions about closure.
Adjacent Mining Tenure - RMI	MetRes is the operator of Millennium Coal Mine. Millennium Coal Mine re-commenced utilisation of RMI's processing and train load-out facilities in September 2021.	- Access to RMI processing capacity. - TLO access. - Tailings disposal.
Adjacent Mining Tenures - Poitrel and Daunia Mines	Whitehaven Coal and Stanmore Resources hold tenements to the south and east of Daunia Mine and Poitrel Mine. Pembroke Resources has rights to a rail corridor alongside the existing Norwich Park Branch Line.	- Future land use and ownership. - Access to rail corridor land.
Overlapping Tenure Holders	Arrow Energy holds an Authority to Prospect which overlaps RMI and Daunia Mine's MLs.	Future land use and tenure.
Local Government	SMC has a long established and cooperative relationship with IRC. SMC and IRC meet at least six monthly. BMC previously had three recent briefings with Council regarding PRC Plan requirements (December 2020, April 2021 and November 2021). As noted above, IRC has a road reserve (an unused 'paper road') within the southern part of Daunia Mine and has interests in stock routes such as along the Isaac River.	- Local employment. - Stock route (Isaac River). - Effects on Council services and infrastructure. - Environmental management. - Rehabilitation progress. - Post-mining landforms. - Management of closure impacts on employment and businesses. - Alignment of rehabilitation plans with local/regional planning goals. - Economic transformation (towards post-mining) and community sustainability.
RMI Operators/Workforce	Sedgman Pty Ltd has operated RMI since 2007, using a contract workforce.	- Timing of closure. - Rehabilitation obligations. - Employment continuity. - Loss of employment/contracting opportunities at closure.
Interested Stakeholders		
Stanmore Resources Employees and Contractors	Stanmore Resources communicates regularly with its personnel through various means. Information on PRC Planning and its relevance to RMI has been provided on-site by managers and through regular communications.	- Job opportunities. - Loss of jobs with closure. - Closure planning in context with other mining industry changes e.g., autonomous haulage. - Workers' conditions.

Stakeholders	Details	Interests
		Sustainability of communities that are dependent on mining.
Businesses	SMC's procurement team have relationships with an extensive network of small business suppliers, including Indigenous businesses. As there is no likelihood of RMI's PRC Planning having a significant effect on businesses during the next ten years, business are considered interested rather than affected stakeholders at this point. There is potential to engage Traditional Owners and other Indigenous businesses in e.g., rehabilitation services as part of a broader portfolio-wide or business-wide program.	- Opportunities to participate in supply chain (e.g., exploration, environmental management, rehabilitation). - Economic transformation (towards a post-mining landscape). - Economic and community sustainability. - Loss of supply opportunities with closure.
Community Members and Groups	The Moranbah community is the closest to RMI, at approximately 20 kms to the west. Community members and groups in Moranbah and throughout the Bowen Basin have been provided with information about PRC Planning through Community consultation processes.	- Local employment and business opportunities. - With closure, loss of jobs and supply opportunities. - Community and regional sustainability. - Environmental management.
State Government: - DoR - DES - Member for Burdekin - Office of the Minister for Environment, Great Barrier - Reef, Science and the Arts	Corporate Affairs conducts as-needed engagement with Ministers and Members of Parliament and will provide briefings on PRC Planning as part of regular engagements. DoR's Deputy Director-General Georesources and Director Native Title Services and Coal Hub have been kept informed on PRC Planning.	- Legislative compliance. - Resource development. - Employment opportunities. - Public interest. - Environmental management. - Economic transformation (towards post-mining). - Financial assurance. - Environmental risk management. - Future land use and landform.

2.3 Ongoing Consultation

2.3.1 Consultation Objectives, Engagement Type and Frequency

A dedicated Community Consultation Plan (CCP) has been compiled for RMI's PRC planning (Elliot Whiteing, 2021) (Appendix 7). This plan documents the iterative consultation process to be followed to enable ongoing PRCP-related engagement with the relevant stakeholders (Table 17).

Table 17: Process to be Followed for Ongoing Community Consultation for RMI PRC Planning

Consultation Objective	Engage Key Stakeholders in Identifying Community Objectives and Aspirations for Post-Mining Land Use and Landform, and Social Value Opportunities	
Community Member	Engagement Type	Proposed Consultation Frequency
Landowners and lessees within and adjacent to RMI. Traditional owners – Barada Barna People (BBAC) IRC Community members	Advise landowners, lessees, Traditional Owners and IRC in writing when the PRC Plan is approved and provide a copy of the PRC Plan for their information.	Once-off
	Meet with directly affected and adjacent landholders, BBAC and IRC to provide an update on the PRC Plan and progress with rehabilitation, and invite their inputs and feedback on: • The approved PMLUs and post-mining landforms. • Any particular values or opportunities in specific disturbed areas. • Rehabilitation methods which would optimise future grazing opportunities, land management or water storage. • Shared value initiatives, e.g., infrastructure retention, capacity building, environmental management, research or delivery partnerships. • Rehabilitation methods, schedule, and progress towards milestones.	As requested, or as agreed with individual representatives / agencies.
	Through meetings with IRC: • Provide an update on the status of the PRC Plans and rehabilitation. • Forecast upcoming PRC Plan consultation for other SMC assets. • Seek to understand Council's strategic analysis and planning for Isaac LGA and the RMI project area.	Bi-annually, or as agreed with IRC.
	Meet with the landholder accommodating the road access to RMI, Daunia and Poitrel Mines to consult on the rehabilitation of the road and surrounding areas and reflect their feedback in ongoing planning requirements.	Two years prior to closure, subsequent consultation to be agreed.
	Participate in Council, community or industry-led initiatives which aim to harness social value from mine closure and rehabilitation planning, and/or work towards from economic transformation/transition.	As invited.
	In cooperation with BBAC and other First Nations within Isaac LGA, and on a portfolio-wide basis: • Communicate the pipeline of opportunities relating to rehabilitation work and land management. • Develop a shared understanding of business capabilities relevant to closure and rehabilitation works. • Plan and implement an Indigenous business capability development program to match rehabilitation opportunities, if this is required.	Once-off process.

	Via Smart Transformations Advisory Committee members, and/or PRC Plan-specific workshops or focus groups, seek the involvement of community members and groups in articulating community aspirations for rehabilitation, PMLUs and economic transformation.	Once-off, portfolio-wide process.
Engagement Objective	Demonstrate Transparency Regarding SMC's PRCP Intentions and Timeframes to SMC Personnel and Local Communities	
Community Member	Engagement Type	Proposed Consultation Frequency
SMC employees and contractors	Keep the RMI workforce updated (via Coal Connect, a weekly email newsletter to personnel) if there are changes to the PRC Plan.	Ongoing engagement process.
Moranbah community members and groups	Using Community Connect (SMC's monthly community newsletter) and community forums such as interagency meetings, partnership meetings and community and business networks, provide community updates on PRC Planning (RMI-specific as relevant and portfolio wide)	Ongoing engagement process.
Local businesses and SMC suppliers	Provide information about the pending closure of RMI and potential future supply opportunities as part of closure and rehabilitation.	Two years prior to closure; subsequent consultation to be agreed.
Elected representatives and Government agencies	Provide updates via letters and/or meetings on PRC Planning to: • Office of the Minister for Resources (Queensland). • Office of the Minister for Environment, Great Barrier Reef, Science and Youth Affairs (Queensland). • Shadow Minister for Resources. • Shadow Minister for Environment, Great Barrier Reef, Science and Youth Affairs Resources. • Member for Burdekin (Queensland Parliament). • DES PRCP Team and Business Centre Coal. • Director, Native Title Services and Coal Hub, Department of Resources. • Deputy Director-General Georesources, Department of Resources. • Assistant Secretary Assessments and Governance Branch, DAWE.	As requested, or as agreed with individual representatives /agencies.

Engagement Objective	Cooperate with IRC, Utility Owners and Adjacent Mining and Energy Tenement Owners as Part of PRC Planning	
Community Member	Engagement Type	Proposed Consultation Frequency
Poitrel Mine	Involve internal SMC stakeholders in PRC Planning processes to build capacity for community engagement on PRC Planning issues and support effective delivery of PRC Plans.	Ongoing.
Arrow Energy	Write to advise Arrow Energy of any substantive changes to RMI's closure or rehabilitation schedule and consult with Arrow Energy Holdings regarding their interests in areas of overlapping tenure within RMI.	As requested, or as agreed with company representatives.
Queensland Rail and Aurizon	Maintain correspondence with Queensland Rail and Aurizon regarding progressive rehabilitation activities as they affect the Norwich Park Branch Railway and undertake engagement regarding the decommissioning of the train load-out facility/rail interface.	As requested, or as agreed with individual representatives/agencies.
MetRes	Maintain correspondence with MetRes regarding RMI's closure and rehabilitation schedule, including advice regarding closure scheduling in accordance with contractual agreements between SMC and MetRes.	As required, and then two years prior to closure.
Other adjacent/nearby mining operations	Advise Whitehaven Coal, Stanmore Resources and Pembroke Resources in writing if there are any substantive changes to the closure and rehabilitation schedule in future iterations of the PRC Plan. At a business level, SMC will participate in industry and research partnerships of relevance to PRC Planning and rehabilitation.	As requested, or as agreed with individual representatives /mining operations.
DoR	Provide updates on PRC Planning to the Director Native Title Services and Coal Hub, Rockhampton and the Deputy Director General, Department of Resources, in writing or through regular meetings.	As requested, or as agreed with DoR representatives.

2.3.2 Community Consultation Information Sharing

Information to be released as part of ongoing community consultation will include:

- Rationale and scope for PRC Plan and PRCP Schedule;
- Approved activities and PMLUs for RMI;
- On-site activities and areas of disturbance;
- Proposed rehabilitation methods, schedule and milestones.
- Opportunities for community consultation as part of the PRC Plan's implementation.

Where required, communication tools could include:

- A holding statement for general enquiries;
- Frequently asked questions and answers (FAQs) and a PRC Planning fact sheet available to support consultation activities;
- Face-to-face and virtual meetings;
- Updates and fact sheets about PRC Planning for SMC assets through Community Connect.

2.3.3 Addressing Feedback / Comments

As noted in the PRCP Guideline (DES, 2021), in addition to the annual return requirements that relate to EAs, if a PRC Plan applies to the activities, the annual return must also include an evaluation of the effectiveness of the PRC Plan, including the environmental management carried out under the PRCP Schedule, for the year to which the annual return relates.

SMC will monitor and report on the progress and outcomes of progressive rehabilitation activities against rehabilitation milestones provided in the PRCP Schedule. This monitoring will aim to demonstrate a successful rehabilitation trajectory towards achievement of the approved PMLU, and/or to inform corrective action where required, which will be reported as part of annual returns.

Information about rehabilitation progress will also be delivered as part of the consultation methods detailed in Table 17, and any feedback will be considered in subsequent updates of this PRC Plan.

The PRC Plan Community Consultation Register will also be updated as community consultation activities outlined in Table 17 are completed. Feedback recorded in the Community Consultation Register will be considered in framing and detailing future PRC Plan amendments for RMI.

The above is also documented as part of the Community Consultation Register (Error! Reference source not found.).

Relationship with PRCP Schedule

As a site to which transitional provisions apply, RMI has land outcomes identified in the EA. Consultation with stakeholders commenced at point of acquisition and continued over time. Specific communications were issued prior to submission of the RMI PRC Plan and consultation will continue as per the process documented in the CCP. Achievement of the PMLUs of cattle grazing, woodland habitat and watercourse are in line with consultation completed to date.

3 POST-MINING LAND USES

Legislative Requirement

In accordance with 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.

PRCP Guideline (Section 3.2)

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 PRC Plan carried out on the land have ended. Relevant activity for a PRC Plan is defined in the EP Act as the relevant activities to be carried out on land the subject of the plan. It is not the intention of this definition to include third-party activities or assets that continue to exist once mining activities have ceased, such as third-party pipeline easements, power easements or overlapping tenures for other EAs.

The rehabilitation planning part of the PRC Plan must include a detailed description of the nominated PMLU(s) for the site. The description must include (where relevant), but is not limited to:

- A description of the use of the land;
- If applicable, the specific vegetation types (e.g., RE 13.2.9) or land suitability classification (e.g., Class 4);
- Identification of any permanent or essential management infrastructure to be included as part of the PMLU; and
- Completion criteria for measuring whether the PMLU has been successfully achieved.

Where a PMLU has been previously addressed in a land outcome document and is able to be transitioned into the PRCP Schedule, the holder is not required to complete the information requirements under section 126C(1)(j) of the EP Act in this section for those PMLUs.

However, the legislative requirements under section 126C(1)(d) of the EP Act still apply. All PMLUs transitioned into the PRCP Schedule must still meet the requirements of a PMLU explained in this section, particularly that the PMLU can be rehabilitated to a stable condition.

Where PMLUs have not been pre-approved, the applicant must include all of the requirements stated in this section.

3.1 Nominated PMLUs

A number of PMLUs are permitted for RMI under the EA (Appendix 1), of which the following three are proposed as PMLUs at RMI once operations cease:

- Cattle grazing;
- Woodland habitat;
- Watercourse.

To inform suitability of PMLU options for RMI, an understanding of pre-mining land use is required. The predominant pre-mining and historical land use within and surrounding RMI is associated with cattle grazing (Section 1.2.9.2). In addition to cattle grazing, areas of woodland habitat and watercourse vegetation have persisted along the riparian area of New Chum Creek and adjacent plains (Figure 8).

The proposed PMLUs have been recommended based on reinstating the pre-mining land uses wherever practical, considering:

- Post-mining landforms;
- Available topsoil quantity and quality;
- Presence of mapped ecological sensitive areas associated with Endangered regional ecosystems and mapped habitat for threatened species listed under the EPBC Act or Queensland Nature Conservation Act 1994 (NC Act);
- New Chum Creek watercourse;
- Vegetation associated with woodland habitat within a 100 m corridor along the New Chum Creek as required under the EA.

The PMLUs are underpinned by rehabilitation objectives that focus on achieving a safe, stable, non-polluting and sustainable post-mining landscape (as defined in the EA).

The relevant EA acceptance criteria for the PMLUs of cattle grazing, woodland habitat and watercourse have been transitioned to the milestone criteria in the PRCP schedule for the final milestone of achieving the PMLU to a stable condition.

Proposed PMLU locations are illustrated in Figure 10 (and the Final Site Design Map in Figure 24).

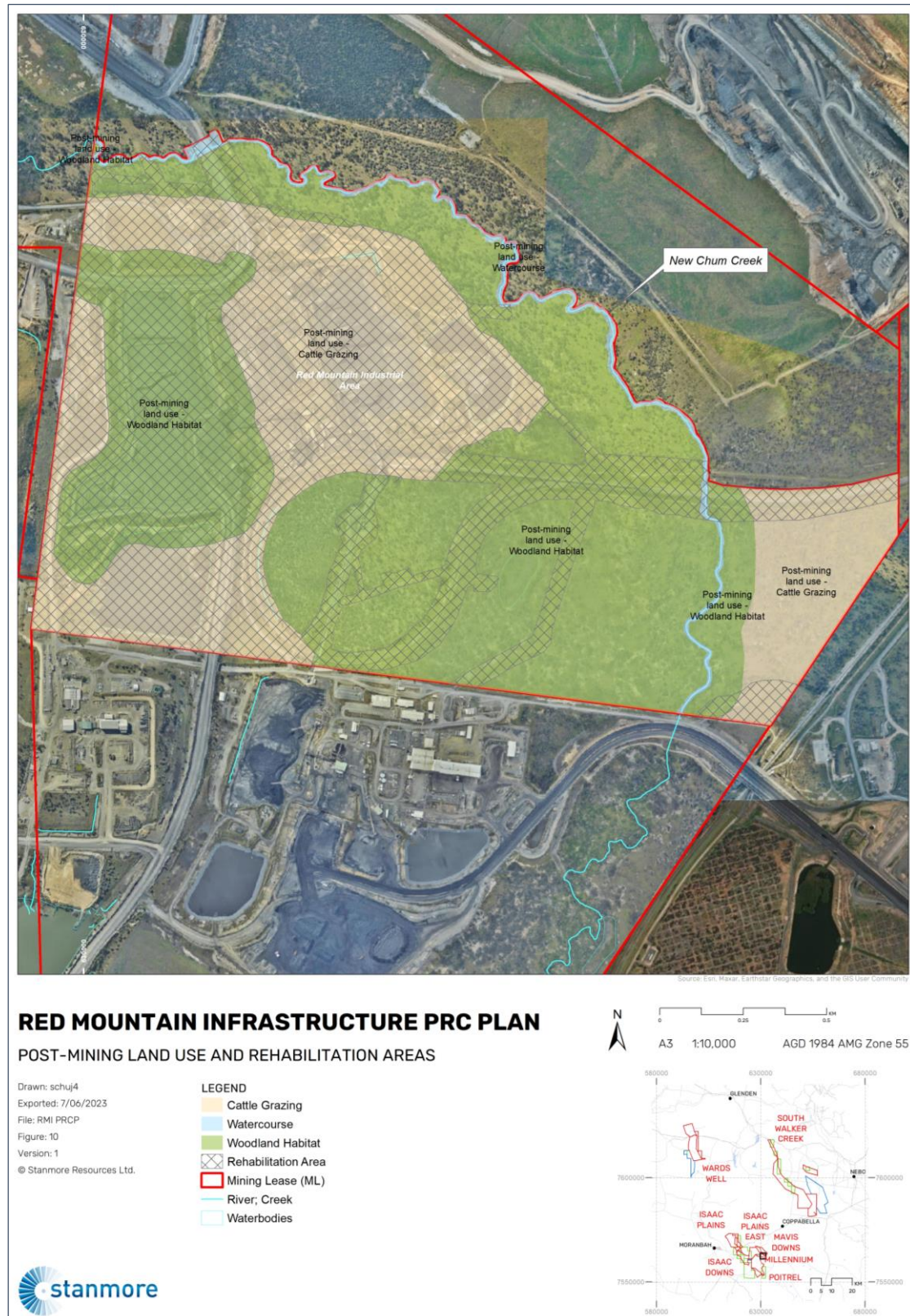


Figure 10: RMI Post-Mining Land Use and Rehabilitation Areas

3.1.1 Cattle Grazing

The EA objectives, indicators and acceptance criteria PMLU of cattle grazing are listed in Table 18.

The EA relevant acceptance criteria have been transitioned to the milestone criteria. Modifications of the criteria have been undertaken to ensure they meet the SMART criteria. These criteria are presented in the Schedule and are demonstrative of achieving a safe, stable, non-polluting and sustainable post mining land use.

Table 18: RMI EA Post-Mine Land Use Objectives, Indicators and Acceptance Criteria - Cattle Grazing.

Goal	Objective	Indicator	Acceptance Criteria
Safe to Humans and Wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use.	Hazard assessment.	A hazard assessment has been completed by an appropriately qualified person to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use.
Stable	Rehabilitation is geotechnically stable Rehabilitation is erosionally stable	Factor of safety Extent, slope gradient and groundcover	≥1.5. - Groundcover >50%. - Landforms reshaped with maximum 10% slopes (RA1, RA2, RA3). - No active gully erosion, where an active gully is a gully that has increased in area >5% since the previous monitoring period. - Landform is free draining.
Non-Polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH, EC Turbidity	Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP schedule PRCPEPML00819113 (Appendix 4, Figure 3 - Water Data Evaluation Process).
	Deep drainage from rehabilitation achieves relevant water quality objectives for groundwater	EC	Deep drainage from the area is not significantly different to EC levels as per relevant regional ecosystem as per PRCP EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of: - the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or - local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
Able to Sustain an Agreed Post-Mining Land Use	Rehabilitation is suitable for sustainable cattle grazing	Land suitability assessment for cattle grazing	Land suitability class ≥3, or not different from pre-mining class if ≥4, as per PRCP schedule PRCP EPML00819113 (Appendix 4, Table 5 – Pasture condition assessment table). The assessment is to be conducted by an appropriately qualified person. For RM13(e), if the land suitability class is

Goal	Objective	Indicator	Acceptance Criteria
			assessed as being not different from pre-mining class if ≥ 4 for all or a portion of a rehabilitation area, an assessment of reference sites must be carried out to determine if the limitation/s resulting in the class of ≥ 4 is consistent with that of reference sites. • Certification by an appropriately qualified person¹ that pasture meets a pasture condition rating ≤ 3, based on the Pasture Condition Assessment Table as per “Stocktake: Balancing Supply and Demand” (developed by FutureBeef - futurebeef.com.au), as provided in PRCP EPML00819113 (Appendix 4, Table 5) Pasture condition assessment table.

The assessment of pre-mining and post-mining land suitability for cattle grazing on rehabilitated lands, as specified in the EA Acceptance Criteria (Table 18) is based on the ‘*Rule-set for land suitability assessment of cattle grazing on coal mine rehabilitation*’ (Short, 2020) (hereafter referred to as the grazing rule-set).

The grazing rule-set uses land use limitations selected from the comprehensive list provided in the Queensland Land Evaluation Guidelines and is based on:

- The target PMLU of sustainable cattle grazing;
- The regional-scale of application across the Bowen Basin;
- Diagnostic attributes that can be readily correlated to mapping units at potential mapping scales of 1:50,000 and larger;

Table 19 provides the grazing rule-set limitations and associated indicators for assessing land suitability class for cattle grazing on rehabilitated land, indicating:

- The Class 1 to Class 2 boundary represents the attribute level at which the limitation starts to affect productivity.
- The Class 3 to Class 4 boundary determines whether rehabilitation is suitable or not and therefore able to sustain an agreed PMLU of grazing as required under the EA.

Table 19: Draft Land Suitability Rule-Set for Cattle Grazing on Rehabilitation at RMI

Limitation	Indicator	Units	Suitability Class				
			1	2	3	4	5
Water availability	PAWC in ERD	mm/0.6d	> 75	75 - 60	< 60 - 45	< 45 - 30	< 30
Nutrient supply	P in 0.1m	mg / kg	> 20	20 - 14	< 14 - 8	< 8 - 4	< 4
	pH in 0.1m	pH units	7.3 – 6.6	< 6.6. – 6.0 or > 7.3 – 8.0	< 6.0 – 5.5 or > 8.0 – 8.5	< 5.5 – 5.0 or > 8.5 – 9.0	< 5.0 or > 9.0
Soil physical factors	Surface soil structure	variable	Fine (peds < 10mm)	Coarse (peds > 10mm)	Surface crust	Very hard setting	Massive
Salinity	EC in ERD	dS/m	< 2	2 - < 4	4 - < 10	10 - < 16	≥ 16
Rockiness	Fragments on surface	%	< 5	5 - 10	10 - 30	30 - 60	> 60
Topography (slope)	Gradient, surface	%	< 5	5 - < 10	10 - < 15	15 - < 20	≥ 20
	Vertical interval, surface	m	Nil ripping furrows	Regular ripping furrows < 0.2m	Regular ripping furrows > 0.2 – 0.4m	Regular ripping furrows > 0.4 – 0.6m	Regular ripping furrows > 0.6m
Water erosion, surface soil	Slope (ESP in 0.1m < 6)	%	< 5	5 - 8	> 8 - 12	> 12 - 18	> 18
	Slope (ESP in 0.1m > 6 - < 14)	%	< 3	3 - 6	> 6 - 10	> 10 - 12	> 12
	Slope (ESP in 0.1m > 14)	%	< 1	1 - 2	> 2 - 4	> 4 - 6	> 6
Sub-soil erosion	ESP at 0.5m	%	< 7	7 - 14	> 14 - 23	> 23 - 34	> 34
Potentially acid forming materials	pH < 4.5	pH units	Not likely to be present within 5m of surface	Not likely to be present within 3m of surface	Not likely to be present within 2m of surface	Present immediately below root zone (0.9 – 0.6m)	Present within root zone (surface 0.6m)

The rehabilitated land suitability according to the grazing rule-set, for the stockpiled topsoil, is summarised in Table 20. Topsoil samples reported no unsuitable limitations. Topsoil sample RMI4 (Stockpile 1) was assessed as the most suitable for cattle grazing whereas RMI1 (Stockpile 3) and RMI2 (Stockpile 2) were assessed as suitable. Undisturbed sites RMI5 and RMI6 indicate that the site is suitable for cattle grazing.

Table 20: Rehabilitated Land Suitability for Stockpiled Topsoil

	Soil Samples					
	Stockpile 3	Stockpile 2	Stockpile 1	Undisturbed Sites		
	RMI1	RMI2	RM13	RMI4	RMI5	RMI6
Suitability Class	3	3	1	2	1	2

Cattle grazing is proposed for the majority of the disturbed areas (Figure 10).

These areas also have lower overall slopes and are not associated with the woodland or watercourse areas detailed in Sections 3.1.2 and 3.1.3. The predominately undisturbed area to the east of New Chum Creek (outside of the 100m buffer zone) is given the pre-mining suitability of Class 2 and is associated with SMU DB4 and DB2 (Figure 5).

3.1.2 Woodland Habitat

The EA objectives, indicators and acceptance criteria for a PMLU of woodland habitat are listed in Table 21. The EA relevant acceptance criteria have been transitioned to the milestone criteria. Modifications have also been incorporated to ensure the criteria align to SMART principles (e.g., BioCondition assessment). These criteria are presented in PRCP Schedule EPML00819113 (Appendix 2) and are demonstrative of achieving a safe, stable, non-polluting and sustainable post mining land use.

Table 21: RMI EA Post-Mine Land Use Objectives, Indicators and Acceptance Criteria - Woodland Habitat

Goal	Objective	Indicator	Criteria
Safe to Humans and Wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use.	Hazard assessment	A hazard assessment has been completed by an appropriately qualified person to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use.
Stable	Rehabilitation is geotechnically stable	Factor of safety	≥1.5 unless an alternative is justified by an appropriately qualified engineer.
	Rehabilitation is erosionally stable	Groundcover (steep slopes, >15%)	Demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP EPML00819113 (Appendix 2). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3.
		Groundcover (lesser slopes, ≤15%)	Demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP EPML00819113 (Appendix 2). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3.

Goal	Objective	Indicator	Criteria
Non-Polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH, EC Turbidity	Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP schedule PRCPEPML00819113 (Appendix 4, Figure 3 - Water Data Evaluation Process).
	Deep drainage from rehabilitation achieves relevant water quality objectives for groundwater	EC	Deep drainage from the area is not significantly different to EC levels as per relevant regional ecosystem as per PRCP sc00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of: - the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or - local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
Able to Sustain an Agreed Post- Mining Land Use	Native woodland habitat characteristics	Species richness: - Trees - Shrubs - Grasses	Demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP EPML00819113 (Appendix 2). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3.
		Tree canopy cover	Demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP EPML00819113 (Appendix 2). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3.

EA condition E6 states “A buffer distance of not less than one hundred (100) metres must be retained on either side of the vegetation along New Chum Creek within Mining Lease 70312 to minimise environmental impacts to regional ecosystems except as indicated in Table E2 (Work Areas in Nature Conservation Areas).”

The vegetation in this buffer will be maintained by assigning this area as a woodland habitat PMLU (outside the watercourse PMLU as discussed in Section 3).

Woodland habitat has also been proposed for:

- Undisturbed and disturbed areas within mapped ecologically sensitive areas including (Figure 6):
 - Category B ESAs mapped in association with Endangered Ecosystems.
 - Matters of State environmental significance (MSES) associated with mapped habitat for threatened species listed under the EPBC Act or NC Act.
- Areas of the post-mining landform associated with the rehabilitated ROM pad due to unsuitable topsoil material (see Section 6.1.3).
- Areas proposed as woodland habitat are shown in Figure 10.

3.1.3 Watercourse

A watercourse is defined under the Water Act 2000 as “...a river, creek or other stream, including a stream in the form of an anabranch or a tributary, in which water flows permanently or intermittently, regardless of the

frequency of flow events, in a natural channel, whether artificially modified or not; or in an artificial channel that has changed the course of the stream.”

A waterway as defined under the Fisheries Act 1994 includes a “river, creek, stream, watercourse or inlet of thesea. This definition includes freshwater and tidal waters, both permanent and ephemeral waterways, and includes drainage features.”

New Chum Creek, which has Strahler Stream Orders of 2 and 3 watercourse, enters the lease from the north- west and runs along the northern lease boundary before turning south, to the east of the CHPP and rail loop (Section 1.2.4, Figure 4).

Hence, the proposed PMLU for New Chum Creek is a watercourse (Figure 10). (Lateral limits of the New Chum Creek watercourse PMLU has been mapped to the outer banks using digital terrain modelling taken from Lidar data and aerial imagery current as of 6 July 2021). The disturbance areas of the haul road and railway that traverse New Chum Creek have been allocated to RA4.

The RMI EA provides objectives, indicators and acceptance criteria for a watercourse PMLU, however, these criteria have been developed for rehabilitated creek diversions. As the disturbed sections of New Chum Creek on RMI are associated with a *natural watercourse*, more suitable milestone criteria have been developed to ensure that all disturbed areas are revegetated with trees, shrub and grasses endemic to the area, sufficient to re-establish a riparian environment and protect bed and banks from erosion. Rehabilitation works will follow:

- Requirements for Riverine Protection Permits and/or exemptions under the Water Act 2000 (Riverine protection permit exemptions requirements, Department of Natural Resources, Mines and Energy, WSS/2013/726, Version 2.01, 13/11/2019).
- Accepted development requirements for operational work (constructing or raising waterway barrier works) under the *Fisheries Act 1994* and *Planning Act 2016*. (The sections of New Chum Creek requiring rehabilitation are listed as amber (moderate impact) and green (low impact) (Figure 11).

3.2 Community Consultation

Achievement of the PMLUs of cattle grazing, woodland habitat and watercourse are in line with consultation completed to date (refer to Section 2).

3.3 Regional Planning Integration

The PMLUs at RMI consider the pre-mining land use, adjacent land uses and approved EA conditions. Existing land use in the area is primarily cattle grazing and coal mining.

Under the Isaac Regional Planning Scheme (February 2021), RMI is located in a *rural* zone, which includes uses such as grazing, farming, forestry, tourism and extractive industries. Land use performance outcomes for this rural zone include ensuring development:

- a. Is consistent with the rural character of the locality;
- b. Supports the primary rural function of the zone;
- c. Protects rural, natural and scenic values of the locality; and
- d. Includes boundary realignments were used to align with mining or petroleum tenements.

In addition, the Queensland Government, via its Mackay, Isaac and Whitsunday Regional Plan (February 2012), maps RMI in a *regional landscape and rural production area*, which includes land used for agriculture, water catchment, traditional uses, conservation areas and native forests.

The defined uses for both of these plans are consistent with the PMLUs proposed for RMI.

Relationship with PRCP Schedule

- The proposed PMLUs for RMI are consistent with pre-mining land use, adjacent land uses and approved EA conditions. The PMLU extents consider the post-mining landform, available topsoil, existing vegetation, and ecological sensitive areas.
- The EA acceptance criteria for cattle grazing and woodland are transitioned to the milestone criteria for achieving these PMLUs. Milestone criteria for the New Chum Creek watercourse has been defined in terms potential requirements for Riverine Protection Permits and/or exemptions, and water barrier works delineations, aiming to ensure that all disturbed areas are revegetated with trees, shrub, and grasses endemic to the area, sufficient to re-establish a riparian environment and protect bed and banks from erosion.

4 NON-USE MANAGEMENT AREAS

Legislative Requirement

In accordance with sections 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 applicant considers the area cannot be rehabilitated to a stable condition;
- Include copies of reports 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
- State the extent to which the non-use management area is consistent with any strategies or plans for the land of a local government, the State or the Commonwealth.

PRCP Guideline (Section 3.3)

A NUMA is defined in the EP Act 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. Proposed NUMAs must be justified under the criteria set out in section 126D(2) of the EP Act.

The rehabilitation planning part of the PRC Plan must also include:

- a. Information demonstrating that the proposed footprint of each NUMA is as small as practicable;
- b. An assessment of the NUMA location options, having regard to the constraint of the resource location, with an analysis of the potential environmental harm and sensitivity of the surrounding environment of each option;
- c. A description of the proposed location of each NUMA and the environmental values of the surrounding environment;
- d. Evidence showing how the proposed location will prevent or minimise environmental harm.

In accordance with section 126D(1)(c) of the EP Act, the applicant must develop and implement management milestones within the PRCP Schedule which achieve best practice management and minimise environmental harm for any NUMAs contained in the proposed PRC Plan. As part of the development of management milestones, the applicant must conduct a NUMA specific risk assessment to identify and quantify risks and associated controls. The risk assessment should have an overarching goal of identifying and controlling any significant risks to the community and the environment.

The proposed PRC Plan must include a detailed description of the nominated NUMA(s) for the site. The description must include, but is not limited to:

- Description of the land at surrender
- Any relevant safety features
- Completion criteria for measuring whether the NUMA has achieved sufficient improvement.

Where a NUMA has already been identified in a land outcome document and is able to be transitioned into the PRCP Schedule, the applicant is not required to comply with sections 126C(1)(g) or (h) or 126D(2) or (3) of the EP Act. NUMAs transitioned into the PRCP Schedule are not required to complete the information requirements under section 126C(1)(j) of the EP Act in this section for those NUMAs. However, the legislative requirements under section 126C(1)(d) of the EP Act still apply.

Where a NUMA has not been pre-approved and is proposed as part of the transition into the PRC Plan, the applicant must include all of the requirements identified in this section.

4.1 Nominated NUMAs

No non-use management areas (NUMAs) are nominated for RMI.

4.2 Management Methods

Not applicable. There are no NUMAs planned for RMI.

4.3 Community Consultation

Not applicable. There are no NUMAs planned for RMI.

4.4 Regional Planning Integration

Not applicable. There are no NUMAs planned for RMI.

Relationship with PRCP Schedule

Not relevant as there are no NUMAs planned at RMI.

5 VOIDS IN FLOODPLAINS

Legislative Requirement

In accordance with 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.

PRCP Guideline (Section 3.4)

- Section 41C of the EP Regulation states the decision considerations for a void situated wholly or partly in a flood plain. A void is considered to be located in a flood plain if the flood plain modelling shows that, when all relevant activities carried out on the land have ended, the land is the same height as, or lower than, the level modelled as the peak water level 0.1% AEP for a relevant watercourse under the guideline Australian Rainfall and Runoff (2019) (ARR).
- Where a land outcome document has a pre-approved land outcome for a void with a location specified, flood plain modelling is not required. If a void has been identified as a NUMA in a land outcome document but the location is not identified, the applicant is required to carry out flood plain modelling in accordance with this section of the guideline. While the provision in the EP Act relating to voids located within a floodplain having to rehabilitate to a stable condition does not apply, the PRC Plan must include how the proposed location of the void minimises risks to the environment. Therefore, the flood plain modelling is required to support the assessment of the proposed location of the void.
- If there are no land outcomes identified in a land outcome document, the applicant is required to carry out flood plain modelling in accordance with this section of the guideline.

Not applicable. RMI is a CHPP and does include the excavation of any voids.

Relationship with PRCP Schedule

Not relevant as there are no voids planned at RMI.

6 REHABILITATION AND MANAGEMENT METHODOLOGY

Legislative Requirement

In accordance with 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.

PRCP Guideline (Section 3.6.1)

- The proposed rehabilitation or management methodologies will underpin the development of the milestone criteria and support how the proposed PMLU will be achieved, or the NUMA will be managed. As per section 126C(1)(j) of the EP Act, the administering authority requires information describing how the proposed rehabilitation or management methodologies have been developed and will be implemented.
- This section outlines the range of information that the administering authority considers is necessary to underpin the development of the rehabilitation or management methodologies applicable to new and existing mines for most domains. The applicant must include the information as appendices to the rehabilitation planning part.

6.1 General Rehabilitation Practices

PRCP Guideline (Section 3.6.1)

This section outlines the range of information that the administering authority considers is necessary to underpin the development of the rehabilitation or management methodologies applicable to new and existing mines for most domains. The applicant must include the information as appendices to the rehabilitation planning part

6.1.1 Hydrogeology

PRCP Guideline (Section 3.6.1)

Assess the hydrogeology of the site and all connected strata and develop a conceptual model of the mine site's groundwater systems. This information must be integrated into the design of rehabilitation strategies and choice of PMLU or NUMA.

The approved RMI activities include the operation of a CHPP, water dams, tailings drying cells, ROM and product coal pads, rail load-out and other associated surface infrastructure/activities. The RMI operations do not include voids or underground workings used for the extraction of resources, permanent disposal of regulated wastes such as tailings or other materials, or on-site groundwater extraction/dewatering activities. Therefore, the RMI site has a low potential to adversely impact on groundwater aquifers. Based on the low potential for adverse risks to groundwater, the hydrogeological assessments completed as part of the development of the PRC Plan included review of existing information and development of Hydrogeological Conceptual Site Models (CSMs). Numerical groundwater modelling has not been required or undertaken.

As detailed in Section 1.2.4 there are two primary hydrostratigraphic units occurring at the area in which the RMI site is located:

- Inferred alluvial aquifer associated with New Chum Creek; and
- Fort Cooper Coal Measure Aquifer (FCCMA) located within interbedded siltstones, sandstones, minor mudstones, shales and coal measures.

A hydrogeological CSM for the existing operational environment is shown in Figure 12.

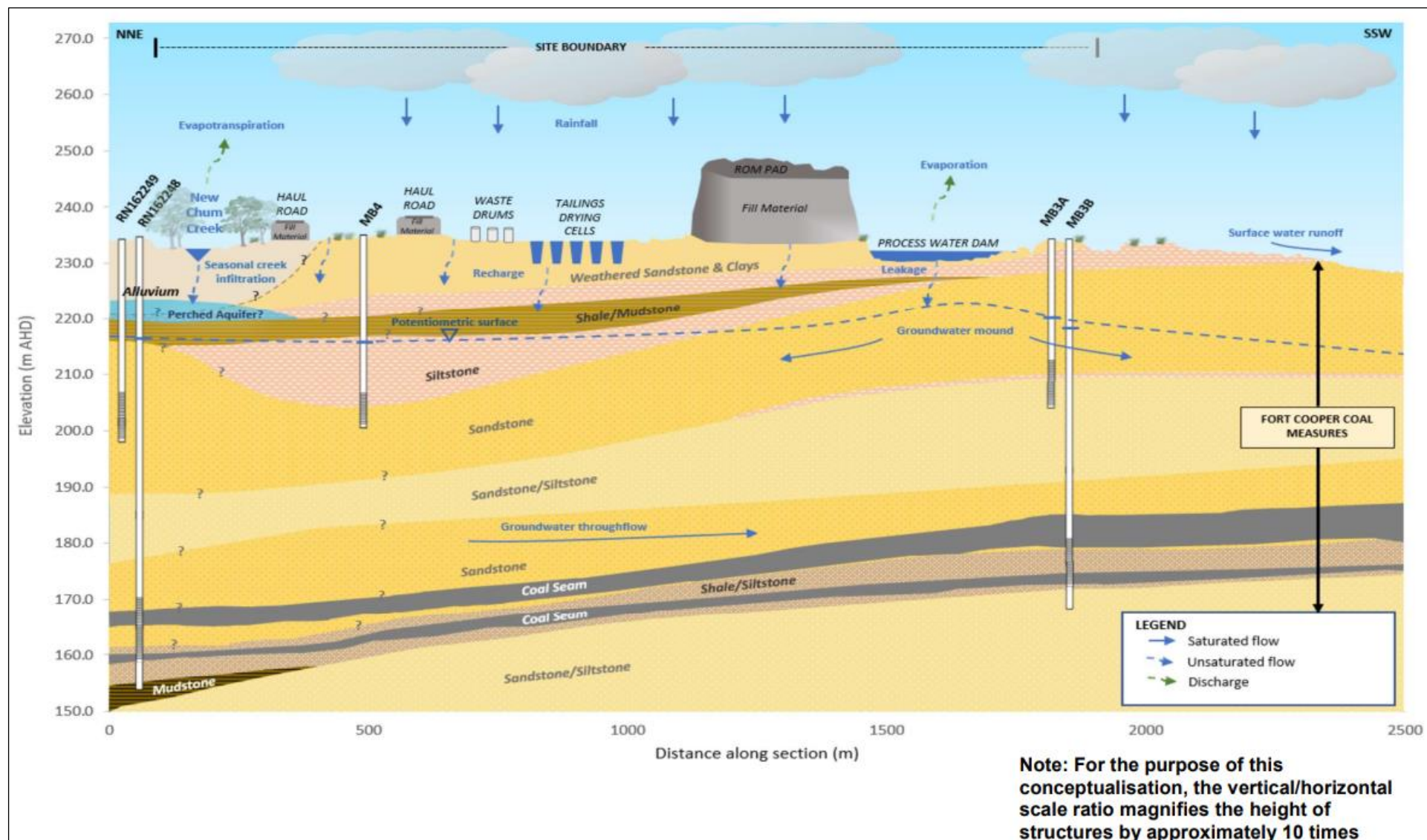


Figure 12: Existing Environment Hydrogeological Conceptual Site Model Illustration.

There are no known monitoring or extraction bores located within the alluvial aquifer within the proximity of the RMI site. The bore logs for existing bores identify a shale mudstone unit approximately 15 m below ground surface in the proximity of New Chum Creek, which may act as an aquitard resulting in perched groundwater within the alluvium. Recharge of the alluvial aquifer would occur through infiltration during flows within the ephemeral drainage lines and rainfall. Groundwater movement within the alluvial aquifer would follow the alluvium/paleo channels associated with New Chum Creek to the south of the site.

The FCCMA is the primary aquifer within the proximity of the RMI site and is monitored through five on-site monitoring bores. Groundwater flow through the deeper coal seam sections of the aquifer may be dominated by primary porosity through a porous media, while in other sections of the aquifer, groundwater flow would be expected to follow secondary porosity pathways through fracture networks. The dual porosity of the FCCMA means that groundwater flow paths are likely to be heterogeneous and may be challenging to accurately predict.

Recharge of the FCCMA at RMI is expected to be primarily through rainfall; flows within the ephemeral drainage lines; and on-site storage structures (dams and tailing drying cells) during operations.

Groundwater flows within the FCCMA are generally heading in a southerly direction, with some potential local deviation due to groundwater mounding below the process water dam. A potentiometric surface for the FCCMA and inferred flow directions are shown in Figure 13.

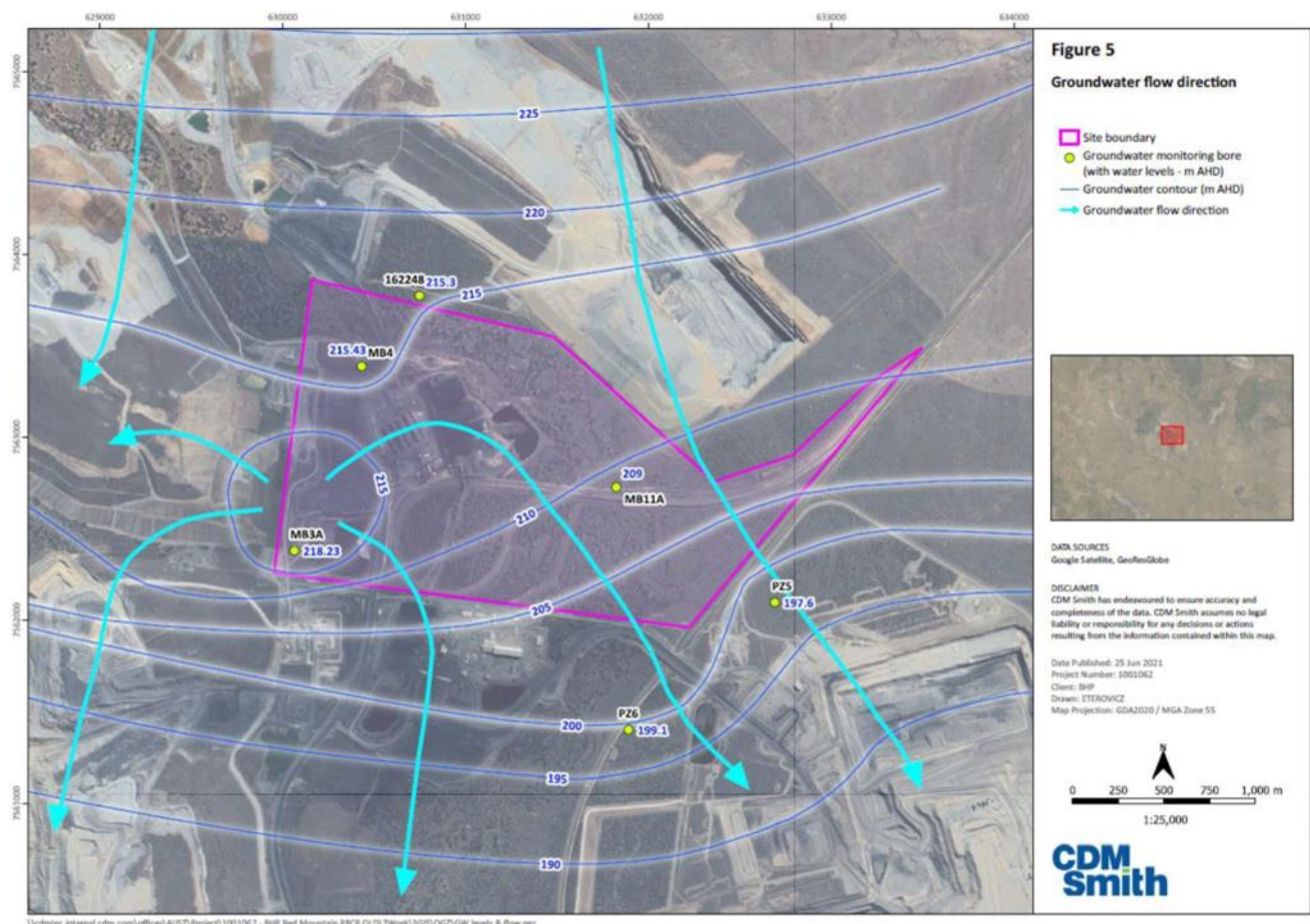


Figure 13: FCCMA Potentiometric Surface and Inferred Groundwater Flow Direction.

Groundwater velocity within the FCCMA is highly uncertain due to a lack of site-specific hydraulic parameter data (hydraulic conductivity and effective porosity) and dual porosity of the aquifer. Based on an inferred hydraulic gradient of 0.003 across the site; an effective porosity of 0.1; and a hydraulic conductivity of 0.1 m/d, the expected groundwater velocity would be in the order of 1 m/year. Groundwater flow through the sandstone and siltstone units would likely have a lower effective porosity and lower hydraulic conductivity, but considering this is conceptually a fractured rock unit, higher groundwater velocities may be expected. Ultimately the velocity of groundwater in the siltstone and sandstone will depend on the frequency and

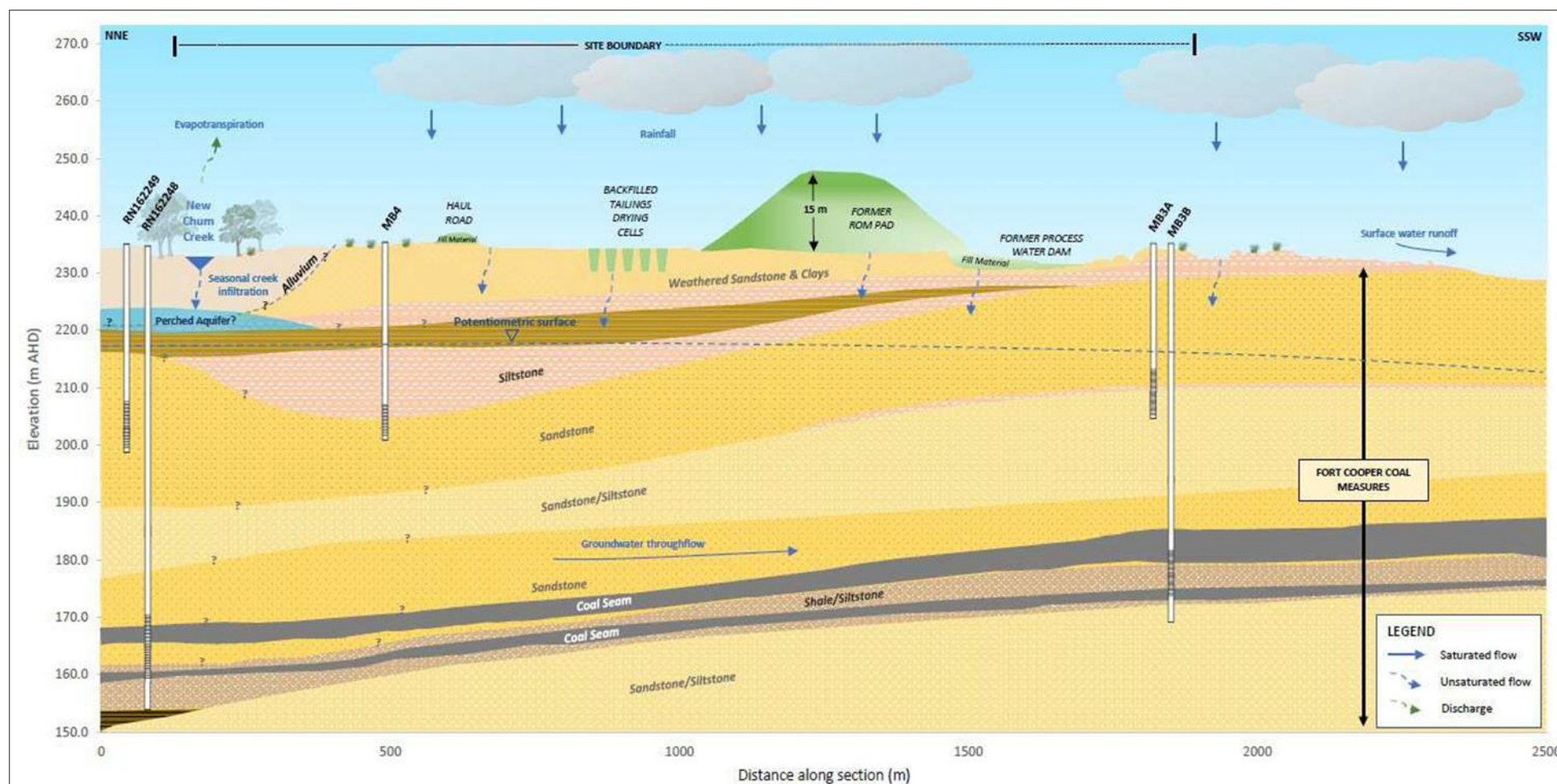
interconnectivity of these fractures, as there is likely to be limited groundwater movement through the matrix of the rock.

Groundwater is predicted to discharge from the site via through flow in the FCCMA and more regionally via discharge to open cut mining operations to the south of the site including the Daunia and Poitrel pits that intersect the water table. Future changes to surrounding mining operations, including the commencement of underground operations at Millennium and potential future cessation of some mining activities to the south, has the potential to influence future groundwater flow directions, heights and quality. As the influence of surrounding mining operations on groundwater are outside of the control RMI and the potential for adverse impacts to groundwater post closure from RMI are limited, the cumulative hydrogeological impacts from surrounding mine sites are not considered further as part of this PRC Plan.

As detailed in Section 1.2.5 the groundwater quality within the FCCMA, measured through the on-site monitoring bores indicates the groundwater is suitable for beneficial use of stock watering for beef cattle, sheep and horses. Although there are currently no groundwater extraction bores located within the immediate vicinity of RMI, groundwater is used within the region to support grazing activities.

Any residual land contamination will be investigated at closure and remediated/managed as appropriate to minimise the potential for any on-going unacceptable risk to groundwater quality. Upon completion of operations at RMI, rehabilitation works will include the removal of coal and carbonaceous materials before backfilling the dams and tailings drying cells to form a free draining surface across the site. Rehabilitation works will also include the removal of the on-site Millennium haul road and rail line culverts that cross New Chum Creek, which will return flow and flood conditions within the creek to a state similar to pre-operational conditions. Therefore, rehabilitation works will return the on-site mechanisms for groundwater recharge to a condition similar to pre- operations. Any groundwater mounding caused by seepage from the water holding structures and any increased recharge resulting from flooding caused by the culverts will be removed by the rehabilitation works.

The post-mining landform presents a low potential for adverse risks to hydrogeological and hydro-geochemical conditions and will not alter the hydrostratigraphic units. The final landform does not include water holding structures, voids/underground workings, and/or encapsulated carbonaceous wastes and removes artificial impediments to New Chum Creek flows. A post-rehabilitation hydrogeological CSM is illustrated in Figure 14.



Note: For the purpose of this conceptualisation, the vertical/horizontal scale ratio magnifies the height of structures by approximately 10 times

Figure 14: Post-Rehabilitation Conceptual Site Model Illustration.

Relationship with PRCP Schedule

As the RMI operations do not extract groundwater from the site, do not have any voids or underground workings, and the final landform will be free draining, the site is not anticipated to have a detrimental impact to the hydrogeological environment. Therefore, no rehabilitation activities are required to restore or manage groundwater aquifers. The risks associated with hydrogeology at RMI have been assessed to be low.

The information in this section is relevant to the highlighted **RAs** and **RMs** in the PRCP Schedule:

RA1			RA2				RA3				RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

RM1	- Services disconnected - Built and service infrastructure demolished and removed (except where agreed in writing by the post-mining land owner/holder) - Concrete, bitumen and aggregate removed - Rubbish removed - No more than 10% visible coaly and carbonaceous mineral waste on surface - Dried tailings removed - Water and sediment within dams removed - Creek crossing culverts removed.
RM2	- Contaminated land investigation completed by an appropriately qualified person in accordance with the Environmental Protection Act (1994) including: - a Site Suitability Statement confirming the suitability of the property for the PMLUs; and - Audit Certification. - The Contaminated Land Investigation Document is supported by a Site Investigation Report and, where appropriate, a Validation Report and/or a draft Site Management Plan. - In the event that residual contamination is identified and presents a potential unacceptable risk to the nominated PMLUs or environmental values, remediation works and/or implementation of management controls are completed. - Where ongoing management of residual contamination is deemed appropriate, a draft Site Management Plan is prepared, and approval of the draft Site Management Plan is obtained from the administering authority.
RM3	- Tailings drying cells backfill completed - Dams backfill completed - Haul road and rail base material removed within 100m of New Chum Creek, and disturbed bed and banks returned to a profile similar to the pre-disturbance condition in accordance with associated riverine and/or operation works permits or associated exemptions (RA3, RA4) - Landforms reshaped with maximum 10% slopes (RA1, RA2, RA3) - Landform reshaped to be free-draining and consistent with surrounding topography.
RM13	- A hazard assessment has been completed by an appropriately qualified person to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. - Groundcover >50%. - Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3 – Water Data Evaluation Process). - Deep drainage from the area is not significantly different to EC levels as per PRCP EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of: - the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

- local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
 - Land suitability class ≤ 3 , or not different from pre-mining class if ≥ 4 , as per PRCP Schedule EPML00819113 (Appendix 4, Table 5 Pasture condition assessment table). The assessment is to be conducted by an appropriately qualified person. For RM13(e), if the land suitability class is assessed as being not different from pre-mining class if ≥ 4 for all or a portion of a rehabilitation area, an assessment of reference sites must be carried out to determine if the limitation/s resulting in the class of ≥ 4 is consistent with that of reference sites.
 - Certification by an appropriately qualified person¹ that pasture meets a pasture condition rating ≤ 3 , based on the Pasture Condition Assessment Table as per “Stocktake: Balancing Supply and Demand” (developed by FutureBeef - futurebeef.com.au), as provided in PRCP EPML00819113 (Appendix 4, Table Pasture condition assessment).
 - No active gully erosion, where an active gully is a gully that has increased in area $>5\%$ since the previous monitoring period.
 - Landform is free-draining.
-
- RM14
- A BioCondition assessment is completed by an appropriately qualified person¹ using the methodology outlined in the latest version of the Queensland Herbarium’s BioCondition Assessment Manual.
 - The BioCondition assessment required by 14(a) demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP Schedule EPML00819113 (Appendix 2). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3.
 - A hazard assessment has been completed by an appropriately qualified person to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use.
 - Rehabilitation of RA2 is assessed as geotechnically stable by an appropriately qualified person with FoS ≥ 1.5 , unless an alternative is justified by an appropriately qualified engineer.
 - Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process.
 - Deep drainage from the area is not significantly different to EC levels as per PRCP EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of:
 - the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or
 - local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
 - No active gully erosion, where an active gully is a gully that has increased in area $>5\%$ since the previous monitoring period.

6.1.2 Flooding

PRCP Guideline (Section 3.6.1)

Section 3.4 of this guideline requires flood plain modelling for the purpose of voids located within a flood plain being rehabilitated to a stable condition. In addition to this, the applicant must also assess the flooding susceptibility and influence across the site. If flooding is a consideration, develop a hydrologic model of the catchment and a hydraulic model of the proposed mining area. Knowledge of flooding is integral to the rehabilitation planning process, including the placement and design of mine domains.

The approved activities at RMI do not include any voids, underground workings, diversions, significant spoil dumps or permanent tailings disposal areas that could significantly impact flood hydrology. Rehabilitation of the site will also include:

- Demolition and removal of all CHPP infrastructure;
- Decommissioning/backfilling of all dams and tailings drying cells;

- Removal of carbonaceous coal materials including tailings, rejects and surface materials;
- Removal of culverts associated with the Millennium Mine haul road and the rail line; and
- Re-contouring of the disturbed surfaces to render the landform free draining and suitable for rehabilitation/revegetation to support the nominated PMLUs.

Due to the low potential for flooding risks to the final landform, a RMI-specific PRC Plan rehabilitation flood model has not been developed. To assist with the interpretation of potential flooding risks, flood modelling (Engeny Water Management (2019)) completed for the Poitrel Mine's existing landforms, which included the culverts on New Chum Creek (to be removed as part of the rehabilitation works), has been utilised.

The 2019 creek flood modelling for 1% AEP and 0.1% AEP (Figure 15) indicated the following for New Chum Creek:

- The 1% AEP flood depth model indicated a flood depth up to 3m within the alignment of New Chum Creek and the up-stream side of culverts on New Chum Creek as it passes under the: haul road from the Millennium Mine; on-site rail loop; and Poitrel Mine Road to the south of RMI. There is little to no flood intrusion into the operational areas or dams.
- The 0.1% AEP flood depth model indicated a flood depth of up to 5m within the alignment of New Chum Creek and the up-stream side of culverts on New Chum Creek as it passes under the: haul road from the Millennium Mine; on-site rail loop; and Poitrel Mine Road to the south of RMI. Within the operational areas, flood waters associated with extreme events are up to 1.5m depth in the environment dam and up to 1m depth surrounding the product stockpile pad. The flood waters within operational areas are a result of restricted flows through the culvert and flooding of the Millennium haul road which directs flood waters into the operational areas.

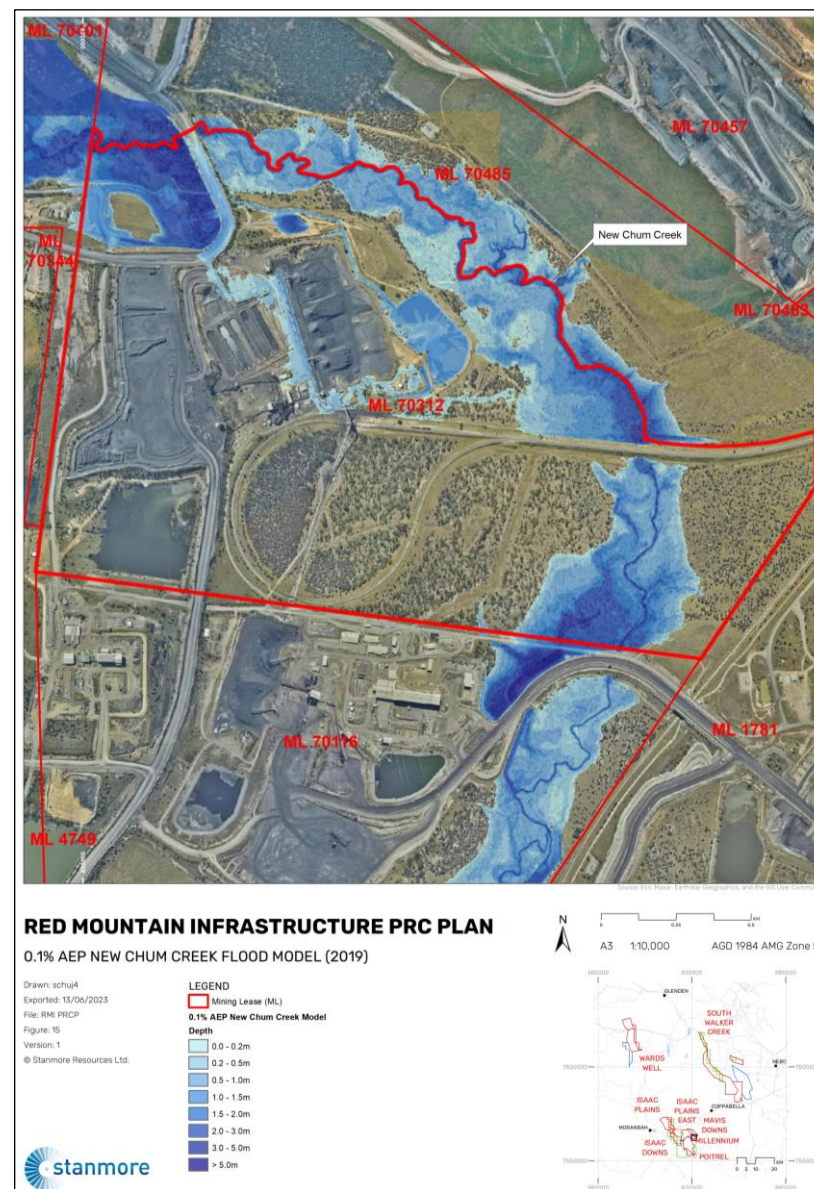
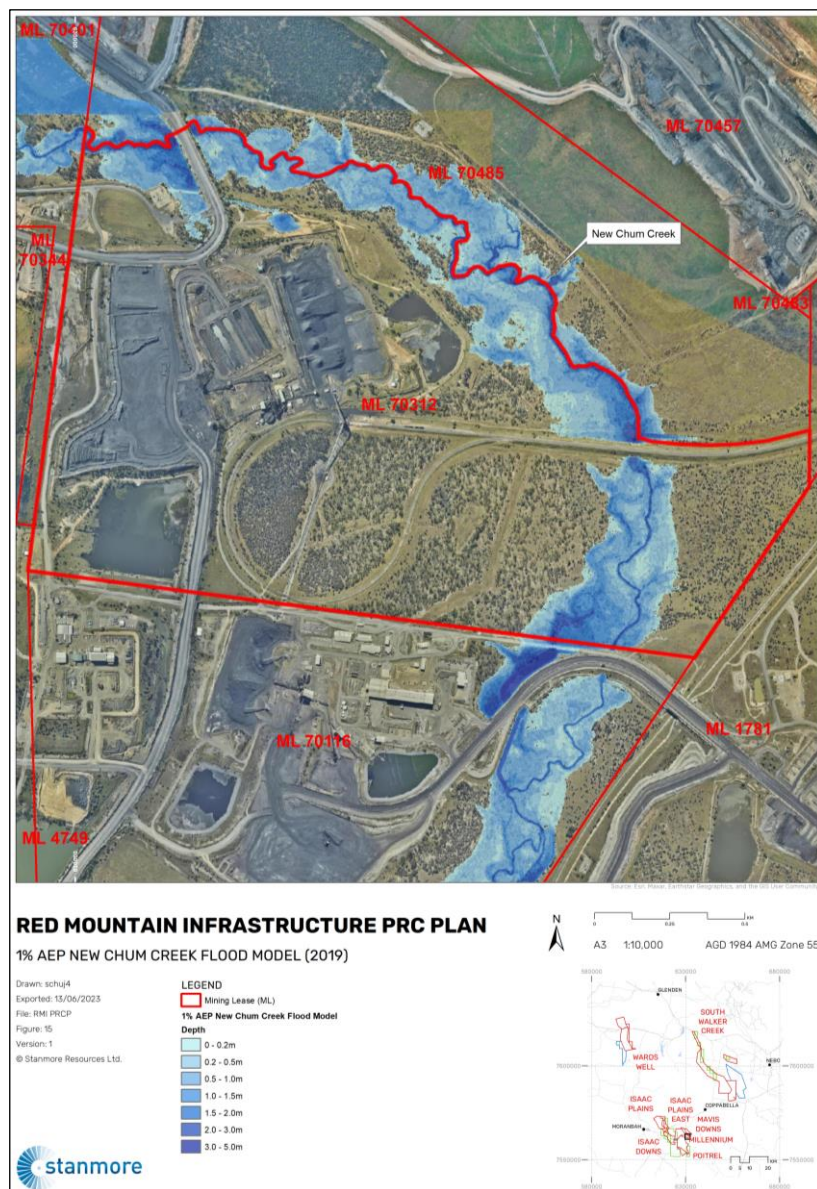


Figure 15: 1% AEP and 0.1% AEP Flood Depths (2019)

RMI rehabilitation activities will include the removal of the on-site culverts under the Millennium Mine haul road and the rail line (including fill materials from within the 100 m New Chum Creek Buffer, see Section 6.1.5). This rehabilitation work will restore the flood hydrology at these culverts to a condition which is consistent with the pre-operational/natural environment. The reduction of the flood heights through the removal of the on-site culverts will minimise the potential for flood waters to enter the RMI rehabilitated areas and upstream off-site mine site landforms. Flood hydrology down-stream of RMI will continue to be influenced by the off-site Poitrel Mine Road culvert, Poitrel Mine's diversions of New Chum Creek and the down-stream mine site landforms. Rehabilitation of these down-stream landforms, will be considered as part of the PRC plans for these mine sites, noting the closure and rehabilitation timing of the RMI site is currently tied to the closure of these down-stream mines.

Relationship with PRCP Schedule

The final RMI landform will remove on-site culverts and associated fill material from New Chum Creek and restore flood hydrology at these locations to a condition similar to pre-development. Flood risks associated with the final landforms have been assessed to be low.

The information in this section is relevant to the highlighted **RAs** and **RMs** in the PRCP Schedule:

RA1			RA2				RA3				RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

- | | |
|-----|---|
| RM1 | <ul style="list-style-type: none"> Services disconnected Built and service infrastructure demolished and removed (except where agreed in writing by the post-mining land owner/holder) Concrete, bitumen and aggregate removed Rubbish removed No more than 10% visible coaly and carbonaceous mineral waste on surface Dried tailings removed Water and sediment within dams removed Creek crossing culverts removed. |
| RM3 | <ul style="list-style-type: none"> Tailings drying cells backfill completed Dams backfill completed Haul road and rail base material removed within 100m of New Chum Creek, and disturbed bed and banks returned to a profile similar to the pre-disturbance condition in accordance with associated riverine and/or operation works permits or associated exemptions (RA3, RA4) Landforms reshaped with maximum 10% slopes (RA1, RA2, RA3) Landform reshaped to be free-draining and consistent with surrounding topography. |

6.1.3 Waste Characterisation

PRCP Guideline (Section 3.6.1)

- Characterise mine wastes in a report that describes the likely physical behaviour and chemical reactivity of the waste materials under the conditions in which they would be stored. The report must address the constituent elements present, and their likely future speciation and mobility.
- All mined material should be classified on its propensity to be potentially acid or non-acid forming, to generate neutral metalliferous or saline drainage, and its susceptibility to weathering.

A dedicated Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste was undertaken to inform this PRC Plan (**Error! Reference source not found.**).

6.1.3.1 Background

Current activities of relevance to this waste characterisation report comprise:

- Short-term storage of ROM coal on the ROM pad (ROM coal awaiting processing at the CHPP);

- ROM coal processing at the CHPP. The CHPP produces two mineral waste types:
 - Coarse reject: sent off-site for disposal. A small proportion of coarse rejects have been used at RMI for bunds at the ROM pad, product coal stockpile and haul roads; and
 - Tailings (see below).
- Short-term storage of tailings within in-ground tailings drying cells (to 'dewater' the tailings), prior to being excavated after approximately 3-4 days and sent off-site for disposal;
- Short-term storage of product coal on the product coal stockpile, awaiting off-site transport by rail
- Water management and sediment control utilising two dams:
 - Process Water Dam (PWD): collecting surface water run-off and sediment from the western side of the site and providing water for use in the CHPP and dust control on-site. The PWD is also an authorised water release point, subject to water release conditions as stipulated in the EA; and
 - Environment Dam (ED): collecting surface water run-off and sediment from the eastern side of the site and transferring water to the PWD. The ED is also an authorised water release point, subject to water release conditions as stipulated in the EA.

At the cessation of operations coaly and carbonaceous mineral waste (e.g., remnant coal on the ROM pad, remnant tailings in the tailings drying cells, sediment in the dams) will be excavated, removed off-site and disposed into mine spoil at Poitrel Mine. For the purposes (and in the context of) rehabilitation and closure of mineral waste facilities, the only mineral waste remaining on-site in significant quantities will be the ROM pad base and haul roads, portion of which will be used to fill/cap/cover other site facilities as necessary (subject to a contaminated land assessment being undertaken prior to earthworks).

Historical documentation suggests that clean, unweathered, Permian-age waste from Poitrel Mine was used to construct the ROM pad extension (RMJV, 2014), while no information is available to confirm the source for the construction material for the original ROM pad base or haul roads. For the purpose of this assessment, it is assumed that waste for the construction of the original ROM pad and haul roads was sourced from the neighbouring mines (Poitrel and/or Millennium Mine).

No samples have been collected from within the ROM pad, however the SMC Coal Geochemical Database contains detailed geochemical data for overburden/interburden material from Poitrel Mine (and other Rangal Coal Measures sites), which is considered representative of ROM pad and haul road bulk material. Note that the Millennium mine is adjacent to Poitrel Mine, with mining occurring within the same formations as those mined at Poitrel Mine. It is very unlikely that geochemical properties of materials mined from the two sites would be different in any significant way.

In this context the geochemical characteristics and potential hazards associated with mineral waste materials on-site are discussed by type:

- **General Spoil** – assumed to comprise a mix of weathered and fresh sandstone, siltstone, mudstone and sedimentary materials within the ROM pad base, haul roads, and also provides the base material for the site. However, to introduce a level of conservatism in the risk assessment we have assumed that a small proportion (5%) of this waste may be comprising carbonaceous spoil; and
- **Coaly and Carbonaceous Material** – comprises coal, tailings, coarse rejects and dam sediment. These are the surface materials currently on the ROM pad, product coal stockpile, tailings drying cells, etc. This material is not expected to be remaining on-site following remediation in any material quantity.

6.1.3.2 Geochemical Characteristics of Spoil

Environmental geochemical data for overburden and interburden (spoil) from Poitrel Mine (215 samples) has been used as proxies to infer the geochemical and physical properties of the ROM pad base and haul roads at RMI. Key results are summarised in the sections below.

Potential for Acid and Metalliferous Drainage (AMD)

Spoil, representing the ROM pad base and haul roads, is expected to generate pH-neutral to alkaline contactwater (run-off and seepage). Available geochemical data shows the following:

- The total sulphur (S) concentration of this material is very low, with a maximum total S concentration of 0.18% (90th percentile = 0.03%). Combined with generally moderate to high acid neutralising capacity (ANC) values (median 29 kilograms of sulphuric acid per tonne of rock [kg H₂SO₄/t]), all samples but two were classed as non-acid forming (NAF). Two samples (out of 215 samples) had an uncertain (UC) classification and have been conservatively sub-classified as 'uncertain – potentially acid forming' [UC(PAF)];
- Total metal and metalloid concentrations are generally very low compared to average element abundance in soil in the earth's crust; and
- Soluble multi-element results indicate that leachate from spoil material is expected to contain low concentrations of soluble metals and metalloids.

Based on the results, non-carbonaceous overburden has a negligible potential to generate acid/acidic drainage (AD) and/or neutral metalliferous drainage (NMD). Due to the very low total S (and negligible sulphide) concentrations, the potential for Saline Drainage (SD) (sulphate-derived salinity from sulphide oxidation) is also negligible.

Potential for Saline Drainage (SD) from Salt Dissolution

Spoil has electrical conductivity (EC1:5) values ranging from 85 to 493 microSiemens per centimetre (µS/cm), with median and 90th percentile values of 271 and 377 µS/cm, respectively. On this basis, spoil in the ROM pad base and haul roads is expected to generate low-salinity contact water (run-off and seepage) [oxidative and non-oxidative salinity].

Sodality potential

Spoil samples had relatively low cation exchange capacity (CEC) values and high exchangeable sodium percentage (ESP) values, resulting in all samples being classified as 'strongly sodic' with potential for dispersion. Emerson Aggregate Class testing found all samples to be dispersive (Class 3) or likely to suffer from 'some dispersion' (Class 2). As such spoil materials are inferred to be sodic with potential for dispersion.

6.1.3.3 Geochemical Characteristics of Coaly and Carbonaceous Mineral Waste

Environmental geochemical data for 102 coaly and carbonaceous samples from RMI, representing tailings and coarse rejects, coal collected from the CHPP, drill-hole core from Poitrel Mine representing general spoil, and in-situ surface samples, were collected and tested to support this project. Key results are summarised in the sections below.

Potential for Acid and Metalliferous Drainage (AMD)

Coaly and carbonaceous material, represented by surface materials currently on the ROM pad, product coal stockpile pad, dam sediments, coarse rejects from the CHPP and tailings from the tailings drying cells and CHPP, are expected to generate pH-neutral to alkaline contact water (run-off and seepage).

These materials have a wide total S distribution – particularly the tailings samples, which have a 90th percentile total S of 1.25% (75th percentile = 1.01 %). The other coaly and carbonaceous types (e.g., coal, rejects, surface and sediment materials at RMI) have lower total S values (generally), with a combined 75th percentile total S value of 0.36 %. The sulphide concentration of coaly and carbonaceous materials was relatively low – typically about 35-40 % of the total S concentration.

Based on the results, about 80 % of samples were classified as NAF, and 11% classified as NAF-S (i.e., NAF with total S >1%). The remaining 9 % of samples were classified as potentially acid forming – low capacity (PAF- LC) – indicating that the large majority of coaly and carbonaceous materials (as bulk materials) have low potential to generate acid/acidity.

Total metal and metalloid concentrations are very low compared to average element abundance in soil in the earth's crust. A small number of samples were enriched with respect to one or more of Mo, S and/or Te. The level of 'enrichment' displayed from a relatively small number of samples is not cause for concern.

Soluble multi-element results indicate that leachate from coaly and carbonaceous material is expected to contain low concentrations of soluble metals and metalloids – similar to spoil materials.

While total S concentrations are higher (generally) than spoil materials, the total S concentration of coaly and carbonaceous materials is still relatively low (median = 0.28%; 75th percentile = 0.51%, which is consistent with the

75th percentile total S concentration for coal from the PTM coal quality database). Due to the low total S concentrations, the potential for Saline Drainage (sulphate-derived salinity from sulphide oxidation) is also low.

Coaly and carbonaceous material (as a bulk material) is considered to have a low potential to generate AMD.

Potential for Saline Drainage (SD) from Salt Dissolution

Excluding surface and sediment materials sampled in April 2021 (Gp4 materials), all other coaly and carbonaceous materials have relatively low EC1:5 values, with median and 90th percentile values of 224 and 468 $\mu\text{S}/\text{cm}$, respectively. The Gp4 surface samples had a very wide range of EC1:5 values, ranging from 434 to 2080 $\mu\text{S}/\text{cm}$, with no clear distinction between the various surface sample types. The higher salinity/EC values observed in some surface (and dam sediment) coaly and carbonaceous samples were consistent with the brackish salinity/EC observed in dam water from the ED and PWD, and thus may be associated with accumulation of salts from evaporation of water used for dust suppression.

On this basis, most coaly and carbonaceous material has the potential to generate relatively low-salinity contact water (run-off and seepage), however some surface material may be more saline due to ongoing surface evaporation processes.

Sodicity Potential

Coaly and carbonaceous materials were not assessed for sodicity and dispersion potential as these materials will be removed from site and disposed at PTM. Remnant coaly and carbonaceous materials do not report to final landform surfaces (or near-surfaces) and are not directly used as revegetation and rehabilitation materials.

6.1.3.3 Geochemical Source-Pathway-Receptor (SPR) assessment

A source hazard geochemical assessment was applied to the two source material groups/types. The source hazard score is a formula devised by the authors that takes into account the propensity (ability) to generate AMD, the AMD capacity (severity) and the quantity (volume/tonnage) of AMD that could be produced. For general spoil the AMD source hazard score was 'Highly Unlikely'. For coaly and/or carbonaceous material the AMD source hazard score was 'Unlikely'. When combined, the AMD hazard score for the final landform (i.e., rehabilitated site) at closure is Highly Unlikely and the likelihood for AMD generation from the final landform is also 'Highly Unlikely'.

The majority of the existing coaly and carbonaceous source material will be removed during decommissioning and rehabilitation, therefore there will not be a 'source' at closure. Despite the 'Unlikely' AMD source hazard posed by this material, there may be potential for 'land contamination' beneath existing coaly and/or carbonaceous storage facilities. To manage this potential hazard, a contaminated land detailed site investigation will be undertaken at the end of the operational life RMI to guide the final excavation depth to mitigate and manage potential contamination.

A conceptual environmental geochemical model (source-pathway-receptor (SPR) model (CDM Smith, 2021) for RMI (within the mining lease) identified potential environmental receptors and likely pathways to those receptors. The nearest surface water feature is New Chum Creek, located at the site boundary (the creek forms the northern and eastern boundary). The nearest groundwater receptor was the unconfined aquifer below the site. Outside of the mining lease, the nearest homestead is located over 7 km from RMI and, as such, its' consideration as a receptor is implausible.

The risk assessment considered the potential AMD and SD (non-oxidative) risks posed by the final landform (rehabilitated ROM pad, haul roads, CHPP area etc. and limited amounts of diffused remnant coaly / carbonaceous waste) to the above receptors, with respect to likelihood of impacting the receptor and severity of impact. The risk rating is 'Low'.

The 'Low' risk rating was assigned with consideration for the following key aspects:

- **Source Materials Hazard:** The ROM Pad base is comprised predominantly of non-carbonaceous overburden/interburden with an assumed small proportion of coaly and carbonaceous material. Non-carbonaceous overburden/interburden from Tertiary/ Permian-age material in the Bowen Basin is widely recognised as posing a low AMD risk. Operational placement and rehandling of the waste during rehabilitation and reshaping will ensure extensive co-mingling of all waste types. All materials have low EC values, with release of (non-oxidative) salinity rated as a low-hazard. The low total S and excess ANC of the waste results in a 'Highly Unlikely' hazard score for AMD generation (refer above);

- **Pathways:** The closest surface water receptor is located greater than 100m away from the final reshaped ROM pad. The water table occurs approximately 20m below the site surface within the unconfined FCCM. Coaly and/or carbonaceous waste facilities (e.g., tailings drying cells) will not be left on-site. It is unlikely that any AMD or saline drainage will report to surface water or groundwater pathways;
- **Receptors:** Receptors identified in this qualitative assessment include ephemeral creeks, the unconfined groundwater aquifer and people living in the homesteads near the project area, of which there are no homesteads located within several kilometers of the site. Due to the geochemical nature of the materials remaining on-site, the likelihood of undiluted salinity or AMD (if any) to reach and impact on surface water or groundwater receptors has been rated highly unlikely;
- The overall rating of the source assessment showed that the risk rating for AMD or salinity to impact receptors is Low:
 - Hazards ('Highly Unlikely' for AMD generation and 'Highly Unlikely' for ability to release significant salinity);
 - Pathways ('Unlikely' to 'Highly Unlikely' for AMD and SD to report to surface water or groundwater pathways); and
 - Receptors ('Highly Unlikely' for pathways to connect receptors to sources of AMD).

6.1.3.4 Management Measures

The assessment has found that the environmental risks posed by mineral wastes currently on-site at RMI and likely to be present at closure are low. As such, no specific AMD management measures (e.g., compaction, segregation, special handling, alkaline amendment or capping systems) are required to manage mineral wastematerials during rehabilitation and closure – other than the measures detailed in the PRCP.

It is noted that coaly and carbonaceous mineral waste is planned to be excavated/removed off-site to neighbouring Poitrel Mine for disposal during decommissioning – leaving the bulk ROM pad base and haul roadsto be used for backfilling tailing drying cells and dams, and general site cover material if required. Final rehabilitation requirements will also be supported by a contaminated land detailed site investigation undertakenat the end of the RMI operational life.

Relationship with PRCP Schedule

Environmental risks posed by the mine waste associated with the mining-related activities are low. As such, no specific rehabilitation measures are required to manage geochemical risks (e.g., compaction, segregation, special handling, alkaline amendment or capping systems).

The information in this section is relevant to the highlighted **RAs** and **RMs** in the PRCP Schedule:

RA1			RA2				RA3				RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

- | | |
|-----|--|
| RM1 | <ul style="list-style-type: none"> • Services disconnected • Built and service infrastructure demolished and removed (except where agreed in writing by the post-mining land owner/holder) • Concrete, bitumen and aggregate removed • Rubbish removed • No more than 10% visible coaly and carbonaceous mineral waste on surface • Dried tailings removed • Water and sediment within dams removed • Creek crossing culverts removed. |
|-----|--|

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

- | | |
|------|---|
| RM2 | <ul style="list-style-type: none"> Contaminated land investigation completed by an appropriately qualified person in accordance with the Environmental Protection Act (1994) including: <ul style="list-style-type: none"> a Site Suitability Statement confirming the suitability of the property for the PMLUs; and Audit Certification. The Contaminated Land Investigation Document is supported by a Site Investigation Report and, where appropriate, a Validation Report and/or a draft Site Management Plan. In the event that residual contamination is identified and presents a potential unacceptable risk to the nominated PMLUs or environmental values, remediation works and/or implementation of management controls are completed. Where ongoing management of residual contamination is deemed appropriate, a draft Site Management Plan is prepared, and approval of the draft Site Management Plan is obtained from the administering authority. |
| RM13 | <ul style="list-style-type: none"> A hazard assessment has been completed by an appropriately qualified person to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. Groundcover >50%. Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3 – Water Data Evaluation Process) Deep drainage from the area is not significantly different to EC levels as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of: <ul style="list-style-type: none"> the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or local water quality objectives developed in accordance with the Queensland Water Quality Guidelines Land suitability class ≤ 3, or not different from pre-mining class if ≥ 4, as per PRCP_EPML00819113 (Appendix 4, Table 5 – Pasture condition assessment table). The assessment is to be conducted by an appropriately qualified person. For RM13(e), if the land suitability class is assessed as being not different from pre-mining class if ≥ 4 for all or a portion of a rehabilitation area, an assessment of reference sites must be carried out to determine if the limitation/s resulting in the class of ≥ 4 is consistent with that of reference sites. Certification by an appropriately qualified person¹ that pasture meets a pasture condition rating ≤ 3, based on the Pasture Condition Assessment Table as per “Stocktake: Balancing Supply and Demand” (developed by FutureBeef - futurebeef.com.au), as provided in PRCP Schedule EPML00819113 (Appendix 4, Table – Pasture condition assessment). No active gully erosion, where an active gully is a gully that has increased in area >5% since the previous monitoring period. Landform is free draining. |
| RM14 | <ul style="list-style-type: none"> A BioCondition assessment is completed by an appropriately qualified person using the methodology outlined in the latest version of the Queensland Herbarium’s BioCondition Assessment Manual. The BioCondition assessment required by 14(a) demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP Schedule EPML00819113 (Appendix 2). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3. A hazard assessment has been completed by an appropriately qualified person¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. Rehabilitation of RA2 is assessed as geotechnically stable by an appropriately qualified person with FoS ≥ 1.5, unless an alternative is justified by an appropriately qualified engineer. Rainfall runoff from rehabilitation is not significantly different to upstream values for the |

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

- following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3 – Water Data Evaluation Process).
- Deep drainage from the area is not significantly different to EC levels as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of:
 - the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or
 - local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
 - No active gully erosion, where an active gully is a gully that has increased in area >5% since the previous monitoring period.

6.1.4 Soil and Capping Material

PRCP Guideline (Section 3.6.1)

The rehabilitation and management methodology should include that soil assessment activities are supplemented by additional surveys conducted at appropriate intervals to assess soil resources in planned disturbance areas. In addition to the assessment of soils, the proposed rehabilitation methodologies in the rehabilitation planning part must also address topsoil management. Topsoil management must ensure sufficient topsoil quantity and quality is available in those instances that waste rock or tailings cannot support the proposed PMLU. Integrated soil and waste rock characterisation and mapping should form the foundation of the rehabilitation strategies. The available soil resources and capping material should be assessed prior to the commencement of operations.

A preliminary assessment of soils at RMI was undertaken to inform this PRC Plan (GTE, 2021 – **Error! Reference source not found.**).

6.1.4.1 PMLU Requirements

The assessment of soil and capping materials supports the proposed PMLUs of cattle grazing, woodland habitat and watercourse at RMI.

Cattle Grazing

The function of the surface for cattle grazing is to support germination and establishment of the pasture seed mix, characterised by:

- Sufficient water availability and nutrients for pasture;
- Soil structure that does not limit infiltration;
- Soil salinity within tolerable ranges for pasture species; and
- Reduced rockiness to encourage vegetation growth.
- ESP that is non-sodic to limit piping and tunnel erosion potential;
- No AMD materials or areas of low concentrations of diffuse AMD waste;
- The stockpiled topsoil indicated negligible to moderate limitations to supporting cattle grazing (GTE, 2021). These limitations are associated with soil physical condition and can be managed with amelioration, as detailed in sections 6.1.3.2 and 6.1.3.3.

Woodland Habitat and Watercourse

The function of the surface for woodland habitat and watercourse is to support a seed mix of native species, and includes:

- Providing sufficient water availability and nutrients for native grasses, shrubs and trees;
- Soil structure that does not limit infiltration;

- Soil salinity within tolerable ranges for salt tolerant native species;
- Rock to increase erosion resistance and encourage root pathways for deep rooted species;
- ESP that is non-sodic to limit piping and tunnel erosion potential;
- No AMD materials or areas of low concentrations of diffuse AMD waste.

The establishment of native vegetation using spoil is found to have several advantages over a typical topsoil approach (Carroll and Tucker, 2000, Carroll et al, 2000, Spargo and Doley, 2016, Kopittke et al, 2004, Davis et al, 1998, Erskine and Fletcher, 2013). Challenges associated with using topsoil for native vegetation on engineered landforms include:

- Topsoil contains a natural seedbank with higher proportions of invasive species, making it difficult to establish native grasses, shrubs and trees due to competition;
- Topsoil structure is often incompatible as a cover with many wastes and spoils in engineered landforms. Poor cohesion between layers can result in excessive erosion of surface soils and limited root penetration for deep rooted species;
- Excessive erosion rates on topsoil covered landforms removes planted seed and natural seedbank into sediment control structures;
- Topsoil structure can often limit effectiveness of surface roughness (cross ripping) as they do not contain sufficient competent rock or non-dispersive clays to maintain surface treatment to limit erosion.

Based on the limitations of using topsoil on slopes and engineered landforms to support native vegetation, seed in the woodland and watercourse PMLU areas will be directly sowed into ameliorated spoil or subsoil material. The waste characterisation data for RMI (Section 6.1.3) indicates subsoil and spoil at RMI is:

- pH-neutral to alkaline (7.0 – 9.0);
- Low concentrations of soluble metals and metalloids;
- Negligible potential to generate acid drainage, neutral metalliferous drainage or saline drainage (from sulphide oxidation);
- Non-saline (85 to 493 $\mu\text{S}/\text{cm}$);
- Expected to be sodic with potential for dispersion.

Soil chemistry and physical characteristics are therefore suitable for use as the surface material for woodland habitat and watercourse with appropriate amelioration. Further sampling of spoil and subsoils will be undertaken prior to rehabilitation activities to determine the amelioration treatment required to enhance the success of rehabilitation of these materials.

6.1.4.2 Topsoil Management

Quality and Quantity

Major topsoil stockpiles at RMI have been sampled to understand quality and suitability as a surface soil for cattle grazing (Figure 5) (GTE, 2021). The topsoil samples have presented limitations including dispersion and nutrient levels; however, they also indicate that they are suitable for re-use as a surface soil for cattle grazing PMLU with appropriate amelioration and management. A summary of the stockpiled topsoil qualities and ratings is provided in Table 22.

Table 22: RMI Stockpiled Topsoil Quality, Per Sample (RMI1 – RMI4).

	Stockpile 3	Stockpile 2		Stockpile 1
Analysis (unit)	RMI1	RMI2	RMI3	RMI4
Soil pH (H2O)	8.07	7.46	6.79	6.36
pH Rating	Moderate alkaline	Mildly alkaline	Neutral	Slightly acidic
Soil EC (dS/m)	0.174	0.083	0.183	0.096
EC Rating	Moderate	Low	Moderate	Low
Soil Cl [mg/kg])	111	53	117	61
Cl Rating	Very low	Very low	Very low	Very low
CEC (meq/100g)	16	8.7	10	7.4
CEC Rating	Moderate	Low	Low	Low
ESP (%Na/CEC)	0.31	0.30	0.87	0.35
ESP Rating	Non-sodic	Non-sodic	Non-sodic	Non-sodic
Ca/Mg (ratio)	3.2	2.1	3.6	2.7
Ca/Mg Rating	Very high	Very high	Very high	Very high
Zinc (mg/kg)	1.7	<0.5	0.93	0.80
Zinc Rating	Moderate	Low to very low	Moderate	Moderate
Mn (mg/kg)	8.2	8.6	16	20
Mn Rating	Moderate	Moderate	Moderate	Moderate
Copper (mg/kg)	1.2	0.66	1.0	0.73
Copper rating	Moderate	Moderate	Moderate	Moderate
Total Organic Carbon (%)	1.1	0.85	1.3	1.9
TOC Rating	Low	Low	Low	Moderate
P (mg/kg) (Colwell)	12	13	22	16
P Rating	Moderate	Moderate	High	Moderate
Total Nitrogen (%)	0.07	0.05	0.08	0.09
TN Rating	Low	Low	Low	Low
C/N (Ratio)	16	19	16	17
C/N Rating	Moderate to high	High	Moderate to high	High
EAT (No.)	2	5	5	5
EAT Rating	Slaking and some dispersion	Dispersion observed in aggregate/water suspension	Dispersion observed in aggregate/water suspension	Dispersion observed in aggregate/water suspension

The volume of available topsoil in stockpiles is shown in Table 23.

Topsoil placement depth across cattle grazing areas at RMI is recommended at a minimum placement depth of 100mm (GTE, 2021). At this placement depth, 95,000 m³ of topsoil would be required for the rehabilitation of the cattle grazing areas. However, there is sufficient topsoil stockpiled at RMI to apply 150 mm of topsoil over the disturbed areas with a PMLU of cattle grazing.

Table 23: RMI Stockpiled Topsoil Volume.

	Topsoil Stockpile					Total
	1	2	3	4	5	
Volume (m³)	85,472	49,686	6,924	1,515	1,381	144,978

6.1.4.3 Amelioration

Before rehabilitation activity is undertaken at RMI, soils, subsoils and spoil will require a detailed assessment by an appropriately qualified person to determine amelioration requirements. An amelioration program will be developed to address the potential limitations listed in Table 24 (GTE, 2021).

Table 24: Potential Limitations of Topsoil and Spoil.

Material	Potential Limitations
Stockpile 1	• Dispersion may occur when saturated and disturbed; • Nitrate levels low; • Sulfate levels low; • CEC levels low.
Stockpile 2	• Dispersion may occur when saturated and disturbed; • Nitrate levels low; • Sulfate levels low; • CEC levels low; • Macro nutrients low, K, Na.
Stockpile 3	• Slaking and some dispersion; • pH >8; • Nitrate levels low; • Sulfate levels low; • CEC levels low; • Macro nutrients low Na.
Stockpile 4	• Limitations not expected to differ from stockpiles 1 – 3.
Stockpile 5	• Limitations not expected to differ from stockpiles 1 – 3.
Spoil	• Slaking and dispersion; • pH >8; • Nitrate levels low; • CEC levels low; • Organic carbon low.

6.1.4.4 Surface Treatment

For cattle grazing areas, topsoil shall be recovered from the topsoil stockpiles and placed an average of 150 mm over the target PMLU area.

For cattle grazing and woodland habitat, seedbed preparation of the surface will focus on ensuring good contact between the soil and the seed and creating a friable seedbed. This will include ripping prior to sowing of seed.

Relationship with PRCP Schedule

The geochemical assessment on spoil, soil survey and topsoil management methodologies ensure that there is suitable quantity and quality of growth media available to support the PMLUs of cattle grazing, woodland habitat, and watercourse.

The information in this section is relevant to the highlighted **RAs** and **RMs** in the PRCP Schedule:

RA1			RA2				RA3				RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

- | | |
|-----|---|
| RM4 | <ul style="list-style-type: none"> • Topsoil is placed at an average thickness of 150mm • An assessment of growth media characteristics is completed by an appropriately qualified person that identifies amelioration and other treatments required to achieve the following primary growth media quality targets: <ol style="list-style-type: none"> 1. Surface pH (pH units) 5 - 7; 2. Salinity (EC1:5; dS/m) <0.75; 3. Sodicity (ESP; %) <6; 4. Total N (mg/kg) >1,000; 5. Available (mg/kg) P >10; 6. Available (mg/kg) K >200; 7. Organic Carbon (%) >1. • Amelioration and physical treatments are applied as identified in 4(b) • Rip across contour. • Primary growth media quality targets: criteria provided as a post-ameliorant target. Initial soil analysis values may be outside of these ranges, however they must be achieved where that is a requirement of this PRCP schedule. |
| RM5 | <ul style="list-style-type: none"> • An assessment of growth media characteristics is completed by an appropriately qualified person that identifies amelioration and other treatments required to achieve the following primary growth media quality targets: <ol style="list-style-type: none"> 1. Surface pH (pH units) 6 - 9 2. Salinity (EC1:5; dS/m) <0.75 3. Sodicity (ESP; %) <6 4. Total N (mg/kg) >1,000 5. Available (mg/kg) P >10 6. Available (mg/kg) K >200 7. Organic Carbon (%) >1 • Amelioration and physical treatments are applied as identified in RM5(a) • Rip across contour |
| RM6 | <ul style="list-style-type: none"> • An assessment of growth media characteristics is completed by an appropriately qualified person, and amelioration and other treatments required identified • Ameliorant and physical treatments are applied as identified in RM6(a) • Sediment and erosion controls established in accordance with associated riverine and/or operation works permits or associated exemptions. |

6.1.5 Landform Design

PRCP Guideline (Section 3.6.1)

The final landform design must be based on the proposed PMLUs and NUMAs and demonstrate that the land will be safe and structurally stable.

Landform design considers the landform development and reshape of all relevant activity areas after the removal of infrastructure and wastes, and prior to placement of topsoil and seed.

3D Design

The overall site slopes from approximately 240RL on the western lease boundary to 220RL in the south-east corner where New Chum Creek exits the ML. The average slope across the site is about 1.5%. The remaining ROM pad is located on the west side of the lease and rises to 247RL.

The 3D post-mining landform design with 2m contours is shown in Figure 16.

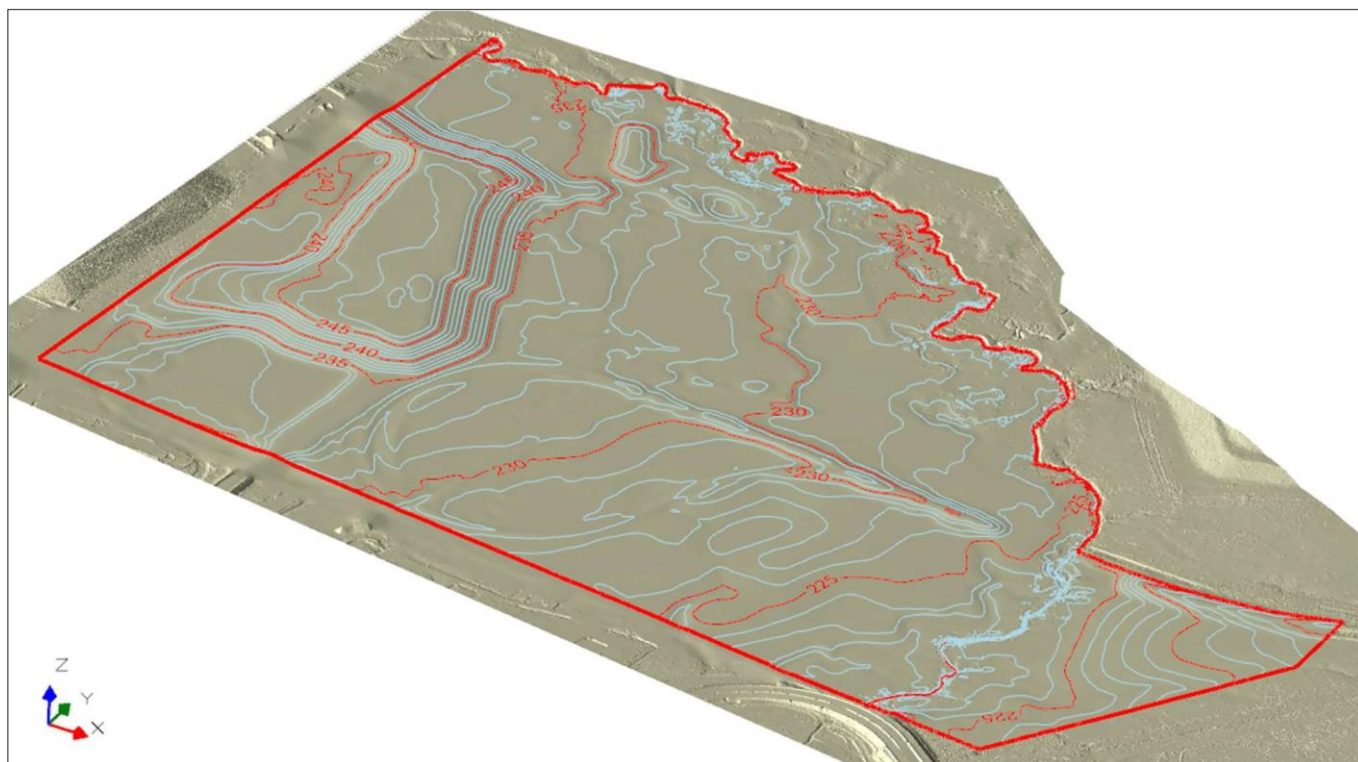


Figure 16: 3D Post-Mining Landform Design – 2m Contours (View from South-East).

6.1.5.1 Method of Determining Landform Design

Landform Structures

The relevant activities and areas (Section 1.4.1) considered when determining the landform design are detailed in Table 25.

Table 25: Landform Structures for RMI.

Landform Structure	Footprint Area (ha)	Landform Design and Rehabilitation
Infrastructure and General Areas – CHPP and associated infrastructure, administration, workshop, laydown areas, roads, drains, rail area, train load-out and associated infrastructure	113	Area will be reshaped to be free-draining with lower-gradient slopes of maximum 10% and blended in with surrounding area.
Coal Stockpiles	35	After removal of visible coal (no more than 10% visible coaly and carbonaceous mineral waste on surface), the remaining footprint area will be reshaped to be free-draining with lower-gradient slopes of maximum 10% and blended in with surrounding area.
Tailings Drying Cells	3	- After removal of dried tailings residue, the cells will be backfilled with spoil from the ROM pad or haul road base to be free-draining. - Area will be reshaped and blended in with surrounding area.
Water Dams	18	- After dam water and sediment is removed, the dam walls will be dozed back over the dam footprint and additional backfill from the coal stockpile base or haul road base will be placed in the area to make free-draining. - Area will be reshaped and blended in with surrounding area.
Topsoil Stockpiles	5	After topsoil stockpiles have been depleted, area will be reshaped to be free-draining and blended in with surrounding area if required.

Removal of infrastructure (Section 6.5) and contaminated land requirements (Section 6.5.3) will be completed where required, prior to reshaping of the final landform. After reshaping of the final landform, topsoil is spread over the required areas (Section 6.1.4) and revegetated (Section 0).

Key Considerations

RMI is surrounded by coal mines with Poitrel Mine to the south-west, Millennium Mine to the north and the west, and Daunia Mine to the south and east. Landforms at these sites range up to 80m in height.

At closure, over 80% of the RMI landform will be similar to the pre-mining topography, with a small proportion of land higher than pre-mining levels. These areas are of minimal height and include the reshaped ROM pad, plus minor areas of haul roads and the rail loop. The site will be free-draining, with over 70% of the site having a final slope of <3%.

When considering RMI in the broader context with the surrounding area, it does not present any impact or risk to the surrounding land uses, sensitive receptors (nearest receptor is >6.5km), local and regional topography, or visual amenity.

Landform Runoff

The landform at closure will be free-draining and water-shedding. The surface water flow is shown in . The main water flow from the original CHPP area and north of the rail line, is to the east, with the majority of the water entering New Chum Creek downstream of the Millennium mining operation. The water from the west side of the lease flows south into the Poitrel Mine lease. The water south of the rail line flows to the south-east towards New Chum Creek.

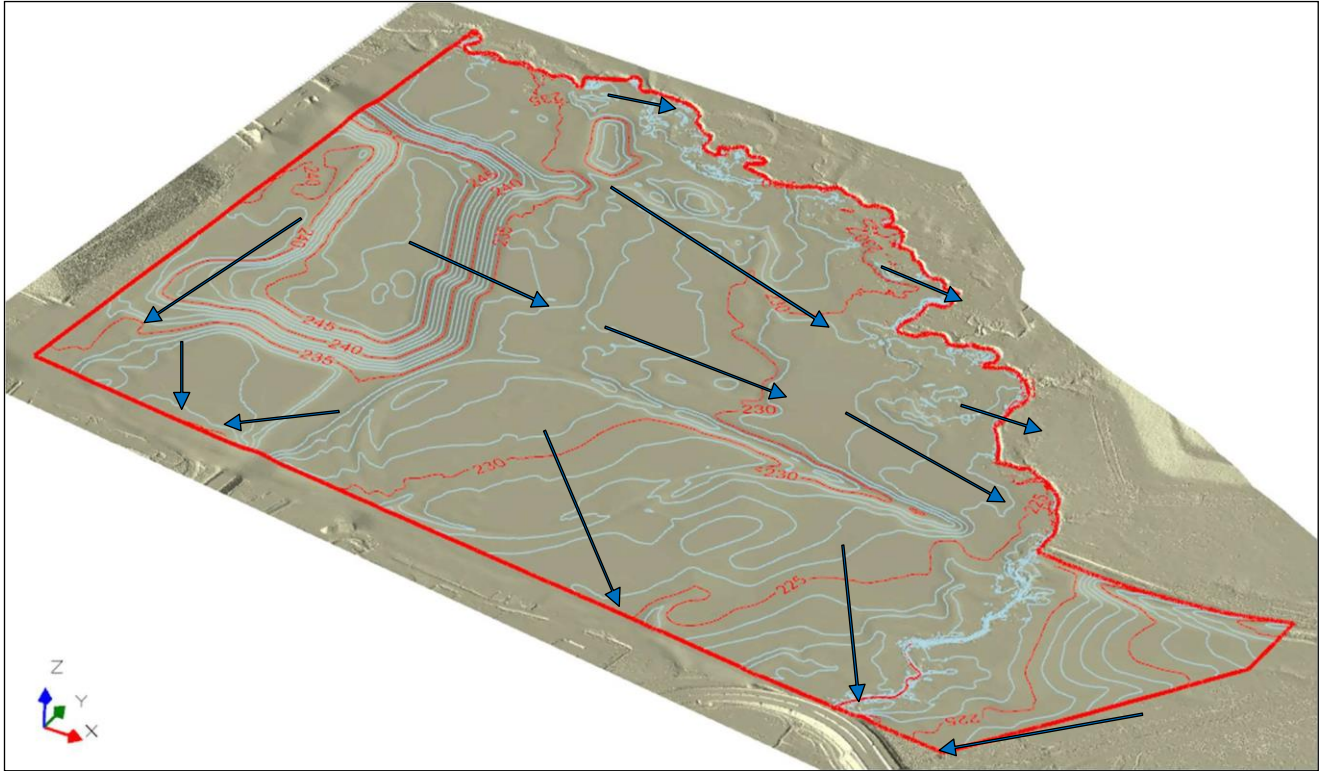


Figure 17: Indicative Surface Water Flow Direction – 2m Contours (View from South-East).

Materials

The rehabilitation of RMI requires:

- Spoil from the ROM pad and haul roads to fill the tailings drying cells and dams to make free-draining;
- Topsoil for disturbed areas to be rehabilitated to a PMLU of cattle grazing (Section 3.1.1).

Waste Placement

Dried tailings will be removed from the tailings drying cells and visible coal will be removed from coal stockpiles and disposed of at Poitrel Mine (no more than 10% visible coaly and carbonaceous mineral waste remaining on surface). Further material will be removed from disturbed areas or additional material placed over areas, if identified as part of the spoil assessment (Section 6.1.3) or contamination assessment (Section 6.5.3).

Hydrological and Hydrogeological Assessments

The final landform will restore the hydrological site conditions to a state similar to that present pre-development of the CHPP by:

- Backfilling and reshaping to be free-draining;
- Removal of the on-site culverts and associated fill material from within New Chum Creek.

A desktop assessment of potential flood risks to the final landform and surrounding land uses (Section 6.1.2), identified a low potential for adverse risks.

As the site does not include voids, underground workings, deep areas of fill, permanent disposal of carbonaceous wastes, or disturbance of the hydrostratigraphic units which support the alluvial or FCCM aquifers, the potential impacts from the RMI final landforms to hydrogeology have been assessed to be low (Section 6.1.1).

Specific Landform Requirements

There are no specific landform requirements.

Long-Term Landform Stability

The landform stability risk is considered low due to:

- The landform being free-draining;
- 40% of the site is undisturbed;
- Over 80% is similar to the pre-mining topography;
- 70% of the site has a final slope of <3%;
- ROM pad averages approximately 10m above pre-mining levels and will be reshaped to maximum 10% slopes, which are lower-gradient slopes for rehabilitation in the Bowen Basin;
- The remaining haul roads and rail loop range to a maximum height of 4m above pre-mining levels and will be reshaped to maximum 10% slopes;
- Soil, subsoils and spoil will be assessed to determine any additional treatment to promote revegetation suitable for the PMLU and limit dispersion potential (Section 6.1.4).

Method of Construction

The only 'constructed' landforms on the site are the ROM pad, haul roads and rail loop. The ROM pad and haul roads were dumped by haul trucks and are compacted and stable.

Quality Assurance / Quality Control

The proposed actions referenced in Table 25 are the key controls that will be put in place to manage the landform risks associated with achieving the PMLUs. Quality assurance and quality control activities are built into all necessary execution and verification activities of these controls. Monitoring and reporting processes verify controls and ensure that controls are executed effectively (Section 8).

Trial Methodology

As the landform design is low risk, no trial methodology is proposed.

Limitations and Assumptions

The final contaminated land assessment (Section 6.5.3) will identify if additional material needs to be remediated, or removed from site, or managed. This is covered in the rehabilitation schedule through rehabilitation milestone RM2.

All 'constructed' landforms are compacted, therefore no further settling is expected.

Relationship with PRCP Schedule

- Over 80% of the landform is similar to the pre-mining topography, with 70% of the site having a final slope of <3%. Areas higher than the pre-mining levels are minimal height and will be reshaped with 10% maximum slopes. All disturbance areas will be reshaped to be free-draining and blended in with the surrounding topography. The landform is therefore suited to the pre-mining and surrounding land uses of cattle grazing, woodland habitat and watercourse.
- The risk associated with landform failure is low.

The information in this section is relevant to the highlighted **RAs** and **RMs** in the PRCP Schedule:

RA1			RA2				RA3				RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

RM3	• Tailings drying cells backfill completed. • Dams backfill completed. • Haul road and rail base material removed within 100m of New Chum Creek, and disturbed bed and banks returned to a profile similar to the pre-disturbance condition in accordance with associated riverine and/or operation works permits or associated exemptions (RA3, RA4). • Landforms reshaped with maximum 10% slopes (RA1, RA2, RA3). • Landform reshaped to be free-draining and consistent with surrounding topography.
	• A hazard assessment has been completed by an appropriately qualified person to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. • Groundcover >50%. • Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3 – Water Data Evaluation Process). • Deep drainage from the area is not significantly different to EC levels as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of: – the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or – local water quality objectives developed in accordance with the Queensland Water Quality Guidelines • Land suitability class ≤3, or not different from pre-mining class if ≥4, as per PRCP Schedule EPML00819113 (Appendix 4, Table 5 – Pasture condition assessment table). The assessment is to be conducted by an appropriately qualified person. For RM13(e), if the land suitability class is assessed as being not different from pre-mining class if ≥4 for all or a portion of a rehabilitation area, an assessment of reference sites must be carried out to determine if the limitation/s resulting in the class of ≥4 is consistent with that of reference sites. • Certification by an appropriately qualified person¹ that pasture meets a pasture condition rating ≤3, based on the Pasture Condition Assessment Table as per “Stocktake: Balancing Supply and Demand” (developed by FutureBeef - futurebeef.com.au), as provided in PRCP Schedule EPML00819113 (Appendix 4, Table – Pasture condition assessment table). • No active gully erosion, where an active gully is a gully that has increased in area >5% since the previous monitoring period. • Landform is free draining.
RM14	A BioCondition assessment is completed by an appropriately qualified person using the methodology outlined in the latest version of the Queensland Herbarium’s BioCondition Assessment Manual. The BioCondition assessment required by 14(a) demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP Schedule EPML00819113 (Appendix 2). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3. • A hazard assessment has been completed by an appropriately qualified person¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. • Rehabilitation of RA2 is assessed as geotechnically stable by an appropriately qualified person with FoS ≥1.5, unless an alternative is justified by an appropriately qualified engineer • Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process.

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

- Deep drainage from the area is not significantly different to EC levels as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of:
 - the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or
 - local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
- No active gully erosion, where an active gully is a gully that has increased in area >5% since the previous monitoring period.

6.1.6 Cover Design

PRCP Guideline (Section 3.6.1)

A cover design is required for the surface treatment of a mine landform or other waste material. Hence, the cover system design must be appropriate for the type(s) of waste the project will generate and reflect a risk-based approach. Where waste has the potential for AMD, neutral mine drainage or saline mine drainage, an appropriate cover system must be designed.

The cover design should include:

- Identification and specification of the objectives of the cover system;
- A detailed description of the design including the thickness of each layer;
- A detailed description of construction methodology including any proposed staging of the cover system;
- A quantitative assessment that identifies the location and quantity of proposed capping material available on-site;
- Proposed QA/QC for the construction of the cover system including the timely implementation of corrective actions where deviations from the design are identified.

The waste characterisation (Section 6.1.3) and potential contaminants (Section 6.1.7) showed there is a low environmental risk associated with any material remaining on-site, and no cover designs are required.

Relationship with PRCP Schedule

The waste characterisation (Section 6.1.3) and potential contaminants (Section 6.1.7) showed there is a low environmental risk associated with any material remaining on-site, and no cover designs are required.

6.1.7 Water Management

PRCP Guideline (Section 3.6.1)

The rehabilitation planning part must include a description of the following:

- A description of the contaminants that pose a risk to environmental values of the receiving environment;
- Source, pathway and fate of contaminants that have the potential to impact environmental values;
- Infiltration and seepage intervention and collection controls;
- Surface water diversions and long-term management requirements;
- Dewatering requirements;
- Ongoing water management and reduction requirements (i.e., treatment).

The management of water resources during CHPP operations at RMI includes the following.

- Supply of water used within the CHPP from a mixture of sources including:
 - Poitrel Mine via the Braeside pipeline;
 - Poitrel Mine site water via a pipeline;
 - Millennium Mine from the Southern Void or Western Dam via pipeline;
 - Runoff from the Millennium Mine Mountain Dump captured in the process water dam via overland flow;

- Sunwater/Burdekin Water pipeline scheme.
- The capture and storage of water within the following two on-site dams:
 - Environment dam (full design capacity of 72ML), which is used to collect and store runoff from the CHPP infrastructure area and to transfer water to the process water dam;
 - Process water dam (full design capacity of 297ML), which is used to store, recycle and supply process water to the CHPP;
- Two release points from the on-site dams are permitted for conditional release of water to New Chum Creek under the site's EA, noting that since the operation of the site by BMC (commencing in 2018), no releases of water from the dams have occurred;
- Maintenance of a vegetated buffer zone of 100m along New Chum Creek with the only exceptions being the Millennium Mine haul road and the rail line crossings;
- Bunding/surface drains that provide segregation of mine affected water and runoff from undisturbed areas;
- Sampling and assessment of water quality within the process water dam, environment dam, New Chum Creek and the groundwater as outlined in the EA, to assist in the identification of potential releases of contaminants into the environment.

The final landform for RMI (Section 0) includes: the removal of all above ground infrastructure; removal of carbonaceous and coal material (no more than 10% visible coaly and carbonaceous mineral waste remaining on surface); decommissioning of the dams; removal of the culverts and associated fill material within New Chum Creek; and reshaping the landform to be free draining. The final landform does not include voids; underground workings, deep areas of fill material, permanent containment of tailings or other carbonaceous wastes; or landforms containing AMD materials. Also, at the completion of operations, contaminated land investigations are to be undertaken and any identified contaminated material that presents an unacceptable risk to the proposed PMLUs or environmental values will be remediated and/or managed.

A Preliminary Site Investigation (PSI) (**Error! Reference source not found.**) undertaken in accordance with the National Environment Protection (Assessment of Site Contamination) Measure (1999: Rev 2013) (ASC NEPM), was undertaken as part of the development of the RMI PRC Plan. The PSI was undertaken to identify existing potential contamination land risks associated with the operation of the CHPP that could impact on the PMLUs and surrounding environmental values at closure. Figure 18 illustrates the Contaminated Land Conceptual Site Model (CSM) for the RMI site at closure.

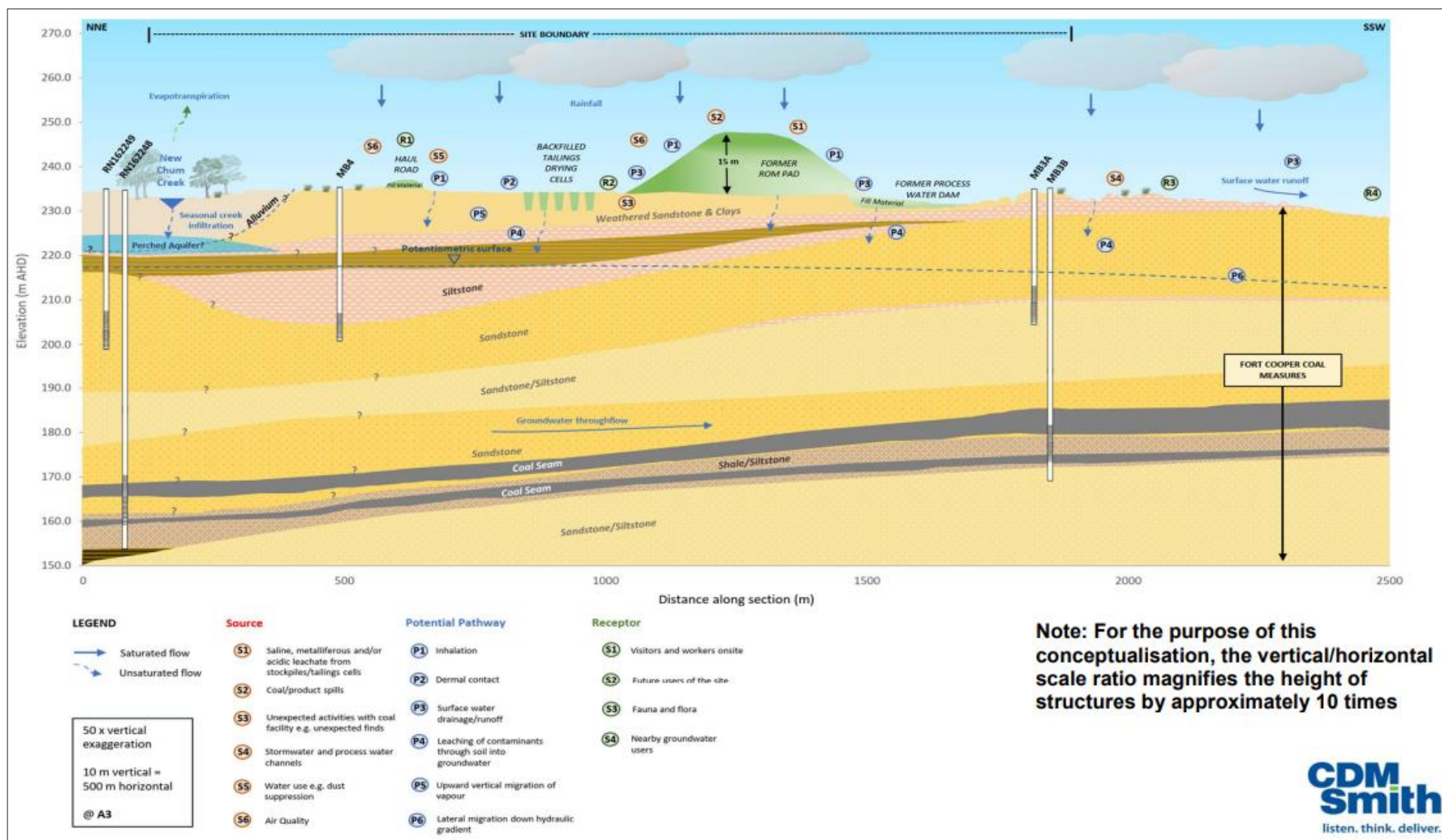


Figure 18: Post-Mining Contaminated Land Conceptual Site Model.

6.1.7.1 Potential Contaminants

The PSI (Appendix 9), through the review of available information, site monitoring data and a site inspection, did not confirm the presence of any areas of existing contamination that have the potential to impact on the nominated PMLUs or environmental values. As a conservative measure, noting the on-going nature of operations at RMI and absence of a targeted Detailed Site Investigation, the PSI identified the following potential contaminants:

- Hazardous materials stored and utilised as part of the CHPP operations including:
 - petroleum hydrocarbons (diesel, oils, greases);
 - Alcohols/solvents (Methyl Isobutyl Carbinol (MIBC));
 - Flocculants;
 - Coolants/transmission fluids associated with maintenance works;
 - Waste oils and other fluids.
- Leachate from carbonaceous materials processed on-site and seepage from the water storage dams and tailings drying cells including:
 - Metals;
 - Salinity/sulfates;
 - Acids/alkalis;
 - Ammonium nitrate;
 - Particulate matter.
- Disturbed soils and imported fill material from adjacent sites including:
 - Metals;
 - Salinity/sulfates;
 - Acids/alkalis;
 - Particulate matter.

6.1.7.2 Source, Pathway and Fate

The assessment of the carbonaceous wastes and fill materials used on-site has identified a low potential for impacts to the nominated PMLUs and environmental values (Section 6.1.3). Therefore, the identified primary sources, such as coal and carbonaceous materials (tailings/rejects), imported overburden fill materials from adjacent sites, and disturbed soils are not considered likely to cause contamination of the site resulting from the material's geochemical properties. Therefore, upon removal of the coal/carbonaceous materials off-site and the revegetation of the disturbed areas, exposure pathways to water resources are considered incomplete and unlikely to require management beyond what is proposed as part of the RMs.

All stored hazardous materials (primary sources) are to be removed as part of rehabilitation of the site. Therefore, any residual contaminant sources at closure associated with hazardous materials storage during operations, will be restricted to secondary sources such as contaminant plumes within the soil and groundwater beneath the site. A contaminated land investigation will be undertaken as part of the rehabilitation of the site to assess the potential for any residual contamination to impact on the proposed PMLUs and environmental values. This investigation, undertaken after the completion of site operations, will identify any contamination that will require remediation and/or management as part of the site rehabilitation works. Should contamination be identified that requires on-going management to enable the site to be utilised for the nominated PMLUs or to protect environmental values, a draft Site Management Plan (SMP) under the provisions of the *Environmental Protection Act (1994)*, will be prepared and submitted to the

administering authority for consideration and will inform the rehabilitation of the site, where appropriate. Any on-going water management requirements will also be detailed within the draft SMP, if required.

6.1.7.3 On-Going Water Management Requirements

Based on the current condition of the RMI site and the nominated RMs, on-going water management including infiltration and seepage intervention, diversions, dewatering requirements, and treatment of water, is not envisaged to be required. The nominated rehabilitation milestone (RM2) and associated milestone criteria include the completion of contaminated land investigations and where appropriate, remediation and/or management based on the condition of the site at the time of closure. These rehabilitation commitments provide the appropriate controls should site conditions change during the operations to facilitate the implementation of any appropriate on-going water management controls.

Relationship with PRCP Schedule

The final landform at RMI will be free draining and is not anticipated to require any on-going water management. A contaminated land investigation will be undertaken at the completion of operations and prior to the reshaping of the landform to assess the area for potential sources of contamination that could impact environmental values. Where required remediation and management of any identified contamination will be undertaken to minimise the potential for adverse impacts to water resources.

The information in this section is relevant to the highlighted RAs and RMs in the PRCP Schedule:

RA1			RA2				RA3				RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

RM2	- Contaminated land investigation completed by a suitably qualified person in accordance with the National Environment Protection (Assessment of Site Contamination) Measures and the Queensland Environmental Protection Act (1994). - In the event that residual contamination has been identified and presents a potential unacceptable risk to the nominated PMLUs or environmental values, remediation works and/or implementation of management controls will be undertaken. - Where ongoing management of residual contamination is deemed appropriate, a draft Site Management Plan will be prepared for the administering authority's consideration.
RM13	- A hazard assessment has been completed by an appropriately qualified person to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. - Groundcover >50%. - Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) – Water Data Evaluation Process - Deep drainage from the area is not significantly different to EC levels as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of: - the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or - local water quality objectives developed in accordance with the Queensland Water Quality Guidelines - Land suitability class ≤3, or not different from pre-mining class if ≥4, as per PRCP Schedule EPML00819113 (Appendix 4, Table 5 – Pasture condition assessment table). The assessment is to be conducted by an appropriately qualified person. For RM13(e), if the land suitability class is assessed as being not different from pre-mining class if ≥4 for all or a portion of a rehabilitation area, an assessment of reference sites must be carried out to determine if the limitation/s resulting in the class of ≥4 is consistent with that of reference sites.

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

- Certification by an appropriately qualified person¹ that pasture meets a pasture condition rating ≤ 3 , based on the Pasture Condition Assessment Table as per “Stocktake: Balancing Supply and Demand” (developed by FutureBeef - futurebeef.com.au), as provided in PRCP_EPML00819113 (Appendix 4, Table – Pasture condition assessment table).
- No active gully erosion, where an active gully is a gully that has increased in area $>5\%$ since the previous monitoring period.
- Landform is free draining.

RM14

- A BioCondition assessment is completed by an appropriately qualified person¹ using the methodology outlined in the latest version of the Queensland Herbarium’s BioCondition Assessment Manual.
The BioCondition assessment required by 14(a) demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP Schedule EPML00819113 (Appendix 2). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3.
- A hazard assessment has been completed by an appropriately qualified person¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use
- Rehabilitation of RA2 is assessed as geotechnically stable by an appropriately qualified person with FoS ≥ 1.5 , unless an alternative is justified by an appropriately qualified engineer
- Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3 - Water Data Evaluation Process).
- Deep drainage from the area is not significantly different to EC levels as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of:
 - the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or
 - local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
- No active gully erosion, where an active gully is a gully that has increased in area $>5\%$ since the previous monitoring period.

RM15

- A hazard assessment has been completed by an appropriately qualified person¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use.
- Groundcover on banks $>80\%$.
Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process.
- A BioCondition assessment is completed by an appropriately qualified person¹ using the methodology outlined in the latest version of the Queensland Herbarium’s BioCondition Assessment Manual.
- The BioCondition assessment required by 15(d) demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP Schedule EPML00819113 (Appendix 3). The relevant regional ecosystem is RE 11.3.25.

6.1.8 Revegetation

PRCP Guideline (Section 3.6.1)

- The revegetation plan must propose activities that will establish self-sustaining vegetation communities that are appropriate for the intended PMLU (e.g., natural ecosystems, grazing, forestry and some agricultural and other land uses). Revegetation should, therefore, not only establish a ground cover, but also, in some domains, establish associated fauna habitat and other ecological services.
- The rehabilitation planning part must include details of the site preparation required for rehabilitation activities.

6.1.8.1 Revegetation Objectives

The following are the revegetation objectives, consistent with the planned PMLUs:

- To establish vegetation cover on all rehabilitation areas to limit erosion;
- To establish a good condition cattle grazing pasture with a dominance of 3P (i.e., palatable, perennial, and productive) native and exotic grass species;
- To establish woodland habitat with an overall structure and diversity of native trees and shrubs and grasses consistent with surrounding native ecosystems;
- To establish watercourse vegetation with trees, shrub and grasses endemic to the area, sufficient to re-establish a riparian environment and protect bed and banks from erosion;
- To limit invasive weed species presence and abundance to levels similar to those on site prior to mining or representative of adjacent areas.

6.1.8.2 Key Flora Species Election

The selection of flora species to be used in revegetation considers the PMLUs outcomes to be achieved. The selection has considered the surrounding and post-mining land use concept, and the capacity of the available topsoil resources at the time of revegetation to support seed.

The provenance (where the seed came from) is considered important for both native tree and pasture species. Attention will be given to sourcing seed as locally as possible from natural populations. Although these local provenance boundary locations may differ between species, attention will be given to ensuring that seed should at least be obtained from the Brigalow Belt north bioregion.

6.1.8.3 Purity

Information related to seed quality will be obtained from the seed supplier prior to purchase. This would include:

- Genus, species (and sub-species for Eucalypt spp.) and seed lot number;
- Collection location;
- Collection date;
- Seeds of other plants, i.e., inclusion of other species seeds;
- Important weed seeds, i.e., inclusion of weed seeds,
- Purity (%)
- Germination (%) (test current within 12 months)
- Percentage of pure live seeds (purity % x germination %)

6.1.8.4 Cattle Grazing Revegetation

Growth Media

The growth media for cattle grazing utilises the available stockpiled topsoil resources at RMI, spread at an average depth of 150mm. The available topsoil quality and quantity is discussed in detail in Section 6.1.4.

The available topsoils range from clay loams to loams which will suit pasture species for clays and lighter textured soils (GTE, 2021).

Topsoils will be ameliorated prior to seeding, as recommended by an appropriately qualified person (Section 6.1.4).

Pasture Species

The pasture species mix for a PMLU of cattle grazing is based on a combination of species recorded during baseline surveys as well as those preferred, palatable and productive (3P) exotic and native pasture species suitable for pasture establishment on either clay or lighter textured soils.

Both the native and exotic pasture species have been recommended using 3P grasses cognisant of grazing best management practices. A productive pasture will have a high percentage of 3P grasses and a high frequency of legumes and a low number of weeds.

Table 26 lists the recommended pasture species and recommended sowing rates for a PMLU of cattle grazing. Species availability may fluctuate from year to year and unavailable species are to be substituted with other species listed in this table. All pasture seed mixes would include 5 kg/ha of Shirohie millet (*Echinochloa esculenta*) or similar as a cover crop to protect soils from erosion.

No sowing or use of *Leucaena* is proposed at RMI, and *Leucaena* detected anywhere on the rehabilitation areas will be required to be controlled in accordance with weed management activities.

Table 26: Recommended Species List and Sowing Rates for Cattle Grazing on Lighter Textured Soils.

Common Name	Scientific Name	Sowing Rate (kg/ha)	Comment
Rhodes grass	<i>Chloris gayanacvv. Callide*</i>	4 ¹	3P grass
	<i>cvv. Katambora*</i>	4 ¹	3P grass
Green panic	<i>Megathyrsus maximus*</i>	2 ¹	3P grass
Black spear	<i>Heteropogon contortus</i>	6	Black spear grass
Stylo ²	<i>Stylosanthes scabra*</i>	2	Legume requires specific rhizobium inoculum strain CB1650.
Wynn cassias	<i>Chamaecrista rotundifolia</i>	2	Legume will inoculate naturally but a Group M strain is recommended.
Cover crop	(e.g., <i>Echinochloa esculenta*</i>)	5	Cover crop for soil protection.
Total		25	

Note: * exotic species, ¹assumes seed is coated and if not coated, use half prescribed rate. ²must be sown within 28 days of inoculation.

Pasture Establishment

Pasture seed mixes will be targeted for planting between September and March. Seed quality will be ascertained prior to planting to ensure highest potential for seed strike and vegetation establishment. A friable or crumbly seed bed will be created by ripping on contour followed by direct planting of seed using agricultural equipment. Seeding can be applied by a drum seeder on small dozer or via a fertiliser spreader

attached to tractor. Seeding can be followed by light till either with a tractor pulled tiller or ripper on a grader to better turn the soil for soil seed contact.

Scientific evidence supports the use of groundcover to reduce the erosion risk in coal mine rehabilitation, with 50% being a conservative target for slope gradients less than 20% (Sheridan et al, 1998; Loch 2000; Carroll, and Tucker 2000, Carroll et al, 2000). Note: Groundcover refers to anything in contact with the soil surface, e.g., vegetation, rocks, stones, sticks, leaves, grass, hay, etc.

Rehabilitation monitoring will assess the condition of the pasture and guide ongoing maintenance and management of pastures on rehabilitated lands (further detail on monitoring is provided in Section 8).

6.1.8.5 Woodland Habitat Revegetation

Woodland habitat is proposed for a number of rehabilitation areas at RMI, as shown in Figure 24, including the ROM pad (RA2) and the disturbed areas within the New Chum Creek 100m buffer zone (RA3).

If required, reference sites will be established for the purpose of monitoring woodland habitat once rehabilitation commences (Section 8).

Revegetation species consider the characteristics of the likely underlying spoil or subsoil material as it relates to the corresponding land zone under the regional ecosystem framework (Wilson & Taylor, 2012). Land zones are categories that describe the major geologies and associated landforms and geomorphic processes of the State of Queensland. The differences between land zones result in marked differences in the function of ecosystems and their associated biodiversity and this is due in part to the effects that geology (lithology, structure, alteration) has on landform, and hydrology and landscape processes (geomorphology and soil formation) (Wilson & Taylor, 2012).

Growth Media

The approach to revegetating woodland habitats is based on direct seeding woodland species into ameliorated subsoils and spoil. Subsoils and spoil will be ameliorated prior to seeding, as recommended by an appropriately qualified person, and may include fertilisers, organic matter and gypsum to meet RM5 milestone criteria (Section 6.1.4).

The land zones associated with the subsoil and spoil materials of the woodland habitat PMLU areas (Section 6.1.4), and those corresponding with the regional ecosystems recorded during baseline surveys, are listed in Table 27.

Table 27: Woodland Habitat Material and Associated Land Zones.

Rehabilitation and Baseline Survey Areas	Underlying Waste Material	Land Zone	Land Zone Description
RA2	Tertiary sediments	4	Tertiary-early Quaternary clay plains
	Weathered Permian waste	9	Fine grained sedimentary rocks
	Unweathered Permian waste	9 and 10	LZ9 Fine grained sedimentary rocks LZ10 Coarse grained sedimentary rocks
RA3	Tertiary sediments	4	Tertiary-early Quaternary clay plains
Baseline Surveys	N/A	3	Recent Quaternary alluvial systems
		4	Tertiary-early Quaternary clay plains
		5	Tertiary-early Quaternary loamy and sandy plains and plateaus
		7	Cainozoic duricrusts

Woodland Habitat Species

Rehabilitation and vegetation monitoring reports from the nearby Poitrel mine site (Biodiversity Assessment and Management Pty Ltd, 2018) and Ecological Australia, 2017) indicate that the majority of woodland habitat species are akin to RE 11.5.3 and 11.4.9 for RA2 and RA3 respectively. This provides a degree of confidence that the proposed species will establish successfully on site. However, creation of a native ecosystem is more likely to achieve successful rehabilitation to a sustainable ecosystem that has habitat values. As such, the species selection has been expanded from a restrictive RE species list to include as many species as possible from the relevant broad vegetation groups (BVG). The relevant BVGs for RE 11.4.9 and RE 11.5.3 are BVG 25a and 17b respectively.

A BioCondition assessment completed by an appropriately qualified person using the methodology outlined in the Queensland Herbarium's BioCondition Assessment will be undertaken to verify that the achievement of the woodland habitat. It is noted that the RMI PRCP woodland habitat species selection is based on BVGs however BioCondition monitoring assessment described by the Queensland Herbarium is based on undisturbed REs. As such, RE 11.5.3 and RE 11.4.9 are used for the purposes of establishing PRCP milestone completion criteria as these are the target RE's based on pre-mining and reference site ecological investigations.

The total recommended seeding rates for upper-story tree species is 5kg/ha, mid and lower story tree and shrub species is 5kg/ha, and ground cover is 5kg/ha.

Selection of seeds will be based on species outlined in Table 28 and Table 29 with a species richness that results in achievement of the respective modified BioCondition criteria (Table 30).

Where possible, seed mixes will be locally sourced, or at minimum, will aim to be sourced from suppliers that harvest from areas demonstrating similar environmental characteristics to that of RMI. In many cases, supply availability and historical seed success performance/quality will be the key factors driving seed sourcing.

Table 28: Recommended Species List for Woodland Habitat at RA2.

BVG	Upper-Storey Tree Species	Mid and Lower Story Tree and Shrub Species	Ground Cover
25a	<i>Eucalyptus thozetiana</i>	<i>Flindersia dissosperma</i>	<i>Paspalidium caespitosum</i>
	<i>Eucalyptus cambageana</i>	<i>Alphitonia excelsa</i>	<i>P. distans</i> ,
	<i>Eucalyptus crebra</i>	<i>Terminalia oblongata</i>	<i>Sporobolus caroli</i>
	<i>Acacia harpophylla</i>	<i>Acacia rhodoxylon</i>	<i>S. scabridus</i>
	<i>Acacia cambagei</i>	<i>Apophyllum anomalum</i>	<i>Enteropogon acicularis</i> ,
	<i>Casuarina cristata</i>	<i>Enchylaena tomentosa</i>	<i>Ancistrachne uncinulata</i>
		<i>Ehretia membranifolia</i>	<i>Cyperus gracilis</i>
		<i>Santalum lanceolatum</i>	<i>Cymbopogon refractus</i>
		<i>Eremophila mitchellii</i> ,	<i>Eragrostis lacunaria</i>
		<i>Alectryon diversifolius</i>	<i>Aristida personata</i>
		<i>Eremophila mitchellii</i>	<i>Eriochloa pseudoacrotricha</i>
		<i>Carissa ovata</i>	<i>Enchylaena tomentosa</i>
		<i>Geijera parviflora</i>	<i>Abutilon oxycarpum</i>
		<i>Grevillea parallela</i>	<i>Brunoniella australis</i>
		<i>Melaleuca tamariscina</i>	<i>Capparis lasiantha</i>
		<i>Alectryon oleifolius</i>	<i>Nyssanthes erecta</i>
			<i>Einadia nutans</i> ,
			<i>Commelina diffusa</i>
			<i>Evolvulus alsinoides</i>

Table 29: Recommended Species List for Woodland Habitat at RA3.

BVG	Upper-Storey Tree Species	Mid and Lower Story Tree and Shrub Species	Ground Cover
17b	<i>Eucalyptus populnea</i> <i>Eucalyptus melanophloia</i> <i>Corymbia clarksoniana</i> <i>Eucalyptus crebra</i> <i>Corymbia dallachiana</i> <i>Eucalyptus melanophloia</i> <i>Eucalyptus brownii</i>	<i>Lysiphyllum hookeri</i> or <i>L. carronii</i> <i>Eremophila mitchellii</i> <i>Acacia excelsa</i> <i>Cassia brewsteri</i> <i>Erythroxylum astrale</i> <i>Alphitonia excelsa</i> <i>Dodonaea viscosa</i> <i>Senna artemisioides</i> <i>Carissa lanceolata</i> <i>Geijera parviflora</i> <i>Archidendropsis basaltica</i> <i>Ventilago viminalis</i> <i>Flindersia dissosperma</i> <i>Carissa ovata</i> <i>Capparis lasiantha</i>	<i>Chrysopogon fallax</i> <i>Eragrostis lacunaria</i> <i>Fimbristylis dichotoma</i> <i>Themeda triandra</i> <i>Enteropogon acicularis</i> <i>Heteropogon contortus</i> <i>Cymbopogon refractus</i> <i>Panicum effusum</i> <i>Aristida calycina</i> <i>Evolvulus alsinoides</i> <i>Brunoniella australis</i> , <i>Euphorbia drummondii</i> <i>Rhynchosia minima</i> <i>Sida hackettiana</i> <i>Alternanthera micrantha</i> <i>Eremophila debilis</i> <i>Abutilon oxycarpum</i> <i>Melhania oblongifolia</i>

Assessable Attributes and Weightings for Deriving the Final BioCondition Score.

Assessable attributes and weightings for deriving the final BioCondition score is outlined in Table 30. Proposed rehabilitation completion criteria for which incorporates BioCondition scoring is outlined below:

- For RA2, the BioCondition assessment required by RM14 demonstrates achievement of 50% of total maximum BioCondition score of undisturbed regional ecosystem 11.5.3;
- For RA3, the BioCondition assessment required by RM14 demonstrates achievement of 50% of total maximum BioCondition score of undisturbed regional ecosystem 11.4.9.

Table 30 contains BioCondition benchmark data for the nominated Regional Ecosystems that represent the native woodland planted for RA2 and RA3, as referenced by criterion 14(b) (EMPL00819113 PRCP Schedule). Data derived from Queensland Government BioCondition benchmark database (https://www.qld.gov.au/data/assets/excel_doc/0023/170285/biocondition-benchmark-database-table.xlsx). A revised PRCP benchmark is identified from the remnant vegetation benchmark, and only a subset of BioCondition assessable attributes are used, as some (i.e., large trees, coarse woody debris) would not be achievable in the timeframe from revegetation (RM8) to achievement of the post-mining land use (RM14).

Table 30: Benchmark for Native Woodland Rehabilitation Areas (RA2 and RA3).

Regional Ecosystem	11.5.3 Benchmark	11.5.3 PRCP Benchmark (RA2)	11.4.3 Benchmark	11.4.3 PRCP Benchmark (RA3)
Short description	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland	Rehabilitated <i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest	Rehabilitated <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest
Recruitment	100%	100%	100%	100%
Non-native plant cover	0	≤ 10%	0	≤ 10%
Tree species richness	6	≥ 3 (including <i>Eucalyptus populnea</i>)	2	≥ 2 (including <i>Acacia harpophylla</i>)
Native shrub species richness	6	≥ 3	10	≥ 5
Native grass species richness	6	≥ 4	4	≥ 4
Native forb other species richness	10	≥ 5	13	≥ 7
Tree canopy cover	20%	≥ 10%	70%	≥ 35%
Shrub canopy cover	3%	≥ 2%	48%	≥ 24%
Native perennial grass	19%	≥ 10%	6%	≥ 3%
Litter grid cover	20%	≥ 10%	75%	≥ 38%

Scarification

In most cases, *Acacia* spp. seeds have a hard coat which is impermeable to water and germination will not normally occur unless some sort of pre-treatment is conducted. In nature this hard coat leads to seed dormancy until it is broken down over time or by the heat of bushfire. Approximately half of the hard-coated *Acacia* spp. seeds should be scarified prior to sowing. This will allow scarified seeds to imbibe and germinate. By only scarifying half of the seeds additional reserve are maintained in the soil seed bank. Seed scarification can be required from the supplier prior to delivery however needs to be sown as soon as possible after scarification.

Woodland Habitat Establishment

Woodland habitat should be sown in the warmer months of the year from September to March or November to January, when the probability of rainfall is highest. A seed bed will be created by ripping on the contour followed by direct planting by a drum seeder on small dozer or via a fertiliser spreader attached to tractor. Seeding can be followed by light till either with a tractor pulled tiller or ripper on a grader to better turn the soil for soil seed contact.

6.1.8.6 Watercourse Revegetation

Rehabilitation and vegetation monitoring reports from the nearby Poitrel mine site (Biodiversity Assessment and Management Pty Ltd, 2018) (Ecological Australia, 2017) indicate that watercourse habitat species (RA4) is akin to RE 11.3.25. This provides a degree of confidence that the proposed species will establish successfully on site. However, creation of a native ecosystem is more likely to achieve successful rehabilitation to a sustainable ecosystem that has habitat values. As such, the species selection has been

expanded from a restrictive RE species list to include as many species as possible from the relevant broad vegetation group (BVG). The relevant BVGs for RE 11.3.25 is 16a.

A BioCondition assessment completed by an appropriately qualified person using the methodology outlined in the Queensland Herbarium's BioCondition Assessment will be undertaken to verify that the achievement of the watercourse habitat. It is noted that the RMI PRCP watercourse species selection is based on BVG however BioCondition monitoring assessment described by the Queensland Herbarium is based on undisturbed regional ecosystems. As such, RE 11.3.25 is used for the purposes of establishing PRCP milestone completion criteria as this is the target RE based pre-mining and reference site ecological investigations. It is also noted that Table 31 and Table 32 contains BioCondition benchmark data for the nominated Regional Ecosystems that represent the native woodland planted for RA2 and RA3, as referenced by criterion 15(e) (EMPL00819113 PRCP Schedule). Data derived from Queensland Government BioCondition benchmark database (https://www.qld.gov.au/data/assets/excel_doc/0023/170285/biocondition-benchmark-database-table.xlsx). A revised PRCP benchmark is identified from the remnant vegetation benchmark, and only a subset of BioCondition assessable attributes are used, as some (i.e., large trees, coarse woody debris) would not be achievable in the timeframe from revegetation (RM9) to achievement of the post-mining land use (RM15).

Table 32 do not contain mid story shrub species and BioCondition benchmark scores respectively. This is consistent with that stated on the Queensland Government Website (<https://apps.des.qld.gov.au/regional-ecosystems/details/?re=11.3.25>) which states that '*RE11.3.25 may often consist of a tall shrub layer*' and '*that low shrubs are present but rarely form a conspicuous layer*'. This is also consistent with the departments BVG 16a description which states '*that a shrub layer is frequently absent*' (https://www.des.qld.gov.au/data/assets/pdf_file/0029/81929/descriptions-of-broad-vegetation-groups.pdf).

Growth Media

The approach to revegetating the watercourse area is based on direct seeding watercourse species onto the reshaped subsoil formed to create the New Chum Creek watercourse bed and banks.

The underlying subsoils of New Chum Creek are associated with natural Quaternary alluvium. The subsoils in the disturbed areas will be ameliorated, as recommended by an appropriately qualified person, and may include fertilisers, organic matter and gypsum (Section 6.1.4).

Watercourse Revegetation Species

The vegetation in the New Chum Creek watercourse is associated with riparian vegetation which includes species adapted to upper-, mid- and lower banks (revegetation zones) as illustrated in Figure 19.

This includes riparian vegetation comprising upper-storey, under-storey and groundcover. The revegetation species have considered the characteristics of the regional ecosystems recorded during baseline surveys associated with New Chum Creek (Section .2.8) as well as the underlying Quaternary alluvium subsoil.

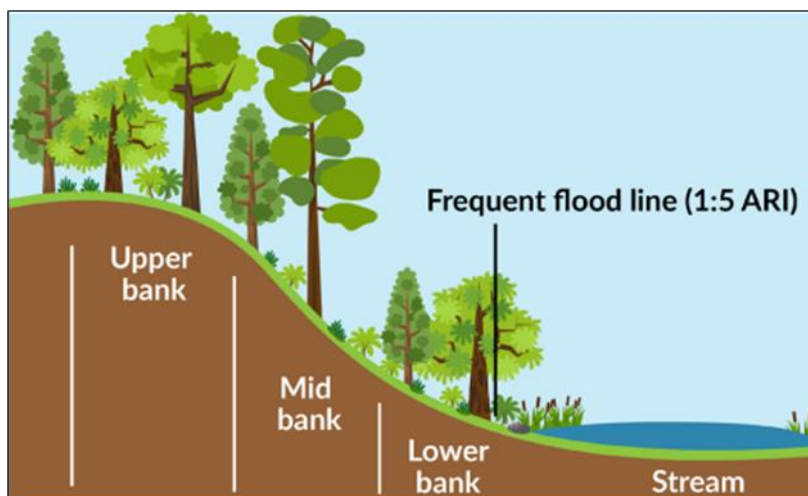


Figure 19: Typical Riparian Revegetation Plantings Zone (BCCA, 2014).

Table 31: Recommended Species List for Watercourse Habitat at RA4.

BVG	Upper-storey tree species	Ground Cover
16a	<i>Eucalyptus camaldulensis</i>	<i>Heteropogon contortus</i>
	<i>Eucalyptus tereticornis</i>	<i>Themeda triandra</i>
	<i>Eucalyptus coolabah</i>	<i>Chrysopogon fallax</i>
	<i>Melaluca sp.</i>	<i>Imperata cylindrica</i>
	<i>Corymbia tessellaris</i>	<i>Eulalia aurea</i>
	<i>Angophora spp.</i>	<i>Cyanthillium cinereum</i>
	<i>Casuarina cunninghamiana</i>	<i>Phyllanthus virgatus</i>
		<i>Eustrephus latifolius</i>
		<i>Brunoniella australis</i>
		<i>Crotalaria montana</i>
		<i>Rostellularia adscendens</i>
		<i>Evolvulus alsinoides</i>
		<i>Sida spp</i>

Table 32 contains BioCondition benchmark data for the nominated Regional Ecosystems that represent the native woodland planted for RA2 and RA3, as referenced by criterion 15(e) (EMPL00819113 PRCP Schedule). Data derived from Queensland Government BioCondition benchmark database (https://www.qld.gov.au/data/assets/excel_doc/0023/170285/biocondition-benchmark-database-table.xlsx). A revised PRCP benchmark is identified from the remnant vegetation benchmark, and only a subset of BioCondition assessable attributes are used, as some (i.e., large trees, coarse woody debris) would not be achievable in the timeframe from revegetation (RM9) to achievement of the post-mining land use (RM15).

Table 32: Benchmark for Watercourse Rehabilitation Area (RA4).

Regional Ecosystem	11.3.25 Benchmark	11.3.25 PRCP Benchmark (RA4)
Short description	<i>Eucalyptus tereticornis</i> +/- <i>E. camaldulensis</i> woodland fringing drainage lines	Rehabilitated <i>Eucalyptus tereticornis</i> +/- <i>E. camaldulensis</i> woodland fringing drainage lines woodland
Recruitment	100%	100%
Non-native plant cover	0	≤ 10%
Tree species richness	4	≥ 3
Native shrub species richness	4	≥ 3
Native grass species richness	8	≥ 4
Native forb other species richness	13	≥ 6
Tree canopy cover	34%	≥ 15%
Shrub canopy cover	NA/	NA
Native perennial grass	35%	≥ 15%
Litter grid cover	21%	≥ 10%

Watercourse Vegetation Establishment

It is recommended hydromulching/hydroseeding, or similar, is used to establish watercourse vegetation. Hydromulching/hydroseeding, or similar, involves spraying a mixture of the seed, amelioration and organic

matter onto the prepared rehabilitation surface to ensure effective seed-to-soil contact to foster revegetation and prevent soil erosion. Supplementary tube stock planting may be required for certain species, dependent on the performance outcomes of hydromulching/hydroseeding, or similar.

The cover crop will establish quickly on the exposed subsoil surfaces and work to provide a root system that will stabilise the subsoil and prevent erosion until new seedlings have established. The roots also create pores in the surface to allow water to penetrate the ground, conserving water and reducing overland flow on the surface.

Irrigation

Irrigation may be required during the construction phase depending on growth, season and weather conditions. It is recommended the direct seeding (hydromulch/hydroseeding application) be watered as follows:

- Weekly during the first 6 weeks of establishment (depending on season and weather conditions);
- Followed by fortnightly watering for a further six weeks (depending on season and weather conditions);
- When necessary, as until practical completion to achieve milestone criteria; and

Each watering event shall deliver irrigation quality water. If rainfall occurs, irrigation shall not be performed.

6.1.8.7 Fauna Habitat and Use Requirements.

The predominant PMLU for RMI will be cattle grazing. The woodland habitat PMLU provides habitat opportunities and connectivity for native fauna species. Revegetation with native tree species will aim to connect surrounding areas of natural habitat. Where available, logs and other woody debris will be distributed in revegetated areas to provide additional fauna habitat opportunities.

Relationship with PRCP Schedule

The revegetation approach for RMI focuses on selection and establishment of suitable species based on the growth media and vegetation communities and associated BVGs on RMI and surrounding areas. The selected species will best support achievement of the surface requirements and PMLU outcomes of cattle grazing, woodland habitat, and watercourse

The information in this section is relevant to the highlighted **RAs** and **RMs** in the PRCP Schedule:

RA1			RA2				RA3				RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

RM7	Completed seeding in accordance with recommended pasture mix (grasses, cover crop and legumes) and seeding rates (up to 25kg/ha) as listed in PRCP Schedule EPML00819113 (Appendix 4, Table 1 – Recommended species list and sowing rates for grazing at RA1).
RM8	- Primary growth media quality targets² listed in 5(a) are achieved based on a number of representative samples as determined by an appropriately qualified person - Completed seeding using a selection of species outlined in: - RA2: PRCP schedule EPML00819113 (Appendix 4, Table 2 – Recommended species list for woodland habitat at RA2) - RA3: PRCP schedule EPML00819113 (Appendix 4, Table 3 – Recommended species list for woodland habitat at RA3). - Completed seeding as per recommended sowing rates for individual species where possible and total recommended seeding rates for dominant tree species (5kg/ha), mid-storey species (5kg/ha), and groundcover species (5kg/ha).

The following **Milestone Criteria** will demonstrate achievement of the **RM**s:

- | | |
|------|--|
| RM9 | <ul style="list-style-type: none"> Completed seeding in accordance with recommended species as outlined in PRCP Schedule EPML00819113 (Appendix 4, Table 4 – Recommended species list for watercourse at RA4). Completed seeding as per the recommended sowing rates for individual species where possible and total recommended seeding rates for upper bank (5kg/ha), mid bank (5kg/ha), and lower bank (5kg/ha) plus 5kg/ha of suitable cover crop (e.g., <i>Echinochloa esculenta</i>). |
| RM10 | <ul style="list-style-type: none"> Pasture condition rating ≤ 3, based on the Pasture Condition Assessment Table as per “Stocktake: Balancing Supply and Demand” (Developed by FutureBeef - futurebeef.com.au), as provided in PRCP Schedule EPML00819113 (Appendix 4, Table 5 – Pasture condition assessment), including: <ul style="list-style-type: none"> Preferred pasture species (3P grasses³) diversity ≥ 2 species; Preferred pasture (3P) % DM yield $\geq 10\%$; Annual grass DM yield % $< 70\%$; Grasses other than 3P grasses³ and other weeds % DM yield $< 80\%$; Crown cover (3P grasses²) - at worst, moderate to low density and some plants dead. ³3P grasses: native and naturalised exotic grass species that are perennial, palatable, and productive plants to stock. |
| RM11 | <ul style="list-style-type: none"> A BioCondition assessment is completed by an appropriately qualified person using the methodology outlined in the latest version of the Queensland Herbarium BioCondition Assessment Manual. The BioCondition assessment required by 11(a) demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP Schedule EPML00819113 (Appendix 1). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3. No active gully erosion, where an active gully is a gully that has increased in area $> 5\%$ since the previous monitoring period. |
| RM12 | <ul style="list-style-type: none"> Revegetation species presence on upper banks, mid-banks and lower banks representative of sown seed mix as detailed in RM9. Groundcover is $> 80\%$ on banks. Total invasive plant cover is $\leq 10\%$. |
| RM13 | <ul style="list-style-type: none"> A hazard assessment has been completed by an appropriately qualified person to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use. Groundcover $> 50\%$. Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process. Deep drainage from the area is not significantly different to EC levels as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of: <ul style="list-style-type: none"> the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or local water quality objectives developed in accordance with the Queensland Water Quality Guidelines. Land suitability class ≤ 3, or not different from pre-mining class if ≥ 4, as per PRCP EPML00819113 (Appendix 4, Table 5 Pasture condition assessment). The assessment is to be conducted by an appropriately qualified person. For RM13(e), if the land suitability class is assessed as being not different from pre-mining class if ≥ 4 for all or a portion of a rehabilitation area, an assessment of reference sites must be carried out to determine if the limitation/s resulting in the class of ≥ 4 is consistent with that of reference sites. Certification by an appropriately qualified person that pasture meets a pasture condition rating ≤ 3, based on the Pasture Condition Assessment Table as per “Stocktake: Balancing Supply |

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

and Demand" (developed by FutureBeef - futurebeef.com.au), as provided in PRCP Schedule EPML00819113 (Appendix 4, Table – Pasture condition assessment).

- No active gully erosion, where an active gully is a gully that has increased in area >5% since the previous monitoring period.
- Landform is free draining.

RM14

- A BioCondition assessment is completed by an appropriately qualified person using the methodology outlined in the latest version of the Queensland Herbarium's BioCondition Assessment Manual.
- The BioCondition assessment required by 14(a) demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP Schedule EPML00819113 (Appendix 2). The relevant regional ecosystem is 11.5.3 for RA2, and 11.4.3 for RA3.
A hazard assessment has been completed by an appropriately qualified person¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use
- Rehabilitation of RA2 is assessed as geotechnically stable by an appropriately qualified person with FoS ≥ 1.5 , unless an alternative is justified by an appropriately qualified engineer
- Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process.
- Deep drainage from the area is not significantly different to EC levels as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process, of:
 - the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or
 - local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
- No active gully erosion, where an active gully is a gully that has increased in area >5% since the previous monitoring period.

RM15

- A hazard assessment has been completed by an appropriately qualified person¹ to confirm safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use
- Groundcover on banks >80%
- Rainfall runoff from rehabilitation is not significantly different to upstream values for the following: pH, EC and turbidity as per PRCP Schedule EPML00819113 (Appendix 4, Figure 3) Water Data Evaluation Process
- A BioCondition assessment is completed by an appropriately qualified person using the methodology outlined in the latest version of the Queensland Herbarium BioCondition Assessment Manual.
- The BioCondition assessment required by 15(d) demonstrates achievement of the PRCP Benchmark for each assessable attribute for the relevant regional ecosystem as per PRCP Schedule EPML00819113 (Appendix 3). The relevant regional ecosystem is RE 11.3.25.

6.2 Tailings Storage Facilities

PRCP Guideline (Section 3.6.2)

The tailings require characterisation to determine the geochemistry, rheology and geotechnical parameters that influence therehabilitation or management strategies and the capacity of the site to support revegetation.

The design for a TSF must include relevant elements:

- Lining of TSF (i.e., embankments and base of structure)
- Leak detection systems
- Cellular design of TSF

- Seepage collection systems
- Design storage allowance
- Spillway location
- Designing TSF for progressive rehabilitation.

Tailings are temporarily stored in five tailings drying cells at RMI. The solids from these cells are excavated within a few days of deposition and co-disposed in spoil dumps off-site, including the neighbouring Poitrel and Millennium mining operations. The decant water is returned for re-use in the CHPP.

No permanent tailings storage facilities will remain on-site with decommissioning of the tailings drying cells to include:

- Removal and disposal of any residue tailings;
- Contaminated land assessment; and
- Backfill to make the area free-draining.

Relationship with PRCP Schedule

The decommissioning of the tailings drying cells is included in the RMs and relevant criteria developed.

6.3 Voids

PRCP Guideline (Section 3.6.3)

- The information requirements of this domain are dependent on the nature of the proposed PMLU or NUMA for the void. For mine sites with voids, the rehabilitation planning part must include a void closure plan, which includes options for minimising final void area and volume; final void dimensions; pit wall geotechnical and geochemical stability, final slope angles, void hydrology, groundwater modelling, water balance and predicted long-term water quality.
- A geotechnical report should focus on how the void will achieve post-closure slopes that will exhibit stability characteristics consistent with the planning and design of the post-closure mine void.
- If floodwaters are likely to move over backfilled material, an assessment of the hydraulic properties must be conducted to assess whether instability may occur.
- The rehabilitation and management strategies in the plan must include the supervision, verification and auditing of engineering work carried out to achieve the post-closure void landform, to ensure construction is consistent with the geotechnical design.
- The rehabilitation and management strategy must also include confirmation that the post-closure landform demonstrates the level of stability as specified by the design.

There are no voids on-site at RMI, so this section is not applicable.

Relationship with PRCP Schedule

Not relevant as there are no voids planned at RMI.

6.4 Underground Mining

PRCP Guideline (Section 3.6.4)

For underground mining operations, the rehabilitation planning part must include:

- A geotechnical study;
- An assessment of groundwater interactions and potential lowering of groundwater levels;
- The development of a hydrogeological conceptual model;
- Subsidence analysis and modelling and a subsidence vegetation/habitat impact assessment;
- Consideration of how potential entries to underground workings will be sealed (i.e. through some form of capping or back filling)
- How surface ponding and cracking will be mitigated;
- Identification of post-closure stabilisation of underground workings in order to manage the potential for unplanned surface subsidence and unplanned ground collapse such as sinkholes and pot holing.

There is no underground mining, so this section is not applicable.

Relationship with PRCP Schedule
Not relevant as there is no underground mining at RMI.

6.5 Built Infrastructure

PRCP Guideline (Section 3.6.5)

The administering authority's expectation of rehabilitation relating to built infrastructure is that it will be decommissioned, demolished, salvaged and/or disposed of unless it is being formally retained by the landholder to achieve an appropriate PMLU.

The rehabilitation planning part must include:

- Identification of infrastructure that will be decommissioned and the methods for decommissioning.
- A description of infrastructure that will remain post rehabilitation and the identification of ongoing maintenance requirements.
- Evidence of agreement for any infrastructure that will have ownership transferred.

In accordance with EA condition E9, 'all infrastructure constructed by, or for the EA holder during the approved activities - including water storage structures, must be removed from the site prior to surrender, except where agreed in writing by the post-mining land owner/holder'. However, the EA further notes that this is not applicable where the landowner/landholder is also the environmental authority holder, which is the case for RMI.

Table 33 details the infrastructure associated with the approved activities at RMI. This infrastructure will be decommissioned and removed from site prior to surrender, except for any fencing required to support the PMLUs. Priority will be to salvage or recycle any infrastructure, over demolition and disposal. Amendments may be sought if the infrastructure is assessed in the future as being beneficial to the PMLU, as agreed in writing with the post-mining landowner/land holder.

The neighbouring Daunia mining operation utilises the RMI train load-out facilities and rail line. The timing of the decommissioning and removal of the infrastructure required to service only the RMI operation is based on the proposed timing of the Poitrel Mine operation. However, the timing for decommissioning and removal of the conveyor from Daunia Mine, train load-out facilities (and associated services to operate) and rail line, is based on the proposed completion of the Daunia Mine.

Further detail on the rehabilitation stages after decommissioning of the infrastructure, such as landform reshape, surface preparation, revegetation and monitoring are covered in the relevant sections of this PRCP.

Table 33: Infrastructure Associated with the Approved RMI Activities.

Infrastructure	
Built Infrastructure	Steel, Concrete and Brick Buildings • CHPP • Conveyors • Stackers • Hoppers • Reject bin • Reclaim tunnel • Administration and crib buildings • Workshop • Coal testing lab • Fuel, oil and chemical storage • Fences

Infrastructure	
	Rail and Train Load-Out Related Infrastructure • Train loading bin and facilities (utilised by RMI and Daunia) • Daunia conveyor • Rail loop and spur
	Supporting Services • Pipes and pumps • Power lines • Switchyard and substations • Communications towers
Water Infrastructure	• Process water dam • Environment dam • Drains

6.5.1 Decommissioning Built Infrastructure

Decommissioning of the built infrastructure with no beneficial post-mining re-use will include:

- Disconnect services;
- Dismantle power feeds, water and communication-related feeder lines;
- Demolish and remove built and service-related infrastructure through salvage or recycling activities, or demolish and dispose of off-site;
- Demolish and remove concrete, bitumen and aggregate, and dispose off-site;
- Remove demolition-related waste products and rubbish and dispose off-site.

6.5.2 Water Infrastructure

Decommissioning of the water-related infrastructure will include:

- Removal of any remaining water in accordance with the EA condition F25 or F26:
 - F25: Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of the environmental authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder or a third party for the purpose of supplying stock water, irrigation water, or construction and/or road maintenance - subject to compliance with the water quality release limits specified in the EA; or
 - F26: Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this environmental authority and deposited into artificial water storage structures, such as dams or tanks, for the purpose of supplying water to any operation licensed for either ERA13 (mining black coal) or ERA31 (mineral processing). The volume, pH and electrical conductivity of water transferred must be monitored and recorded.
- Removal of dam sediment and dispose at Poitrel Mine (or alternative site as agreed to by the administering authority); and
- Breaching dam walls, backfill and reshaping of the area to make it free draining.

6.5.3 Contaminated Land Assessment

In accordance with the EA conditions E7, F1, and F41, contaminants must not be released in a manner that constitutes serious environmental harm, and spillage of any wastes, contaminants or other materials must be cleaned up as quickly as practicable, stored in accordance with relevant standards and handled in a way that prevents environmental harm.

A contaminated land assessment will be undertaken in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure* or equivalent in place at the time of investigation at completion of the operation of the CHPP and prior rehabilitation-related surface preparation and revegetation. The contaminated land investigation will assess the site for potential contamination that has the potential to adversely impact nominated PMLUs and/or environmental values. In the event that land contamination is identified, the potential risks will be assessed and, where required, remediation will be undertaken and/or a SMP developed to allow the mining lease area to be safely utilised for the nominated PMLUs.

Relationship with PRCP Schedule

- The EA requires all infrastructure constructed for the approved activities, to be removed from the site prior to surrender and any spills and releases to be cleaned up and the area remediated.
- A contaminated land assessment will be undertaken at the completion of operations and prior to final landform development and shaping. Where required, remediation and/or management of any identified contamination that has the potential to present unacceptable risks to the nominated PMLU or environmental values will be undertaken. Upon completion of the contaminated land investigation and, where required remediation and/or management, risks associated with contaminated land will be low.

The information in this section is relevant to the highlighted **RAs** and **RMs** in the PRCP Schedule:

RA1			RA2				RA3				RA4			
RM1	RM2	RM3	RM4	RM5	RM6	RM7	RM8	RM9	RM10	RM11	RM12	RM13	RM14	RM15

The following **Milestone Criteria** will demonstrate achievement of the **RMs**:

RM1	• Services disconnected • Built and service infrastructure demolished and removed (except where agreed in writing by the post-mining land owner/holder) • Concrete, bitumen and aggregate removed • Rubbish removed • No more than 10% visible coaly and carbonaceous mineral waste on surface • Water and sediment within dams removed • Creek crossing culverts removed
RM2	• Contaminated land investigation completed by a suitably qualified person in accordance with the National Environment Protection (Assessment of Site Contamination) Measures and the Queensland Environmental Protection Act (1994). • In the event that residual contamination has been identified and presents a potential unacceptable risk to the nominated PMLUs or environmental values, remediation works and/or implementation of management controls will be undertaken. • Where ongoing management of residual contamination is deemed appropriate, a draft Site Management Plan will be prepared for the administering authority's consideration.

6.6 Summary of Key Rehabilitation and Management Practices

The key rehabilitation activities for each relevant activity at RMI is shown in Table 34. The rehabilitation activities drive achievement of the RMI rehabilitation milestones and inform the associated PRCP Schedule.

Table 34: Key Rehabilitation Activities and Rehabilitation Milestones for RMI.

Rehabilitation area	Relevant Activities	Area (ha)	Rehabilitation Activities (to drive achievement of Rehabilitation Milestones)	Rehabilitation Timing	Rehabilitation Milestones
RA1	- CHPP and associated infrastructure - Administration, crib and general buildings - Workshop; fuel, oil and chemical storage - Laydown and general areas - Roads - Product coal stockpile - Tailings drying cells - Dams and drains - Rail area and associated train loading infrastructure - Topsoil stockpiles	96	- Disconnect services - Demolish and remove built and service infrastructure - Remove concrete, bitumen and aggregate - Remove rubbish - Remove visible coal and dried tailings - Remove dam water and sediment - Undertake assessment for contaminated land and, where appropriate, remediate impacted areas, and/or implement management controls and/or develop a SMP - Backfill tailings drying cells and dams with material from the ROM pad and/or haul road base - Reshape the landform to be free-draining with maximum 10% slopes, and blend in with the surrounding topography - Spread topsoil to an average thickness of 150mm - Assess soil characteristics to determine ameliorant and other treatment requirements - Apply ameliorants and other treatments - Rip across contour - Seed - Undertake monitoring and maintenance to demonstrate achievement of a cattle grazing PMLU	51 ha of the main industrial, product coal stockpile and drying cells area is available once RMI coal processing is complete in 2036 9ha associated with administration areas and workshop is available once the majority of the rehabilitation of the main area is complete in 2039 24ha associated with the dams and drains is available once rehabilitation of the processing areas is tracking towards achieving surface requirements in 2049 12ha associated with the rail area is available once Daunia coal loading is complete in 2051	RM1 RM2 RM3 RM4 RM7 RM10 RM13.

Rehabilitation area	Relevant Activities	Area (ha)	Rehabilitation Activities (to drive achievement of Rehabilitation Milestones)	Rehabilitation Timing	Rehabilitation Milestones
RA2	- Roads - Rail area and associated train loading infrastructure - Topsoil stockpiles	33	- Disconnect services - Demolish and remove built and service infrastructure - Remove concrete, bitumen and aggregate - Remove rubbish - Undertake assessment for contaminated land and, where appropriate, remediate impacted areas, and/or implement management controls and/or develop a SMP - Remove road and rail line base material and culverts to re-establish pre-mining levels within 100m of New Chum Creek - Reshape the landform to be free-draining with maximum 10% slopes, and blend in with the surrounding topography - Assess surface material characteristics to determine ameliorant and other treatment requirements - Apply ameliorants and other treatment - Rip across contour - Seed - Undertake monitoring and maintenance to demonstrate achievement of a woodland habitat PMLU	5ha available once RMI coal processing is complete in 2036 28ha available once Daunia coal loading is complete in 2051	RM1 RM2 RM3 RM5 RM8 RM11 RM14

Rehabilitation area	Relevant Activities	Area (ha)	Rehabilitation Activities (to drive achievement of Rehabilitation Milestones)	Rehabilitation Timing	Rehabilitation Milestones
RA3	- Roads - Rail area and associated train loading infrastructure - Topsoil stockpiles	33	- Disconnect services - Demolish and remove built and service infrastructure - Remove concrete, bitumen and aggregate - Remove rubbish - Undertake assessment for contaminated land and, where appropriate, remediate impacted areas, and/or implement management controls and/or develop a SMP - Remove road and rail line base material and culverts to re-establish pre-mining levels within 100m of New Chum Creek - Reshape the landform to be free-draining with maximum 10% slopes, and blend in with the surrounding topography - Assess surface material characteristics to determine ameliorant and other treatment requirements - Apply ameliorants and other treatment - Rip across contour - Seed - Undertake monitoring and maintenance to demonstrate achievement of a woodland habitat PMLU	5ha available once RMI coal processing is complete in 2036 28ha available once Daunia coal loading is complete in 2051	RM1 RM2 RM3 RM5 RM8 RM11 RM14

Rehabilitation area	Relevant Activities	Area (ha)	Rehabilitation Activities (to drive achievement of Rehabilitation Milestones)	Rehabilitation Timing	Rehabilitation Milestones
RA4	Road Rail Area	0.9	- Disconnect services - Demolish and remove built and service infrastructure - Remove concrete, bitumen and aggregate - Remove rubbish - Remove road and rail line base material and culverts to re-establish New Chum Creek according to terms of Riverine Protection Permits and/or exemptions, and waterway barrier works programs - Undertake assessment for contaminated land and, where appropriate, remediate impacted areas, and/or implement management controls and/or develop a SMP - Assess surface material characteristics to determine ameliorant and other treatment requirements - Apply ameliorants and other treatment - Seed - Undertake monitoring and maintenance to demonstrate achievement of a watercourse PMLU	0.5ha available once RMI coal processing is complete in 2036 0.4ha available once Daunia coal loading is complete in 2051	RM1 RM2 RM3 RM6 RM9 RM12 RM15

7 RISK ASSESSMENT

Legislative Requirement

In accordance with 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.

7.1 Identifying, Assessing and Treating Risks

PRCP Guideline (Section 3.7)

- As per section 126C(1)(j) of the EP Act, the administering authority considers it necessary for the proposed PRC Plan to contain a risk assessment of all proposed NUMAs. The risk assessment must be carried out to identify the risks of the NUMA causing environmental harm and not being safe and structurally stable and detail how the applicant intends to manage and minimise the identified risks.
- The *AS ISO 31000:2018 Risk Management – Guidelines (Standards Australia, 2018)* describes risk assessment as the overall process of risk identification, risk analysis, risk evaluation and risk treatment. Each of these aspects must be included in the risk assessment in the rehabilitation planning part.

Information requirements in this section apply to all applicants whether or not they are an existing EA holder. Existing holders may have the required information available from previously submitted plans/reports/applications that, if still valid, can be used in the PRC Plan.

7.2 Risk Methodology

A risk-based approach to the RMI PRC Planning has been undertaken in term of the method described in Figure 20.

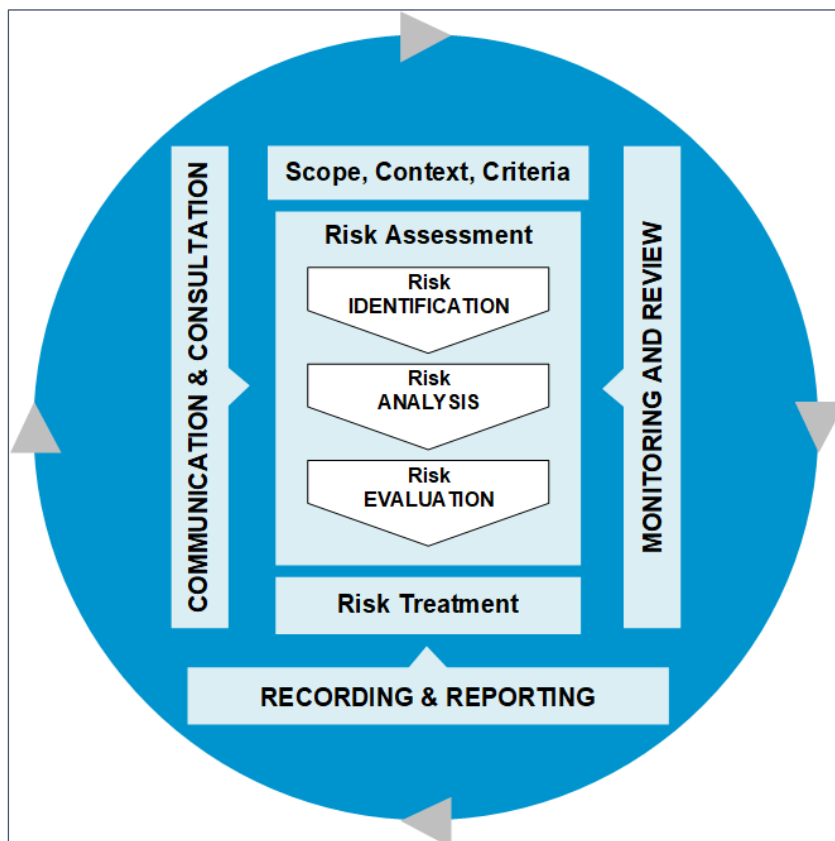


Figure 20: ISO 31000-Compliant Risk-Based Approach Followed for the RMI PRC Plan.

7.3 Risk Identification

The risk event - a stable condition for land described as a post-mining land use not being achieved - was assessed per ISO 31000 methodology described in Figure 20 above (the full risk assessment is included in (Appendix 10), where stable condition is defined as per section 111A of the EP Act:

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

For RMI the PMLUs being assessed are cattle grazing, woodland habitat and watercourse (Section 3).

A number of scenarios were identified in the risk identification process related to a stable condition for the land described as the PMLUs not being achieved:

- Landform failure;
- Alteration of hydrogeological conditions;
- Alteration of surface water systems;
- Alteration of flood hydrology;
- Insufficient, inadequate or inappropriate soil and capping material required for rehabilitation activities;
- Insufficient identification and management of waste characterisation;
- Inadequate and/or inappropriate cover design (not applicable for RMI and therefore not assessed further);
- Inadequate and/or inappropriate revegetation;
- Failure of TSF rehabilitation (not applicable for RMI and therefore not assessed further);
- Stability failure of rehabilitated void (not applicable for RMI and therefore not assessed further);
- Stability failure of underground mine workings (not applicable for RMI and therefore not assessed further); and
- Deterioration of built infrastructure conditions.

7.3.1 Risk Analysis, Evaluation and Relevant Treatments

The table included in Appendix 10 provides the full detail of risk analysis, risk evaluation and risk treatment for these scenarios. Worst case outcomes were assessed for each scenario, preventative and mitigating controls identified and from there a residual risk rating was calculated. The likelihood and severity tables, as well as the outcomes of the residual risk rating (RRR) heat map ratings matrix are provided in Table 35, Table 36 and Table 37 respectively.

Table 35: Risk Likelihood Table.

Likelihood Table			
Uncertainty	Frequency	Likelihood Factor	Guidance
Highly Likely	Likely to occur within a 1-year period	3	Event is expected to occur >80% of the time during a 5-year planning cycle
Likely	Likely to occur within a 1 - 5-year period	1	Event is expected to occur 60% to 80% of the time during a 5-year planning cycle
Probable	Likely to occur within a 5 -20-year period	0.3	Event is expected to occur 30% to 60% of the time during a 5-year planning cycle
Unlikely	Likely to occur within a 20 -50-year period	0.1	Event is expected to occur 10% to 30% of the time during a 5-year planning cycle
Highly Unlikely	Not likely to occur within a 50-year period	0.03	Event is expected to occur <10% of the time during a 5-year planning cycle

Table 36: Risk Severity Table.

Severity Table		
Severity Level	Descriptor	Severity Factor
5	Severe impact to the environment and where recovery of ecosystem function takes 10 years or more	1000
4	Serious impact to the environment, where recovery of ecosystem function takes between 3 and up to 10 years	300
3	Substantial impact to the environment, where recovery of ecosystem function takes between 1 and up to 3 years	100
2	Measurable but limited impact to the environment, where recovery of ecosystem function takes less than 1 year	30
1	Minor, temporary impact to the environment, where the ecosystem recovers with little intervention	10

Table 37: Residual Risk Rating (RRR) Heat Map.

			Severity Level	S1	S2	S3	S4	S5
			Severity Factor	10	30	100	300	1000
	Likelihood	Likelihood Factor	Timeframe	Residual Risk Calculation (With Controls in Place and Effective)				
Likelihood	Highly Likely	3	Within 1 year	30	90	300	900	3000
	Likely	1	Within 1-5 years	10	30	100	300	1000
	Probable	0.3	Within 5-20 years	3	10	30	90	300
	Unlikely	0.1	Within 20-50 years	1	3	10	30	100
	Highly Unlikely	0.03	Within 50 years	0.3	1	3	10	30

With controls in place and implemented effectively, the RRR for the identified risk scenarios of this risk event is deemed to be low (RRR of 3).

The risk treatments for each scenario that are necessary for achieving a stable condition for the land described as the PMLUs are shown below in Table 38.

Table 38: Necessary Risk Treatments Identified to Achieve a Stable Condition for the PMLUs.

Aspect	Risk Treatment
Risk Event 1. Landform Failure	
Reasons for selecting treatment option	Greatest chance of stable condition being achieved considering the majority of the final landform is similar to pre-mining landform.
Responsibility for plan: - Approval - Implementation	- Mine Planning; - Operations.
Proposed actions	- Minimise slope angles; - Surface cover of vegetation to provide erosion resistance; - Rehabilitation monitoring and maintenance.
Resource requirements	- Available material inventory; - Equipment capabilities; - Survey; - Rehabilitation monitoring data.
Performance measures and constraints	Tracking against completion criteria.
Reporting and monitoring	Rehabilitation monitoring.
Risk timing and scheduling	From commencement of rehabilitation activities to final achievement of PMLU.
Risk Event 2. Alteration of Hydrogeological Conditions	
Reasons for selecting treatment option	- Low potential for AMD issues; - Hydrogeological conceptual model indicates GDE's, if present, are associated with Alluvium and not regional aquifer that could be impacted by tailings drying cells and dams; - No voids, dams, permanent disposal of tailings, all infrastructure removed from site and contaminated land investigation/remediation/management at completion of operations.
Responsibility for plan: - Approval - Implementation	- EA Holder. - Execution Team.
Proposed actions	- Maintenance of existing monitoring bore network - Monitoring at defined frequency.
Resource requirements	Monitoring bores maintained and monitoring undertaken.
Performance measures and constraints	Groundwater closure criteria.
Reporting and monitoring	- Monitoring at defined frequency. - Reporting under existing EA requirements.
Risk timing and scheduling	Bi-annually.
Risk Event 3. Alteration of Surface Water Systems	
Reasons for selecting treatment option	No permanent disposal of tailings on-site;

Aspect	Risk Treatment
	- No voids or underground workings; - Low AMD potential identified; - No alteration of the alignment of drainage lines or creeks required; - All infrastructure removed at completion of operations.
Responsibility for plan: - Approval - Implementation	- EA Holder. - Execution Team.
Proposed actions	Monitoring of surface water flows when available.
Resource requirements	Collection and analysis of samples.
Performance measures and constraints	Surface water closure criteria and WQO.
Reporting and monitoring	- Monitoring when surface water flows are available. - Reporting under existing EA requirements.
Risk timing and scheduling	During run off events.
Risk Event 4. Contaminated Land Impacting on Environmental Receptors, Rehabilitation and Attainment of PMLUs at RMI	
Reasons for selecting treatment option	Contaminated land investigations will be completed at closure and hazardous material removed.
Responsibility for plan: - Approval - Implementation	- EA Holder. - Execution Team.
Proposed actions	Contaminated land investigation at time of closure and surface water and groundwater monitoring to demonstrate risks are managed.
Resource requirements	Suitably Qualified Consultant to undertake contaminated land investigation at closure and collection of surface water and groundwater samples.
Performance measures and constraints	Attainment of surface water and groundwater closure criteria.
Reporting and monitoring	Contaminated land investigation report and reporting of water quality as per EA.
Risk timing and scheduling	Contaminated land Investigation at closure and water sampling as per PRCP monitoring program.
Risk Event 5. Flooding Influences on Rehabilitation and RMI Final Landforms	
Reasons for selecting treatment option	Landforms to be removed out of the New Chum Creek alignment, any interaction of the landforms with flooding would require in the order of a 0.1% AEP scale event.
Responsibility for plan: - Approval - Implementation	- EA Holder. - Execution Team.
Proposed actions	Inspection of rehabilitation areas and immediate surrounds post any flooding event that results in inundation.
Resource requirements	N/A.
Performance measures and constraints	No damage to infrastructure as a result of changes to flood regime or change to flood extent.

Aspect	Risk Treatment
Reporting and monitoring	Inspection post any extreme flood events.
Risk timing and scheduling	Post extreme flood events.
Risk Event 6. Rehabilitated Landforms Resulting in Alteration of Flood Hydrology Upstream and Downstream	
Reasons for selecting treatment option	- Raised landforms (haul road and rail line) and associated culverts to be removed out of the New Chum Creek 100m buffer zone. - Peak flows to be returned to pre-operational conditions, reducing upstream flooding potential. Downstream mining lease also operated by SMC.
Responsibility for plan: - Approval - Implementation	- EA Holder. - Execution Team.
Proposed actions	Inspection of rehabilitation areas and immediate surrounds post any flooding event that results in inundation.
Resource requirements	N/A.
Performance measures and constraints	No damage to infrastructure as a result of changes to flood regime or change to flood extent.
Reporting and monitoring	- Inspection post any extreme flood events. - Reporting under existing EA requirements.
Risk timing and scheduling	Post extreme flood events.
Risk Event 7. Insufficient, Inadequate or Inappropriate Soil/Spoil and Capping Material Required for Rehabilitation Activities	
Reasons for selecting treatment option	Enables utilisation of site resources for greatest chance of stable condition being achieved.
Responsibility for plan: - Approval - Implementation	- Environment. - Operations.
Proposed actions	- Management of topsoil application during rehabilitation. - Topsoil, subsoil and spoil assessment by suitably qualified person to determine ameliorant and fertiliser requirements. - Rehabilitation monitoring.
Resource requirements	- Topsoil inventory. - Survey. - Rehabilitation monitoring data.
Performance measures and constraints	Tracking against completion criteria.
Reporting and monitoring	Rehabilitation monitoring.
Risk timing and scheduling	From assessment of topsoil, subsoil and spoil to final achievement of PMLU.
Risk Event 8. Insufficient Identification and Management of Waste Characterisation	
Reasons for selecting treatment option	The environmental risk posed by the mine waste is low: The vast majority of the spoil remaining on site (ROM pad and backfill material) has negligible potential for AMD; conservatively it has been assumed that 95%

Aspect	Risk Treatment
	of the waste is non-carbonations with negligible AMD potential and that 5% is carbonaceous with low potential to generate AMD.
Responsibility for plan: - Approval - Implementation	- EA Holder. - Mine Planning Team. - Environment Team. - Execution Team.
Proposed actions	- Waste characterisation during operations if additional inert waste is used for major constructions (i.e., expanding ROM pad). - Prioritise use of tertiary, weathered and non-carbonaceous material for backfill (i.e. avoid utilizing bulk carbonaceous waste, if discrete areas are identified during reshaping and re-handling).
Resource requirements	Data from waste characterisation.
Performance measures and constraints	Tracking against milestone criteria.
Reporting and monitoring	Rehabilitation monitoring.
Risk timing and scheduling	From planning of bulk sample activities to final achievement of PMLU.
Risk Event 9. Inadequate and/or Inappropriate Revegetation	
Reasons for selecting treatment option	Proposed revegetation seed mix is aligned to growth media, landforms and PMLUs. Revegetation species have been selected based those species known to occur within the surrounding environment as well as those species that have performed successfully on similar landforms, growth media and PMLUs at other sites.
Responsibility for plan: - Approval - Implementation	- Environment. - Operations.
Proposed actions	- Management of topsoil application during rehabilitation - Topsoil, subsoil and spoil assessment by suitably qualified person to determine ameliorant and fertiliser requirements. - Rehabilitation monitoring.
Resource requirements	Rehabilitation monitoring data.
Performance measures and constraints	Tracking against completion criteria.
Reporting and monitoring	Rehabilitation monitoring.
Risk timing and scheduling	From assessment of topsoil, subsoil and spoil to final achievement of PMLU.
Risk Event 10. Deterioration of Built Infrastructure Land Conditions	
Reasons for selecting treatment option	Remediation of any contamination to occur during operations, no contamination expected to be remediated during rehabilitation.
Responsibility for plan:	Environment.
Approval Implementation	Operations.
Proposed actions	- Undertake a preliminary contaminated land assessment prior to the completion of the approved activities, conduct a detailed site investigation and develop remediation plan if required. - Rehabilitation monitoring.

Aspect	Risk Treatment
Resource requirements	Rehabilitation monitoring data.
Performance measures and constraints	Tracking against completion criteria.
Reporting and monitoring	Rehabilitation monitoring.
Risk timing and scheduling	From commencement of activities to final achievement of PMLU.

Relationship with PRCP Schedule

A risk-based approach has been adopted to develop the milestones in the PRCP Schedule. This is primarily driven by a residual risk rating. Should a risk event materialise, the additional proposed actions identified in this risk section will be implemented and, where necessary, adjusted accordingly (in line with the risk treatment identified in this section).

7.4 Rehabilitation Trials

PRCP Guideline (Section 3.7.1)

In accordance with section 126C(1)(j) of the EP Act, if rehabilitation trials are planned, the rehabilitation planning part must state:

- The objective of the trial(s);
- The trial design including, but not limited to, the location, underlying land characteristics and potential issues;
- The details of how the trial(s) will be carried out;
- When the trial(s) will commence;
- The duration of the trial(s);
- How the trial(s) will be assessed for success;
- How the results of the trial(s) will be incorporated into rehabilitation strategies and the development of milestones, and;
- Where the trials have previously been carried out by the applicant.

The information requirements in this section will apply to all applicants, whether or not they are an existing EA holder, who have planned or commenced rehabilitation trials. Existing EA holders can provide details of any rehabilitation trials that have occurred prior to the submission of the proposed PRC Plan.

The rehabilitation outcomes are considered low risk and no rehabilitation trials will be conducted.

8 MONITORING AND MAINTENANCE

PRCP Guideline (Section 3.8)

Under section 126C(1)(j) of the EP Act, the administering authority considers monitoring and maintenance necessary to decide if the PRC Plan is consistent with the requirements of the legislation. The rehabilitation planning part must contain a monitoring and maintenance program that identifies and describes the monitoring systems that will be carried out in order to demonstrate a milestone and milestone criteria have been achieved. The program must include, where relevant to the milestone and milestone criteria (but is not limited to):

- Schedule of monitoring, reporting and review for each milestone
- Description of methodologies and standards, which could include field-based assessments and the application of new remotesensing, GIS and other relevant emerging technologies
- Monitoring that enables the repeatable collection of relevant statistically valid data
- Monitoring using appropriate quality assurance and data management processes and systems
- Regular analysis of site data including multi-year comparison trends and benchmarking against analogue/reference sites

- Contingency strategies if monitoring data indicates milestone criteria are not being met
- Post-closure monitoring to ensure milestone criteria has been demonstrated
- Intent of monitoring reports, such as provision of results and key findings

The information requirements in this section will apply to all applicants whether or not they are an existing EA holder. However, existing holders may already have the required information available from previously submitted plans/reports/applications that, if still valid, could be used in the PRC Plan. If there has/is any monitoring or maintenance of areas already rehabilitated, details must be included in the PRC Plan.

8.1 Milestone Monitoring and Schedule

The RMs and associated milestone criteria for RMI are detailed in Section 10.3. To demonstrate achievement of the RMs, as they relate to achieving the PMLUs of cattle grazing, woodland habitat and watercourse, a combination of the following approaches will be used:

- Rehabilitation reporting requirements (RM1 to RM9);
- Ongoing rehabilitation monitoring (RM10 to RM15), comprising of desktop and field-based assessments and associated reporting.

These approaches are detailed in Table 39.

Table 39: Rehabilitation Milestones with Relevant Reporting Requirements.

Milestone Reference	Rehabilitation Milestone	Reporting Requirements
RM1	Infrastructure decommissioning and removal	• Undertake visual inspections • Document inspections
RM2	Remediation and/or management of contaminated land	• Documentation by a suitably qualified person confirming the land does not present an unacceptable risk to proposed future land uses or the environment
RM3	Landform development and reshaping	• Survey/LiDAR of landform • Analyse final landform against design • Documentation of riverine and/or operation works permits or associated exemptions
RM4	Surface preparation (cattle grazing)	• Survey/LiDAR of surface and extent after topsoil is placed • Document topsoil depth • Document soil assessment • Document soil ameliorants and physical treatments applied
RM5	Surface preparation (woodland habitat)	• Document spoil/subsoil assessment • Document ameliorants and physical treatments applied
RM6	Surface preparation (watercourse)	• Documentation of riverine and/or operation works permits or associated exemptions • Document subsoil assessment • Document ameliorants and physical treatments applied
RM7	Revegetation (cattle grazing)	• Document seed mix, purity information, planting timing, planting rates and areas

Milestone Reference	Rehabilitation Milestone	Reporting Requirements
RM8	Revegetation (woodland habitat)	Document seed mix, purity information, planting timing, planting rates and areas
RM9	Revegetation (watercourse)	Document seed mix, purity information, planting timing, planting rates and areas
RM10	Achievement of surface requirements (cattle grazing)	Undertake rehabilitation monitoring as per Sections 8.2 - 8.5
RM11	Achievement of surface requirements (woodland habitat)	Undertake rehabilitation monitoring as per Sections 8.2 - 8.5
RM12	Achievement of surface requirements (watercourse)	Undertake rehabilitation monitoring as per Sections 8.2 - 8.5
RM13	Achievement of post-mining land use to a stable condition (cattle grazing)	Undertake rehabilitation monitoring as per Sections 8.2 - 8.5
RM14	Achievement of post-mining land use to a stable condition (woodland habitat)	Undertake rehabilitation monitoring as per Sections 8.2 - 8.5
RM15	Achievement of post-mining land use to a stable condition (watercourse)	Undertake rehabilitation monitoring as per Sections 8.2 - 8.5

8.2 Rehabilitation Monitoring

Rehabilitation monitoring will be conducted according to that described in the EPML00819113 PRCP Schedule

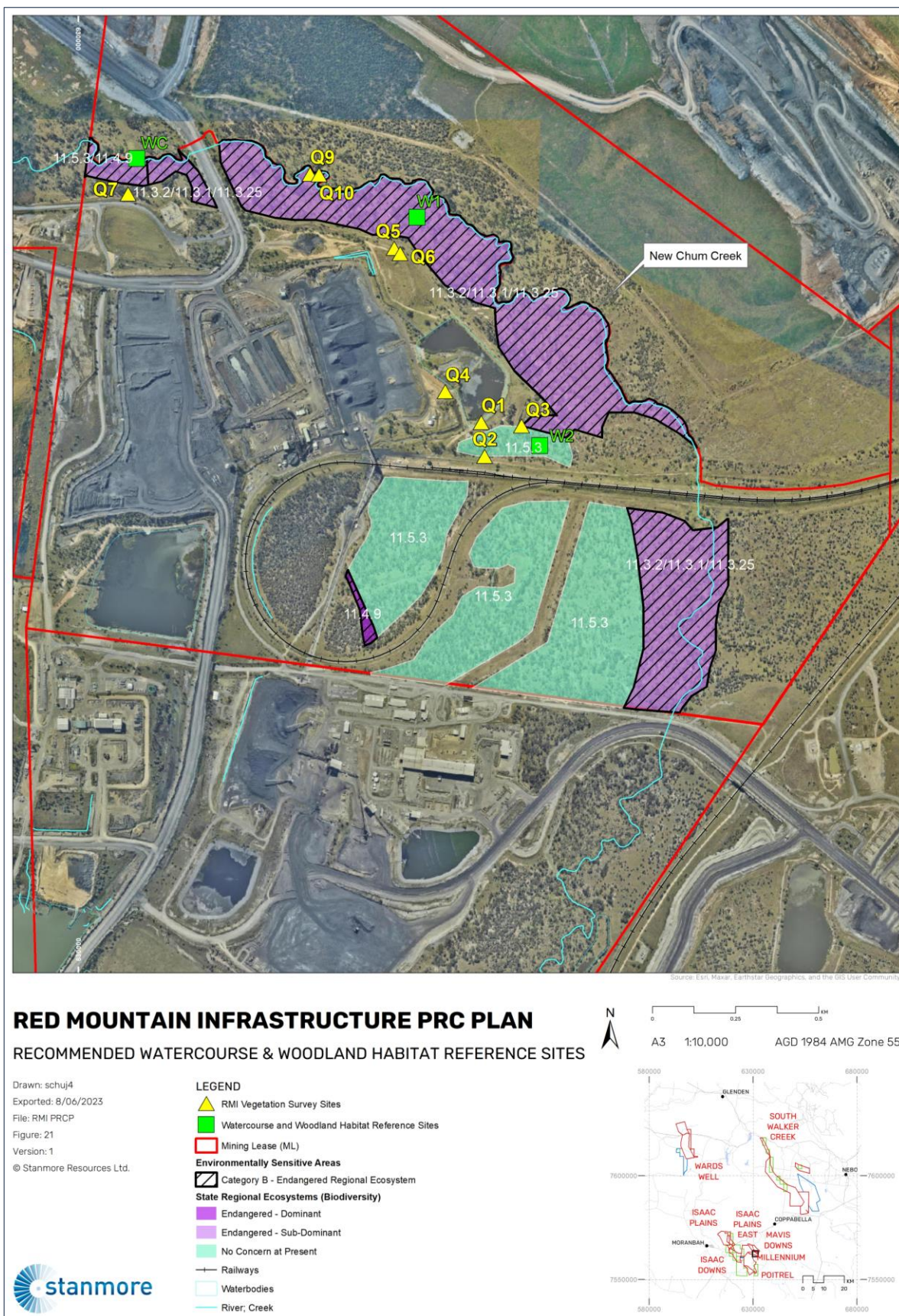


Figure 21: RMI Recommended Watercourse and Woodland Habitat Reference Sites (if required)

8.2.1 Monitoring Schedule

The rehabilitation monitoring program has been designed to demonstrate achievement of surface requirements (RM10 - RM12) and PMLU to a stable condition (RM13 - RM15). The monitoring program follows a phased approach (Year 0, Year 1, Year 2 and every four years thereafter) to ensure greater accuracy and efficiency in data collection and analysis over time.

The ongoing and consistent phased approach of the monitoring program ensures that there is continual monitoring of rehabilitation parameters against milestone criteria up to the point of surrender of the EA. Table 40 shows how the monitoring schedule progresses over time (from Year 0) and the rehabilitation parameters monitored during each phase. This allows assessment of the performance and trajectory of the rehabilitation against milestone criteria and accounts for the influence of seasonal variations and extreme weather events over time.

Table 40: Monitoring Schedule and Measured Rehabilitation Parameters.

Rehabilitation Parameters	Monitoring Schedule				
	Year 0	Year 1	Year 2	Year 6	Year 10+ (4-Yearly Thereafter)
All PMLUs					
Landform and erosion	✓	✓	✓	✓	✓
Soil and spoil	✓	x	✓	✓	✓
Groundcover	✓	✓	✓	✓	✓
Invasive plants	✓	✓	✓	✓	✓
Cattle Grazing					
Pasture species Richness	✓	✓	✓	✓	✓
Pasture yield	x	x	✓	✓	✓
Pasture condition	x	x	✓	✓	✓
Grazing Land Suitability Assessment	x	x	x	✓	✓
Woodland Habitat and Watercourse Vegetation					
Species richness	✓	✓	✓	✓	✓
Tree density and basal area	x	x	✓	✓	✓
Tree canopy and shrub cover	x	x	✓	✓	✓
Recruitment	x	x	✓	✓	✓

8.2.2 Monitoring Sites

Permanent rehabilitation monitoring sites will be established at the start of the rehabilitation monitoring program (Year 0). The permanent sites will be assessed during all phases of rehabilitation monitoring.

The permanent field monitoring sites are selected prior to commencing any field monitoring work and are selected using the following criteria:

- Representative of rehabilitation slope;
- Located in a lower slope position to capture maximum hydrologic and erosion processes;
- Accessibility (vehicle access preferred);
- Located on mining lease or SMC owned land;

- Low risk of site being disturbed by mining activity in the future;
- At least one permanent rehabilitation monitoring site will be established in each RA.

8.2.3 General Rehabilitation Parameters

8.2.3.1 Landform and Erosion

Landform and erosion are assessed as part of all monitoring phases.

Prior to commencing the field monitoring work, a desktop assessment using LiDAR data and aerial imagery will be completed to:

- Develop a Digital Elevation Model (DEM) to assess the rehabilitated slope against the landform design (Year 0);
- Identify new areas of potential erosion for field validation.

Field-based erosion monitoring will be conducted at the permanent monitoring sites as well as any new areas identified in the desktop assessment.

The field survey involves establishing an erosion monitoring transect by running a 50m tape perpendicular to the slope and across the erosional activity identified during the LiDAR analysis.

For the purposes of the RMI PRCP a gully shall be defined as an area of erosion >0.3m depth (*Australian Soils and Land Survey Field Handbook*, McDonald et al, 1990).

8.2.3.2 Soil and Spoil

Soil profile pits or cores within the rehabilitated areas will be established at the permanent rehabilitation monitoring sites during Year 0 monitoring. The parameters detailed in Table 41 are monitored during Year 0, Year 2, and every four years thereafter. Surface sampling refers to the layer at 0 – 10cm; and sub-surface sampling refers to layers at 10 – 30cm, 30 – 60cm and 90 – 100cm.

Table 41: Soil and Spoil Analysis Parameters for RMI's Monitoring Program.

Category	Analyte	Purpose of Analyte	Depth		Monitoring Phase	
			Surface	Sub-Surface	Year 0	Year 2 (and Every 4 Years Thereafter)
Acidity / Alkalinity	pH	Identify anomalies that may affect plant growth and sustainability.	✓	✓	✓	✓
Salinity	EC	Identify leaching profile. High salinity can lead to poor vegetation germination and establishment, reduced plant growth and vigour.	✓	✓	✓	✓
	Chloride	Identify leaching profile. High chloride can lead to poor vegetation germination and establishment, reduced plant growth and vigour.	✓	✓	✓	✓
Exchangeable Cations	Cation Exchange	Major factor in soil fertility. Controls soil stability, nutrient	✓	✓	✓	✓

Category	Analyte	Purpose of Analyte	Depth		Monitoring Phase	
			Surface	Sub-Surface	Year 0	Year 2 (and Every 4 Years Thereafter)
	Capacity (CEC)	availability and buffers soil's chemical properties.				
	Exchangeable Cations	Exchangeable Calcium is linked to soil stability. High levels of exchangeable Magnesium can cause clay dispersion, instability when wet and hard setting.	✓	✓	✓	✓
	Exchangeable Sodium Percentage (ESP)	ESP is a measure of the dominance of sodium ions on the soil's cation exchange complex. Sodicity in soils can lead to slaking and dispersion which impact soil structure and stability.	✓	✓	✓	✓
Organic Matter	Organic Carbon	An indicator of soil nutrient stores and a contributor to improvements in soil structure. Changes through time in organic carbon are a key indicator of rehabilitation success.	✓	x	✓	✓
Major Elements	Total Nitrogen	Indicator of soil nutrient store and is also a major plant nutrient.	✓	x	✓	✓
	Extractable Phosphorous (Colwell method)	Indicator of Phosphorous readily available to plants.	✓	x	✓	✓
	Total Phosphorous	Indicator of total store of Phosphorous, some of which is readily available. Key indicator of potential for long-term success or failure of rehabilitation.	✓	x	✓	✓
	Potassium	Important plant nutrient.	✓	x	✓	✓
	Total Sulphur	Indicator of potential for Acid and Metalliferous Drainage processes.	✓	x	✓	✓
	Sulphate	Important plant nutrient and can be an indicator of potential Acid and	✓	x	✓	✓

Category	Analyte	Purpose of Analyte	Depth		Monitoring Phase	
			Surface	Sub-Surface	Year 0	Year 2 (and Every 4 Years Thereafter)
Trace Elements		Metalliferous Drainage processes.				
	Calcium	Important plant nutrient.	✓	x	✓	✓
	Magnesium	Important plant nutrient.	✓	x	✓	✓
	Manganese	Trace element with minor importance for vegetation success.	✓	x	✓	✓
	Iron	Trace element with minor importance for vegetation success.	✓	x	✓	
	Zinc	Trace element important for vegetation success.	✓	x	✓	✓
	Copper	Trace element important for vegetation success.	✓	x	✓	✓
Metals	-	Metals that have been identified as occurring at elevated levels during material characterisation analysis should be tested during monitoring.	✓	✓	✓	✓
Physical Parameters	Particle size (PSA)	Soil texture strongly affects water entry and storage. Soil texture will impact erosion and vegetation success and should be considered when planning species mixes for planting.	✓	✓	✓	x
	Emerson Aggregate Test	Indicator of clay dispersion. Should be interpreted in conjunction with ESP and EC data.	✓	✓	✓	x
Field Analysis	Soil Profile Characteristics	Horizon depths, Field colour, Field texture, Structure, Root density and depth, Soil plant available water capacity (PAWC – initial only)	✓	✓	✓	x

8.2.3.3 Groundcover

Groundcover is assessed at the permanent rehabilitation monitoring sites as part of all monitoring phases. Groundcover type is recorded as either live cover (species recorded), standing dry cover, litter, rock, coal, fallen woody debris or bare ground, and percent cover calculated.

8.2.3.4 Invasive Plants

An invasive plant is a prohibited or restricted matter under the Queensland Biosecurity Act 2014, and is defined as a species that has, or is likely to have an adverse impact on a biosecurity consideration because of the introduction, spread or increase in population size of the species in an area. A complete list of invasive plant species is outlined in schedule 4 of the Biosecurity Regulations 2016.

Invasive plants are assessed at the permanent rehabilitation monitoring sites as part of all monitoring phases.

The presence and percent cover of invasive plants, calculated as a percentage of the total vegetation cover, is recorded at each site.

8.2.4 Cattle Grazing Rehabilitation Parameters

8.2.4.1 Pasture Species Richness

Pasture species richness is assessed at the permanent rehabilitation monitoring sites as part of all monitoring phases.

Species richness is classified into the number of preferred pasture species (identified as perennial grasses that are productive and palatable to stock) (3P), intermediate pasture species, undesirable and annual species occurring within the pasture including but not limited to those listed in Table 42.

Table 42: Preferred, Intermediate and Undesirable Pasture Species.

Preferred Species		Other Intermediate Species		Other Undesirable Species	
Scientific Name	Common Name	Scientific Name	Common Name	Scientific Name	Common Name
<i>Cenchrus ciliaris</i> *	Buffel Grass	<i>Bothriochloa decipiens</i>	Pitted Bluegrass	<i>Aristida spp.</i>	Wire Grasses
<i>Heteropogon contortus</i>	Black Spear Grass	<i>Cynodon dactylon</i>	Green Couch	<i>Sporobolus spp.</i>	Native Rat's Tail Grasses
<i>Dichanthium sericeum</i>	Queensland Bluegrass	<i>Cymbopogon refractus</i>	Barbwire Grass	<i>Chloris divaricata</i>	Slender Chloris
<i>Chloris gayana</i> cvv. <i>Callide</i> *	Rhodes grass				
<i>Megathyrsus maximus</i> *	Green panic				
<i>Stylosanthes scabra</i> *	Stylo				
<i>Chamaecrista rotundifolia</i>	Wynn cassias				

8.2.4.2 Pasture Yield

Pasture yield and quality is assessed at the permanent rehabilitation monitoring sites from Year 2. This allows at least two seasons after seeding for pasture species to establish.

Pasture yield is assessed using percentage dry matter (DM) yield in kg/ha for preferred pasture species as well as the proportion of dry matter yield for annual grasses and undesirable grasses or weeds.

8.2.4.3 Pasture Condition

Pasture condition is assessed at the permanent rehabilitation monitoring sites from Year 2. This allows at least two seasons after seeding for pasture species to establish. Pasture condition is assessed using preferred species

diversity (Table 42), pasture health and pasture yield. Pasture condition ratings and criteria are shown in Table 43.

Table 43: Pasture Condition Assessment Table.

Condition Rating	Condition Indicators				
	Preferred Pasture Species		Annual Grass % DM Yield	Undesirable Grasses and Other Weeds % DM yield	Preferred Pasture Species Diversity
	% DM Yield	Crown Cover			
1	> 80 %	Dense and plants healthy	< 20 %	< 20 %	> 5 species
2	60 – 80 %	High to moderate density and some plants unhealthy	20 – 40 %	20 – 30 %	3 – 5 species
3	10 – 60 %	Moderate to low density and some plants dead	40 – 70 %	30 – 80 %	2 – 3 Species
4	< 10 %	Sparse and many plants dead	> 70 %	> 80 %	0 or 1 species

8.2.4.4 Grazing Land Suitability Assessment

A land suitability assessment according to the grazing rule-set (refer to Section 3.1.1) is undertaken to track achievement of a PMLU of cattle grazing for the first time in Year 6, to ensure vegetation has had time to establish. If the rehabilitation fails to meet the completion criteria, another assessment will be undertaken during the next scheduled monitoring.

8.2.5 Woodland Habitat and Watercourse Rehabilitation Parameters

8.2.5.1 BioCondition Assessment

BioCondition assessment is completed by an appropriately qualified person using the methodology outlined in the Queensland Herbarium's *BioCondition Assessment Manual version 2.2* and modified in accordance with section 6.1.8 Revegetation.

If vegetation composition across the rehabilitation appears to have a high degree of spatial variability, it is likely that the monitoring site may not capture a representative species richness for canopy species (trees). In this case, it may be necessary to establish additional vegetation assessment sites across the rehabilitation – these will be identified and included in the monitoring program as rehabilitation monitoring proceeds over time.

8.2.5.2 Watercourse Monitoring

Water quality monitoring will be undertaken in accordance with the *DES Monitoring and Sampling Manual: Environmental Protection (Water) Policy*, Brisbane: Department of Environment and Science Government (2018).

8.2.6 Surface Water Monitoring

As New Chum Creek is ephemeral and does not support base flows, the collection of surface water samples and assessment of surface water quality representative of discharges to receiving environments cannot be undertaken on a fixed schedule. Due to the temporal nature of the surface waters within the ephemeral drainage lines, rehabilitation-related surface water monitoring will need to be undertaken opportunistically during surface water runoff events.

Opportunistic surface water monitoring will be undertaken for the analytes listed in the EA conditions post-establishment of RM3, until the nominated PMLUs are achieved (Table 44 - RM13, RM14 and RM15).

The location of the surface water monitoring points for this opportunistic monitoring are illustrated in Figure 22 and summarised in Table 44. Other monitoring locations may be deemed necessary by SMC to demonstrate attainment of the milestone criteria – these will be identified and included in the monitoring program as rehabilitation monitoring proceeds over time.

Table 44: RMI Surface Water Sample Locations.

Sample Location	Approximate Easting / Northing	Description
RMISW01	E: 630183 N: 7563638	Upstream adjacent to lease boundary within New Chum Creek.
RMISW02	E: 631705 N: 7563046	Upstream from where surface water runoff from the majority of the rehabilitated operational areas discharges into New Chum Creek. Noting the presence of the Millennium Mine to the north of New Chum Creek, this location with sample location RMISW03 will assist with understanding the quality of surface water discharges from the RMI rehabilitated area.
RMISW03	E:631900 N: 7562898	Downstream from where surface water runoff from the majority of the rehabilitated operational areas discharges into New Chum Creek. Noting the presence of the Millennium Mine to the north of New Chum Creek, this location with sample location RMISW02 will assist with understanding the quality of surface water discharges from the RMI rehabilitated area.
RMISW04	E:631910.38 N:7562017	Downstream lease boundary in New Chum Creek.

The surface water indicators and acceptance criteria detailed in Table E1 (Rehabilitation Requirements) of the EA have been adopted for the purpose of this PRC Plan. Surface water monitoring will be undertaken for pH, EC and turbidity and the milestone criteria will be 'not significantly different to upstream values. To assist with the application of SMART principles for the evaluation of surface water results, Appendix 11 outlines the approach and statistical parameters to be adopted for determining significantly different at RMI.

8.2.7 Groundwater Monitoring

Groundwater monitoring will be undertaken on the five existing monitoring bores (MB3A, MB3B, MB04, MB11A and MB11B - Figure 22) and any additional monitoring bores deemed required by BMC to evaluate the site's groundwater condition. Where required, these bores may be decommissioned and re-installed to allow final landform establishment.

Groundwater monitoring will be undertaken bi-annually with one monitoring event representative of the dry season and one monitoring event representative of the wet season each year. Groundwater monitoring will be continued for a minimum of five years from the time of final landform establishment. After five years of groundwater monitoring results indicating compliance with the monitoring plan and attainment of the milestone criteria, a review of the groundwater data will be undertaken by an appropriately qualified person to determine the need for (or not) further monitoring. Groundwater monitoring, where required to demonstrate compliance with the milestone criteria, will be undertaken for the total monitoring duration nominated in Table 43 for the establishment of the PMLUs (RM13, RM14 and RM15).

The groundwater indicator (EC) and acceptance criteria detailed in Table E1 (Rehabilitation Requirements) of the EA have been adopted for the purpose of this PRC Plan.

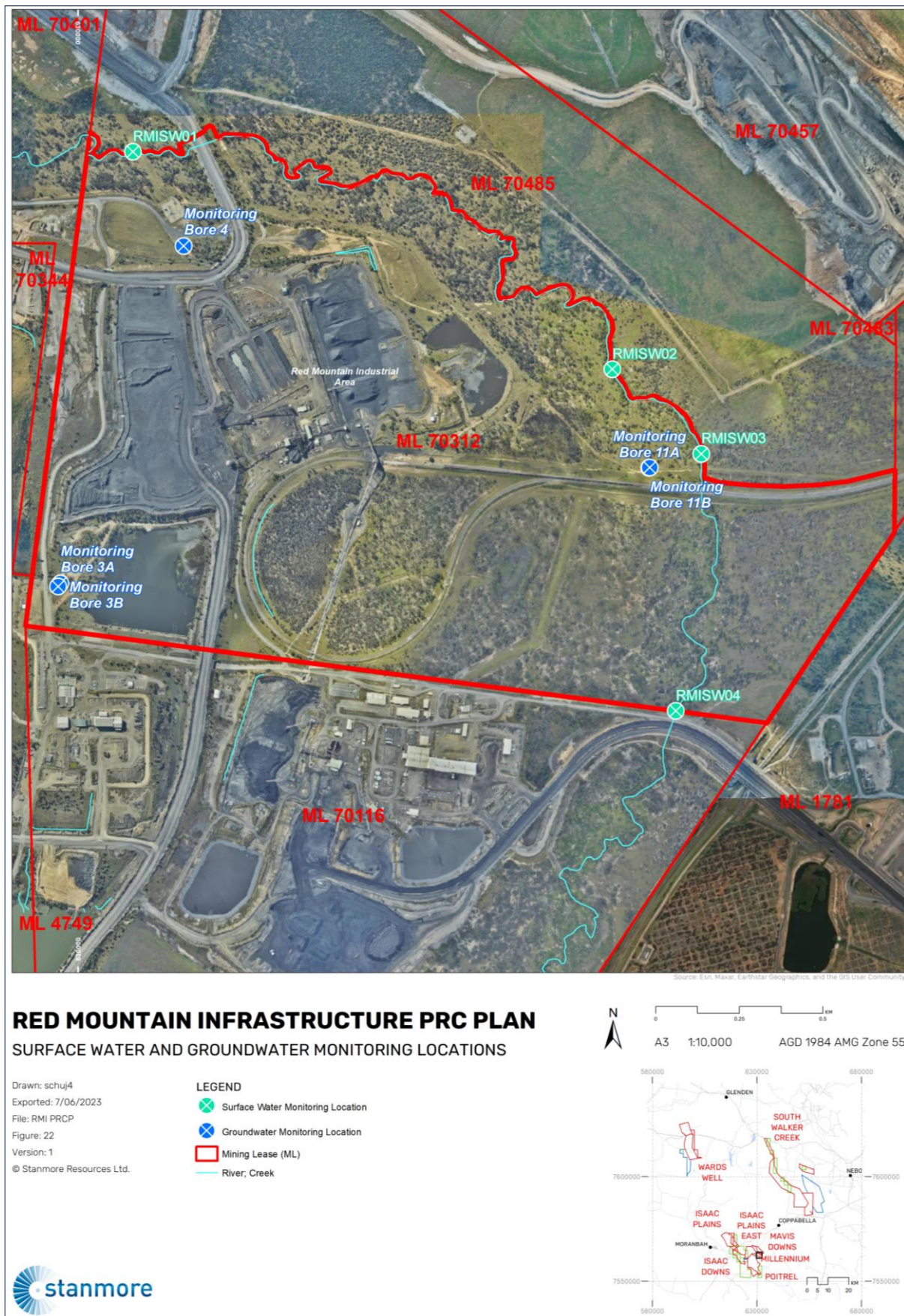


Figure 22: Rehabilitation-Related Surface Water and Groundwater Monitoring Locations at RMI.

8.3 Achieving Monitoring Across the PRCP Schedule

As mentioned in Section 8.1, RM1 to RM9 will be subject to ongoing reporting requirements to ensure achievement of the associated milestone criteria. The timing of the rehabilitation milestones specific to achievement of surface requirements (RM10 – RM12) and achievement of PMLUs (RM13 – RM15), are listed in Table 45 detailed in the section that follows.

Table 45: Time for Achievement of Surface Requirements and PMLUs Rehabilitation Milestones.

Rehabilitation Milestone Reference	Rehabilitation Milestone	Milestone Achievement Timeline after Revegetation (in PRCP Schedule)
RM10	Achievement of surface requirements (cattle grazing)	10 years
RM11	Achievement of surface requirements (woodland habitat)	15 years
RM12	Achievement of surface requirements (watercourse)	15 years
RM13	Achievement of post-mining land use to a stable condition (cattle grazing)	15 years
RM14	Achievement of post-mining land use to a stable condition (woodland habitat)	20 years
RM15	Achievement of post-mining land use to a stable condition (watercourse)	20 years

8.3.1 Cattle Grazing

Achievement of surface requirements for cattle grazing RM10, is proposed within a 10-year timeframe from revegetation. There are a number of factors which can influence the successful establishment of pastures on post-mined land including soils and landform, soil management and amelioration, species selection, sowing rates, and sowing timing plus rainfall. The revegetation plan has considered these elements and allows a period up to 10-years to achieve RM10 for seasonal rainfall variation to successfully establish a pasture suitable for a PMLU of cattle grazing at RMI.

Achievement of PMLU to a stable condition for cattle grazing RM13, is proposed within a 15-year timeframe from initial revegetation. This includes the 10 years allowed for achieving RM10, plus an additional 5 years for achievement of RM13 (15 years). This will allow for sufficient time to demonstrate the ongoing sustainability of the PMLU for cattle grazing through additional rehabilitation monitoring data associated with landform, erosion, soils, vegetation, pastures, and surface water (Section 8.2.4).

8.3.2 Woodland Habitat and Watercourse

Achievement of surface requirements for woodland habitat RM11 and watercourse RM12 is proposed within a 15-year timeframe from revegetation. This allows for achievement of the relevant BioCondition criteria whereby rehabilitation will require development of multiple tree layers (canopy and shrub) as well as evidence of recruitment which would not be possible in <15 years.

Achievement of post-mining land use to a stable condition for woodland habitat RM14 and watercourse RM15 is proposed within a 20-year timeframe from revegetation. This includes the 15 years allowed for achieving RM11 and RM12, plus an additional 5 years for achievement of RM14 and RM15. This allows for initial establishment and successional process, and senescence of Acacia and other pioneer species as well as natural recruitment to occur.

8.4 Maintenance

Maintenance will be implemented when monitoring identifies issues with the rehabilitation, or milestone criteria are not being met. In order to select the most appropriate remedial actions, the likely cause would be assessed. Contributing factors may be related to:

- Climatic conditions (i.e., droughts).
- Weed presence.
- Poor drainage design.
- Insufficient vegetation cover.
- Influence of adjacent land use.
- Soil type.

Required rehabilitation actions are to be entered into SMC's work management system for actioning.

8.5 Data Analysis and Reporting

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

The rehabilitation data will be stored and processed within internal geospatial and document management systems.

8.6 Quality Assurance and Quality Control

The quality assurance and quality control process to be followed as part of RMI ongoing rehabilitation monitoring is illustrated in Figure 23. The process provides for initial execution of the rehabilitation in accordance with the rehabilitation measures, followed by verification of how this execution was undertaken (again, according to these measures). Based on the verification outcomes, allowance is made for implementation of corrective action and/or maintenance, as needed (Section 8.5). The rehabilitated areas as well as corrected and/or maintenance areas then undergo further rehabilitation monitoring, and subsequent execution of the rehabilitation measures. This process allows for a repetitive execution-verification-monitoring QA/QC approach, to ensure rehabilitation areas progress on a trajectory towards achievement of milestone criteria and eventual certification.



Figure 23: Rehabilitation Monitoring Quality Assurance / Quality Control Process.

Relationship with PRCP Schedule

- The EA requires all infrastructure constructed for the approved activities, to be removed from the site prior to surrender and any spills and releases to be cleaned up and the area remediated.
- SMC's rehabilitation monitoring program is designed to track rehabilitation performance over time to identify compliance to milestone criteria, identify remedial and maintenance actions, as well as ensure continuous improvement in rehabilitation methodologies.

9 REFERENCES

The following references have been used to support development of the PRC Plan:

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B. PRCP SCHEDULE

10 PRCP SCHEDULE

Legislative Requirement

In accordance with section 126D(1) of the EP Act, the PRCP Schedule in the PRC Plan must:

- a. Describe the area of each resource tenure either a post-mining land use or non-use management area, and
- b. For each post-mining land use state:
 - i. Each rehabilitation milestone required to achieve a stable condition, and
 - ii. When each rehabilitation milestone is to be achieved, and
- c. For each non-use management area state:
 - i. Each management milestone, and
 - ii. When each management milestone is to be achieved, and
- d. Include maps showing the land mentioned in (a), (b) and (c).

10.1 Final Site Design

The final site design for RMI, including maximum disturbance, tenure boundaries and the PMLUs, is shown in Figure 24.

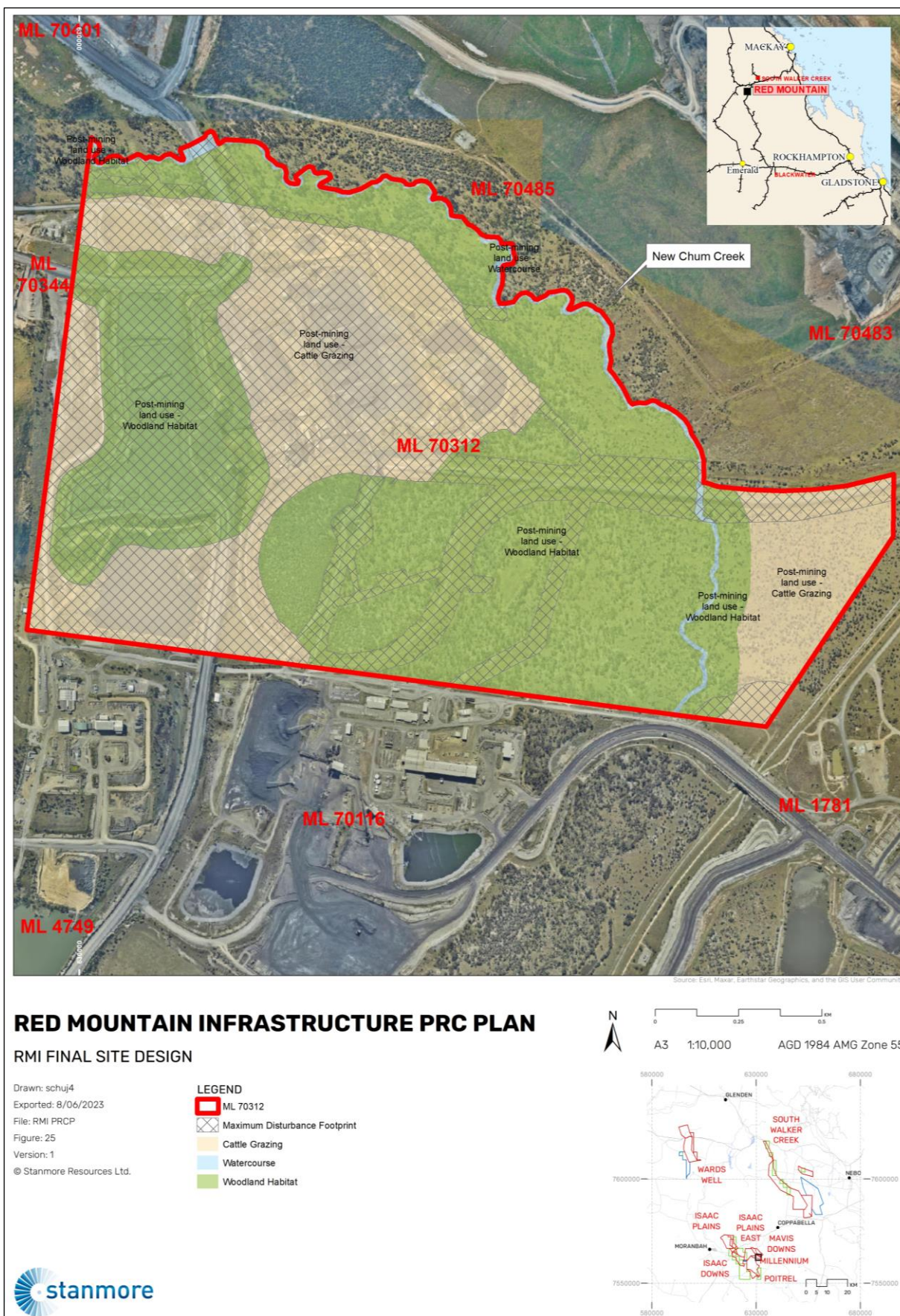


Figure 24: RMI Final Site Design.

10.2 Reference Map

The RMI reference map showing the rehabilitation areas is shown in Figure 25.

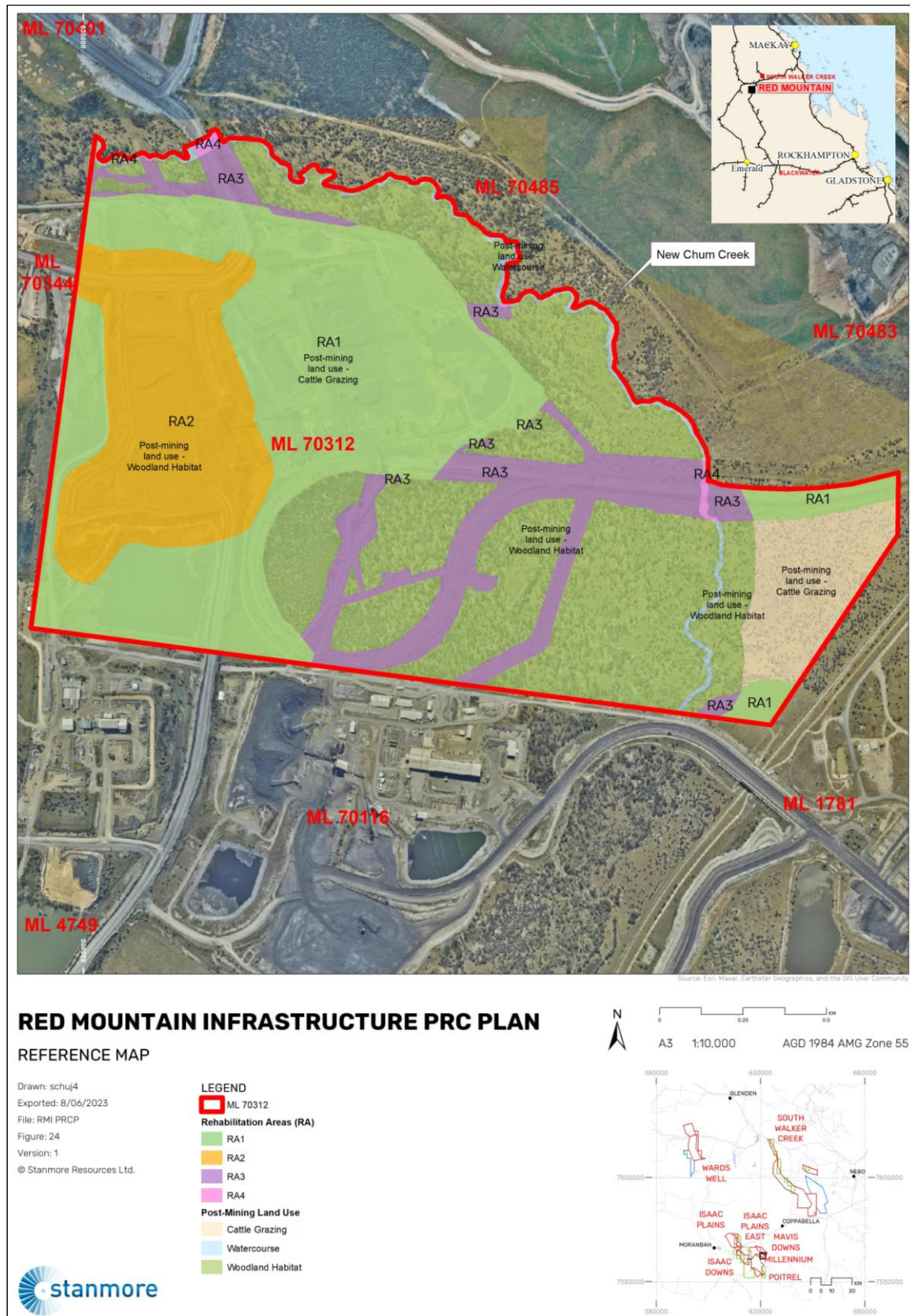


Figure 25: RMI Reference Map.

10.3 Rehabilitation Milestones

The rehabilitation milestones and milestone criteria for RMI are shown in PRCP Schedule EPML00819113

10.4 Schedule

The schedule is based on the land being rehabilitated as soon as practicable after the land becomes available, as required under section 126D(4) of the EP Act. For RMI, areas become progressively available once the coal processing is complete, with final land becoming available once train loading has ended.

Rehabilitation milestones RM1 – RM9 will be completed in the same time period for each RA, while completion of RM10 – RM15 is dependent on varying weather seasonality and undesirable weather periods. Achievement of rehabilitation milestones RM10 – RM15 will be demonstrated prior to the scheduled date if possible.

The PRCP Schedule is provided PRCP Schedule EPML00819113.

11 LIST OF APPENDICES

- Appendix 1: RMI's Environmental Authority EA (EPML00819113)
- Appendix 2: Queensland Department of Environment and Science (3 December 2020): Progressive Rehabilitation and Closure Plan Transition Notice. Ref. EPML00819113
- Appendix 3: SMC (26 November 2020): Progressive Rehabilitation and Closure Plan BMC Red Mountain Infrastructure - DES Pre-Notification Memo
- Appendix 4: CDM Smith (30 August 2021): Hydrogeological Conceptual Site Model - Red Mountain Infrastructure Coal Handling and Preparation Plant, Poitrel Mine Road, Coppabella, QLD, 4741
- Appendix 5: GE Environmental (6 August 2021): Soil and Capping Study for Transitional PRCP for the Red Mountain Infrastructure Project
- Appendix 6: Queensland Government Department of Environment and Science Databases (Related to Vegetation and Regional Ecosystems)
- Appendix 7: Elliot Whiteing (November 2021): Red Mountain Infrastructure PRCP Community Consultation Plan and Community Consultation Register
- Appendix 8: SMC (12 September 2021): Red Mountain Infrastructure Progressive Rehabilitation and Closure Plan Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste
- Appendix 9: CDM Smith (31 August 2021): Preliminary Site Investigation (PSI) Red Mountain Infrastructure Coal Handling and Preparation Plant, Poitrel Mine Road, Coppabella, QLD, 4741
- Appendix 10: Red Mountain Infrastructure PRCP Risk Assessment Matrix
- Appendix 11: Approach to Evaluating Water Milestone Criteria.

Permit

Environmental Protection Act 1994

Environmental authority EPML00819113

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

Environmental authority number: EPML00819113

Environmental authority takes effect on 12 July 2022

The anniversary date of this environmental authority is the same day each year and remains 16 December. The payment of the annual fee will be due each year on this day.

An annual return will be due each year on 01 April.

Environmental authority holder(s)

Name(s)	Registered address
STANMORE SMC PTY LTD	Level 32, 12 Creek St BRISBANE CITY QLD 4000 Australia

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
ERA 31 - Mineral processing 2: Processing, in a year, the following quantities of mineral products, other than coke (b) more than 100,000t	ML70312
ERA 62 - Resource recovery and transfer facility operation 1: Operating a facility for receiving and sorting, dismantling, baling or temporarily storing- (c) category 2 regulated waste	ML70312

Additional information for applicants

Environmentally relevant activities

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



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

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

Contaminated land

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

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

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

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

Take effect

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

- a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority-on the nominated day; or
- b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or
- c) otherwise-on the day the authority is issued.

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

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

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



Alisha Stewart
 Department of Environment and Science
 Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
 Business Centre Coal
 Department of Environment and Science
 Phone: 07 4987 9320
 Email: crmining@des.qld.gov.au

Date issued: 12 July 2022

Privacy statement

Pursuant to section 540 of the EP Act, the Department is required to maintain a register of certain documents and information authorised under the EP Act. A copy of this document will be kept on the public register. The register is available for inspection by members of the public who are able to take extracts, or copies of the documents from the register. Documents that are required to be kept on the register are published in their entirety, unless alteration is required by the EP Act. There is no general discretion allowing the Department to withhold documents or information required to be kept on the public register. For more information on the Department's public register, search 'public register' at www.qld.gov.au. For queries about privacy matters please email privacy@des.qld.gov.au or telephone 13 74 68.

Obligations under the *Environmental Protection Act 1994*

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

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

Other permits required

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

Conditions of environmental authority

Schedule A: General	
Condition number	Condition
A1	This environmental authority authorises environmental harm referred to in the conditions. Where there is no condition or this environmental authority is silent on a matter, the lack of a condition or silence does not authorise environmental harm.
A2	Prevent and /or minimise likelihood of environmental harm In carrying out the environmentally relevant activities, the environmental authority holder must take all reasonable and practicable measures to prevent and/or to minimise the likelihood of environmental harm being caused. Any environmentally relevant activity, that, if carried out incompetently, or negligently, may cause environmental harm, in a manner that could have been prevented, shall be carried out in a proper manner in accordance with the conditions of this environmental authority.
A3	Maintenance of measures, plant and equipment The environmental authority holder must ensure: a) that all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority are installed; b) that such measures, plant and equipment are maintained in a proper condition; c) that such measures, plant and equipment are operated in a proper manner; and d) that all instruments and devices used for the measurement or monitoring of any parameter under any condition of this environmental authority are properly calibrated.
A4	Monitoring and records Except where specified otherwise in another condition of this environmental authority, all monitoring records and reports required by this environmental authority must be kept for a period of not less than five (5) years.
A5	Monitoring and determinations required under any condition of this environmental authority must be conducted by an appropriately qualified person(s).
A6	Upon request from the administering authority, copies of monitoring results, records, registers, management plans and reports required by the conditions of this environmental authority must be made available and provided to the administering authority within ten (10) business days or an alternative timeframe agreed between the administering authority and the environmental authority holder.

A7	Notification of emergencies, incidents and exceptions The environmental authority holder must notify the administering authority by written notification within twenty-four (24) hours after becoming aware of any emergency or incident that results in the release of contaminants not in accordance, or reasonably expected to be not in accordance, with the conditions of this environmental authority.
A8	Within ten (10) business days following the initial notification under condition A7, or the receipt of monitoring results associated with the notification made under condition A7, whichever is the latter, the environmental authority holder must provide further written advice to the administering authority, including the following: a) results and interpretation of any samples taken and analysed; b) outcomes of actions taken at the time to prevent or minimise unlawful environmental harm; and c) proposed actions to prevent a recurrence of the emergency or incident.
A9	Complaints The environmental authority holder must record all environmental complaints received about the mining activities, including: a) name, address and contact number for of the complainant; b) time and date of complaint; c) reasons for the complaint; d) investigations undertaken; e) conclusions formed; f) actions taken to resolve the complaint, including the use of appropriate dispute resolution if required; g) any abatement measures implemented; and h) person responsible for resolving the complaint.
A10	A register of alternative arrangements must be established and maintained by the environmental authority holder. The register must include: a) the location to which the alternative arrangement applies; b) the period of the alternative arrangement; c) details about the particular environmental nuisance impact or impacts the arrangement is for; and d) details about the mitigation measures, where relevant.

A11	Monitoring on request When requested by the administering authority, the environmental authority holder must investigate any nuisance, or contaminant release, or environmental harm, or complaint that is neither frivolous nor vexatious in the opinion of the authorised person, by: a) undertaking the monitoring specified by the administering authority; b) undertaking the monitoring in the timeframe nominated or agreed to by the administering authority; c) completing an analysis and interpretation of the monitoring results; and d) implementing abatement measures, where required.
A12	The results of the investigation undertaken in accordance with condition A11 must be provided to the administering authority within twenty (20) business days of completion of the monitoring timeframe in accordance with condition A11(b), or a longer timeframe agreed to by the administering authority.

Schedule B: Air	
Condition number	Condition
B1	Odour nuisance The release of noxious or offensive odour or any other noxious or offensive airborne contaminant resulting from the mining activities must not cause an environmental nuisance, at any sensitive place or commercial place.
B2	If the administering authority determines odour released from the mining activities to constitute an environmental nuisance, the environmental authority holder must immediately implement abatement measures so that emissions from the mining activities do not result in further environmental nuisance.
B3	Dust nuisance The release of dust or particulate matter or both resulting from the mining activities must not cause an environmental nuisance, at any sensitive place or commercial place.
B4	Monitoring of dust and particulate matter resulting from the mining activities, undertaken in accordance with condition A11, must be carried out at a place relevant to the potentially affected sensitive place or commercial place and must not exceed the following levels when measured at any sensitive place or commercial place: a) dust deposition, measured as total insoluble matter, of 120 milligrams per square metre per day, averaged over one month, when monitored in accordance with the most recent version of Australian Standard AS3580.10.1 <i>Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method</i>. b) a concentration of particulate matter with an aerodynamic diameter of less than 10 micrometre (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24-hour averaging time, when monitored in accordance with the most recent version of either: i. Australian Standard AS3580.9.6 <i>Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 high volume sampler with size selective inlet – Gravimetric method</i>; or ii. Australian Standard AS3580.9.8 <i>Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 continuous direct mass method using a tapered element oscillating microbalance analyser</i>; or iii. Australian Standard AS3580.9.9 <i>Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 low volume sampler – Gravimetric method</i>; or iv. Australian Standard AS3580.9.11 <i>Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 beta attenuation monitors</i>. NOTE: Exceedances due to events that cannot be managed by the environmental authority holder, such as bushfires, fuel reduction burning for fire management purposes or dust storms, would not be considered to be in breach of condition B4 if the environmental authority holder can demonstrate that the exceedance was caused by such events.

B5	If monitoring, undertaken in accordance with condition A11, indicates exceedance of the relevant limits in condition B4, the environmental authority holder must immediately implement abatement measures so that emissions from the mining activities do not result in further environmental nuisance.
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Schedule C: Noise and Vibration	
Condition number	Condition
C1	Noise nuisance Noise from the mining activities must not cause an environmental nuisance, at any sensitive place or commercial place.
C2	Noise is not considered an environmental nuisance under condition C1 if monitoring shows that noise does not exceed the limits in Table C1 – Noise Limits , at any sensitive place or commercial place.
C3	Noise monitoring Noise monitoring, undertaken in accordance with condition A11 , must comply with the most recent version of the administering authority's <i>Noise Measurement Manual</i> , and must include the following descriptors, characteristics and conditions: a) L_{A10}, adj, 10 mins; b) L_{A1}, adj, 10 mins; c) the level and frequency of occurrence of impulsive or tonal noise; d) atmospheric conditions including wind speed and direction; e) effects due to extraneous factors such as traffic noise; and f) location, date and time of recording.
C4	If monitoring, undertaken in accordance with condition A11 , indicates exceedance of the relevant limits in Table C1 – Noise Limits , the environmental authority holder must immediately implement abatement measures so that emissions from the mining activities do not result in further environmental nuisance.

Table C1 – Noise Limits

Noise Level dB(A)	Monday to Saturday			Sunday and Public Holidays		
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	Day (9am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 9am)
Sensitive Place						
L_{A10} , adj, 10 mins	B/g + 5	B/g + 5	B/g + 0	B/g + 5	B/g + 5	B/g + 0
L_{A1} , adj, 10 mins	B/g + 10	B/g + 10	B/g + 5	B/g + 10	B/g + 10	B/g + 5
Commercial Place						
L_{A10} , adj, 10 mins	B/g + 10	B/g + 10	B/g + 5	B/g + 10	B/g + 10	B/g + 5
L_{A1} , adj, 10 mins	B/g + 15	B/g + 15	B/g + 10	B/g + 15	B/g + 15	B/g + 10

Schedule D: Waste	
Condition number	Condition
D1	Waste management A Waste Management Plan must be developed by an appropriately qualified person(s) and implemented. The Waste Management Plan must include: a) a description of the mining activities that may generate waste; b) waste management control strategies, including: i. the types and amounts of wastes generated by the mining activities; ii. segregation of the wastes; iii. storage of the wastes; iv. transport of the wastes; and v. monitoring and reporting matters concerning the wastes; c) how the waste will be dealt with in accordance with the waste management hierarchy (that is, avoid, reuse, recycling, energy recovery, disposal); d) the hazardous characteristics of the wastes generated including disposal procedures for hazardous wastes; e) procedures for dealing with accidents, spills and other incidents; f) the indicators or other criteria on which the performance of the waste management program will be assessed; and g) staff training.
D2	Waste must not be burned or allowed to be burned on the mining leases unless approved by the administering authority prior to burning.
D3	A designated area must be set aside for the segregation of economically viable, recyclable solid and liquid waste.
D4	Records must be maintained and must include the following information: a) date of pickup of waste; b) description of waste; c) cross reference to relevant waste transport documentation; d) quantity of waste; e) origin of the waste; f) destination of the waste; and g) intended fate of the waste, for example, type of waste treatment, reprocessing or disposal. <i>NOTE: Records of documents maintained in compliance with a waste tracking system established under the Environmental Protection Act 1994 or any other law for regulated waste will be deemed to satisfy this condition.</i>

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D5	Records of trade and regulated wastes or material leaving the mining lease for recycling or disposal, including the final destination and method of treatment, must be in accordance with the <i>Environmental Protection Regulation 2019</i> .
D6	All regulated waste received at and removed from the mining leases must be transported by a person who holds a current authority to transport such waste under the provisions of the <i>Environmental Protection Act 1994</i> .
D7	Except as otherwise permitted under the conditions of this environmental authority, all waste removed from the mining leases must be taken to a facility that is lawfully allowed to accept such waste under the provisions of the <i>Environmental Protection Act 1994</i> .

Schedule E: Land	
Condition number	Condition
E1	Topsoil Topsoil must be strategically stripped ahead of mining in accordance with a Topsoil Management Plan.
E2	A topsoil inventory, which identifies the topsoil requirements for rehabilitation and availability of suitable topsoil on site, must be provided with any Estimated Rehabilitation Cost application.
E3	Rehabilitation landform criteria Unless otherwise permitted under the conditions of this environmental authority, all areas significantly disturbed by mining activities must be rehabilitated in accordance with Table E1 – Rehabilitation Requirements .

Table E1 – Rehabilitation Requirements

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

Post Mining Land Use	Goal	Objective	Indicator	Acceptance Criteria
Dryland cropping	Safe to humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
	Stable	Rehabilitation is geotechnically stable	Factor of safety	≥1.5
		Rehabilitation is erosionally stable	Percentage of cultivation at >1% slope gradient with functional contour banks	100% of rehabilitated areas
	Non-polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
		Deep drainage from rehabilitation achieves relevant water quality objectives for groundwater	EC	Not significantly different to: (a) the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or, (b) local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
	Able to sustain the agreed post-mining land use	Rehabilitation is suitable for sustainable dryland cropping	Land suitability assessment for dryland cropping	Land suitability class ≤3 or not different from pre-mining class if ≥4. Assessment completed in accordance with the <i>Regional Land Suitability Frameworks for Queensland 2013</i> unless otherwise agreed in writing between the administering authority and the environmental authority holder.
Woodland habitat	Safe to humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
	Stable	Rehabilitation is geotechnically stable	Factor of safety	≥1.5 unless an alternative is justified by an appropriately qualified person
		Rehabilitation is erosionally stable	Groundcover (steep slopes, >15%)	80%
			Groundcover (lesser slopes, ≤15%)	50%
	Non-polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
		Deep drainage from rehabilitation achieves relevant water quality objectives for groundwater	EC	Not significantly different to: (a) the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or, (b) local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
	Able to sustain the agreed post-	Native bushland characteristics	Species richness Trees Shrubs Grasses	≥2 ≥3 ≥4

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Post Mining Land Use	Goal	Objective	Indicator	Acceptance Criteria
	mining land use		Tree canopy cover	≥10%
Water Storage	Safe to humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
	Stable	Rehabilitation is geotechnically stable	Factor of Safety	≥1.5
		Rehabilitation is erosionally stable (banks and immediate surrounds)	Groundcover	>50%
	Non-polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
		Deep drainage from rehabilitation achieves relevant water quality objectives for groundwater	EC	Not significantly different to: (a) the EPP (Water) schedule documents water quality objectives for relevant groundwater chemistry zones; or, (b) local water quality objectives developed in accordance with the Queensland Water Quality Guidelines.
	Able to sustain the agreed post-mining land use	Rehabilitation retains water that is a potential resource for cattle grazing, with quality according to ANZECC guidelines version October 2000	TDS Calcium Magnesium Nitrate Nitrite Sulphate	≤5,000mg/L ≤1,000mg/L ≤2,000mg/L ≤400mg/L ≤30mg/L ≤1,000mg/L
Watercourse	Safe to humans and wildlife	Safety hazards are not significantly different to surrounding unmined landscapes subject to the same land use	Hazard assessment	No significant difference
	Stable	Rehabilitation is erosionally stable	Geomorphic index (IDC method)	Greater or equal to upstream or downstream values.
	Non-polluting	Rainfall runoff from rehabilitation achieves relevant water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
	Able to sustain the agreed post-mining land use	Riparian vegetation	Riparian vegetation index (IDC method)	Greater or equal to upstream or downstream values.

E4	Progressive rehabilitation must commence within twelve (12) months of when areas become available within the mining leases.
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E5	Complete an investigation into rehabilitation of disturbed areas and submit a report to the administering authority proposing acceptance criteria within two (2) years of project closure for review and comment. On acceptance of the criteria proposed in the Rehabilitation Management Plan, the criteria must be specified in this environmental authority. The Rehabilitation Management Plan must include, at a minimum: a) map existing areas of rehabilitation; b) develop design objectives for rehabilitation of disturbed areas and post mining land uses across the mine; c) specify spoil characteristics, soil analysis, soil separation for use on rehabilitation; d) detail rehabilitation methods applied to areas; e) contain landform design criteria including end of mine design; f) detail how landform design will be consistent with the surrounding topography; g) identify success criteria for areas and itemise revegetation criteria; h) explain planned native vegetation rehabilitation areas and corridors; i) identify at least a minimum of three (3) reference and three (3) rehabilitation sites to be used to develop rehabilitation success criteria; j) describe rehabilitation indicators and the monitoring program to be used; k) develop a contingency plan for rehabilitation maintenance or redesign; l) describe end of mine landform design plan and post mining land uses across the mine; m) include a cost benefit analysis / triple bottom line assessment (or an alternative assessment method) of the proposed final landform design criteria and alternatives; n) propose Endangered Regional Ecosystem (ERE) management and offset protection; and o) identify and consider the potential for cumulative impacts on rehabilitation outcomes as a result of applying mine affected water with high electrical conductivity for dust suppression.
E6	Nature conservation A buffer distance of not less than one hundred (100) metres must be retained on either side of the vegetation along New Chum Creek within Mining Lease 70312 to minimise environmental impacts to regional ecosystems except as indicated in Table E2 – Work Areas in Nature Conservation Areas.

Table E2 – Work Areas in Nature Conservation Areas

Description	Easting (GDA94)	Northing (GDA94)
Transport Corridor – New Chum Creek	629200	7564300
New Chum Creek Crossing	630450	7563660
CHPP Infrastructure (Tailings Storage Facility)	630511 630619 630673 630622	7562965 7562775 7562810 7562994
Receiving Waters Upstream Background Monitoring Point (MP1.1)	630183	7563638

E7	Preventing contaminant release to land Contaminants must not be released to land in manner that constitutes a nuisance, material harm or serious environmental harm.
E8	Storage and handling of chemicals and flammable or combustible liquids All chemicals and flammable or combustible liquids must be stored and handled in accordance with the most recent version of an Australian Standard where such is applicable. Where no relevant Australian Standard exists, store such materials within an effective on-site containment system.
E9	Infrastructure All infrastructure, constructed by or for the environmental authority holder during the mining activities including water storage structures, must be removed from the site prior to surrender, except where agreed in writing by the post mining landowner/ landholder. <i>NOTE: This is not applicable where the landowner/ landholder is also the environmental authority holder.</i>

Schedule F: Water	
Condition number	Condition
F1	Contaminant Release Contaminants that will or have the potential to cause environmental harm must not be released directly or indirectly to any waters as a result of the mining activities, except as permitted under the conditions of this environmental authority.
F2	Unless otherwise permitted under the conditions of this environmental authority, the release of mine affected water to waters must only occur from the release points specified in Table F1 – Mine Affected Water Release Point .
F3	The release of mine affected water to internal water management infrastructure that is installed and operated in accordance with a Water Management Plan that complies with conditions F31 to F35 inclusive is permitted.
F4	The release of mine affected water to waters in accordance with condition F2 must not exceed the release limits stated in Table F2 – Mine Affected Water Release Limits when measured at the monitoring points specified in Table F1 – Mine Affected Water Release Point for each quality characteristic.

Table F1 – Mine Affected Water Release Point

Release Point (RP)	Easting (GDA94)	Northing (GDA94)	Mine Affected Water Source and Location	Monitoring Point	Receiving Environment Description
RP2	631259	7563193	Environmental Dam	Spillway and end of pipe	Isaac River (via New Chum Creek)

Table F2 –Mine Affected Water Release Limits

Quality Characteristic	Release Limit	Monitoring Frequency	Comment
Electrical Conductivity ($\mu\text{S}/\text{cm}$)	Release limits specified in Table F4	Daily during release (the first sample must be taken within 2 hours of commencement of release)	
pH (pH units)	6.5 (minimum) 9.0 (maximum)	Daily during release (the first sample must be taken within 2 hours of commencement of release)	
Turbidity (NTU)	500	Daily during release (the first sample must be taken within 2 hours of commencement of release)	
Suspended Solids (mg/L)	Limit to be determined based on receiving water reference data and achievable best practice sedimentation control and treatment	At commencement and prior to cessation of release (at a minimum) and weekly during a release	Suspended solids are required to measure performance of erosion and sediment control measures
Sulphate (SO_4^{2-}) (mg/L)	Release limits specified in Table F4	At commencement and prior to cessation of release (at a minimum) and weekly during a release	Drinking water environmental values from NHMRC 2006 Guidelines or ANZECC

F5	The release of mine affected water to waters from the RP2 must be monitored at the location specified in Table F1 – Mine Affected Water Release Point for each quality characteristic and at the frequency specified in Table F2 –Mine Affected Water Release Limits and Table F3 – Release Contaminant Trigger Investigation Levels. <i>NOTE: the administering authority will take into consideration any extenuating circumstances prior to determining an appropriate enforcement response in the event condition F5 is contravened due to a temporary lack of safe or practical access. The administering authority expects the environmental authority holder to take all reasonable and practicable measures to maintain safe and practical access to designated monitoring locations.</i>
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Table F3 –Release Contaminant Trigger Investigation Levels

Quality Characteristic	Trigger Level (µg/L)	Comment of Trigger Level	Monitoring Frequency
Aluminium	55	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release.
Arsenic	13	For aquatic ecosystem protection, based on SMD guideline	
Cadmium	0.2	For aquatic ecosystem protection, based on SMD guideline	
Chromium	1	For aquatic ecosystem protection, based on SMD guideline	
Copper	2	For aquatic ecosystem protection, based on LOR for ICPMS	
Iron	300	For aquatic ecosystem protection, based on low reliability guideline	
Lead	4	For aquatic ecosystem protection, based on SMD guideline	
Mercury	0.2	For aquatic ecosystem protection, based on LOR for CV FIMS	
Nickel	11	For aquatic ecosystem protection, based on SMD guideline	
Zinc	8	For aquatic ecosystem protection, based on SMD guideline	
Boron	370	For aquatic ecosystem protection, based on SMD guideline	
Cobalt	90	For aquatic ecosystem protection, based on low reliability guideline	
Manganese	1900	For aquatic ecosystem protection, based on low reliability guideline	
Molybdenum	34	For aquatic ecosystem protection, based on low reliability guideline	
Selenium	10	For aquatic ecosystem protection, based on LOR for ICPMS	
Silver	1	For aquatic ecosystem protection, based on LOR for ICPMS	
Uranium	1	For aquatic ecosystem protection, based on LOR for ICPMS	
Vanadium	10	For aquatic ecosystem protection, based on LOR for ICPMS	
Ammonia	900	For aquatic ecosystem protection, based on LOR for ICPMS	
Nitrate	1100	For aquatic ecosystem protection, based on Qld WQ Guidelines (2008) for TN	
Petroleum hydrocarbons (C6-C9)	20	For aquatic ecosystem protection, based on LOR	
Petroleum hydrocarbons (C10-C36)	100	For aquatic ecosystem protection, based on LOR	

NOTES:

1. All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal/metalloids apply if dissolved results exceed trigger.
2. The quality of characteristics required to be monitored as per Table F3 can be reviewed once the results of two (2) years monitoring data is available, or if sufficient data is available to adequately demonstrate negligible environmental risk. It may be determined that a reduced monitoring frequency is appropriate or certain quality characteristics can be removed from Table F3 by amendment.
3. SMD – slightly moderately disturbed level of protection, guideline refers ANZECC & ARMCANZ (2000).
4. LOR – typical reporting for method stated. ICPMS/CV FIMS – analytical method required to achieve LOR.

F6	If quality characteristics of the release exceed any of the trigger levels specified in Table F3 – Release Contaminant Trigger Investigation Levels during a release event, the environmental authority holder must compare the downstream results in the receiving waters to the trigger values specified in Table F3 –Release Contaminant Trigger Investigation Levels and: (1) where the trigger values are not exceeded then no action is to be taken; or (2) where the downstream results exceed the trigger values specified in Table F3 –Release Contaminant Trigger Investigation Levels for any quality characteristic, compare the results of the downstream site to the data from background monitoring sites and: (a) if the result is less than the background monitoring site data, then no action is to be taken; or (b) if the result is greater than the background monitoring site data, complete an investigation into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining: i. details of the investigations carried out; and ii. actions taken to prevent environmental harm. <i>NOTE: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with condition F6(2)(b), no further reporting is required for subsequent trigger events for that quality characteristic.</i>
F7	If an exceedance in accordance with condition F6(2)(b) is identified, the environmental authority holder must notify the administering authority within twenty-four (24) hours of receiving the result.
F8	Mine Affected Water Release Events The environmental authority holder must ensure a stream flow gauging station(s) is installed, operated and maintained to determine and record stream flows at the locations and flow recording frequency specified in Table F4 –Mine Affected Water Release During Flow Events.
F9	Notwithstanding any other condition of this environmental authority, the release of mine affected water to waters in accordance with condition F2 must only take place during periods of natural flow events in accordance with the receiving water flow criteria for discharge specified in Table F4 –Mine Affected Water Release During Flow Events for the release point(s) specified in Table F1 –Mine Affected Water Release Point.
F10	The release of mine affected water to waters in accordance with condition F2 must not exceed the electrical conductivity and sulphate release limits or the maximum release rate (for all combined release point flows) for each receiving water flow criteria for discharge specified in Table F4 –Mine Affected Water Release During Flow Events when measured at the monitoring point(s) specified in Table F1 –Mine Affected Water Release Point.
F11	The daily quantity of mine affected water released from each release point must be measured and recorded at the monitoring points in Table F1 –Mine Affected Water Release Point.
F12	Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build-up of sediment in such waters.

Table F4 –Mine Affected Water Release During Flow Events

Receiving waters	Release Point (RP)	Gauging Station	Gauging Station Easting (GDA94)	Gauging Station Northing (GDA94)	Receiving Water Flow Recording Frequency	Receiving Water Flow Criteria for Discharge (m ³ /s)	Maximum Release Rate (for all combined RP flows)	Electrical Conductivity and Sulphate Release Limits
Isaac River via New Chum Creek	RP2	Isaac River Upstream Monitoring Point (MP5) Hydraulic modelling has indicated that the actual flow at this point is equal to 2.93 multiplied by the flow measured at the Goonyella Gauging Station	627886	7556459	Continuous (minimum daily)	Low Flow <14 m ³ /s for a period of 28 days after natural flow events that exceed 14m ³ /s	Maximum 1.1m ³ /s and release must not exceed the natural flow rate in the receiving waters when measured at the gauging station at MP5	Electrical conductivity: 700 µS/cm Sulphate (SO ₄ ²⁻): 250 mg/L
						Medium Flow (Low) > 14 m ³ /s	< 1.2 m ³ /s	Electrical conductivity: 1,500 µS/cm Sulphate (SO ₄ ²⁻): 500 mg/L
							< 0.833 m ³ /s	Electrical conductivity: 2,000 µS/cm Sulphate (SO ₄ ²⁻): 500 mg/L
							< 0.7 m ³ /s	Electrical conductivity: 2,500 µS/cm Sulphate (SO ₄ ²⁻): 500 mg/L
							< 0.5 m ³ /s	Electrical conductivity: 2,940 µS/cm Sulphate (SO ₄ ²⁻): 500 mg/L
						Medium Flow (High) > 35 m ³ /s	< 2.1 m ³ /s	Electrical conductivity: 2,000 µS/cm Sulphate (SO ₄ ²⁻): 1,000 mg/L
							< 1.3 m ³ /s	Electrical conductivity: 3,000 µS/cm Sulphate (SO ₄ ²⁻): 1,000 mg/L
							< 1.1 m ³ /s	Electrical conductivity: 3,500 µS/cm Sulphate (SO ₄ ²⁻): 1,000 mg/L
						High Flow > 59 m ³ /s	< 3.6 m ³ /s	Electrical conductivity: 2,000 µS/cm Sulphate (SO ₄ ²⁻): 1,000 mg/L
							< 2.2 m ³ /s	Electrical conductivity: 3,000 µS/cm Sulphate (SO ₄ ²⁻): 1,000 mg/L
							< 1.4 m ³ /s	Electrical conductivity: 4,500 µS/cm Sulphate (SO ₄ ²⁻): 1,000 mg/L

F13	Notification of release event The environmental authority holder must notify the administering authority via WaTERS as soon as practicable and no later than twenty-four (24) hours after commencing to release mine affected water to the receiving environment. The release commencement notification must include the submission of written advice to the administering authority of the following information: a) release commencement date and time; b) expected release cessation date and time; c) release point(s); d) release rate; e) receiving water(s) including the natural flow rate; and f) any details (including available data) regarding likely impacts on the receiving water(s).
F14	The environmental authority holder must notify the administering authority via WaTERS as soon as practicable and no later than twenty-four (24) hours after cessation of a release event notified under condition F13. The release cessation notification must include the submission of written advice to the administering authority of the following information: a) release cessation date and time; b) receiving water(s) including the natural flow rate; and c) volume of water released. <i>NOTE: Successive or intermittent releases occurring within twenty-four (24) hours of the cessation of any individual release can be considered part of a single release event and do not require individual notification for the purpose of compliance with conditions F13 and F14 and F15, provided the relevant details of the release are included within the notification provided in accordance with conditions F13 and F14 and F15.</i>
F15	Within twenty-eight (28) days of notification under condition F14, the environmental authority holder must provide the administering authority via WaTERS the following information in writing: a) confirmation of: i. the release commencement date and time; ii. the release cessation date and time; iii. receiving water(s) including the natural flow rate; iv. volume of water released; b) all in-situ and laboratory water quality monitoring results; c) details regarding the compliance of the release with the conditions of Schedule F: Water of this environmental authority (i.e. contamination limits, natural flow, discharge volume); d) whether the release of water resulted in any impacts to the receiving environment; and e) any other matter(s) pertinent to the water release event.
F16	Notification of release event exceedance If the release limits defined in Table F2 –Mine Affected Water Release Limits are exceeded, the environmental authority holder must notify the administering authority within twenty-four (24) hours of receiving the results.

F17	The environmental authority holder must, within twenty-eight (28) days of the notification provided in accordance with condition F16, provide a report to the administering authority via WaTERS detailing: a) the reason for the release; b) the location of the release; c) the total volume of the release and which (if any) part of this volume was non-compliant; d) the total duration of the release and which (if any) part of this period was non-compliant; e) all water quality monitoring results; f) any general observations; g) all calculations; and h) any other matters pertinent to the water release event.
F18	Monitoring of water quality storage Water storages stated in Table F5 – Onsite Water Storage Monitoring must be monitored in accordance with Table F5 – Onsite Water Storage Monitoring.

Table F5 – Onsite Water Storage Monitoring

Water Storage Description	Easting (GDA94)	Northing (GDA94)	Monitoring Frequency	Water Quality Parameters
Process Water Dam	630481	7562541	Quarterly	pH Electrical Conductivity Turbidity
Environmental Dam	631274	7562981		

F19	Receiving Environment Monitoring and Contaminant Trigger Levels The quality of the receiving waters must be monitored at the locations specified in Table F7 – Receiving Water Upstream Background and Downstream Monitoring Points for each quality characteristic and at the monitoring frequency stated in Table F6 – Receiving Waters Contaminant Trigger Levels and Table F3 –Release Contaminant Trigger Investigation Levels.
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F20	If quality characteristic(s) of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in Table F6 – Receiving Waters Contaminant Trigger Levels during a release event the environmental authority holder must compare the downstream results to the upstream results in the receiving waters and: (1) where the downstream result is the same or a lower value than the upstream value for the quality characteristic then no action is to be taken; or (2) where the downstream results exceed the upstream results, complete an investigation into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining: (a) details of the investigations carried out; and (b) actions taken to prevent environmental harm. <i>NOTE: Where an exceedance of a trigger level has occurred and is being investigated in accordance with F20(2) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.</i>
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Table F6 – Receiving Waters Contaminant Trigger Levels

Quality Characteristic	Trigger Level	Monitoring Frequency
pH (pH units)	6.5 to 8.5	Daily during the release
Electrical Conductivity ($\mu\text{S}/\text{cm}$)	1,000	
Suspended Solids (mg/L)	To be determined. Turbidity may be required to assess ecosystems impacts and can provide instantaneous results.	
Turbidity (NTU)	750	
Sulphate (SO_4^{2-}) (mg/L)	1,000	

Table F7 – Receiving Waters Upstream Background and Downstream Monitoring Points

Monitoring Point (MP)	Receiving Waters Location Description	Easting (GDA94)	Northing (GDA94)
Upstream Background Monitoring Points			
MP1.1	New Chum Creek – 1,947m upstream of RP2	630183	7563638
MP5 (EA EPML00963013)	Isaac River – 4,760m upstream of the confluence of New Chum Creek and Isaac River	627831	7556405
Downstream Monitoring Points			
MP4	Isaac River – 215m downstream of the confluence of New Chum Creek and Isaac River	631808	7553672

F21	Receiving Environment Monitoring Program (REMP) The environmental authority holder must develop and implement a Receiving Environment Monitoring Program (REMP) to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity. This must include monitoring the effects of the mine on the receiving environment periodically (under natural flow conditions) and while mine affected water is being discharged from the site. For the purposes of the REMP, the receiving environment is the waters of New Chum Creek and connected or surrounding waterways within Isaac River ten (10) kilometres downstream of the release. The REMP should encompass any sensitive receiving waters or environmental values downstream of the authorised mining activity that will potentially be directly affected by an authorised release of mine affected water.
F22	The REMP must: - assess the condition or state of receiving waters, including upstream conditions, spatially within the REMP area, considering background water quality characteristics based on accurate and reliable monitoring data that takes into consideration temporal variation (e.g. seasonality); - be designed to facilitate assessment against water quality objectives for the relevant environmental values that need to be protected; - include monitoring from background reference sites (e.g. upstream or background) and downstream sites from the release (as a minimum, the locations specified in Table F7 – Receiving Water Upstream Background and Downstream Monitoring Points); - specify the frequency and timing of sampling required in order to reliably assess ambient conditions and to provide sufficient data to derive site specific background reference values in accordance with the <i>Queensland Water Quality Guidelines 2009</i>. This should include monitoring during periods of natural flow irrespective of mine or other discharges; - include monitoring and assessment of dissolved oxygen saturation, temperature and all water quality parameters listed in Table F2 – Mine Affected Water Release Limits and Table F3 – Release Contaminant Trigger Investigation Levels; - include, where appropriate, monitoring of metals/metalloids in sediments (in accordance with ANZECC & ARMCANZ 2000, BATLEY and/or the most recent version of AS5667.1 Guidance on Sampling of Bottom Sediments); - include, where appropriate, monitoring of macroinvertebrates in accordance with the AusRivas methodology; - apply procedures and/or guidelines from ANZECC & ARMCANZ 2000 and other relevant guideline documents; - describe sampling and analysis methods and quality assurance and control; and - incorporate stream flow and hydrological information in the interpretations of water quality and biological data.

F23	A report outlining the findings of the REMP, including all monitoring results and interpretations in accordance with conditions F21 and F22 must be prepared annually. This report must include the following: a) an assessment of background reference water quality; b) the condition of downstream water quality compared against water quality objectives; and c) the suitability of current discharge limits to protect downstream environmental values.
F24	Water reuse Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this environmental authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder or a third party for the purpose of: a) supplying stock water subject to compliance with the quality release limits specified in Table F8 – Stock Water Release Limits; or b) supplying irrigation water subject to compliance with quality release limits in Table F9 – Irrigation Water Release Limits; or c) supplying water for construction and/or road maintenance in accordance with the conditions of this environmental authority; or d) supplying water to any operation licensed for either ERA13 (mining black coal) or ERA31 (mineral processing). The volume, pH and electrical conductivity of water transferred must be monitored and recorded.

Table F8 – Stock Water Release Limits

Quality Characteristic	Units	Minimum	Maximum
pH	pH units	6.5	8.5
Electrical Conductivity	µS/cm	N/A	5000

Table F9 – Irrigation Water Release Limits

Quality Characteristic	Units	Minimum	Maximum
pH	pH units	6.5	8.5
Electrical Conductivity	µS/cm	N/A	Site specific value determined in accordance with ANZECC & ARMCANZ (2000) Irrigation Guidelines

F25	If the responsibility for mine affected water is given or transferred to another person in accordance with condition F24: a) the responsibility for the mine affected water must only be given or transferred in accordance with a written agreement (the third party agreement); and b) the third party agreement must include a commitment from the person utilising the mine affected water to use it in such a way as to prevent environmental harm or public health incidents and specifically make the persons aware of the General Environmental Duty (GED) under section 319 of the <i>Environmental Protection Act 1994</i>, environmental sustainability of the water disposal and protection of environmental values of waters; and c) the third party agreement must be signed by both parties to the agreement.
F26	Water general All determinations of water quality and biological monitoring must be: a) performed by a person or body possessing appropriate experience and qualifications to perform the required measurements; b) made in accordance with methods prescribed in the latest edition of the administering authority's <i>Monitoring and Sampling Manual</i>; c) collected from the monitoring locations identified within this environmental authority, within ten hours of each other where possible; d) carried out on representative samples; and e) analysed at a laboratory accredited (e.g. NATA) for the method of analysis being used. <i>Note: Condition F26 requires the Monitoring and Sampling Manual to be followed and where it is not followed because of exceptional circumstances this should be explained and reported with the results.</i>
F27	The release of any contaminants as permitted by this environmental authority, directly or indirectly to waters, other than internal water management infrastructure that is installed and operated in accordance with a Water Management Plan that complies with conditions F29 to F33 inclusive: a) must not produce any visible discolouration of receiving waters; and b) must not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter.

F28	Annual water monitoring reporting The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format with each annual return: a) the date on which the sample was taken; b) the time at which the sample was taken; c) the monitoring point at which the sample was taken; d) the measured or estimated daily quantity of mine affected water released from all release points; e) the release flow rate at the time of sampling for each release point; f) the results of all monitoring and details of any exceedances of the conditions of this environmental authority; and g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.
F29	Water Management Plan A Water Management Plan must be developed by an appropriately qualified person(s) and implemented for all mining activities.
F30	The Water Management Plan required by condition F29 must: a) provide for effective management of actual and potential environmental impacts resulting from water management associated with the mining activity carried out under this environmental authority; and b) be developed in accordance with administering authority's guideline <i>Preparation of water management plans for mining activities</i> and include: i. a study of the source of contaminants; ii. a water balance model for the site; iii. a water management system for the site; iv. measures to manage and prevent saline drainage; v. measures to manage and prevent acid rock drainage; vi. contingency procedures for emergencies; and vii. a program for monitoring and review of the effectiveness of the Water Management Plan.
F31	The Water Management Plan required by condition F29 must be reviewed each calendar year and a report prepared by an appropriately qualified person(s). The report must: a) assess the plan against the requirements under condition F30; b) include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year; and c) identify any amendments made to the Water Management Plan following the review.

F32	The environmental authority holder must attach to the review report required by condition F31 a written response to the report and recommended actions, detailing the actions taken or to be taken by the environmental authority holder on stated dates: a) to ensure compliance with this environmental authority; and b) to prevent a recurrence of any non-compliance issues identified.
F33	The review report required by condition F31 and the written response to the review report required by condition F32 must be submitted to the administering authority with the subsequent annual return under the signature of the appointed signatory for the annual return.
F34	Saline drainage The environmental authority holder must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of saline drainage.
F35	Acid rock drainage The environmental authority holder must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of acid rock drainage.
F36	Stormwater and water sediment controls An Erosion and Sediment Control Plan must be developed by an appropriately qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of stormwater.
F37	Stormwater, other than mine affected water, is permitted to be released to waters from: a) erosion and sediment control structures that are installed and operated in accordance with the Erosion and Sediment Control Plan required by condition F36; and b) water management infrastructure that is installed and operated, in accordance with a Water Management Plan that complies with conditions F29 to F33 inclusive, for the purpose of ensuring water does not become mine affected water.
F38	The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any receiving waters.
F39	Any spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any stormwater drainage system or receiving waters.
F40	Treated sewage effluent Sewage may be treated by a sewage treatment plant/s with a daily peak design capacity less than 21 equivalent persons (EP). Any other sewage must be removed as waste in accordance with condition D6 and D7.

F41	Dust suppression and civil construction limits Associated water may be used for the purpose of civil construction and dust suppression on haul roads and ROM areas only. The water cannot be used if contaminant or water quality concentrations are capable of causing environmental harm. The water is not authorised to be directly released into or near watercourses.
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Schedule G: Structures	
Condition number	Condition
G1	Assessment of consequence category The consequence category of any structure must be assessed by a suitably qualified and experienced person, in accordance with the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)</i>, at the following times: a) prior to the design and construction of the structure, if it is not an existing structure; or b) prior to any change in its purpose or the nature of its stored contents.
G2	A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.
G3	Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)</i> .
G4	Design and construction of a regulated structure Conditions G5 to G9 inclusive do not apply to existing structures. <i>NOTE: Construction of a dam includes modification of an existing dam – see definitions.</i>
G5	All regulated structures must be designed by, and constructed under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)</i>. <i>NOTE: Certification of design and construction may be undertaken by different persons.</i>
G6	Construction of a regulated structure is prohibited unless the environmental authority holder has submitted a consequence category assessment report and certification to the administering authority has been certified by a suitably qualified and experienced person for the design and design plan and the associated operating procedures in compliance with the relevant condition of this environmental authority.
G7	Certification must be provided by the suitably qualified and experienced person who oversees the preparation of the design plan in the form set out in the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)</i> , and must be recorded in the Register of Regulated Structures.

G8	Regulated structures must: a) be designed and constructed in accordance with and conform to the requirements of the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)</i>; b) be designed and constructed with due consideration given to ensuring that the design integrity would not be compromised on account of: i. floodwaters from entering the regulated dam from any watercourse or drainage line; and ii. wall failure due to erosion by floodwaters arising from any watercourse or drainage line. c) for regulated dams associated with a failure to contain – seepage, have the floor and sides of the dam designed and constructed to prevent or minimise the passage of the wetting front and any entrained contaminants through either the floor or sides of the dam during the operational life of the dam and for any period of decommissioning and rehabilitation of the dam.
G9	Certification by the suitably qualified and experienced person who supervises the construction must be submitted to the administering authority on the completion of construction of the regulated structure, and state that: a) the 'as constructed' drawings and specifications meet the original intent of the design plan for that regulated structure; and b) construction of the regulated structure is in accordance with the design plan.
G10	Operation of a regulated structure Operation of a regulated structure, except for an existing structure, is prohibited unless the environmental authority holder has submitted to the administering authority: a) one paper copy and one electronic copy of the design plan and certification of the 'design plan' in accordance with condition G6; b) a set of 'as constructed' drawings and specifications; c) certification of those 'as constructed drawings and specifications' in accordance with condition G9; d) where the regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, a copy of the certified system design plan; e) the requirements of this environmental authority relating to the construction of the regulated structure have been met; f) the environmental authority holder has entered the details, required under this environmental authority, into the Register of Regulated Structures; and g) there is a current operational plan for the regulated structures.

G11	For existing structures that are regulated structures: a) where the existing structure that is a regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, the environmental authority holder must submit to the administering authority within twelve (12) months of the commencement of this condition a copy of the certified system design plan including that structure; and b) there must be a current operational plan for the existing structures.
G12	Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in a manner that is consistent with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.
G13	Mandatory Reporting Level Conditions G14 to G17 inclusive only apply to regulated structures which have not been certified as low consequence category for 'failure to contain – overtopping'.
G14	The Mandatory Reporting Level (the MRL) must be marked on a regulated dam in such a way that, during routine inspections of that dam, it is clearly observable.
G15	The environmental authority holder must, as soon as practical and within forty-eight (48) hours of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.
G16	The environmental authority holder must immediately on becoming aware that the MRL has been reached, act to prevent the occurrence of any unauthorised discharge from the regulated dam.
G17	The environmental authority holder must record any changes to the MRL in the Register of Regulated Structures.
G18	Design Storage Allowance The environmental authority holder must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to 1 July of each year.
G19	By 1 November of each year, storage capacity must be available in each regulated dam (or network of linked containment systems with a shared DSA volume), to meet the Design Storage Allowance (DSA) volume for the dam (or network of linked containment systems).
G20	The environmental authority holder must notify the administering authority as soon as possible and within forty-eight (48) hours of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year.

G21	The environmental authority holder must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.
G22	Annual inspection report Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.
G23	At each annual inspection, the condition and adequacy of all components of the regulated structure must be assessed and a suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and include recommended actions to ensure the integrity of the regulated structure.
G24	The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)</i> .
G25	The environmental authority holder must: a) within twenty (20) business days of receipt of the annual inspection report, provide to the administering authority: i. the recommendations section of the annual inspection report; and ii. if applicable, any actions being taken in response to those recommendations; and b) if, following receipt of the recommendations and (if applicable) actions, the administering authority requests a full copy of the annual inspection report from the environmental authority holder, provide this to the administering authority within ten (10) business days of receipt of the request.
G26	Transfer arrangements The environmental authority holder must provide a copy of any reports, documentation and certifications prepared under this environmental authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.
G27	Decommissioning and rehabilitation Dams must not be abandoned but be either: a) decommissioned and rehabilitated to achieve compliance with condition G28; or b) be left in-situ for a beneficial use(s) provided that: i. it no longer contains contaminants that will migrate into the environment; and ii. it contains water of a quality that is demonstrated to be suitable for its intended beneficial use(s); and iii. the administering authority, the environmental authority holder and the landholder agree in writing that the dam will be used by the landholder following the cessation of the environmentally relevant activity(ies).

G28	After decommissioning, all significantly disturbed land caused by the carrying out of the environmentally relevant activity(ies) must be rehabilitated to meet the following final acceptance criteria: a) the landform is safe for humans and fauna; b) the landform is stable with no subsidence or erosion gullies for at least three (3) years; c) any contaminated land (e.g. contaminated soils) is remediated and rehabilitated d) not allowing for acid mine drainage; or e) there is no ongoing contamination to waters (including groundwater); f) rehabilitation is undertaken in a manner such that any actual or potential acid sulphate soils on the area of significant disturbance are treated to prevent or minimise environmental harm in accordance with the <i>Instructions for the treatment and management of acid sulfate soils (2001)</i>; g) all significantly disturbed land is reinstated to the pre-disturbed soil suitability class; h) for land that is not being cultivated by the landholder: i. groundcover, that is not a declared pest species is established and self-sustaining ii. vegetation of similar species richness and species diversity to pre-selected analogue sites is established and self-sustaining, and iii. the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the mining activity(ies). i) for land that is to be cultivated by the landholder, cover crop is revegetated, unless the landholder will be preparing the site for cropping within 3 months of mining activities being completed.
G29	Register of Regulated Structures A Register of Regulated Structures must be established and maintained by the environmental authority holder for each regulated structure.
G30	The environmental authority holder must provisionally enter the required information in the Register of Regulated Structures when a design plan for a regulated structure is submitted to the administering authority.
G31	The environmental authority holder must make a final entry of the required information in the Register of Regulated Structures once compliance with condition G10 and G11 has been achieved.
G32	The environmental authority holder must ensure that the information contained in the Register of Regulated Structures is current and complete on any given day.
G33	All entries in the Register of Regulated Structures must be approved by the chief executive officer for the environmental authority holder, or their delegate, as being accurate and correct.
G34	The environmental authority holder must, at the same time as providing the annual return, supply to the administering authority a copy of the records contained in the Register of Regulated Structures, in the electronic format required by the administering authority.

G35	Transitional arrangements All existing structures that have not been assessed in accordance with either, the Manual or the former <i>Manual for Assessing Hazard Categories and Hydraulic Performance of Dams</i>, must be assessed and certified in accordance with the Manual within six (6) months of amendment of the environmental authority adopting this schedule.
G36	All existing structures must subsequently comply with the timetable for any further assessments in accordance with the Manual specified in Table G1 – Transitional Requirements for Existing Structures, depending on the consequence category for each existing structure assessed in the most recent previous certification for that structure.
G37	Table G1 – Transitional Requirements for Existing Structures ceases to apply for a structure once any of the following events has occurred: a) it has been brought into compliance with the hydraulic performance criteria applicable to the structure under the Manual; or b) it has been decommissioned; or c) it has been certified as no longer being assessed as a regulated structure.
G38	Certification of the transitional assessment required by G35 and G36 (as applicable) must be provided to the administering authority within six (6) months of amendment of the environmental authority adopting this schedule.

Table G1 – Transitional Requirements for Existing Structures

Transition period required for existing structures to achieve the requirements of the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)</i>			
Compliance with Criteria	High	Significant	Low
>90% and a history of good compliance performance in last 5 years	No transition required	No transition required	No transitional conditions apply. Review consequence assessment every 7 years.
>70% to ≤90%	Within 7 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 10 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	No transitional conditions apply. Review consequence assessment every 7 years.
>50 to ≤70%	Within 5 years unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 7 years unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Review consequence assessment every 7 years.
≤50%	Within 5 years or as per compliance requirements (e.g. TEP timing)	Within 5 years or as per compliance requirements (e.g. TEP timing)	Review consequence assessment every 5 years.

Schedule H: Groundwater	
Condition number	Condition
H1	Groundwater The holder of this environmental authority must not release contaminants to groundwater
H2	Groundwater Monitoring and Management Program A Groundwater Monitoring and Management Program must be: a) developed by an appropriately qualified person; and b) implemented by the environmental authority holder for all stages of mining activities
H3	The Groundwater Monitoring and Management Program required by condition H2 must: a) identify potential groundwater impacts due to the mining activities; b) include a site conceptual groundwater model; c) describe the sampling and monitoring methodology; d) detail an appropriate quality assurance and quality control program; and e) provide the process for notifying the administering authority and investigating exceedances in accordance with conditions H4-H5
H4	Groundwater Monitoring Groundwater quality and standing water levels must be monitored: a) at the locations and at the frequencies specified in Table H1 – Groundwater Monitoring Program; and b) for the quality characteristics specified in Table H2 – Groundwater Trigger Levels
H5	If the groundwater contaminant triggers defined in Table H2 – Groundwater Trigger Levels are exceeded on three (3) consecutive monitoring occasions, the environmental authority holder must complete an investigation into the potential for environmental harm and notify the administering authority within twenty (20) business days of receiving the analysis results.
H6	The Groundwater Monitoring and Management Program must be reviewed by 31 November 2023 and thereafter every two (2) years by an appropriately qualified person. The review report must: a) analyse the results of groundwater monitoring to: i) describe any impacts to groundwater levels and groundwater quality due to the mining activity; ii) determine trends in groundwater levels and groundwater quality; b) assess the adequacy of the Groundwater Monitoring and Management Program; and c) provide recommendations to the environmental authority holder to address the findings of parts (a) and (b) of the review.

H7	Within twenty (20) business days of receiving the review report required by condition H6, the environmental authority holder must provide to the administering authority: a) the review report; b) if applicable, any actions being taken by the environmental authority holder to address the recommendations the review report; and c) if action is not being taken to address a recommendation, the environmental authority holder must provide justification for not taking action.
H8	Annual groundwater monitoring data must be submitted to the administering authority via WaTERS by 30 September each calendar year.
H9	Bore Construction The construction, management, maintenance and decommissioning of groundwater monitoring bores must be undertaken in a manner that: a) prevents contaminants entering the groundwater; b) ensures the integrity of bores to obtain representative groundwater samples from the target aquifer; and c) maintains the hydrogeological environment within the aquifer.

Table H1 – Groundwater Monitoring Program

Monitoring Location	Easting (GDA94)	Northing (GDA94)	Monitoring Frequency
Interpretation Bores			
MB4 (RN141750)	630430	7563386	Quarterly
Compliance Bores			
MB3A (RN141748)	630061	7562378	Quarterly
MB3B (RN141749)	630054	7562368	Quarterly
MB11A	631821	7562723	Quarterly
MB11B	631823	7562724	Quarterly

Table H2 – Groundwater Trigger Levels

Quality Characteristic	Units	Trigger Levels				
		MB4	MB3A	MB3B	MB11A	MB11B
Water Level	RL	Monitored for interpretative reasons only – no triggers apply	Groundwater drawdown fluctuations in excess of two (2) metres per year ¹			
pH	pH units		6.5 - 8.5	6.5 - 8.5	6.5 – 8.5 ²	6.5 – 8.5 ²
EC	µS/cm		16,000	16,000	16,000 ²	16,000 ²
Sulfate	mg/L		398	398	398 ²	398 ²
Dissolved Aluminium	mg/L		0.055	0.055	0.055 ²	0.055 ²
Dissolved Antimony	mg/L		0.009	0.009 ²	0.009 ²	0.009 ²
Dissolved Arsenic	mg/L		0.013	0.013	0.013 ²	0.013 ²
Dissolved Iron	mg/L		0.70	0.70	0.70 ²	0.70 ²
Dissolved Mercury	mg/L		0.0006	0.0006	0.0006 ²	0.0006 ²
Dissolved Molybdenum	mg/L		0.034	0.034 ²	0.034 ²	0.034 ²
Dissolved Selenium	mg/L		0.011	0.011	0.011 ²	0.011 ²
Dissolved Silver	mg/L		0.001	0.001 ²	0.001 ²	0.001 ²
Total recoverable hydrocarbons C6-C10	µg/L		20	20	20 ²	20 ²
Total recoverable hydrocarbons >C10-C40	µg/L		100	100	100 ²	100 ²

NOTES:

1. Notification in accordance with conditions H5 does not apply in the event that the standing water level monitoring results indicate a correlation between the Process Water Dam and monitoring bore MB3A.
2. Fewer than the recommended 18 data points have been used to derive these trigger levels, therefore the adopted trigger levels are considered interim and may require subsequent revision.

END OF CONDITIONS

Definitions

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

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

- a) vegetation establishment, survival and succession;
- b) vegetation productivity, sustained growth and structure development;
- c) fauna colonisation and habitat development;
- d) ecosystem processes such as soil development and nutrient cycling, and the recolonisation of specific fauna groups such as collembola, mites and termites which are involved in these processes;
- e) microbiological studies including recolonisation by mycorrhizal fungi, microbial biomass and respiration;
- f) effects of various establishment treatments such as deep ripping, topsoil handling, seeding and fertiliser application on vegetation growth and development;
- g) resilience of vegetation to disease, insect attack, drought and fire; and
- h) vegetation water use and effects on ground water levels and catchment yields.

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

Administering authority is the agency or department that administers the environmental authority provisions under the *Environmental Protection Act 1994*.

Alternative arrangement in relation to a sensitive place or a commercial place, means:

- a) A written agreement:
 - i. between the environmental authority holder and a third party;
 - ii. that identifies a particular type(s) of environmental nuisance;
 - iii. about the way in which the particular environmental nuisance impact(s) will be dealt with;
 - iv. at a particular location; and
 - v. for a defined period of time.
- b) An alternative arrangement must make clear to the third party that by entering in to the agreement that:
 - i. their place will be excluded as a sensitive place or commercial place; and
 - ii. the consequences of exclusion as a sensitive place or commercial place.

Note: An alternative arrangement may include, but is not limited to, details of the nuisance abatement measures to be implemented, provision of alternative accommodation, or agreement between the parties that the location will not be considered a sensitive place or commercial place for the purposes of the Environmental Authority, for the duration of the alternative arrangement. The written agreement may be in any form, with some examples being a lease, or an agistment, or a conduct and compensation agreement under the *Mineral Resources Act 1989*.

Annual exceedance probability or AEP means the probability that at least one event in excess of a particular magnitude will occur in any given year.

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

- a) against recommendations contained in previous annual inspections reports;
- b) against recognised dam safety deficiency indicators;
- c) for changes in circumstances potentially leading to a change in consequence category;
- d) for conformance with the conditions of this authority;
- e) for conformance with the 'as constructed' drawings;
- f) for the adequacy of the available storage in each regulated dam, based on an actual observation or observations taken after 31 May each year but prior to 1 November of that year, of accumulated sediment, state of the containment barrier and the level of liquids in the dam (or network of linked containment systems); and
- g) for evidence of conformance with the current operational plan.

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

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

Assessed or assessment by a suitably qualified and experienced person in relation to a consequence assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit of the assessment:

- a) exactly what has been assessed and the precise nature of that determination;
- b) the relevant legislative, regulatory and technical criteria on which the assessment has been based;
- c) the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and
- d) the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

Associated works in relation to a dam, means:

- a) operations of any kind and all things constructed, erected or installed for that dam; and
- b) any land used for those operations.

Authority means an environmental authority or a development approval.

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

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

- a) of benefit to that owner in that it adds real value to their business or to the general community;
- b) in accordance with relevant provisions of the *Environmental Protection Act 1994*;
- c) sustainable by virtue of written undertakings given by that owner to maintain that dam; and
- d) the transfer and use have been approved or authorised under any relevant legislation.

Certification in relation to regulated structures, means assessment and approval must be undertaken by a suitably qualified and experienced person in relation to any assessment or documentation required by the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)* or this environmental authority, including design plans, 'as constructed' drawings and specifications, construction, operation or an annual report regarding regulated structures, undertaken in accordance with the Board of Professional Engineers of Queensland Policy Certification by RPEQs (ID: 1.4 (2A)).

Certifying, certify or certified have a corresponding meaning as 'certification' in relation to regulated structures.

Chemical means:

- a) an agricultural chemical product or veterinary chemical product within the meaning of the *Agricultural and Veterinary Chemicals Code Act 1994 (Commonwealth)*; or
- b) a dangerous good under the dangerous goods code; or
- c) a lead hazardous substance within the meaning of the *Workplace Health and Safety Regulation 1997*; or
- d) a drug or poison in the Standard for the Uniform Scheduling of Drugs and Poisons prepared by the Australian Health Ministers' Advisory Council and published by the Commonwealth; or
- e) any substance used as, or intended for use as:
 - i. a pesticide, insecticide, fungicide, herbicide, rodenticide, nematocide, miticide, fumigant or related product; or
 - ii. a surface active agent, including, for example, soap or related detergent; or
 - iii. a paint solvent, pigment, dye, printing ink, industrial polish, adhesive, sealant, food additive, bleach, sanitiser, disinfectant, or biocide; or
 - iv. a fertiliser for agricultural, horticultural or garden use; or
- f) a substance used for, or intended for use for:
 - i. mineral processing or treatment of metal, pulp and paper, textile, timber, water or wastewater; or
 - ii. manufacture of plastic or synthetic rubber.

Commercial place means:

- a) A work place that is used as:
 - i. an office; or
 - ii. a place of business; or
 - iii. a place used for commercial purposes.
- b) Despite paragraph (a), the following places are not commercial places:
 - i. subject to paragraph (c), a place that is the subject of an alternative arrangement; or
 - ii. places that are part of the mining activity; or
 - iii. employees accommodation or public roads; or
 - iv. a property owned or leased by one or more of the environmental authority holders, or a related company, whether or not it is subject to an alternative arrangement.
- c) A place that is the subject of a current alternative arrangement in relation to a particular type(s) of environmental nuisance, is not a commercial place for the purposes of that type(s) of environmental nuisance, however remains a commercial place for the purpose of other types of environmental nuisances.

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

Consequence category means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)*.

Construction or constructed in relation to a dam includes building a new dam and modifying or lifting an existing dam, but does not include investigations and testing necessary for the purpose of preparing a design plan.

Contaminate means to render impure by contact or mixture.

Contaminated means the substance has come into contact with a contaminant.

Contaminant can be

- a) a gas, liquid or solid; or
- b) an odour; or
- c) an organism (whether alive or dead), including a virus; or
- d) energy, including noise, heat, radioactivity and electromagnetic radiation; or
- e) a combination of contaminants.

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

Dam means a land-based structure or a void that contains, diverts or controls flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works.

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

Design plan is a document setting out how all identified consequence scenarios are addressed in the planned design and operation of a regulated structure.

Design storage allowance or DSA means an available volume, estimated in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)* published by the administering authority, must be provided in a dam as at 1 November each year in order to prevent a discharge from that dam to an annual exceedance probability (AEP) specified in that Manual.

Designer for the purposes of a regulated dam, means the certifier of the design plan for the regulated dam.

Disturbance of land includes:

- a) compacting, removing, covering, exposing or stockpiling of earth;
- b) removal or destruction of vegetation or topsoil or both to an extent where the land has been made susceptible to erosion;
- c) carrying out mining within a watercourse, waterway, wetland or lake;
- d) the submersion of areas by tailings or hazardous contaminant storage and dam/structure walls;
- e) temporary infrastructure, including any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc.) which is to be removed after the mining activity has ceased; or
- f) releasing of contaminants into the soil, or underlying geological strata.

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

- a) areas off lease (e.g. roads or tracks which provide access to the mining lease);
- b) areas previously disturbed which have achieved the rehabilitation outcomes;
- c) by agreement with the administering authority, areas previously disturbed which have not achieved the rehabilitation objective(s) due to circumstances beyond the control of the mine operator (such as climatic conditions);
- d) areas under permanent infrastructure. Permanent infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc.) which is to be left by agreement with the landowner; or
- e) disturbance that pre-existed the grant of the tenure.

End of pipe means the location at which water is released to waters or land.

Environmental authority means an environmental authority granted in relation to an environmentally relevant activity under the *Environmental Protection Act 1994*.

Environmental authority holder means the holder of this environmental authority.

Environmentally relevant activity means an environmentally relevant activity as defined under section 18 of the *Environmental Protection Act 1994*.

Existing authority has the meaning in section 94 of the *Environmental Offsets Act 2014*.

Existing structure means a structure that was in existence prior to 23 January 2017.

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

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

Holder, for a mining tenement, means a holder of the tenement under the *Mineral Resources Act 1989*, and the holder of the associated environmental authority under the *Environmental Protection Act 1994*.

Hydraulic performance means the capacity of a regulated dam to contain or safely pass flowable substances based on the design criteria specified for the relevant consequence category in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)*.

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

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

LA_{1, adj, 10 min} means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 1% of any 10 minute measurement period, using Fast response.

Lake includes:

- a) lagoon, swamp or other natural collection of water, whether permanent or intermittent; and
- b) the bed and banks and any other element confining or containing the water.

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

Land use describes the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

Levee means an embankment that only provides for the containment and diversion of stormwater or flood flows from a contributing catchment, or containment and diversion of flowable materials resulting from releases from other works, during the progress of those stormwater or flood flows or those releases; and does not store any significant volume of water or flowable substances at any other times.

Low consequence dam means any dam that is not a high or significant consequence category as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)*.

Mandatory reporting level or MRL means a warning and reporting level determined in accordance with the criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)* published by the administering authority.

Manual means the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)* published by the administering authority.

Matters of state environmental significance or MSES has the meaning in schedule 2 of the *Environmental Offsets Regulation 2014*.

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

mbgl means metres below ground level.

mg/L means milligrams per litre.

Mine affected water means the following types of water:

- a) pit water, tailings dam water, processing plant water;
- b) water contaminated by a mining activity which would have been an environmentally relevant activity under Schedule 2 of the *Environmental Protection Regulation 2008* if it had not formed part of the mining activity;
- c) rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage runoff containing sediment only, provided that this water has not been mixed with pit water, tailings dam water, processing plant water or workshop water;
- d) groundwater which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated;
- e) groundwater from the mine's dewatering activities; or
- f) a mix of mine affected water (under any of paragraphs (a) to (e)) and other water.

Mineral means a substance which normally occurs naturally as part of the earth's crust or is dissolved or suspended in water within or upon the earth's crust and includes a substance which may be extracted from such a substance, and includes:

- a) clay if mined for use for its ceramic properties, kaolin and bentonite;
- b) foundry sand;
- c) hydrocarbons and other substances or matter occurring in association with shale or coal and necessarily mined, extracted, produced or released by or in connection with mining for shale or coal or for the purpose of enhancing the safety of current or future mining operations for coal or the extraction or production of mineral oil there from;
- d) limestone if mined for use for its chemical properties;
- e) marble;
- f) mineral oil or gas extracted or produced from shale or coal by in situ processes;
- g) peat;
- h) salt including brine;
- i) shale from which mineral oil may be extracted or produced;
- j) silica, including silica sand, if mined for use for its chemical properties; or
- k) rock mined in block or slab form for building or monumental purposes.

But does not include:

- a) living matter;
- b) petroleum within the meaning of the *Petroleum Act 1923*;
- c) soil, sand, gravel or rock (other than rock mined in block or slab form for building or monumental purposes) to be used or to be supplied for use as such, whether intact or in broken form; or
- d) water.

Mining activities means the activities:

- a) authorised as per the definition in section 110 of the *Environmental Protection Act 1994*; and
- b) all environmentally relevant activities authorised under this environmental authority.

Modification or modifying (see definition of 'construction').

Natural flow means the flow of water through waters caused by nature.

Noxious means harmful or injurious to health or physical wellbeing.

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

Operational plan includes:

- a) normal operating procedures and rules (including clear documentation and definition of process inputs in the DSA allowance); and
- b) contingency and emergency action plans including operating procedures designed to avoid and/or minimise environmental impacts including threats to human life resulting from any overtopping or loss of structural integrity of the regulated structure.

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

Receiving environment, in relation to an activity that causes or may cause environmental harm, means the part of the environment to which the harm is, or may be, caused. The receiving environment includes (but is not limited to):

- a) a watercourse;
- b) groundwater;
- c) land; and
- d) sediments.

Receiving waters means the waters into which this environmental authority authorises releases of mine affected water.

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

Register of Regulated Structures includes:

- a) date of entry in the register;
- b) name of the dam, its purpose and intended/actual contents;
- c) the consequence category of the dam as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)*;
- d) dates, names, and reference for the design plan plus dates, names, and reference numbers of all document(s) lodged as part of a design plan for the dam;
- e) name and qualifications of the suitably qualified and experienced person who certified the design plan and 'as constructed' drawings;
- f) for the regulated dam, other than in relation to any levees –
 - i. the dimensions (metres) and surface area (hectares) of the dam measured at the footprint of the dam;
 - ii. coordinates (latitude and longitude in GDA94) within five metres at any point from the outside of the dam including its storage area
 - iii. dam crest volume (megalitres);
 - iv. spillway crest level (metres AHD);
 - v. maximum operating level (metres AHD);
 - vi. storage rating table of stored volume versus level (metres AHD);
 - vii. design storage allowance (megalitres) and associated level of the dam (metres AHD);
 - viii. mandatory reporting level (metres AHD);
- g) the design plan title and reference relevant to the dam;
- h) the date construction was certified as compliant with the design plan;
- i) the name and details of the suitably qualified and experienced person who certified that the constructed dam was compliant with the design plan;
- j) details of the composition and construction of any liner;
- k) the system for the detection of any leakage through the floor and sides of the dam;
- l) dates when the regulated dam underwent an annual inspection for structural and operational adequacy, and to ascertain the available storage volume for 1 November of any year;
- m) dates when recommendations and actions arising from the annual inspection were provided to the administering authority; and
- n) dam water quality as obtained from any monitoring required under this authority as at 1 November of each year.

Regulated dam means any dam in the significant or high consequence category as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (Version 4, 10 April 2014) (EM635)* published by the administering authority.

Regulated structure includes land-based containment structures, levees, bunds and voids, but not a tank or container designed and constructed to an Australian Standard that deals with strength and structural integrity.

Regulated waste is defined in the *Environmental Protection Regulation 2008*.

Rehabilitation means the process of reshaping and revegetating land to restore it to a stable landform and in accordance with the acceptance criteria set out in this environmental authority and, where relevant, includes remediation of contaminated land.

Representative means a sample set that covers the variance in monitoring or other data due to either natural changes or operational phases of the mining activities.

o)

Saline drainage is the movement of waters, contaminated with salt(s), as a result of the mining activity.

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

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

Sensitive place means:

- a) Any of the following:
 - i. a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
 - ii. a motel, hotel or hostel; or
 - iii. an educational institution; or
 - iv. a medical centre or hospital; or
 - v. a protected area; or
 - vi. a public park or gardens.
- b) Despite paragraph (a), the following places are not sensitive places:
 - i. subject to paragraph (c), a place that is the subject of an alternative arrangement; or
 - ii. a mining camp (i.e. accommodation and ancillary facilities for mine employees or contractors or both, associated with the mine the subject of the environmental authority), whether or not the mining camp is located within a mining tenement that is part of the mining project the subject of the environmental authority. For example, the mining camp might be located on neighbouring land owned or leased by the same company as one of the environmental authority holders for the mining project, or a related company; or
 - iii. a property owned or leased by one or more of the environmental authority holders, or a related company, whether or not it is subject to an alternative arrangement.
- c) A place that is the subject of a current alternative arrangement in relation to a particular type(s) of environmental nuisance, is not a sensitive place for the purposes of that type(s) of environmental nuisance, however remains a sensitive place for the purpose of other types of environmental nuisances.

Sewage means the used water of persons to be treated at a sewage treatment plant.

Spillway means a weir, channel, conduit, tunnel, gate or other structure designed to permit discharges from the dam, normally under flood conditions or in anticipation of flood conditions.

Stable in relation to land, means land form dimensions are or will be stable within tolerable limits now and in the foreseeable future. Stability includes consideration of geotechnical stability, settlement and consolidation allowances, bearing capacity (trafficability), erosion resistance and geochemical stability with respect to seepage, leachate and related contaminant generation.

Stormwater means all surface water runoff from rainfall.

Structure means dam or levee.

Suitably qualified and experienced person in relation to regulated structures means a person who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 2002*, and has demonstrated competency and relevant experience:

- a) for regulated dams, an RPEQ who is a civil engineer with the required qualifications in dam safety and dam design.
- b) for regulated levees, an RPEQ who is a civil engineer with the required qualifications in the design of flood protection embankments.

Note: It is permissible that a suitably qualified and experienced person obtain subsidiary certification from an RPEQ who has demonstrated competence and relevant experience in either geomechanics, hydraulic design or engineering hydrology.

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

The Act means the *Environmental Protection Act 1994*.

Void means any constructed, open excavation in the ground.

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

Waste and resource management hierarchy has the meaning given by section 9 of the *Waste Reduction and Recycling Act 2011*.

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

Watercourse has the meaning in Schedule 4 of the *Environmental Protection Act 1994* and means a river, creek or stream in which water flows permanently or intermittently:

- a) in a natural channel, whether artificially improved or not; or
- b) in an artificial channel that has changed the course of the watercourse.

Watercourse includes the bed and banks and any other element of a river, creek or stream confining or containing water.

Waters includes all or any part of a river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water in natural or artificial watercourses, bed and banks of a watercourse, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater.

WaTERS means the Water Tracking and Electronic Reporting System.

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

µg/L means micrograms per litre.

µS/cm means microsiemens per centimetre.

END OF DEFINITIONS

END OF ENVIRONMENTAL AUTHORITY

Notice

Environmental Protection Act 1994

Progressive rehabilitation and closure plan transition notice

This statutory notice is issued by the administering authority¹ under section 754 of the Environmental Protection Act 1994 to advise you that you must submit a proposed Progressive rehabilitation and closure plan (PRC plan).

BHP Billiton Mitsui Coal Pty Ltd
Level 14, 480 Queen Street
BRISBANE CITY QLD 4000

Email: peter.conway@bhp.com; trudy.mazucco@bhp.com

Attention: Peter Conway & Trudy Mazucco

Our reference: EPML00819113

Transition Notice for a PRC plan

1 Environmental authority details

Environmental authority EPML00819113 dated 15 November 2019 issued to BHP Billiton Mitsui Coal Pty Ltd.

Land description: ML70312.

2 Required action

The holder(s) of environmental authority EPML00819113 must submit a proposed PRC plan that meets the requirements in sections 126C and 126D of the *Environmental Protection Act 1994*, pursuant to section 754 of the *Environmental Protection Act 1994*. The holder(s) must submit the proposed PRC plan to the administering authority, by **01 December 2021**.

3 Transitional provisions

Pursuant to the transitional provisions in section 754(3) of the *Environmental Protection Act 1994*, the holder(s) of the environmental authority is/are not required to comply with the requirements under section 126C(1)(g) or (h), or 126D(2) or (3) of the *Environmental Protection Act 1994* if—

- (a) an outcome for the land has been identified under a land outcome document; and
- (b) the outcome for the land is the same as, or substantially similar to, the outcome for the land if it were a non-use management area under a PRCP schedule.

¹ The Department of Environment and Science is the administering authority under the *Environmental Protection Act 1994*.

Progressive rehabilitation and closure plan transition notice

A land outcome document is defined under section 750 of the *Environmental Protection Act 1994*.

Section 126C(1)(g) or (h), or 126D(2) of the *Environmental Protection Act 1994* require reasons and evidence to be provided to support a proposed non-use management area.

Section 126D(3) of the *Environmental Protection Act 1994* provides for any void that is contained wholly or partly in a flood plain to be rehabilitated to a stable condition.

In accordance with section 754(4) of the *Environmental Protection Act 1994*, if a land outcome document does not state sufficient detail to identify either the location or area of the land to which the outcome relates, the proposed PRC plan must state—

- (a) if the area is not identified — how the total area of the land to which the outcome relates will be minimised; and
- (b) if the location is not identified — how the mining environmental authority holder will ensure the location of the land to which the outcome relates minimises risks to the environment.

4 Supporting information

As detailed in section 2 of this notice, your PRC plan and associated PRCP schedule is required to address the relevant legislative requirements.

Please refer to the guideline Progressive Rehabilitation and Closure Plans (ESR/2019/4964) for more information about the requirements of the PRC plan and associated PRCP schedule, and the assessment process.

5 Consultation

The administering authority recommends that you request a pre-lodgement meeting to discuss the requirements of the proposed PRC plan in more detail. To request a pre-lodgement meeting, please completed and lodge the form 'Application for pre-lodgement services' (ESR/2015/1664) to arrange a meeting.

Should you have any questions in relation to this notice, please contact Alison Sinclair on telephone 0436 693 333.



Signature

3 December 2020

Date

Chris Wake
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

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



Memorandum

Date 26 November 2020
To Chris Wake, Manager Environmental Services, Department of Environment and Science
From Trudy Mazucco, Principal Closure Planning
Subject Progressive Rehabilitation and Closure Plan BMC Red Mountain Infrastructure

Purpose:

Environmental Authority Holder: BHP BILLITON MITSUI COAL PTY LTD

Environmental authority number: EPML00819113

The purpose of this memo is to provide context and background information for the purpose of completing a Progressive Rehabilitation and Closure Plan (PRCP) for the above Environmental Authority (EA). This information is intended to facilitate the issuing of a notification for PRCP for this EA.

PRCP Guideline analysis:

PRCP Requirement	BHP information submission for review
Introduction	The Red Mountain Infrastructure Coal Handling and Preparation Plant (RMI CHPP) is located in the Bowen Basin, Central Queensland. The RMI CHPP is situated on ML70312 and as of February 2018 RMI CHPP is one hundred percent owned by BHP Mitsui Coal Pty Ltd (BMC) after purchasing Millennium Coal Pty Ltd (Millennium) half of the operation. The project was formally known as Red Mountain Infrastructure Joint Venture (RMIJV). The RMI CHPP is a standalone project with its own Environmental Authority (EA) EPML00819113 and Environmental Management Plan (EMP). The RMI CHPP washes coal from both Millennium Coal Mine (MCM) and Poitrel Coal Mine (BMC) projects.

Rehabilitation Planning Part

- **Project Description** The RMI CHPP is located approximately 140 kilometres (km) southwest of the city of Mackay and 22 km ESE of Moranbah. The RMI CHPP EA (EPML00819113) is held BHP Mitsui Coal Pty Ltd. The project is intended to wash the coal from the adjoining Millennium Mine and Poitrel mine and provide rail loading facilities for BMA Daunia Mine.

BHP Group Limited ABN 49 004 028 077, BHP Group Plc. registration number 3196209 and their respective subsidiaries are members of the BHP Group. The BHP Group is headquartered in Melbourne, Australia.

- Mining activities

Table 2: ERA Provisional Environmental Authorities.

ERA Number	ERA Name
ERA31	Mineral Processing Threshold 2 processing, in a year, the following quantities of mineral products, other than coke – (b) more than 100,000t
ERA56	Regulated waste storage – receiving and storing regulated waste

- PMLUs Post Mining Land Uses (PLMUs) and their respective acceptance criteria are detailed per table E1 of the EA.
- NUMAs Not applicable - all areas under the EA will be rehabilitated in line with the PLMUs identified above.

Voids in floodplains There are no proposed voids and therefore flood plain modelling to support rehabilitation of a void to a stable condition is not required.

Community consultation As a transition site there is no requirement for consultation prior to submission of PRCP, however BHP will follow an engagement plan over the life of the operation, in line with current internal stakeholder engagement frameworks.

Rehabilitation and Management Methodology

- Hydrogeology RMI comprises the coal handling and preparation plant (CHPP), 2 diesel tanks (combined 85,000 litres), bunded storage tanks for methyl isobutyl carbinol and flocculent. There are no long-term storage facilities for overburden, interburden, coarse rejects, or tailings. However, coal washing occurs at the CHPP. Flotation tailings (-0.5mm fraction) from the washing process are temporarily stored in dedicated and designed tailings drying cells on ML70312 before being transported by truck back to Poitrel mine (ML4749) site for co-disposal within spoil dumps. A total of 5 drying cells exist, with a total area of approximately 2.72ha. The average residence time of the tailings in the drying cells from deposition to excavation is generally 16 days.

The groundwater assessment will be based on the regional site setting information as well as the monitoring of 5 groundwater bores since 2010. This information will be compiled to detail a site conceptual model for the hydrogeologic system.

Potential impacts to groundwater quantity/levels will be assessed using the site monitoring data (since 2010) in consideration of environmental values at nearby receptors.

To address potential impacts to water quality, at decommissioning/closure the site will be investigated to document if the land is contaminated and the extent to which the land is impacted. Concentrations will be compared against applicable criteria, considering all relevant environmental values. The potential risks of contamination moving offsite from RMI will be assessed and used to inform remediation options or a site management plan at closure. The investigation and risk assessment process will follow that detailed in the National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 contaminated land in relation to the proposed post mining land use to inform remediation and/or site management options.

At this stage, for any residual contamination, the scope will include a tier 1 risk assessment as per NEPM that will inform decision making with regards to management or additional assessment that may be required. Following the risk based approach assessment such as a numerical model will only be developed if considered required to further assess risk and management options.

The additional requirements pertaining to non-use management areas, voids in floodplains, underground mining and voids are not applicable to RMI based on site authorised activities and planned rehabilitation.

- Flooding

Flood modelling was undertaken in 2019 and indicates that RMI is in New Chum Creek (NCC) floodplain. Given the nature of the RMI site and the absence of voids, it is considered that no further work is required to demonstrate flood susceptibility and influence across the site.

- Soil and capping material

Topsoil has been stripped for all disturbance areas and has been stockpiled on site. BHP is familiar with material characteristics after completion of investigative studies at neighbouring sites.

No further topsoil studies will be conducted.

Topsoil information (that will be indicative of the material at RMI) will be provided but no clay or rock resource information will be provided as it is not required to complete the rehabilitation. Ameliorants will be determined based on BHP's Rehabilitation Manual. Relationship between soils and vegetation ecosystems will not be assessed due to the PMLU returning to its former state prior to the RMI project using stockpiled soils

- Waste characterisation

No coal or coal rejects remaining onsite at closure. It is possible there may be some contamination of surface materials surrounding the CHPP. All wastes from coal processing and contaminated materials will be disposed of offsite.

A targeted geochemical and hydrogeochemical test work program may be required to assist with the preparation of the PRCP for RMI.

Considering that the tailings contained in the drying cells at RMI will be relocated prior to rehabilitation of the cells, they are unlikely to represent a long-term source of AMD related geochemical risk.

However, potential geochemical risk from the drying cells could be associated with downward infiltration from the cell to the underlying substrate.

The geochemical characterisation program for RMI is designed to characterise potential sources that may affect the water quality of any downward moving seepage, namely the tailings while contained the drying cells, and process water.

An assessment of pathways and receptors may be required to ascertain the fate of any potential downward moving seepage, if the source assessment highlights potential mobilisation of elements of environmental concern.

- Landform design

Final landform similar to original topography. Due to the final landform being similar to current topography:

 - 3D plans will not be provided, only 2D maps and plans.
 - No modelling of long term stability or erosion assessments
 - No hydrological and hydrogeological assessments
- Cover design

Cover design will be considered if required based on analysis.
- Water Management

The RMI plan of operations includes the following major water related infrastructure in support of mining activities:

 - Environmental dam;
 - Process water dam;
 - Water supply pipelines and pumps; and
 - Mine Affected Water (MAW) Discharge.

Water quality and flow information is available for NCC based on historic releases. This has been documented in most years as part of the Receiving Environment Monitoring Plan (REMP).

In addition to this, there are up to date consequence category assessments for the Environmental and Process Water Dams as well as operational plans.

A proposed plan to manage and monitor potential impacts to surface water (environmental values, water quality objectives) associated with the RMI major water related infrastructure may be required to demonstrate land is rehabilitated to support Post Management Land Use (PMLU).
- Revegetation

Minimal area to be disturbed
- TSFs

Tailings contained in the drying cells at RMI will be relocated to Poirrel (ML4749) prior to rehabilitation of the cells
- Voids

Not applicable.
- Underground Mining

Not applicable.
- Infrastructure

All infrastructure, constructed by or for the environmental authority holder during the mining activities including water storage structures, must be

removed from the site prior to surrender, except where agreed in writing by the post mining landowner/ landholder.

All infrastructure removed and/or made safe.

On site infrastructure:

- Includes the CHPP, train load-out facility, permanent and temporary buildings, bitumen car parks, mine industrial area (MIA) (workshops, sheds etc.), ROM Pad and coal stockpiles (conveyors, stackers etc.).

Off-site infrastructure:

- All infrastructure removed and/or made safe
- Waste assumed to be transported and disposed of at the Poitrel Mine.
- Opportunities to be investigated includes transfer of asset to third party.

Risk assessment	To be completed
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Rehabilitation Trials and Monitoring and Maintenance	No rehabilitation trials will be included. Monitoring and maintenance will be based on current BHP processes.
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PRCP schedule	To be completed
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Proposed submission date	December 2021
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Recommendation:

Review and consideration of the above analysis to understand if this is sufficient for notification of PRCP for RMI.

Yours sincerely

Trudy Mazucco
Principal Closure Planning
0475 300 433

Memorandum



Figure 2: Location of Environmentally Relevant Activities on ML70312

Appendix 4 **CDM Smith (30 August 2021): Hydrogeological Conceptual Site Model - Red Mountain Infrastructure Coal Handling and Preparation Plant, Poitrel Mine Road, Coppabella, QLD, 4741**



BHP Billiton Mitsui Coal Pty Ltd (BMC)
Hydrogeological Conceptual Site Model - Red Mountain Infrastructure Coal Handling and Preparation Plant, Poitrel Mine Road, Coppabella, QLD

30 August 2021

**CDM
Smith**

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Document History & Status

Document History & Status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
REVA	18/06/2021	Frankie Dean	Frankie Dean	24/06/2021	Final Draft
REV0	25/06/2021	Frankie Dean	Roger Cranswick	25/6/2021	Draft to Client
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Author:	Roger Cranswick & Zlatko Eterovic
Project Manager:	Craig Noble
Client:	BHP Billiton Mitsui Coal Pty Ltd (BMC)
Document Title:	Hydrogeological Conceptual Site Model - Red Mountain Infrastructure Coal Handling and Preparation Plant, Poitrel Mine Road, Coppabella, QLD
Document Version:	REV2 Final for Issue
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Section 1 Introduction

Project Appreciation

BHP Billiton Mitsui Coal Pty Ltd (BMC) has engaged CDM Smith Australia Pty Ltd (CDM Smith) to undertake hydrogeological analysis and conceptual model development for the Red Mountain Infrastructure (RMI) coal handling and preparation plant (CHPP) located on Lot 4 Plan SP190266 covering mining lease ML 70312. As of February 2018, the RMI CHPP changed ownership to BHP Mitsui Coal (BMC). The site is located approximately 140 km south west of Mackay in Central Queensland with the closest regional centre being Moranbah, which is approximately 22 km west of the site, as shown in Figure 1-1.

RMI has been a coal washing and preparation facility since 2006 and was originally designed to be utilised within a joint venture arrangement between Millennium Coal Pty Ltd and BMC to wash coal from the adjoining Peabody Millennium and BMC Poitrel mine projects as shown in

Figure 1-2. The coal is transported to the facility via haul roads to the Run of Mine (ROM) Pad situated in the coal handling area on Figure 1-1, where it is then transferred to the CHPP to be washed, processed, loaded onto trains and transported to the Dalrymple Bay Coal Terminal. The facility has the capacity to wash up to 6Mt pa of coal, which is sent primarily to the export market.

Purpose and Objective

CDM Smith understands BHP require this qualitative assessment of groundwater conditions and hydrogeological conceptual site model (CSM) to support the development of the Transitional Progressive Rehabilitation and Closure Plan (PRC plan) for the RMI.

As such, the objectives of the hydrogeological CSM and groundwater assessment are to:

- Collate and review available site data and information in order to develop an improved understanding of the site hydrogeology and groundwater processes;
- Use this improved understanding to develop a cross-sectional representation of the hydrostratigraphic units with available data to form the structural basis of the CSM;
- Assess the inferred groundwater flow direction and velocity across site;
- Evaluate RMI's potential impacts on groundwater resources;
- Develop a base hydrogeological CSM, such that the considerations of other studies/disciplines (e.g. potential contaminant transport) can be added to a consistent hydrogeological CSM;
- Develop a post closure hydrogeological CSM (including due consideration of proposed rehabilitation approaches and post closure landform) such that the considerations of other studies/disciplines (e.g. residual contaminant transport) can be added to a consistent hydrogeological CSM;

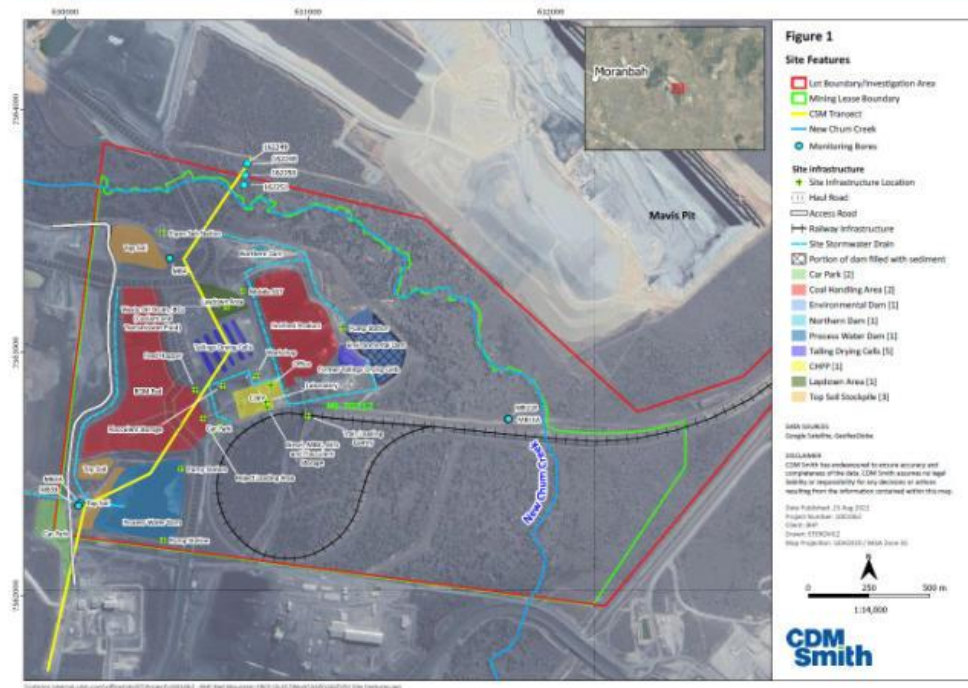


Figure 1-1 Site Overview and CSM Cross Section Location

CDM Smith

CDM Smith-BHP-1001062_RMI_HydrogeologicalConceptualization_REV2 Final

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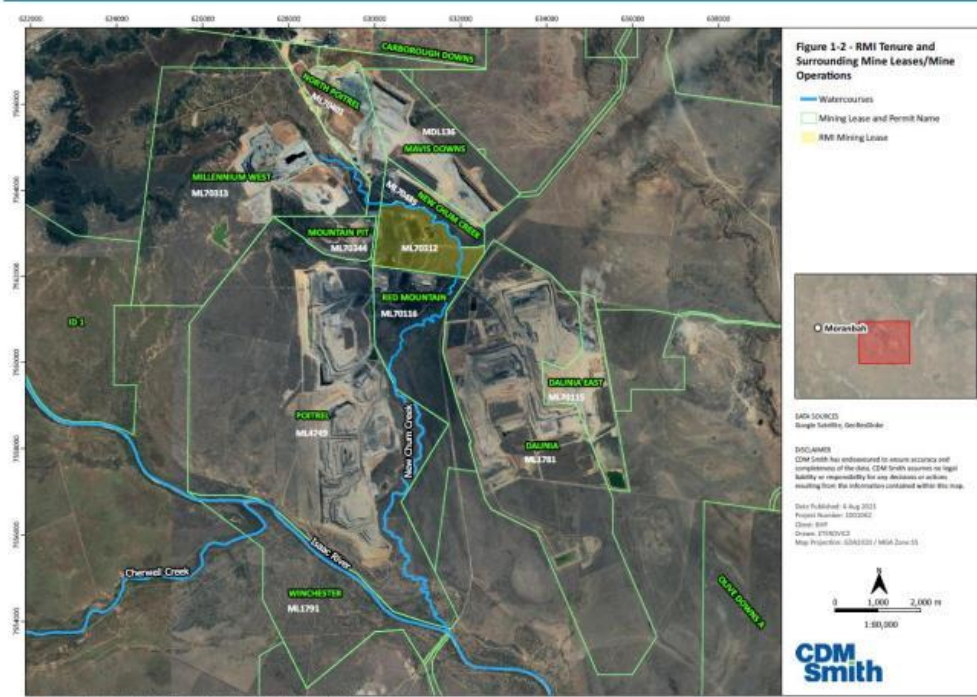


Figure 1-2 RMI Tenure and Surrounding Mine Leases/Mine Operations

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Section 2 Site Setting and Landuse Summary

Section 2 Site Setting and Landuse Summary

The site comprises a Run of Mine (ROM) Coal Pad, coal preparation plant and associated coal stockpiles, topsoil stockpiles, spoil, Tailings Drying Cells, Process Water Dam and Environmental Dam, laydown and industrial areas, access and haul roads, and drains. Disturbed areas at RMI cover approximately 170 ha. Another 118.3 ha are considered undisturbed.

Site Setting

The site setting is summarised in Table 2-1 below.

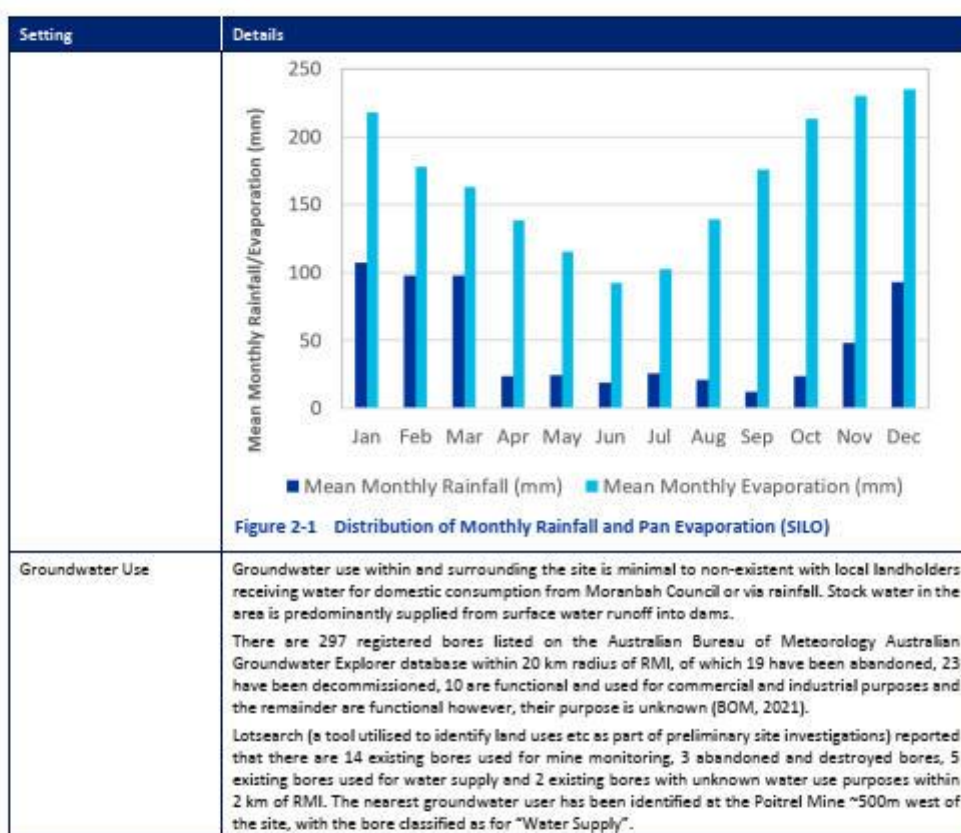
Table 2-1 Site Setting Summary

Setting	Details
Water Features	Based on data from the BHP Peabody Water Management Plan (2017), surface water generated at RMI is divided into five types: External Water: Has been sourced from outside of the operation and is supplied to RMI via the Poirrel Mine Braeside pipeline. There was no available water quality monitoring data for this external supply. Water is also supplied from the Millennium Coal Mine (MCM) operations via the Western Dam, which is supplied via the Sunwater pipeline and surface runoff. Groundwater: there are no direct groundwater inflows to the RMI area. Worked Water / (Mine Affected Water (MAW): Is water of lesser quality than other water types and is available for site utilisation. This water is returned to storage on completion of a task and can be reused: it is retained on site and managed in accordance with the site's EA. Worked water comprises: - Groundwater inflow and rainfall runoff that has been collected on site and pumped to storage; - The CHPP process water including recycled water from coal waste; - Surface drainage water captured in regulated dams from catchment areas disturbed by site operations; and - Any other water which site stores in the worked water system. Worked water surface runoff from ROM pad and from the eastern portion of the Millennium Mining lease drain into the Process Water Dam. Worked water surface runoff from the CHPP and product stockpiles drains to the Environmental Dam. Runoff from catchment within the MCM operations also drains into these dams. It was noted by BHP Peabody (2017) that water quality monitoring at these locations indicated that worked water surface runoff would exceed the Environmental Protection (Water) Policy 2009 water quality objectives (EPP WQOs) at the time of reporting. Surface Water: Is rainfall runoff and, when managed in accordance with the site's Erosion and Sediment Control Plan (ESCP), can be discharged from site. The surface water catchment within the RMI area is that associated with New Chum Creek. There are however water catchments from the adjacent MCM operations that drain to the RMI storages (Process Water Dam). Diverted Water: Is rainfall runoff that is diverted around the CHPP to ensure that the operations do not directly impact the water quality. It is noted that the alignment of New Chum Creek downstream of the RMI (offsite) has been diverted.
Topography and Drainage	The average elevation of the investigation area is ~230 m Australian Height Datum (AHD). Fill material is located under haul roads and approximately 13 m of fill material is located under the ROM pad which will impact onsite and offsite drainage.

Section 2 Site Setting and Landuse Summary

Setting	Details
	A number of offsite mining landforms including but not limited to waste dumps and open cut pits exist which will potentially impact drainage, flood regimes and groundwater flow. The topography of the mining lease is defined by gently undulating plains that drain via the New Chum Creek and continue in a south westerly direction towards the Isaac River, the region's dominant drainage feature. The receiving environment (including connected waterways) for the RMI is: ▪ New Chum Creek (on site boundary to north and east) – flowing in a south easterly direction across RMI to the Isaac River; ▪ Isaac River (6.1 km south west of RMI); and, ▪ The Connors River (Fitzroy) System (southern-most receiving water system).
Surface Water Environment	The RMI site is located within the Isaac River Catchment, which is part of the Fitzroy River Basin. The only water retaining structure in the catchment is the Burton George Dam located on the Isaac River, 45 km to the north of the site. From a regulatory perspective the site is located within the designated Isaac Connors Groundwater Management Area, specifically Unit 2. A watercourse flows through the site (New Chum Creek), with headwaters located to the north west of the site on the far side of the Millennium Mine. The RMI mining lease covers approximately 3.2 km² of the 3,560 km² Isaac River catchment area (BHP Peabody 2017). The New Chum Creek catchment area is 51 km² and RMI covers 6% of this catchment. New Chum Creek is considered an ephemeral watercourse with seasonally variable flows with most flow occurring during the wet season (November to February). New Chum Creek was observed to be dry at the time of the site inspection on 2 June 2021 and is a tributary of Isaac River. The base elevation of New Chum Creek ranges from approximately 238 m AHD west of RMI to 225 m AHD towards the southern boundary of the site (AMEC, 2005). Groundwater elevations underlying the site and in the vicinity of the creek have historically ranged, between 215 m AHD and 218 m AHD. Groundwater elevations are consistently 7 m below the base of the creek, indicating losing conditions during flow periods. The riparian vegetation along New Chum Creek has been identified as an "Unclassified potential Groundwater Dependent Ecosystem (GDE)". New Chum Creek is characterised by coarse sandy bed channels within a wider floodplain. The main channel has a width of ~3m and a depth of ~2m (BHP Peabody 2017). Waterholes can be present within the weeks following rainfall however the stream is short lived so little aquatic vegetation exists. New Chum Creek downstream of RMI has been diverted as part of the neighbouring Poitrel Mine operation.
Local and Regional Geology	RMI is within the Bowen Basin and geologically is located on the western margins of the Taroom Trough. The geology within the site ranges from Late Permian fine grained arenite-mudrock (characterised as calcareous sandstone and shale, mudstone, coal and concretionary limestone), Late Permian coarser grained sedimentary sequences (characterised as lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff and tuffaceous (cherty) mudstone), Early Triassic-middle Triassic arenite-mudrock (characterised as lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base)) and Later tertiary-quaternary alluvium (characterised as locally red-brown mottled, poorly consolidated sand, silt, clay, minor gravel and high-level alluvial deposits (generally related to present stream valleys but commonly dissected)). A fault is present within the south western corner of the lot boundary and several more can be found within 1 km of the site.
Rainfall and Evaporation	Climate data has been obtained for RMI from the SILO point data site (Lat, Long: -22.05, 148.25). Figure 2-1 shows mean monthly rainfall and pan evaporation for the site for the period January 2010 to July 2021. The data demonstrates: ▪ Average annual evaporation (2033 mm) is well in excess of average annual rainfall (595 mm), with evaporation exceeding rainfall for every month of the year; and, ▪ A distinct wet season, with approximately 67% of average annual rainfall occurring during the four-month period from December to March

Section 2 Site Setting and Landuse Summary



Potential Sources

Key activities linked to site operations that have the potential to impact groundwater are as follows:

- Runoff from disturbed land (e.g. stockpiles, ROM and coal pads, roads etc),
- Saline, metalliferous and/or acidic leachate from overburden dumps and stockpiles,
- Discharge of contaminated water to the environment such as overflow and/or seepage from of the Tailings Drying Cells, Process Water Dam and/or the Environmental Dam; and
- Mine Affected Water (MAW) infrastructure including dams, pipes and other plant failing, resulting in uncontrolled water discharge.

Current Surrounding Land Use

Adjacent land use comprises either mining and/or grazing native vegetation are summarised in Table 2-2. Pastoralism has been undertaken in the areas since the 1850s for predominantly cattle grazing and at varying intensities with extensive vegetation cleared for this purpose. This has resulted in significant disturbance of vegetation throughout the area.

Section 2 Site Setting and Landuse Summary

The areas are not suitable for forage or cropping due to the soil water availability and the soil characteristics. Small areas of contamination may be evident in these areas because of cattle dip use.

Table 2-2 Surrounding Land Use Description

Direction	Description / Identifier	Land Use
North	North Poitrel Operations and Mevis Downs Operations	Mining
East	Pastoral lands	Agricultural
South East	Daunie and Daunie East Operations	Mining
South	Pastoral Land including the flow direction of groundwater and New Chum Creek	Agricultural
South West	Poitrel Operations	Mining
West	Mountain Pit	Mining
North West	Millennium West Operations	Mining

Proposed Future Post Closure Landuse

Currently, based on discussions with BHP, it is understood that the post closure land use proposed is woodland and grazing. In accordance with the current planning zones the land is suitable for mining, other minimal use, railway infrastructure and/or grazing. Therefore, the proposed post closure land use fits within the current zoning uses/Groundwater Management Area approved activities. Likewise, as discussed above, the environmental values for groundwater allow for irrigation, stock watering and farm use. Based on the current understanding of the site, there is no preclusions to agricultural use post closure.

Site Environmental Values (EVs)

The current regional EVs are governed by the Environmental Protection (Water) Policy (EPP) 2009 Fitzroy River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Fitzroy River Sub-basin September 2011 (Department of Environment and Heritage Protection, Amended 2013) and is intended to be used for the protection of the Fitzroy Basin river system.

EVs for the site were obtained from the Isaac northern tributaries, Isaac River Sub-Basin (WQ1301) and are summarised as follows:

- Aquatic ecosystems.
- Irrigation.
- Farm supply/use.
- Stock Water.
- Human Consumer.
- Primary Recreation.
- Secondary Recreation.
- Visual Recreation.
- Drinking Water.
- Industrial use and
- Cultural and spiritual Values.

It is expected these EVs will remain in place post closure, subject to any subsequent revision or update by the relevant regulatory authority. A comparison between the known groundwater quality at the site and the above EVs are discussed further in Section Section 0 below.

Section 3 Review of Site Data and Hydrogeological Analysis

Site Data and Information Review/Collation

A summary of the site information used in this assessment is shown in Table 3-1.

Table 3-1 Site Data and Information Source Summary

Reference	Description
BHP & Peabody Energy (2017)	Red Mountain Joint Venture Water Management Plan
BHP (2021)	Environmental monitoring and laboratory analysis datasets and LiDAR DEM
Bureau of Meteorology (BOM) (2021)	http://www.bom.gov.au/water/groundwater/explorer/map.shtml , site accessed 2 August 2021 to review status of bore in the area
JBT (2016)	Review and assessment of the RMJV groundwater monitoring network and data
LotSearch	Tool to gather information on groundwater bores in the area
QLD Globe (2021)	DNRME groundwater and hydrogeology data

Additional site features were digitised based on the latest Google/ESRI aerial imagery and/or from images within referenced reports.

It should be noted that all historic water level data was provided to CDM Smith in the form of reports with hydrographs included, no raw water level data files were available at the time of report preparation.

Groundwater Monitoring

There are three groundwater monitoring sites (including two nested sites) located within the mining lease and a number of nearby bores that provide additional information. Groundwater monitoring bores MB3A, MB3B, MB4, MB11A and MB11B are subject to monitoring. The bore depths range from 30 m below ground surface (m bgs) to 80 m bgs, with other construction and water level details summarised in Table 3-2.

Table 3-2 Monitoring Bore Details Within Mining Lease (refer to Figure 1.1 for borehole locations)

ID	Screen from (m bgs)	Screen to (m bgs)	Screened formation	Depth to water (m bgs)	Hydraulic head (m AHD)	Gauging Date
RN141748 MB3A	22	30	Fort Cooper Coal Measures	16.7	218.2	21/04/2021
RN141749 MB3B	54	63	Fort Cooper Coal Measures Coal seams reported in screened interval	15.3	219.6	21/04/2021
RN141750 MB4	29	36	Fort Cooper Coal Measures	20.24	215.4	21/04/2021

Section 3 Review of Site Data and Hydrogeological Analysis

ID	Screen from (m bgs)	Screen to (m bgs)	Screened formation	Depth to water (m bgs)	Hydraulic head (m AHD)	Gauging Date
MB11A	18	30	Fort Cooper Coal Measures	22.4	209.0	21/04/2021
MB11B	68	80	Fort Cooper Coal Measures	20.0	211.4	21/04/2021
RN162248 MB10B	64	76	Fort Cooper Coal Measures	18.5	215.3	10/12/2013
RN162249 MB10A	27	35	Fort Cooper Coal Measures	19.8	n/a	10/12/2013

Hydrostratigraphy and Hydrogeological Analysis

A generalised site specific local shallow hydrostratigraphic cross section relative to current site operations is presented in Figure 3-1 below (refer to Figure 1.1. for cross-section location). The full cross section is shown in Figure 4-1.

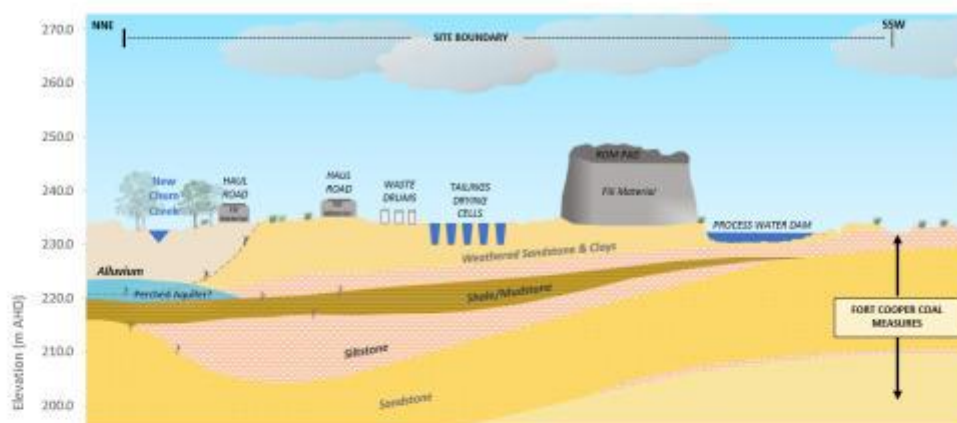


Figure 3-1 Shallow Geology Conceptual Hydrostratigraphic Cross Section

There are two primary hydrostratigraphic units (HSUs) inferred as occurring within or near the RMI site:

- Alluvial aquifer – associated with New Chum Creek and comprised of relatively coarse (i.e. sandy) alluvium derived from re-worked bedrock material; depending on the hydraulic conductivity of underlying units this may be a perched system, or be connected to the regional watertable where the regional groundwater system is shallower further to the south (i.e. off-site). There are no wells are screened in the alluvium, i.e. the formation is not monitored at the site. No information relating to local structural controls at the site (such as faulting) that may be present in the formations beneath the alluvium was available at the time of report preparation.

Section 3 Review of Site Data and Hydrogeological Analysis

- Fort Cooper Coal Measure Aquifer (FCCMA) – comprised of interbedded siltstones, sandstones, minor mudstones, shales and coal measures; likely to be a fractured rock aquifer with relatively low primary porosity (with the exception of coal measures which may have a relatively higher primary porosity) and permeability dependent on the aperture and connectedness of fracture networks. Groundwater flow through the deeper coal seam sections of the aquifer may contain more primary porosity and facilitate groundwater flow through a porous media in addition to preferential pathways through fractures (secondary porosity). The dual porosity of the FCCMA means that groundwater flow paths are likely to be heterogeneous and may be challenging to accurately predict.

These two hydrostratigraphic units, where they contain groundwater, can be considered as unconfined aquifers although there are potential semi-confining aquitard layers present such as the Shale Mudstone layer identified. It should be noted that no groundwater monitoring bores are currently completed in the shallow weathered Sandstone and Clay units identified immediately beneath the site (potentially partially confined by the inferred Shale/Mudstone layer).

Potential Recharge / Discharge Mechanisms

The potential groundwater recharge mechanisms to groundwater identified at the site are as follows:

- Rainfall is the primary recharge mechanism across the site;
- Groundwater infiltration from New Chum Creek (when it is flowing) and the shallow alluvial aquifer attached to the creek path.
- Seepage from site water storage structures – Process Water Dam, Environmental Dam and Tailings Drying Cells;

The following potential discharge mechanisms associated with moving groundwater from site are as follows:

- Evapotranspiration;
- Potential groundwater flow downgradient in the alluvial aquifer to express at surface, in this instance New Chum Creek downstream of RMI has been diverted as part of the neighbouring Poitrel Mine operation so any alluvial flows/discharges will be impacted by this diversion;
- Groundwater via throughflow in the FCCMA and more regionally via discharge to current open cut mining operations to the south of the site including the Daunia and Poitrel pits that may intersect the watertable.

Post closure, the water storage structures will be removed and the primary aquifer recharge mechanisms will consist of direct infiltration via rainfall and infiltration associated with any surface water flow paths. Discharge mechanisms will remain unchanged, with any changes relating to groundwater flow expected to be related to any changes in mining activities occurring adjacent to the site. The changes relating to future mining activities cannot be quantified at this time.

Hydrogeological Analysis

Groundwater Elevation

All groundwater wells on the site are screened within the FCCMA and there is currently no existing monitoring infrastructure targeting the potential perched groundwater system associated with the alluvium of New Chum Creek.

Historical groundwater hydrographs reported in JBT (2016) are shown in Figure 3-2 while the most recent groundwater level observations (21/04/21) are as follows:

- MB3A 218.2 m AHD – decline of around 12 m since 2015
- MB3B 219.6 m AHD – decline of around 5 m since 2015
- MB4 215.4 m AHD – decline of around 2 m since 2015

Section 3 Review of Site Data and Hydrogeological Analysis

- MB11A 209.0 m AHD – decline of around 8 m since 2015
- MB11B 211.4 m AHD – decline of around 8 m since 2015

Historic groundwater level trends with time (Figure 3-2) from MB3A and MB3B would indicate that leakage from the Process Water Dam may be impacting local groundwater levels. Groundwater levels in these bores appear to steadily increase from the start of 2013 before stabilising in mid-2014. This indicates the potential leakage from the Process Water Dam may be leading to groundwater mounding in this location. However, the recent observations from MB3A and MB3B show that the groundwater levels in this location have declined relative to the mid-2010s indicating there may be less leakage from the Process Water Dam than during the period from 2013 to at least 2016 or that the initial mounding has dissipated.

The MB11A and MB11B water levels appear to have reduced by around eight metres from the mid-2010s and may be a response to pit dewatering activities occurring nearby or ground water discharge occurring in the adjoining Daunia mine open pit mine operation.

Water level data in an Excel form for the onsite bores was unavailable at the time of report preparation, so hydrographs of the monitoring bores with a Residual Rainfall Mass (RRM) Curve were not able to be plotted. However when the RRM was plotted against salinity (Figure 3-3 below) we can see a below average rainfall period occurring from mid-2020, indicating the more recent declines in groundwater levels may be partly attributed to climate.

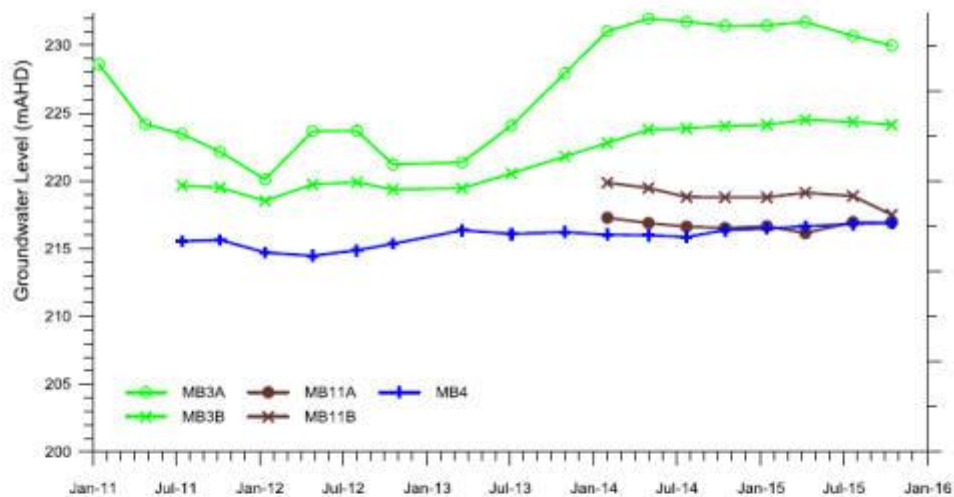


Figure 3-2 Historical Groundwater Level Data (after JBT 2016)

Groundwater Quality

The table below provides a summary of the average groundwater quality parameters based on data provided by BHP for groundwater sampling undertaken since 2018.

Groundwater quality parameters and major ion concentrations for all five monitoring bores are summarised in Table 3-3.

Section 3 Review of Site Data and Hydrogeological Analysis

Table 3-3 Average Water Quality Parameters and Major Ion Concentration (mg/L, except EC: $\mu\text{S}/\text{cm}$ and pH: unitless)

Bore	EC	TDS	pH	Cl	HCO ₃	SO ₄	Na	Mg	Ca	K
Unit	$\mu\text{S}/\text{cm}$	mg/L	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MB3A	3478	2063	7.9	793	565	171	302	231	74	3
MB3B	3062	1685	8.3	645	695	49	389	168	36	5
MB4	3306	1846	7.8	590	898	91	522	137	40	5
MB11A	6893	3773	8.2	1816	649	45	1383	44	38	8
MB11B	5351	3014	7.9	1259	905	116	813	205	111	5
WQOs ¹	<720	-	6.5 – 8.5	-	-	<25	-	-	-	-

Note 1: Water Quality Objectives for Upper Isaac River catchment waters to protect aquatic ecosystems (moderately disturbed)

The groundwater is considered fresh with average salinity ranging from around 1700 – 3700 mg/L with neutral to slightly basic pH. Groundwater salinity is relatively stable over time, with recent increasing trends observed in MB3B and MB11B from the mid-2010s to 2021 (see Figure 3-3). Currently, this is considered to be within reasonable natural variability for groundwater salinity but may also indicate potential groundwater mixing with a part of the aquifer with a higher salinity. Rainfall data indicates that climate variability has some effect on salinity concentrations, particularly from 2014 to 2017. Reduced salinity levels in MB11A appear to correlate with periods of below average rainfall (Figure 3-3), although this reduction has not occurred in the more recent below average rainfall period from mid-2020.

A review of available laboratory analyses of groundwater samples collected suggest the following:

- Total Petroleum Hydrocarbons (TPH) were detected in MB3B at a concentration of 0.19mg/L in April 2021, which exceeds the Groundwater Contaminant Trigger Value of 0.1mg/L. There have not been any other TPH detections greater than the laboratory limit of reporting to date.
- Dissolved metals concentrations (mercury (inorganic), aluminium, antimony, arsenic, molybdenum, selenium and silver) remain below or close to the limits of detection historically and in recent samples.
- Dissolved iron concentrations are typically slightly elevated in MB4 and MB11B (up to 0.9mg/L and 0.4mg/L respectively) compared to other bores (having concentrations near or below detection limits) and are variable over time at relatively low concentrations (i.e., < 1 mg/L) with no apparent trends over time. Dissolved iron concentrations in these wells also exceed the Groundwater Contaminant Trigger Value (0.3mg/L) listed in the EA (EPML00819113).
- Dissolved magnesium concentrations have consistently but only slightly exceeded the Groundwater Contaminant Trigger Value (0.19mg/L) in MB3A and MB11B, with a maximum concentration of 0.27mg/L detected in MB3A in June 2019. There is no apparent trend in concentrations over time.
- Sodium concentrations in MB11A/B have exceeded the Groundwater Contaminant Trigger (0.5mg/L) since February 2019, with a slightly increasing trend observed in MB11A.
- Chloride concentrations are typically elevated in all onsite monitoring wells, ranging between 0.5 – 1.9mg/L, compared to a Trigger Value of 0.04mg/L.
- Sulphate concentrations are typically elevated in MB3A and MB4 with concentrations up to 162mg/L, compared to a Trigger Value of 70mg/L.
- Total Dissolved Solids (TDS) concentrations are shown in Figure 3-3 below and exceed the Trigger Value (2200mg/L) in MB11A/B.

Section 3 Review of Site Data and Hydrogeological Analysis



Figure 3-3 Groundwater Salinity (Total Dissolved Solids) Over Time vs RRM (deviation from mean monthly rainfall plotted against time)

A piper plot can be used to characterise water types based on their major ion chemistry (Figure 3-4). Groundwater samples from MB4, MB11A and MB11B are sodium-chloride type waters while MB3A and MB3B have relatively higher proportions of magnesium and calcium and appear to group less tightly than the other groundwater samples. It is possible that the groundwater in this part of the aquifer is influenced by a localised recharge source, which has changed over time (i.e. leakage from the nearby Process Water Dam).

The samples collected prior to 2016 (inclusive) and after 2016 have been plotted separately for MB3A and MB3B in Figure 3-4 to demonstrate this hypothesis. The sample groups show upward shifts at both monitoring bores in the diamond section of the piper diagram. MB3A also has a distinct shift in the increased proportion of calcium and sulfate concentrations (as seen in the lower left and lower right triangle sections respectively). MB3B shows a similar shift in relative calcium concentrations but not yet as clearly in relative sulfate concentrations (MB3B is the deeper of this nested pair). It is likely that the leakage from the Process Water Dam has resulted in a change to the major ion signature of groundwater at this location, with a resulting signature being a mixture between Process Water and other local recharge processes, the dominant process being rainfall. The major ion signature of MB3B samples post-2016 appears to be trending towards the major ion signature of MB3A samples pre-2016, suggesting there may be some vertical mixing processes occurring at this location.

Section 3 Review of Site Data and Hydrogeological Analysis

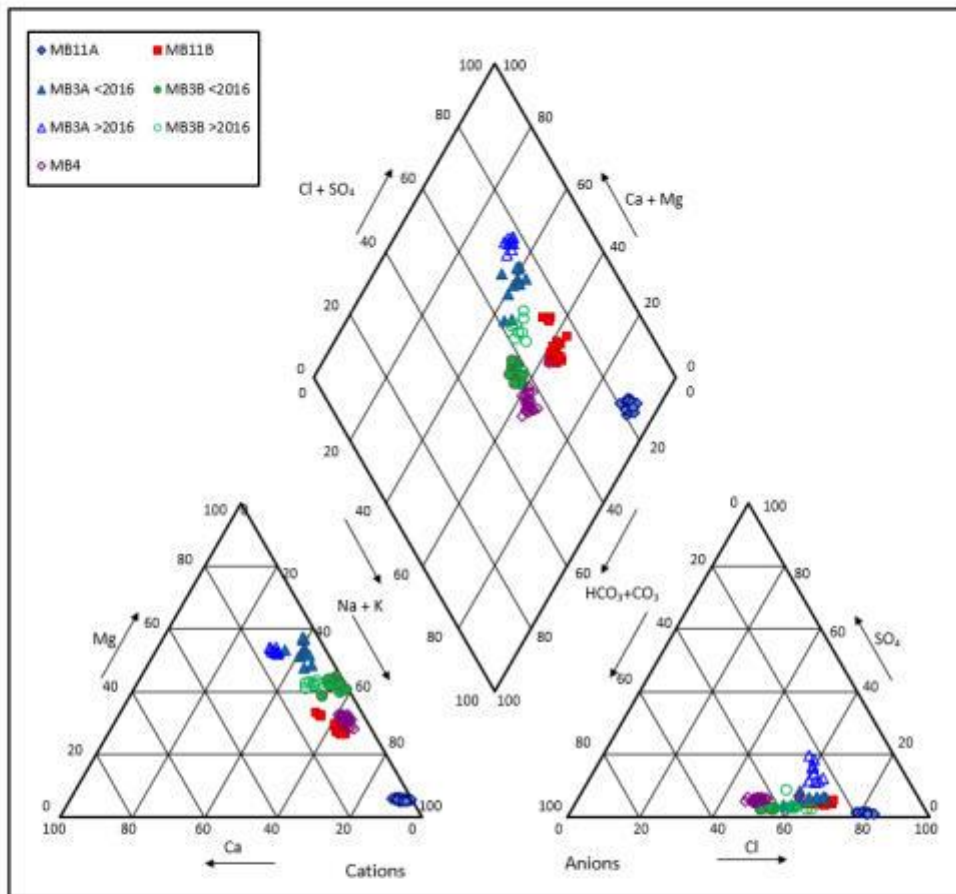


Figure 3-4 Piper Diagram for Groundwater Monitoring Bores on Site

Groundwater Flow Direction and Velocity

Using available groundwater level information from a range of dates, a potentiometric surface was developed for the FCCMA (Figure 3-5). This map shows that there is a hydraulic gradient towards the south of the site. The map is based on groundwater levels measured in the wells on and immediately adjacent to the site, with the potential influence of open pits in adjacent areas on groundwater not included in the inferred potentiometric surface. Groundwater flow direction within the FCCMA is generally from the north-northeast towards the south-southwest, with some local deviation due to groundwater mounding below the Process Water Dam (i.e. at MB3A location). A smaller groundwater mound is inferred in the vicinity of the MB11A (in the east of the site), potentially due to leakage from the settling ponds just to the north.

Generation of a potentiometric surface for other hydrostratigraphic units was not completed due to a lack of data and an insufficient spatial coverage / discontinuity in hydrostratigraphy between data points.

Section 3 Review of Site Data and Hydrogeological Analysis

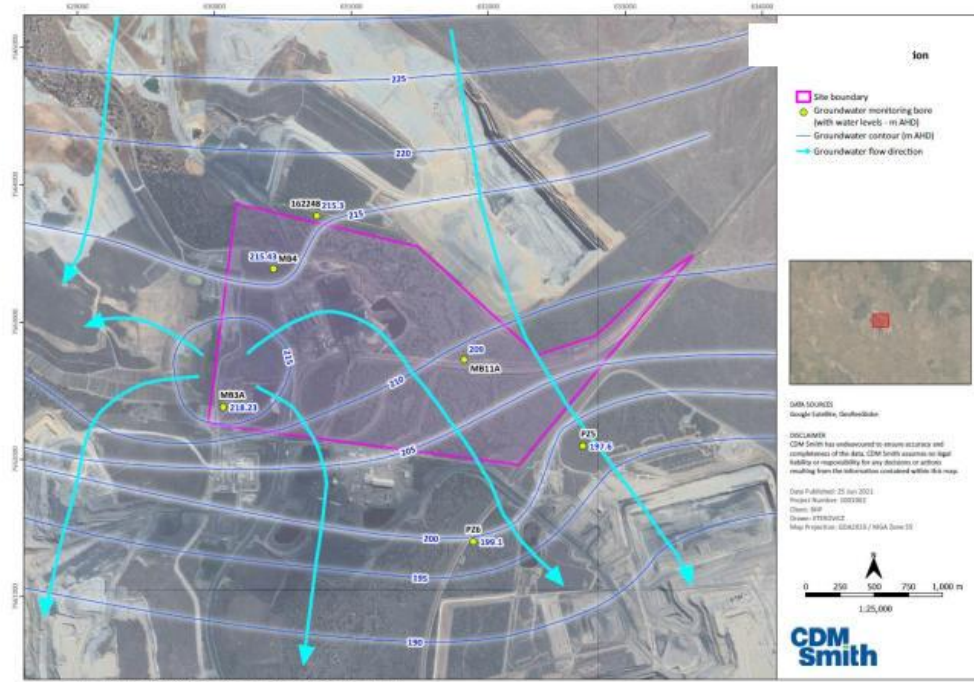


Figure 3-5 Potentiometric Surface of the FCCMA Showing Inferred Groundwater Flow Direction

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Section 3 Review of Site Data and Hydrogeological Analysis

Groundwater velocity is calculated using values of aquifer effective porosity, hydraulic conductivity and hydraulic gradient (Freeze and Cherry, 1979). Groundwater velocity across the site is highly uncertain due to a lack of site-specific hydraulic parameter data (hydraulic conductivity and effective porosity). Using a range of nominal values for effective porosity and hydraulic conductivity based on literature values for similar formations, and assuming an inferred hydraulic gradient across the site (a 4 m elevation difference between 162248 and MB11A across 1500 m is a hydraulic gradient of around 0.003), the possible groundwater velocities across the site that could be assumed are shown in Figure 3-6. Assuming an effective porosity of 0.1 and a hydraulic conductivity of 0.1 m/d, (deemed representative of the coal seam), the groundwater velocity could be around 1 m/year. Groundwater flow through the sandstone and siltstone units would likely have a lower effective porosity and lower hydraulic conductivity, but considering this is conceptually a fractured rock unit higher groundwater velocities may be expected. Ultimately the velocity of groundwater in the siltstone and sandstone will depend on the frequency and interconnectivity of these fractures, as there is likely to be limited groundwater movement through the matrix of the rock.

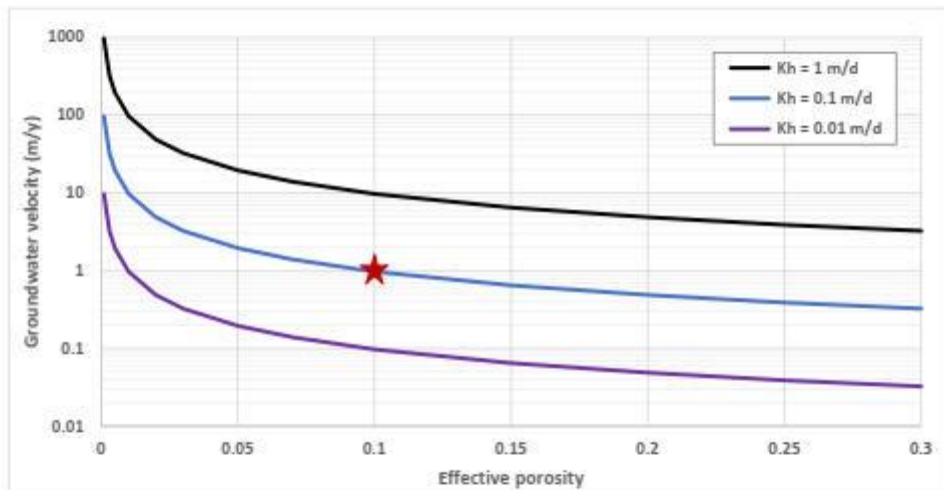


Figure 3-6 Possible Range of Groundwater Velocity under a Hydraulic Gradient of 0.003 m/m

Red star indicates potentially representative value for the coal seam

Section 4 Hydrogeological Conceptual Site Model

Pathways and Receptors Summary

Site activities that have the potential to impact groundwater are detailed in Section 0 above. Considering these activities and the subsequent discussions on the site setting and the subsurface conditions at the site, a Source-Pathway-Receptor Summary has been completed and is presented in Table 4-1 below for both current operations and proposed post-closure conditions.

The development of the preliminary CSM (source-pathway-receptor model) included assessment of the following:

- Sources of contamination (or site activity that can cause contamination);
- Pathways by which contaminants can or may infiltrate to the local watertable and then migrate via groundwater flow pathways; and
- Groundwater receptors, including humans, animals, waterways and ecosystems that may be impacted the identified contamination onsite and offsite.

The summary has been colour coded with:

- Red indicating an open path - documented source – pathway - receptor confirmed;
- Orange indicating a partially open path – based on the site setting and activities there is the potential for this pathway to be open, but requires further investigation;
- Green indicating the pathway is closed with either of the source – pathway - receptor elements closed.

Section 4 Hydrogeological Conceptual Site Model

Table 4-1: Groundwater Source-Pathway-Receptor Summary

Current Operations			Post Closure ¹		
Site Activity	Pathway to Groundwater	Groundwater Receptor	Site Activity	Pathway to Groundwater	Groundwater Receptor
Runoff from disturbed land (e.g. stockpiles, ROM and coal pads, roads etc)	Leaching of contaminants through the soil profile into groundwater Lateral migration of groundwater from up hydraulic gradient through areas	Nearby users of the groundwater <1km	Stockpiles, ROM and coal pads, roads etc removed and land rehabilitated so site activities benign	Leaching of potential contaminants into groundwater no longer possible as site has been rehabilitated Lateral migration of groundwater from up hydraulic gradient through areas	Nearby users of the groundwater
Saline, metalliferous and/or acidic leachate from overburden dumps and stockpiles	Leaching of contaminants through the soil profile into groundwater Lateral migration of groundwater from up hydraulic gradient through areas	Nearby users of the groundwater <1km	Waste dumps and stockpiles have been removed and the land rehabilitated, removing the potential for leachate	Leaching of potential contaminants into groundwater no longer possible as site has been rehabilitated Lateral migration of groundwater from up hydraulic gradient through areas	Nearby users of the groundwater
Discharge of contaminated water to the environment such as overflow and/or seepage from of the Tailings Drying Cells, Process Water Dam and/or the Environmental Dam	Leaching of contaminants through the soil profile into groundwater Lateral migration of groundwater from up hydraulic gradient through areas	Nearby users of the groundwater <1km	The Tailings Drying Cells, Process Water Dam and/or the Environmental Dam will have been removed and the land rehabilitated	Leaching of potential contaminants into groundwater no longer possible as site has been rehabilitated Lateral migration of groundwater from up hydraulic gradient through areas	Nearby users of the groundwater
Mine Affected Water (MAW) infrastructure including dams, pipes and other plant failing, resulting in uncontrolled water discharge	Leaching of contaminants through the soil profile into groundwater Lateral migration of groundwater from up hydraulic gradient through areas	Nearby users of the groundwater <1km	Mine Affected Water (MAW) infrastructure including dams, pipes and other plant will have been removed and the land rehabilitated	Leaching of potential contaminants into groundwater no longer possible as site has been rehabilitated Lateral migration of groundwater from up hydraulic gradient through areas	Nearby users of the groundwater

¹ Closure evaluation assumes all materials will be removed from site and there is no contaminant leachate at depth

Section 4 Hydrogeological Conceptual Site Model

Conceptual Site Model Summary

The hydrogeological CSM for the current operation is presented in Figure 4-1 and described below.

- Groundwater within the FCCMA is derived primarily from rainfall-recharge, which infiltrates across the site via unsaturated flow during the wet season. There are also a number of focussed recharge sources, namely creek infiltration during periods of flow from New Chum Creek, and inferred leakage from the Process Water Dam, Environmental Dam and Tailings Drying Cells via unsaturated flow.
- The unit identified as a Shale/Mudstone directly beneath the site (at ~ 15m bgl) may be an aquitard, and has the potential to prevent recharge waters progressing through the unit and recharging the FCCMA. In some scenarios there may be perched water located immediately above this unit, although it is expected to drain via the fractured rock pathway. This conceptualisation of the shale/mudstone unit would require further investigation to determine the spatial extent and paleotopography of the unit, its thickness and permeability;
- Infiltrated water travels vertically through the unsaturated zone until it meets the watertable as recharge. Newly recharged water mixes with the existing groundwater and travels from areas of high hydraulic head (i.e., water level) to areas of lower hydraulic head via saturated flow.
- Groundwater flow direction within the FCCMA is generally from the north-northeast towards the south-southwest, with some local deviation due to groundwater mounding below the Process Water Dam.
- It is plausible for a transient perched aquifer system to exist within the Alluvial sediments associated with New Chum Creek, but this has not been confirmed through shallow drilling investigations or monitoring wells. If this perched groundwater system exists, infiltrating creek water is likely to then leak from the alluvium through the shale/mudstone geological units to join the deeper watertable within the FCCMA.
- The FCCMA is considered a fractured rock aquifer due to its hard rock sandstone/siltstone geological units and so groundwater flow is dependent on the nature and interconnection of fracture networks. Groundwater flow through the coal seam sections of the aquifer may contain more primary porosity and facilitate groundwater flow through a porous media in addition to preferential pathways through fractures (secondary porosity). The dual porosity of the coal units within the FCCMA means that groundwater flow paths are likely to be heterogeneous and may be challenging to accurately predict.
- Groundwater is predicted to discharge from the site via throughflow in the FCCMA and more regionally via discharge to current open cut mining operations to the south of the site including the Daunia and Poitrel pits that may intersect the watertable (evaporation and pumping).

The hydrogeological CSM for the post closure scenario is presented in Figure 4-2. As noted earlier it is understood that rehabilitation of the site after closure will include the establishment of stable landforms that are intended to support future land uses including potential grazing and woodland habitats.

Section 4 Hydrogeological Conceptual Site Model

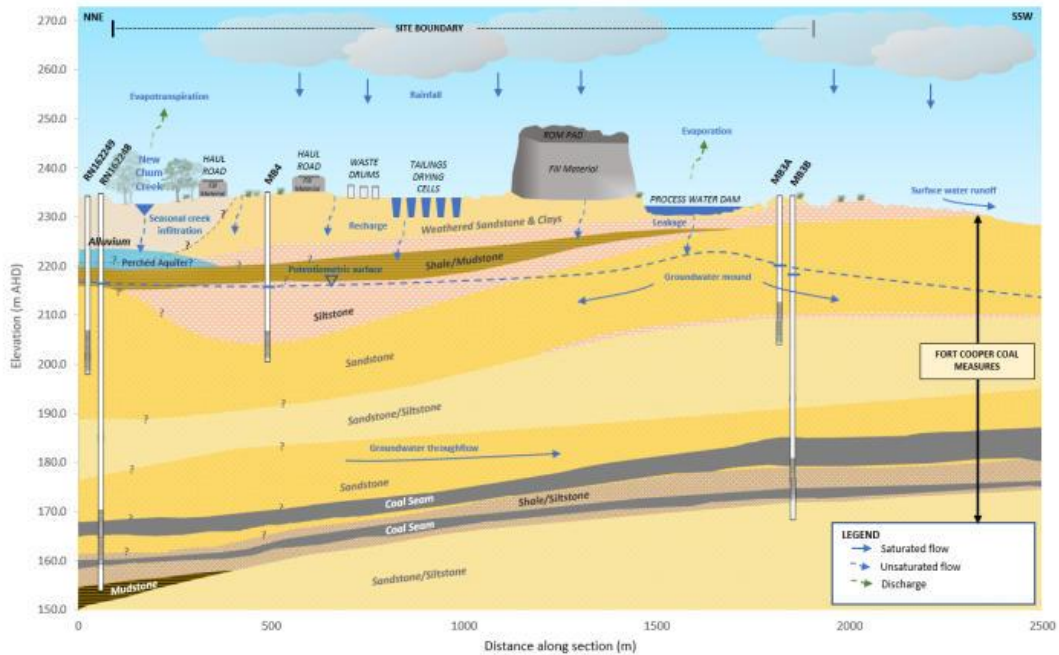


Figure 4-1 Hydrogeological Conceptual Site Model – Current Operations

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Section 4 Hydrogeological Conceptual Site Model

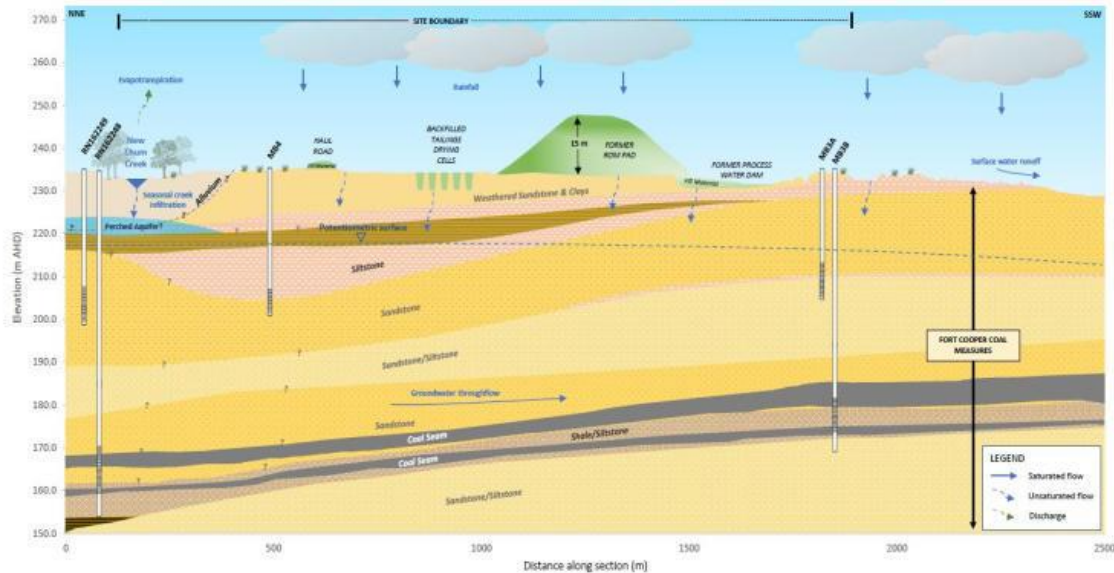


Figure 4-2 Hydrogeological Conceptual Site Model – Post Closure

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Section 5 Risk Assessment

A risk rating (i.e. potential to cause impact to groundwater) has been applied to each potential source of impact identified considering the assessment works completed and the hydrogeological CSM developed.

This risk assessment methodology is adapted from BMC risk assessment methodology. For each sources of potential impact to groundwater, a likelihood rating was selected based on whether the exposure pathways are plausible and a severity rating was selected based on the potential severity of the harm caused by each source to the receptor (groundwater) as per the source-pathway-receptor linkages assessment (refer to Section Section 0 above).

Likelihood and severity rating were selected based on the:

Location of the possible source in relation to any on-site and off-site sensitive receptors;

Existing or proposed groundwater use(s);

Presentation of potential contaminants relating to the source that have the potential to impact groundwater including areal extent, depth below finished ground level, the presence of barriers or containment that prevents or minimises the migration of contamination or exposure pathways;

In-situ leaching characteristics of select contaminants of concern and the potential for leachate to adversely affect groundwater;

Potential for contaminants to be transported from the site at levels of concern by erosive forces and ultimately connect to a groundwater source.

The likelihood ratings and the severity ratings are defined in Table 5-1 and Table 5-2, respectively.

Table 5-1 Likelihood Rating Definitions

Likelihood Level	Description
Highly Likely Factor 3	Likely to occur within a 1-year period
Likely Factor 1	Likely to occur within a 1-to-5-year period
Possible Factor 0.3	Likely to occur within a 5-to-20-year period
Unlikely Factor 0.1	Likely to occur within a 20-to-50-year period
Highly Unlikely Factor 0.03	Not likely to occur within a 50-year period

Section 5 Risk Assessment

Table 5-2 Severity Rating Definitions

Severity Level	Description
Very high Factor 1000	6 or more fatalities or 6 or more chronic life-threatening illnesses; or Severe impact to the environment and where recovery of ecosystem function takes 10 years or more; or Severe impact on community lasting more than 12 months or a substantiated human rights violation impacting 6 or more people; or Severe impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a global level; or US\$2 billion or more.
High Factor 300	1-5 fatalities or 1-5 or more chronic life-threatening illnesses; or Serious impact to the environment, where recovery of ecosystem function takes between 3 and up to 10 years; or Serious impact on community lasting 6-12 months or a substantiated human rights violation impacting 1-5 persons; or Serious impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a national level; or Between US\$250 million and up to US\$2 billion.
Moderate Factor 100	Life altering or long term/permanent disabling injury or illness to one or more persons; or Substantial impact to the environment, where recovery of ecosystem function takes between 1 and up to 3 years; or Substantial impact on community lasting 2-6 months; or Substantial impact on company reputation, legal rights or compliance, social value proposition, or ability to access opportunities at a sub national level (state, territory, province); or Between US\$50 million and up to US\$250 million.
Low Factor 30	Non-life altering or short-term disabling injury or illness to one or more persons; or Measurable but limited impact to the environment, where recovery of ecosystem function takes less than 1 year; or Measurable but limited community impact lasting less than one month; or Measurable but limited impact on company reputation, legal rights or compliance, or social value proposition at a local level (region, city, town); or Between US\$2 million and up to US\$50 million.
Very Low Factor 10	Low level impact resulting in first aid only; or Minor, temporary impact to the environment, where the ecosystem recovers with little intervention; or Minor, temporary community impact that recovers with little intervention; or Minor, temporary impact on company reputation, legal rights or compliance, or social value proposition; or Less than US\$2 million.

The risk rating was then calculated by multiplying the likelihood rating with the severity rating. The risk rating definitions are defined in Table 5-3.

Section 5 Risk Assessment

Table 5-3 Risk Rating Definitions

Risk Level	Description
High >300	Indicates that the activity results in serious or significant or substantial impact to sensitive receptors where recovery requires intervention such as remediation to mitigate or reduce the risk to as low as reasonably practicable.
Moderate 30 to 300	Indicates that the activity has a measurable but manageable level to cause harm or impact to sensitive receptors from the identified contamination sources based on type, pathway and hydraulic gradient. Recovery of the impact is likely achievable in the short term and the risk level could likely be reduced/mitigated with additional data collection or additional controls/monitoring and/or management.
Low <30	Indicates that the activity has a low to tolerable level of risk to cause impact to groundwater based on the identified sources, and pathways being absent or incomplete. The risk level could likely be reduced with collection of data (monitoring/management) or controls put in place (such as remove the source)

Using these definitions and considering the pathways identified a simple risk assessment has been completed and is presented in Table 5-4 and Table 5-5 below for current operations and post closure, respectively.

A completed environmental assessment summary is then provided in Section 6 including an evaluation relative to EVs and potential future land uses.

Table 5-4 Groundwater Risk Assessment – Current Operation

Current Operations				
Site Activity	Pathway Complete	Likelihood	Severity	Risk Level
Runoff from disturbed land (e.g. stockpiles, ROM and coal pads, roads etc)	Nearby users of the groundwater <1km	Unlikely 0.1	Low 30	Low 3
Saline, metalliferous and/or acidic leachate from overburden dumps and stockpiles	Nearby users of the groundwater <1km	Unlikely 0.1	Moderate 100	Low 10
Discharge of contaminated water to the environment such as overflow and/or seepage from the Tailings Drying Cells, Process Water Dam and/or the Environmental Dam	Nearby users of the groundwater <1km	Unlikely 0.1	Moderate 100	Low 10
Mine Affected Water (MAW) infrastructure including dams, pipes and other plant failing, resulting in uncontrolled water discharge	Nearby users of the groundwater <1km	Unlikely 0.1	100	Low 10

Table 5-5 Groundwater Risk Assessment – Post-Closure

Post Closure ¹				
Site Activity	Pathway Complete	Likelihood	Severity	Risk Level
Stockpiles, ROM and coal pads, roads etc removed and land rehabilitated so site activities benign	Nearby users of the groundwater <1km	Unlikely 0.1	Low 30	Low 3
Overburden, dumps and stockpiles have been removed and the land rehabilitated, removing the potential for leachate	Nearby users of the groundwater <1km	Unlikely 0.1	Low 30	Low 3
The Tailings Drying Cells, Process Water Dam and/or the Environmental Dam will have been removed and the land rehabilitated	Nearby users of the groundwater <1km	Unlikely 0.1	Low 30	Low 3
Mine Affected Water (MAW) infrastructure including dams, pipes and other plant will have been removed and the land rehabilitated	Nearby users of the groundwater <1km	Unlikely 0.1	Low 30	Low 3

Section 6 Evaluation of Potential Impacts to GW Resources

Currently groundwater has the potential to flow towards the open pits of adjacent mining leases including the Daunia and Poitrel operations where they intersect the watertable and discharge (through evaporation or pumping) and are managed on those sites. This groundwater table is not thought to be in hydraulic connection with the alluvial aquifer in New Chum Creek, as in the FCCMA does not feed the alluvial aquifer, however the shallow alluvial aquifer may serve as a recharge pathway to the FCCMA following alluvial recharge via rainfall/flow in New Chum Creek.

Depth to groundwater in the FCCMA is likely to be around 15–25 m in the vicinity of the creek (e.g. MB11A and MB11B have recent April 2021 depth to water readings of 22.4 and 20.0 m bgs respectively, while bore 162248 had a depth to water of 18.5 m bgs at in December 2013 – as shown on RN162248 bore report card obtained from QLD Globe).

The average salinity of groundwater samples collected from site monitoring bores (average salinity ranging from around 1700 – 3700 mg/L) is too high to include potable drinking water as a possible use but does suggest a potential use for livestock drinking water, irrigation or industrial uses, as well as water-based recreation (ANZECC & ARMCANZ, 2000). There have been no groundwater users (i.e. extraction wells) identified within or directly adjacent to the site, with the nearest groundwater user identified at the Poitrel Mine ~500m west of the site. Considering potential future land uses based on the current site rehabilitation planning groundwater may potentially be used for livestock drinking water, irrigation, or industrial applications, in which case the current water quality based on sample results to date would indicate the water is suitable for these future land uses.

Currently surface water and stormwater from the disturbed areas of the site is prevented from entering New Chum Creek through on-site water management, limiting the potential for mine affected waters to enter the environment via a surface water. The most likely pathway for stormwater or process water to enter the environment from the site is via the groundwater system (leakage) or intentional controlled releases from the water storage dams under the EA conditions. Noting that since the operation of the site by BMC, there has not been any releases of water from the RMI dams. The post closure final landform will govern surface water flow paths moving forward, but with the site currently proposing the removal of all infrastructure and mine structures the currently disturbed areas will have been rehabilitated, and surface water flows across site will have been returned to a natural setting. As such there is no notable surface water impacts predicted on the environment at this time.

The riparian vegetation along New Chum Creek has been identified as an “Unclassified potential GDE”. During wetter periods of the year, it is likely that creek infiltration and rainfall would be the primary source of water for this riparian vegetation (given it would be available at shallow depths and low salinity).

The base elevation of New Chum Creek ranges from approximately 238 m AHD west of RMI to 225 m AHD towards the southern boundary of the site (AMEC, 2005). Groundwater elevations of the FCCM underlying the site and in the vicinity of the creek have historically ranged, between 215 m AHD and 218 m AHD. Groundwater elevations are consistently 7 m below the base of the creek, indicating losing conditions during flow periods.

During flow periods of New Chum Creek, it is expected that water will be lost through infiltration to the groundwater system rather than gaining any groundwater discharge (baseflow). It is possible there may be a perched alluvial aquifer in the vicinity of New Chum Creek, but this has not been targeted by any existing monitoring bore infrastructure and the nature and occurrence of this aquifer may need to be considered further. During drier periods of the year, there is a relatively thick unsaturated zone beneath the creek which is likely to provide a considerable source of water for vegetation through soil moisture.

Section 6 Evaluation of Potential Impacts to GW Resources

The likelihood of impacts on groundwater resources or receptors is considered low given the current understanding of potential risk pathways identified, namely:

- A relatively deep watertable precluding the possibility of groundwater discharge to New Chum Creek, with current groundwater predicted to discharge downgradient into neighbouring mining operations where those operations are actively mining coal seams of the FCCMA.
- Current onsite stormwater management prevents uncontrolled direct discharge to the surface water environments, with future surface water flows planned to occur across fully rehabilitated land surfaces presenting a low likelihood of future impact to receptors.
- A thick unsaturated zone provides a viable source of soil moisture for use by vegetation during dry periods, rather than potential use of water sourced from the capillary fringe above the watertable (i.e., riparian vegetation communities are less likely to be GDEs).
- Groundwater flowing through the site may ultimately discharge into the open pits of adjacent mining leases to be managed there and is not considered to present an unacceptable any potential impact at this time.
- Groundwater users have not been identified on or in the immediate vicinity of the site, with the nearest groundwater users reported that there are five existing bores used for water supply and two existing bores with unknown water use purposes within 2 km of RMI.
- Given the depth to groundwater, the dilution that would occur should any seepage occur and the water quality results noted to date it is unlikely the current water supply users would be impacted.

Considering the above, the consequence of potential impact to groundwater receptors is considered to be low to moderate given the lack of identified adverse groundwater conditions within the context of its potential uses (non-drinking water quality uses). From a closure perspective and considering the rehabilitation plan for the site (decommissioning and removal of all water storage facilities and site stockpiles) it is expected that post-closure potential impact to groundwater receptors will also be low.

In summary, given the current understanding of groundwater flow, stormwater management, potential GDEs/ecological receptors and absence of nearby groundwater users, there is a low risk of potential impacts on groundwater resources at the site.

Section 7 Conclusions and Recommendations

The key findings in relation to groundwater conditions at the RMI site in development of a hydrogeological CSM include:

- Identification of the primary hydrostratigraphic units on site as the unconfined fractured rock aquifer hosted by Fort Cooper Coal Measures (including siltstones, sandstones and other hard rock units) and a potential perched alluvial aquifer which has not yet been targeted by monitoring infrastructure.
- The unit identified as a Shale/Mudstone directly beneath the site may be an aquitard and has the potential to influence seepage flows and potentially prevent recharge waters progressing through the unit and recharging the FFMA, although this requires further investigation.
- Groundwater on site is sourced from regional groundwater inflow from the north and rainfall recharge occurring on site, with additional recharge sources provided by infiltration during flow periods of New Chum Creek and leakage below site features such as Tailings Drying Cells, Process Water Dam and Environmental Dam.
- Infiltrating water must first travel through a relatively deep unsaturated zone before reaching the watertable at 15–25 m below ground.
- Terrestrial vegetation associated with New Chum Creek identified as an “Unclassified potential GDE” are unlikely to be dependent on groundwater given the shallow and fresher sources of water available from rainfall, creek infiltration and a relatively deep unsaturated zone.
- Groundwater salinity trends are relatively stable, with changes in major ion chemistry identified in MB3A and MB3B, most likely due to the influence of groundwater mixing with leakage from the southern Process Water Dam.
- Groundwater flow direction is inferred based on monitoring bore observations to be generally from the north-northwest towards the south-southeast and may travel at velocities around 1 m/y under notional hydraulic parameter assumptions.
- Given the current understanding of the site, there is a low likelihood and low consequence of potential impacts on groundwater resources and/or receptors.

Recommendations

It is recommended that BMC progress their understanding the actual contamination status at the site to inform the potential for groundwater exposure during operations but also to inform decommissioning and rehabilitation activities, which includes gathering data about contamination at the site that could pose a risk to potential receptors including groundwater. To that end, undertaking a Detailed Site Investigation of, at a minimum, soil and groundwater, is recommended allowing risk ratings to be confirmed and to better inform future closure efforts and long-term rehabilitation goals.

Subsurface drilling on site and the subsequent installation of groundwater monitoring wells suitable for water level and water quality monitoring in relation to this investigation should include but not be limited to the:

- Shallow alluvial aquifer/New Chum Creek, possible hydraulic connection to FFMA.
- Shallow weathered sandstone and clay units identified immediately beneath the site but above the Shale Mudstone unit to determine any perched shallow groundwater/contaminants in this space confined by the Shale Mudstone unit.
- Relevant site locations connected to key currently operating infrastructure to assess seepage (eg drying cells, Process Water Dam etc).

Section 8 Disclaimer and Limitations

This report has been prepared by CDM Smith Australia Pty Ltd (CDM Smith) at the request of BHP Billiton Mitsui Coal Pty Ltd (BMC) for the purpose of conducting a Preliminary Site Investigation (PSI) to support the development of the Transitional Progressive Rehabilitation and Closure Plan (PRC plan) for the Red Mountain Infrastructure (RMI).

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If further information becomes available, or additional assumptions need to be made, CDM Smith reserves its right to amend this report.

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Soil and Capping Study for Transitional PRCP
for the Red Mountain Infrastructure Project

Prepared for BHP Pty Ltd
Prepared by GT Environmental Pty Ltd

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EXECUTIVE SUMMARY

GT Environmental (GTE) was commissioned by BHP Pty Ltd (BHP) to complete a Soil and Capping Study (SC) for the transitional Progressive Rehabilitation and Closure Plan (PRC Plan) for Red Mountain Infrastructure, herein known as the Project.

The project was formerly a Joint Venture (RMJV) with BHP Mitsui Coal (BMC) and Peabody and is now owned by BMC. The project is located approximately 140km southwest of the city of Mackay, in Central Queensland. The nearest regional centre is Moranbah, which is located approximately 20km to the west.

There are several coal mines operating in the vicinity including Millennium Coal Mine, Carborough Downs Mine, Daunia Mine and Poitrel Mine. RMI consists of a Coal Processing Plant (CPP) and supporting infrastructure.

The scope of works for the SCS included

- a desktop survey using publicly available information, existing soil survey reports and Environmental Impact Statements (EIS) to identify and describe existing soil mapping units (SMUs), their distribution, soil capability for agricultural land uses and topsoil resource material across the project site.
- An assessment of topsoil stockpiles samples, classification into desktop SMUs, assessment of land and soil capability and suitability as topsoil resource material.
- An assessment of the materials balance and placement strategy of existing soil resources.

Four SMUs and one variant were identified in the desktop review of the project site. These include;

- A2 (Alluvial, sandy hard duplex soil),
- B4 (Friable Brigalow scrub soil, black cracking clay),
- B4v (Variant to B4, fine red/brown brigalow clay),
- Db2 (Linear gilgai on dark grey, brown clays), and,
- DB4 (Moderately well-structured grey, brown cracking clays).

Six samples were collected from the project site, four (RM1, RM2, RM3 and RM4) from three topsoil stockpiles (Stockpile 1, 2 and 3) and two (RM5 and RM6) from a reference site, Q10.

An assessment of the topsoil samples was undertaken using external guidelines and technical report as well as internal BHP manuals. The topsoil samples reported minor limitations. All four topsoil samples scored 'Good' in the BHP Soil/Spoil weighted scoring system.

Land suitability assessment was conducted for the desktop SMUs and available data from the Daunia Coal Mine Project, Environmental Impact Statement (2008) and associated appendix, Appendix F.2 for SMUs A2 and B4. Previous agricultural assessments for SMUs on site

reported SMU B4 had moderate limitations for rainfed cropping with all other SMUs reporting severe or extreme limitations. Four of the five SMUs were suitable for beef cattle grazing with SMU A2 reporting an unsuitable class.

An assessment of A2 and B4 against GALE, 2015 and Regional Frameworks, 2013 reported SMU A2 not suitable for the land management options with severe limitations, however SMU B4 reported moderate limitations, indicating it was suitable for Class A cropping.

A limited assessment of the topsoil samples for Land Suitability for cattle grazing as per BHP Rehabilitation Monitoring Program indicated negligible to moderate limitations. These limitations potentially outlined that soil physical condition of the surface may reduce the suitability of the topsoil resource material, however recommended amelioration would manage this. This suggests that with the suitable final landform, the topsoils are suitable to support cattle grazing.

A total volume of topsoil resource material onsite is assessed as sufficient for the approximate disturbance area if the topsoil placement depth is 0.10m.

Topsoil resources onsite were assessed as sufficient with amelioration recommendations including the application of fertiliser to stockpile 3, the topsoil placement of Stockpile 3 material on level plains, with a maximum of less than 3% slope and the incorporation of organic matter for stockpile 2.

1 INTRODUCTION

1.1 Project Details

GT Environmental (GTE) was commissioned by BHP Pty Ltd (BHP) to complete a Soil and Capping Study (SCS) for the transitional Progressive Rehabilitation and Closure Plan (PRCP) for Red Mountain Infrastructure (RMI), herein known as the Project.

The project was formerly a Joint Venture (RMJV) with BHP Mitsui Coal (BMC) and Peabody and is now owned by BMC. The project is located approximately 140km southwest of the city of Mackay, in Central Queensland. The nearest regional centre is Moranbah, which is located approximately 20km to the west. There are several coal mines operating in the vicinity including Millennium Coal Mine, Carborough Downs Mine, Daunia Mine and Poitrel Mine. RMI consists of a Coal Processing Plant (CPP) and supporting infrastructure.

Figure 1 includes a Mining Lease (ML) 70312 covering an area approximately 291 hectares (ha) (Project Site).

1.2 Scope of Report

This report provides the following study inputs for the SCS and the transitional PRCP for the project site. This includes:

- A description of the project site setting, topography and geology (Section 2),
- A description of the assessment methods and relevant guidelines (Section 3),
- A desktop survey using publicly available information, existing soil survey reports and Environmental Impact Statements (EIS) to identify and describe existing soil mapping units (SMUs), their distribution, soil capability for agricultural land uses and topsoil resource material across the project site (Section 4.1),
- An assessment of topsoil stockpiles samples, classification into desktop SMUs, assessment of land and soil capability and suitability as topsoil resource material (Sections 4.2 and 4.5), and,
- An assessment of the materials balance and placement strategy of existing soil resources (Section 4.5).

2 PROJECT SETTING

2.1 Land Use

The project site consists of a Coal Handling and Preparation Plant (CHPP) and supporting Infrastructure including a train rail loop, hardstands, haul roads, dams, stockpiles (coal and topsoil), unsealed and sealed roads. No agricultural activities are undertaken in the project site.

Surrounding site land uses includes Millennium Coal Mine to the north and west, Daunia Mine to the east and Poitrel Mine to the south. Undisturbed land between the northern and eastern land uses includes native bushland.

2.2 Topography and Hydrology

The landscape of the study area includes gently undulating plains with elevations in the range of approximately 220 to 250 metres (m) approximately based on digitised orthophoto mapping of the Bowen Basin (Queensland Government, 2012).

New Chum Creek transects from north to south through the project site.

2.3 Regional Geology

Detailed surface geology of the project site (Queensland Globe, 2021) reports it is part of the Fort Cooper Coal Measures, consisting of Lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff, tuffaceous (cherty) mudstone and Late Tertiary – Quaternary red-brown mottled, poorly consolidated sand, silt, clay, minor gravel; high-level alluvial deposits

3 METHODOLOGY

3.1 Overview

A desktop study was undertaken using available soils and land resources information for the project site.

Collection of soil samples for laboratory analysis was undertaken based on the methodology outlined in BHP Qld Coal Rehabilitation Monitoring Program, Initial & Major Monitoring Methodology (2020) (BHP, 2020a).

Laboratory analysis was conducted on the soil samples collected based on analysis requirements outlined in BHP, 2020a, BHP Coal Rehabilitation Manual (2020) (BHP, 2020b) and GTE recommended technical guidelines and documents.

Assessment of soil samples was undertaken against best practice guidelines, technical documents, BHP, 2020a and BHP, 2020b. The suitability of soils for rehabilitation have been assessed using the field and laboratory assessment of texture, fertility, dispersive and structural attributes.

Determination of land suitability for the project site has been conducted based on a review of the land suitability assessment of cattle grazing on coal mine rehabilitation (Short, 2018) as well as woodland habitat suitability BHP, 2020a.

Topsoil resource assessment including a materials balance and placement strategy for the project site have been assessed.

3.2 Desktop Soil Survey Study

GTE conducted a desktop site-wide soil survey to develop an initial soils (reference) map for the project site. GTE reviewed the available soils and land resources information to develop soil mapping unit (SMUs) and their distribution across the project site.

Information included EIS reports, satellite imagery, topographic maps, existing soil studies, prior and current physiographic / geological / vegetation mapping and previous published studies for the site, area and region.

The desktop study also included review of the current disturbance areas onsite, their locations and approximate area.

3.2.1 Regional Land and Soils Report Documentation and References

The following reports and publicly available information were reviewed to identify previous soils and land suitability fieldwork and recommendations relevant to the project site.

- Story et al. (1967), Lands of the Isaac-Comet Area, Queensland, CSIRO

This report describes a total of 28 land systems types across the Isaac-Comet area in central Queensland and comprises of 42,700 square kilometres. It provides land use

limitation information for each soil type, including climate, moisture supply, fertility, wetness, flooding frequency, rockiness, topography, soil physical condition, vegetation, erodibility, landscape complexity and salinity. The information on land use limitations is useful in assisting in the development of recommendations for the stripping and reuse of soils in the project site. This report indicates that the project site is located in the Humboldt land system. This land system indicates that loamy red and yellow earths, texture contrast soils, cracking clay soils and gilgaied cracking clay soils may potentially be present within the project site and its surrounds.

- Daunia Coal Mine Project – Environmental Impact Statement

The land resources section of the Environmental Impact Statement (EIS) provides desktop and fieldwork soils survey information relating to the Daunia Coal Mine Project located to the south, southeast of the project site. This information includes background information such as topography, geology, soil survey methodologies, site sampling plan, soil mapping units, agricultural land suitability assessment, post mine land use suitability and topsoil rehabilitation depths and recommendations. This soil survey information includes soil sampling undertaken in 2004, for the BHP Poitrel EIS (SKM, 2004) as well as the soil survey conducted for the Daunia EIS (2008).

- Millennium Expansion Project – EIS

The land resources section of the EIS provides desktop and fieldwork soils survey information relating to the Millennium Expansion Project (MEP, [2009]) Daunia Coal Mine Project located to the south, southeast of the project site. This information includes background information such as topography, geology, soil survey methodologies, site sampling plan, soil mapping units, agricultural land suitability assessment, post mine land use suitability and topsoil rehabilitation depths and recommendations.

Other resources included,

- "Queensland Globe". State of Queensland. Retrieved 15 July 2021.

Queensland Globe resources allows for the review of the project site spatial data with publicly available topography, surface geology and soils data (Story et al. 1967).

- Red Mountain Infrastructure Joint Venture, Plan of Operations, Version 9 (2018).

The plan of operations outlines the current CHPP related disturbance on ML70312.

- Red Mountain Infrastructure Joint Venture, Topsoil Management Plan, (BHP Billiton, 2017).

The topsoil management plan provided the stockpile areas and inventory (volume in m³).

3.2.2 Satellite Imagery

Satellite Imagery from Google Earth (accessed on 13 July 2021) and Queensland Globe (accessed 15 July 2021) was reviewed as part of the desktop study. Preliminary SMU boundaries were identified with the assistance of this imagery.

3.3 Characterisation of Topsoil Stockpiles and Reference Site

The following sections provide the methodology of topsoil stockpile and analogue (reference) site sampling, analysis and characterisation.

3.3.1 Soil Sample Collection

Soil samples were collected from three existing topsoil stockpiles and one reference site, located outside the project site, refer to Figure 1.

Soil samples were collected from stockpiles by BHP personnel using a hand trowel from 0.00 to 0.10 m depth. The two samples at the reference site were collected at 0.00-0.10 m (RM5) and 0.10-0.20 m (RM6).

Samples were collected in plastic bags, labelled and with the assistance of GTE, couriered to the nominated laboratory (Environmental Analysis Laboratory [EAL], under the additional supervision of Environmental Soil Solutions Australia [ESSA]).

These soil sample, stockpiles identification, reference site and volumes are presented in Table 3-1 and Figure 1.

Table 3-1: Topsoil Stockpile Identification, Volume and Soil Sampling Sites

Stockpile Identification	Volume (m ³)	Soil Sample Identification
Stockpile 1	85,472	RM4
Stockpile 2	49,686	RM2, RM3
Stockpile 3	6,294	RM1
Stockpile 4	1,515	n/a
Stockpile 5	1,381	n/a
Reference Site		
Q10	-	RM5, RM6

3.3.2 Laboratory Analysis

A total of six soil samples were submitted for laboratory analysis. Laboratory analysis was undertaken to assist in the characterisation of the soils and to establish the physical and chemical limitations of soils. Laboratory testing also assists in identifying soils specific management measures for the soil resource.

Samples were analysed at the nominated laboratory EAL, under the additional supervision of ESSA. EAL are accredited by the National Association of Testing Authority (NATA) and

additionally certified by the Australasian Soil and Plant Analysis Council (ASPAC). ESSA consists of Dennis Baker, a soil chemistry specialist.

Laboratory analysis was based on recommended soils tests for surface soil characterisation BHP Man Coal Rehabilitation Manual, (2019), BHP QLD Coal Rehabilitation Monitoring Program, (2019) and recommendations by GTE. The laboratory analysis for surface soil horizons included the following parameters.

- pH (1:5 & Chloride),
- Electrical Conductivity (EC [1:5]),
- EC Saturated (Calculated by GTE),
- Texture class,
- Chloride,
- Organic Carbon,
- Nitrogen, as nitrate and ammonium,
- Bicarbonate extractable P (Colwell),
- Sulfur, S,
- Exchangeable Cations (Ca, Mg, Na, K),
- Cation Exchange Capacity (CEC),
- Exchangeable Sodium Percentage (ESP),
- Calcium/Magnesium (Ca/Mg) Ratio,
- Micronutrients (Mn, B, Cu, Fe, Zn),
- Particle Size Analysis (PSA) – Hydrometer Method (Coarse Sand [CS], Fine Sand [FS], Silt, Clay),
- Emmerson Aggregate Test (EAT), and,
- Munsell Colour.

3.3.3 Sample Characterisation

Sample characterisation was undertaken by reviewing the sample laboratory data and desktop soil survey for the following outcomes;

- Assess the limitations and quality of the stockpile samples and reference site based on the physical and chemical attributes against the manuals, guidelines and technical documents listed below, and,
- Assess the quantity and location of each desktop SMU located on the project site.

The following manuals, guidelines and technical documents were reviewed in assisting the assessment of the SMU physical and chemical attributes;

- Analytical Methods and interpretations used by the Agricultural Chemical Branch, QDPI, for soil and land use surveys. (QDPI Bulletin QB82004, 1982),
- BHP Coal Rehabilitation Manual (2020) (BHP, 2020b),
- BHP Qld Coal Rehabilitation Monitoring Program, Initial & Major Monitoring Methodology (2020) (BHP, 2020a),
- Interpreting Soil Test Results (Hazelton and Murphy, 2016),
- Land Resource Assessment of the Windyers Hill Aream Isaac-Connors and Mackenzie River Catchments, Central Queensland, Volume 2 (Burgess JW, 2003),
- Soil Chemical Methods of Australasia (Rayment GE and Lyons D, 2011), and,
- Soil Testing and Some Test Interpretations used by the QDPI (QDPI Bulletin QI84029, 1984).

3.4 Materials Balance and Placement Strategy

The materials balance and placement strategy would utilise desktop soil survey and soil characterisation information for rehabilitation-related suitability.

This would include the classification of desktop SMUs and topsoil resource material against the land suitability assessment for Cattle Grazing and/or Woodland Habitat post mining land uses (PMLUs) as outlined in BHP, 2020b.

Guidelines for Agricultural Land Evaluation in Queensland (Second Edition) (DSITI & DNRM, 2015) (ALE Guidelines) and Regional Land Suitability Frameworks for Queensland (DNRM, 2013) (Regional Frameworks) were considered, however they relate to fully developed soil profiles, and not the stockpile sampling undertaken by BHP. Desktop information relating to SMUs A2 and B4 are presented in Daunia EIS (2008), Appendix F.2 (2004) and includes full soil profiles and laboratory results which were reviewed.

Recommendations for site-specific soil management activities aligned to the requirements of the BHP, 2020b would be reviewed, including soil amelioration, fertiliser application, resource application depths and seedbed preparation. Identification of additional or alternative growth medium resources to address any deficits would be reviewed as required.

Development of a materials balance and placement strategy indicating areas of preferential placement to optimise rehabilitation for the site would be included, which would consider the haul distance for application, preferred cover material and topsoil management recommendations.

4 ASSESSMENTS

4.1 Desktop Soil Survey

A review of available soil survey information indicated that SMUs have been mapped adjacent to the south and east during the Daunia EIS (2008). Review of the EIS, available spatial data as well as the other desktop available resources such as the Millennium EIS (MEP, 2009) and Poitrel EIS (SKM, 2004) indicated the following SMUs may be present on the project site, refer Table 4-1.

Table 4-1: Soil Mapping Units, Concepts and Australian Soil Classification in the Project site

SMU Code ¹	SMU Concept	Additional Notes	Australian Soil Classification
A2	Alluvial, sandy hard duplex	Hard setting sandy loam duplex soils alongside New Chum Creek often with bleached A2 over hard coarse structured medium yellow clay often heavily mottled. Poplar Box mixed woodlands with associated Brigalow and Blackbutt.	Brown Sodosol
DB4	Moderately well-structured grey, brown cracking clays	Little or no gilgai.	Brown Vertosol ²
B4	Friable Brigalow scrub soil, black cracking clay	Deep well-structured black cracking clay with granular surface mulch.	Black Vertosol
B4v	Variant to B4	Fine granular non-cracking red / brown Brigalow scrub soil.	Black Vertosol
DB2	Linear gilgai on dark grey, brown clays	Cracking and non-cracking clays. Brigalow, Bauhinia, Poplar Box and Dawson Gum.	Brown Vertosol ²

1 – SMU codes are shown as Daunia EIS, 2008

2 – Australian Soil Classification not available for the SMU codes on review. Assessed by GTE based on SMU Code Description and available information.

The available figures in the Daunia EIS (2008), Figure 4-4 presents the SMU distribution adjacent the project site. Review of the landscape patterns, geology and topography features indicated the SMUs distribution as presented in Figure 1. Table 4-2 provides a summary of the areas of each SMU.

Table 4-2: Soil Mapping Units in the Project site

SMU Code	Area (Hectares) on Project Site
A2	186
DB4	24
B4	76
B4v	1

SMU Code	Area (Hectares) on Project Site
DB2	4
Total Area	291

4.2 Soil Characterisation

The following sections outline the characterisation of soil samples collected for the project site. This includes a summary of the laboratory data, assessment against various guidelines and manuals with summaries of the soil samples limitations.

4.2.1 Soil Characterisation of Collected Soil Samples

A total of six samples were collected and send for laboratory analysis. Table 3-1 presents the samples taken from the topsoil stockpiles or reference site.

The following Table 4-3 summarises the soil samples laboratory data. Soil capability is presented in Section 4.3 and suitability as topsoil resource material in Section 4.4. Refer to Appendix A for laboratory certificates.

Table 4-3: Soil Chemistry Results for Soil Samples

Analysis (Unit)	Soil Samples and Associated Sampling Locations					
	RM1	RM2	RM3	RM4	RM5	RM6
	Stockpile 3	Stockpile 2		Stockpile 1	Reference Site Q10	
Soil pH (H2O)	8.07	7.46	6.79	6.36	7.47	6.10
Soil pH (CaCl2 / 0.01M)	6.7	4.2	10	8.2	5.3	6.5
Soil EC (dS/m)	0.174	0.083	0.183	0.096	0.103	0.034
Soil Cl (milligrams per kilogram [mg/kg])	111	53	117	61	66	22
Exch. Ca (milli-equivalent per 100 grams [meq/100g])	11	5.3	7.4	4.9	23	5.6
Exch. Mg (meq/100g)	3.4	2.5	2.0	1.8	5.4	1.6
Exch. K (meq/100g)	1.4	0.79	0.84	0.54	1.5	0.55
Exch. Na (meq/100g)	<0.065	<0.065	0.09	<0.065	0.16	<0.065
CEC (meq/100g)	16	8.7	10	7.4	30	8.1
ESP (%Na/CEC)	0.31	0.30	0.87	0.35	0.54	0.11
Ca/Mg (ratio)	3.2	2.1	3.6	2.7	4.3	3.5
Zinc (mg/kg)	1.7	<0.5	0.93	0.80	1.6	1.0
Mn (mg/kg)	8.2	8.6	16	20	13	34
Iron (mg/kg)	18	16	19	154	30	47
Copper (mg/kg)	1.2	0.66	1.0	0.73	1.1	1.2

Analysis (Unit)	Soil Samples and Associated Sampling Locations					
	RM1	RM2	RM3	RM4	RM5	RM6
	Stockpile 3	Stockpile 2		Stockpile 1	Reference Site Q10	
Boron (mg/kg)	0.44	0.42	0.51	0.41	0.65	0.19
Silicon (mg/kg)	19	31	46	27	50	36
Tot Organic Carbon (%)	1.1	0.85	1.3	1.9	4.2	2.2
Organic Matter (%)	1.8	1.5	2.3	3.4	7.3	3.8
P (mg/kg) (Colwell)	12	13	22	16	106	26
Nitrate (mg/kg)	7.6	9.2	41	14	11	4.4
Ammonia (mg/kg)	0.89	0.51	0.98	1.3	1.2	1.3
Total Nitrogen (%)	0.07	0.05	0.08	0.09	0.30	0.10
Sulfate-S (mg/kg)	2.4	9.3	8.9	7.2	3.3	6.7
C/N (Ratio)	16	19	16	17	16	17
Total P (mg/kg)	312	190	225	264	657	310
Munsell Colour	7.5YR3/2	7.5YR3/3	7.5YR3/3	10YR3/2	10YR3/3	10YR3/2
Texture (Category)	Clay Loam	Clay Loam	Loam	Loam	Silty Clay Loam	Sandy Loam
Moisture Content	13	11	6	10	21	5
Gravel >2mm (%)	3	5	1	2	0	4
CS >50µm (%)	39	55	52	63	23	65
CS >20µm (%)	51	64	62	72	35	73
2-50µm-Silt (%)	30	21	26	23	40	18
2-20µm-Silt (%)	18	12	15	14	28	10
Clay <2µm (%)	31	24	23	14	37	17
EAT (No.)	2	5	5	5	5	5

4.2.2 Assessment of Laboratory data

The assessment of laboratory data was undertaken against several technical documents, references and BHP manuals for surface soil sufficiency and soil/spoil weight scores. The following tables outline the assessments and references.

- Table 4-4 reviews the laboratory data with reference to the guidelines and technical documents in Section 3.3.3, not including BHP documents,
- Table 4-5 reviews the recommended sufficiency levels for surface soils as outlined in Table 3-10 of the BHP, 2020b, and,

- Table 4-7 reviews all samples based on the Soil/Spoil weighted scoring system outlined in the BHP, 2020a.

The assessment summary of the soils samples collected are presented in Sections 4.2.3 to 4.2.8.

Table 4-4: Soil Chemistry Assessment Ratings for Soil Samples – Technical Documents (Section 3.3.3)

Analysis (Unit)	Soil Samples					
	RM1	RM2	RM3	RM4	RM5	RM6
Soil pH (H2O)	8.07	7.46	6.79	6.36	7.47	6.10
pH Rating	Moderate alkaline	Mildly alkaline	Neutral	Slightly acidic	Mildly alkaline	Slightly acidic
Soil EC (dS/m)	0.174	0.083	0.183	0.096	0.103	0.034
EC Rating	Moderate	Low	Moderate	Low	Low	Very low
Soil Cl (mg/kg)	111	53	117	61	66	22
Cl Rating	Very low	Very low	Very low	Very low	Very low	Very low
CEC (meq/100g)	16	8.7	10	7.4	30	8.1
CEC Rating	Moderate	Low	Low	Low	High	Low
ESP (%Na/CEC)	0.31	0.30	0.87	0.35	0.54	0.11
ESP Rating	Non-sodic	Non-sodic	Non-sodic	Non-sodic	Non-sodic	Non-sodic
Ca/Mg (ratio)	3.2	2.1	3.6	2.7	4.3	3.5
Ca/Mg Rating	Very high	Very high	Very high	Very high	Very high	Very high
Zinc (mg/kg)	1.7	<0.5	0.93	0.80	1.6	1.0
Zinc Rating	Moderate	Low to very low	Moderate	Moderate	Moderate	Moderate
Mn (mg/kg)	8.2	8.6	16	20	13	34
Mn Rating	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Copper (mg/kg)	1.2	0.66	1.0	0.73	1.1	1.2
Copper rating	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Tot Organic Carbon (%)	1.1	0.85	1.3	1.9	4.2	2.2
TOC Rating	Low	Low	Low	Moderate	High	Moderate
P (mg/kg) (Colwell)	12	13	22	16	106	26
P Rating	Moderate	Moderate	High	Moderate	Very high	Very high
Total Nitrogen (%)	0.07	0.05	0.08	0.09	0.30	0.10
TN Rating	Low	Low	Low	Low	High	Low
C/N (Ratio)	16	19	16	17	16	17
C/N Rating	Moderate to high	High	Moderate to high	High	Moderate to high	High
EAT (No.)	2	5	5	5	5	5
EAT Rating	Slaking and some dispersion	Dispersion observed in aggregate/water suspension	Dispersion observed in aggregate/water suspension	Dispersion observed in aggregate/water suspension	Dispersion observed in aggregate/water suspension	Dispersion observed in aggregate/water suspension

Table 4-5: Recommended Sufficiency Levels for Surface Soils, BHP, 2020b

Analysis (Unit)	Soil Samples					
	RM1	RM2	RM3	RM4	RM5	RM6
Soil pH (H ₂ O)	8.07	7.46	6.79	6.36	7.47	6.10
Sufficiency As.	Marginal above range	Recommended	Recommended	Recommended	Recommended	Recommended
Soil pH (CaCl ₂ / 0.01M)	6.7	4.2	10	8.2	5.3	6.5
Sufficiency As.	Recommended	Not in range	Not in range	Not in range	Recommended	Recommended
Soil EC (dS/m)	0.174	0.083	0.183	0.096	0.103	0.034
Sufficiency As.	Recommended	Recommended	Recommended	Recommended	Recommended	Recommended
Soil EC _{SAT1}	1.566	0.747	1.83	0.96	0.927	0.476
Sufficiency As.	Recommended	Recommended	Recommended	Recommended	Recommended	Recommended
Soil Cl (mg/kg)	111	53	117	61	66	22
Sufficiency As.	Recommended	Recommended	Recommended	Recommended	Recommended	Recommended
Tot Organic Carbon (%)	1.1	0.85	1.3	1.9	4.2	2.2
Sufficiency As.	Recommended	Not in range	Recommended	Recommended	Not in range	Recommended
Nitrate (mg/kg)	7.6	9.2	41	14	11	4.4
Sufficiency As.	Not in range	Not in range	Recommended	Recommended	Recommended	Not in range
Ammonia (mg/kg)	0.89	0.51	0.98	1.3	1.2	1.3
Sufficiency As.	n/a	n/a	n/a	n/a	n/a	n/a
P (mg/kg) (Colwell)	12	13	22	16	106	26
Sufficiency As.	Recommended	Recommended	Recommended	Recommended	Recommended	Recommended
Sulfate-S (mg/kg)	2.4	9.3	8.9	7.2	3.3	6.7
Sufficiency As.	Not in range	Not in range	Not in range	Not in range	Not in range	Not in range
CEC (meq/100g)	16	8.7	10	7.4	30	8.1
Sufficiency As.	Recommended	Not in range	Not in range	Not in range	Recommended	Not in range
ESP (%Na/CEC)	0.31	0.30	0.87	0.35	0.54	0.11
Sufficiency As.	Recommended	Recommended	Recommended	Recommended	Recommended	Recommended
Exch. Ca (meq/100g)	11	5.3	7.4	4.9	23	5.6
Sufficiency As.	Not in range	Recommended	Recommended	Not in range (marginal)	Not in range	Recommended
Exch. Mg (meq/100g)	3.4	2.5	2.0	1.8	5.4	1.6
Sufficiency As.	Not in range	Recommended	Recommended	Recommended	Not in range	Recommended
Exch. K (meq/100g)	1.4	0.79	0.84	0.54	1.5	0.55

Analysis (Unit)	Soil Samples					
	RM1	RM2	RM3	RM4	RM5	RM6
Sufficiency As.	Not in range	Not in range	Not in range	Recommended	Not in range	Recommended
Exch. Na (meq/100g)	<0.065	<0.065	0.09	<0.065	0.16	<0.065
Sufficiency As.	Not in range	Not in range	Not in range	Not in range	Not in range	Not in range
Zinc (mg/kg)	1.7	<0.5	0.93	0.80	1.6	1.0
Sufficiency As.	Recommended	Not in range	Recommended	Recommended	Recommended	Recommended
Mn (mg/kg)	8.2	8.6	16	20	13	34
Sufficiency As.	Recommended	Recommended	Recommended	Recommended	Recommended	Recommended
Iron (mg/kg)	18	16	19	154	30	47
Sufficiency As.	Recommended	Recommended	Recommended	Not in range	Recommended	Recommended
Copper (mg/kg)	1.2	0.66	1.0	0.73	1.1	1.2
Sufficiency As.	Recommended	Recommended	Recommended	Recommended	Recommended	Recommended
Boron (mg/kg)	0.44	0.42	0.51	0.41	0.65	0.19
Sufficiency As.	Not in range	Not in range	Not in range	Not in range	Not in range	Not in range

1 – EC_{SAT} calculated by GTE using the EC 1:5 result, texture and conversion factors, as presented in Lan Series L137, Science Notes, Queensland Government.

Table 4-6: BHP Soil / Spoil Weighted Scoring System, BHP, 2020a

Soil / Spoil Parameter (Unit)	Soil Sample, Result, Performance Category and Depth					
	RM1	RM2	RM3	RM4	RM5	RM6
	0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.10-0.20
EAT (No.)	2	5	5	5	5	5
Criteria / Score	Fair - 4	Good - 6	Good - 6	Good - 6	Good - 6	Good - 6
Soil pH (H2O)	8.07	7.46	6.79	6.36	7.47	6.10
Criteria / Score	Good - 6	Good - 6	Good - 6	Good - 6	Good - 6	Good - 6
Soil EC (uS/m)	174	83	183	96	103	34
Criteria / Score	Good - 6	Good - 6	Good - 6	Good - 6	Good - 6	Good - 6
Soil Cl [mg/kg]	111	53	117	61	66	22
Criteria / Score	Good - 3	Good - 3	Good - 3	Good - 3	Good - 3	Good - 3
CEC (meq/100g)	16	8.7	10	7.4	30	8.1
Criteria / Score	Good - 6	Fair - 4	Fair - 4	Fair - 4	Good - 6	Fair - 4
ESP (%Na/CEC)	0.31	0.30	0.87	0.35	0.54	0.11
Criteria / Score	Good - 9	Good - 9	Good - 9	Good - 9	Good - 9	Good - 9
Total Organic Carbon (%)	1.1	0.85	1.3	1.9	4.2	2.2 ¹
Criteria / Score	Good - 3	Fair - 2	Good - 3	Good - 3	Good - 3	Good - 3
Nitrate as Nitrogen (mg/kg)	7.6	9.2	41	14	11	4.4 ¹
Criteria / Score	Poor - 1	Poor - 1	Poor - 1	Poor - 1	Poor - 1	Poor - 1
P (mg/kg) (Colwell)	12	13	22	16	106	26 ¹
Criteria / Score	Fair - 2	Fair - 2	Good - 3	Fair - 2	Good - 3	Good - 3
Trace Elements	Not assessed (n/a)	n/a	n/a	n/a	n/a	n/a
Total Score	40	39	41	40	43	41
Soil/Spoil Category ²	Good	Good	Good	Good	Good	Good

1 – Soil / spoil parameters for organic carbon, nitrogen and phosphorus are only assessed for depths 0.00-0.10m. These have been included for consistency of assessment results. The lowest result of either RM5 or RM6 would be used for assessing the soil quality for reference site Q10.

2 – Performance categories for soil/spoil are from Table 10, BHP, 2020a

4.2.3 Characterisation Summary - Soil Sample RM1, Stockpile 3

The following points summarise the assessment for soil sample RM1;

- Soil sample RM1 is a brown clay loam soil from Stockpile 3.
- The limitations of the soil include some dispersive attributes with slaking and some dispersion observed, however ESP was non-sodic. The soil has very low to marginally moderate salinity ratings, low organic carbon, phosphorus is moderate relating to soil fertility and the soil is moderately alkaline.

Dispersive limitations are present. ESP levels are non-sodic and Ca/Mg ratios does not indicate that soil dispersion or unfavourable issues with soil structure, however slaking and some dispersion was reported during the emerson aggregate test. Soil does have low to marginally moderate fertility levels and may be assisted with fertiliser application.

- The sufficiency levels for surface soils are within the recommended ranges for most of the analysis. Analytes that are outside the ranges include nitrate, sulfate, exchangeable calcium, manganese, potassium, sodium and boron. pH is marginally above the recommended range.
- The BHP Soil/Spoil weighted scoring system assessed the performance of the sample and associated Stockpile 3 as 'Good' with a score of 40. Limitations included nitrogen levels which were assessed as poor with all other parameters assessed as fair to good.

4.2.4 Characterisation Summary - Soil Sample RM2, Stockpile 2

The following points summarise the assessment for soil sample RM2;

- Soil sample RM2 is a brown clay loam soil from Stockpile 2.
- The limitations of the soil include some dispersive attributes with dispersion observed in an aggregate-water suspension, however ESP was non-sodic. The soil has very low to low salinity ratings, low organic carbon, phosphorus is moderate relating to soil fertility and the soil is mildly alkaline.

Minor dispersive limitations may be present. Slaking of soils was reported with the suspension of soil sample dispersing after a 1:5 soil water suspension disturbance test. Soil is not dispersive when at field capacity, immersed in water undisturbed. ESP levels are non-sodic and Ca/Mg ratios does not indicate that soil dispersion or unfavourable issues with soil structure. Soil does have low to moderate fertility levels and may be assisted with fertiliser application.

- The sufficiency levels for surface soils are within the recommended ranges for most of the analysis. Analytes that are outside the ranges include pH (CaCl₂ / 0.01M), organic carbon, nitrate, sulfate, CEC, potassium, sodium, zinc and boron.

- The BHP Soil/Spoil weighted scoring system assessed the performance of the sample and associated Stockpile 2 as 'Good' with a score of 39. Limitations included nitrogen levels which were assessed as poor with all other parameters assessed as fair to good.

4.2.5 Characterisation Summary - Soil Sample RM3, Stockpile 2

The following points summarise the assessment for soil sample RM3;

- Soil sample RM3 is a brown loam soil from Stockpile 2. The limitations of the soil include some dispersive attributes with dispersion observed in an aggregate-water suspension, however ESP was non-sodic. The soil has very low to moderate salinity ratings, low organic carbon, phosphorus is high relating to soil fertility and pH is neutral.

Minor dispersive limitations may be present. Slaking of soils was reported with the suspension of soil sample dispersing after a 1:5 soil water suspension disturbance test. Soil is not dispersive when at field capacity, immersed in water undisturbed. ESP levels are non-sodic and Ca/Mg ratios does not indicate that soil dispersion or unfavourable issues with soil structure. Soil does have low to high fertility levels and may be assisted with fertiliser application.

- The sufficiency levels for surface soils are within the recommended ranges for most of the analysis. Analytes that are outside the ranges include pH (CaCl₂ / 0.01M), sulfate, CEC, potassium, sodium and boron.
- The BHP Soil/Spoil weighted scoring system assessed the performance of the sample and associated Stockpile 2 as 'Good' with a score of 41. Limitations included nitrogen levels which were assessed as poor with all other parameters assessed as fair to good.

4.2.6 Characterisation Summary - Soil Sample RM4, Stockpile 1

The following points summarise the assessment for soil sample RM4;

- Soil sample RM4 is a brown loam soil from Stockpile 1. The limitations of the soil include some dispersive attributes with dispersion observed in an aggregate-water suspension, however ESP was non-sodic. The soil has very low to low salinity ratings, moderate organic carbon, phosphorus is moderate relating to soil fertility and the soil has slightly acidic pH.

Minor dispersive limitations may be present. Slaking of soils was reported with the suspension of soil sample dispersing after a 1:5 soil water suspension disturbance test. Soil is not dispersive when at field capacity, immersed in water undisturbed. ESP levels are non-sodic and Ca/Mg ratios does not indicate that soil dispersion or unfavourable issues with soil structure. Soil does have moderate fertility levels and may be assisted with fertiliser application.

- The sufficiency levels for surface soils are within the recommended ranges for most of the analysis. Analytes that are outside the ranges include pH (CaCl₂ / 0.01M), sulfate, CEC, calcium (marginal), sodium, iron and boron.

- The BHP Soil/Spoil weighted scoring system assessed the performance of the sample and associated Stockpile 1 as 'Good' with a score of 40. Limitations included nitrogen levels which were assessed as poor with all other parameters assessed as fair to good.

4.2.7 Characterisation Summary - Soil Sample RM5, Topsoil of Reference Site

The following points summarise the assessment for soil sample RM5;

- Soil sample RM5 is a brown silty clay loam topsoil (0.00-0.10 mbgl) located at the reference site Q10 (refer to Figure 1). The limitations of the soil include some dispersive attributes with dispersion observed in an aggregate-water suspension, however ESP was non-sodic. The soil has very low to low salinity ratings, high organic carbon, phosphorus is very high relating to soil fertility and the soil is mildly alkaline.

Minor dispersive limitations may be present. Slaking of soils was reported with the suspension of soil sample dispersing after a 1:5 soil water suspension disturbance test. Topsoil is not dispersive when at field capacity, immersed in water undisturbed. ESP levels are non-sodic and Ca/Mg ratios does not indicate that soil dispersion or unfavourable issues with soil structure. Soil has favourable fertility levels.

- The sufficiency levels for surface soils are within the recommended ranges for most of the analysis. Analytes that are outside the ranges include organic carbon, sulfate, calcium, magnesium, potassium, sodium and boron.
- The BHP Soil/Spoil weighted scoring system assessed the performance of the topsoil sample as 'Good' with a score of 43. Limitations included nitrogen levels which were assessed as poor with all other parameters assessed as good.

4.2.8 Characterisation Summary - Soil Sample RM6, Subsoil of Reference Site

The following points summarise the assessment for soil sample RM6;

- Soil sample RM6 is a brown sandy loam subsoil (0.10-0.20 mbgl) located at the reference site Q10 (refer to Figure 1). The limitations of the soil include some dispersive attributes with dispersion observed in an aggregate-water suspension, however ESP was non-sodic. The soil has very low to low salinity ratings, high organic carbon, phosphorus is very high relating to soil fertility and the soil is mildly alkaline.

Minor dispersive limitations may be present. Slaking of soils was reported with the suspension of soil sample dispersing after a 1:5 soil water suspension disturbance test. Subsoil is not dispersive when at field capacity, immersed in water undisturbed. ESP levels are non-sodic and Ca/Mg ratios does not indicate that soil dispersion or unfavourable issues with soil structure. Soil has favourable fertility levels within the root zone.

- The sufficiency levels for surface soils are within the recommended ranges for most of the analysis. Analytes that are outside the ranges include nitrate, sulfate, CEC, sodium and boron.

- The BHP Soil/Spoil weighted scoring system assessed the performance of the subsoil sample as 'Good' with a score of 41. Limitations included nitrogen levels which were assessed as poor with all other parameters assessed as good.

4.2.9 Topsoil Sample Assessment Summary

The topsoil samples have presented limitations including dispersion or nutrient levels, however, the topsoil soil samples assessed for each of the three stockpiles indicate they are suitable for reuse for rehabilitation with appropriate amelioration and management.

The following section, Section 4.5 would assess and discuss in further detail specific recommendations for the stockpile soil resources for materials balance and placement strategy.

4.2.10 Assessing Soil Samples as Desktop SMUs

A review of the soil sample laboratory data to assess and categorise as desktop SMUs was unable to be completed. The limited information collected could not be assessed against the desktop SMUs information to compare and categorise as SMUs with certainty.

The topsoil resource material may be considered to consist of multiple SMUs topsoil stripped across the project site and therefore cannot be delineated as separate SMUs. The soil samples RM1, RM2, RM3 and RM4 have therefore been assessed based on data presented.

Samples collected from reference site Q10 were assessed and considered to have an affinity with SMU A2. This is based on the laboratory textures reported as a containing sandy loam, in the subsoil horizon (0.10-0.20 m), available photograph (refer to Plate 1) which indicates a non-cracking surface and brigalow scrub and the landscape area visually observed from satellite imagery as the desktop SMU to the south, SMU A2.

Plate 4-1: Photograph of Representative Site Q10



4.3 Land Suitability

4.3.1 Land Suitability of Desktop SMUs

The desktop soil survey indicated that five SMUs (including one variant) have been mapped across the project site using existing data. Review of the existing desktop SMU data (Daunia EIS, 2008) reported the recommended topsoil depths for rehabilitation and land capability assessments for beef cattle grazing and rainfed cropping.

The methodology used to identify agricultural suitability in this survey followed guidelines established by Land Resources Branch (1989), which is the basis for DME (1995), in addition to the work of Shields and Williams (1991) in the Kilcummin area. Land suitability classification is based on specific land uses assessed using the following classes (based on Shields and Williams, 1991 and DME, 1995). The superseded planning guidelines: The Identification of Good Quality Agricultural Land (GQAL) (DLGP and DPI, 1993) was referenced to establish the four classes of agricultural land for Queensland.

This data is presented in Table 4-7 below and in Figures 3 and 4 with the associated methodologies, class and GQAL assessments extracted from Appendix F.2 in Appendix B.

Table 4-7: Desktop SMUs, Topsoil Striping Depths and Land Suitability Classes

SMU Code ¹	Land Suitability Class – Beef Cattle Grazing	Land Suitability Class – Rainfed Cropping	GQAL	Preferred Use ¹
A2	4	5	C1	Grazing on native pastures
DB4	2	5	C1	Grazing with opportunistic forage possible some years
B4	2	3	C1	Excellent grazing land
B4v	2	4	C1	Excellent grazing land
DB2	2	4	C1	Grazing on improved pastures

¹ – Preferred use as referenced in Daunia, 2008

Current Guidelines and Regional Frameworks for Agricultural Land Evaluation

An assessment was undertaken for SMUs A2 and B4 based on the ALE Guidelines, (2015) and Regional Frameworks, (2013), Suitability Framework for the Inland Fitzroy and Southern Burdekin Area.

Assessment was undertaken based on available desktop soil survey information for SMUs A2 and B4 as presented in Daunia EIS (2008), Appendix F.2 (2004). This includes full soil profiles, descriptions and laboratory results. All land management options have been selected and are presented in Tables 4-8 and 4-9.

An assessment for the remaining SMUs DB2, DB4 and B4v was unable to be undertaken due to the lack of available soil profile and laboratory data.

Table 4-8: Summary of Land Suitability for SMU A2

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E) ¹	12	1	1	1	1	1	1	1	1	1	1	1	1	1
Erosion Hazard (Es)	12	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Narrow Moisture Range (Pm)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	8	4	4	4	4	4	4	4	4	4	4	4	4	4
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4s	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

Table 4-9: Summary of Land Suitability for SMU B4

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E) ¹	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	31	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	2	3	3	2	2	3	2	3	2	2	2	2	3	3
Narrow Moisture Range (Pm)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4s	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Suitability Class		3	3	3	3	3	3	3	3	3	3	3	3	3

The land suitability of the various land management options for SMUs A2 and B4 indicate that following;

- SMU A2 is unsuitable for the nominated land management options with severe limitation, surface condition and soil water availability. This SMU would not be classed as suitable for cropping and would be assessed as grazing land, Class C, and,
- SMU B4 is suitable for all nominated land management options with moderate limitations, soil water availability (it is noted, additional laboratory analysis would likely reduce this) and surface condition. This SMU would be classed as suitable for a wide range of cropping and would be assessed within Class A. If not utilised for crops, it is favourable grazing land for beef cattle.

Land Suitability Framework for Cattle Grazing on Rehabilitation. BHP, 2020a

An assessment for SMUs A2 and B4 based on the land suitability frameworks for cattle grazing as presented in BHP, (2020a). These assessments are presented in Table 4-10 and shown on Figure 5.

An assessment for the remaining SMUs DB2, DB4 and B4v was unable to be undertaken due to the lack of available soil profile and laboratory data.

Table 4-10: Land Suitability, Limited Assessment, Cattle Grazing for SMUs A2 and B4

Limitation (Unit)	SMUs	
	A2	B4
Water Availability (PAWC in ERD), Mm/0.6d	3	1
Nutrient Supply P in 0.10m (mg/kg)	5 ¹	5 ¹
Nutrient Supply, pH in 0.10m (pH Units, 1:5 H2O)	2	2
Soil Physical Factors (Surface soil structure)	4	2
Salinity, EC in ERD, (dS/m)	1	1
Rockiness (Fragments on surface)	1	1
Topography Gradient (Surface)	1	1
Topography Vertical Interval (Surface)	1	1
Water Erosion ESP, excluding slope	1	1
Sub-soil Erosion, ESP at 0.50m	2	1
Potentially Acid Forming Materials pH <4.5	1	1
Suitability Class (Limited Assessment)	4	2

1 – Phosphorus analytical result was undertaken using the Olsen method. The severity of the result and suitability class is not considered representative of the overall class; therefore GTE recommends it be omitted from the overall assessment.

The land suitability of cattle grazing for SMUs A2 and B4 indicate that following;

- Phosphorous results for the two SMU codes A2 (Representative Site 41) and B4 (Representative Site 178) reported were reported at 2 ppm (mg/kg) and 1 ppm (mg/kg) at 0-10cm. The results were assessed as suitability class 5, unsuitable for cattle grazing.

These laboratory results were reported using the Olsen method and compared to a criterion referencing the Colwell method. The results are not considered comparable as these methods may report different results due to soil/extractant ratio and extraction period difference.

- SMU A2 is unsuitable with a severe limitation, soil physical factors due to hard setting surface. This SMU would be classed as sometimes suitable for grazing where rehabilitation that is unsuitable most of the time but may be grazed in better seasons for short periods in conjunction with other country. Amelioration recommendations of the surface may include light ripping of the surface and the addition of organic material.

Further review of Appendix F.2, Daunia, (2004) for the representative site land use indicates SMU A2 was currently being grazed by beef cattle with vegetation and

photographs reporting Buffel grass present over 40% of the ground cover. Stocking rates recommended are 15 ha/ Adult Equivalent (AE) for cattle.

- SMU B4 is suitable with minor limitations, nutrient supply in P (phosphorus). This SMU would be classed as a growing grazing system where rehabilitation on which younger cattle perform well but may be difficult finish at a young age, depending on seasonal conditions. Amelioration recommendations may include the addition of suitable fertilisers to increase phosphorus levels.

Further review of Appendix F.2, Daunia, (2004) for the representative site land use indicates SMU B4 was currently being grazed by beef cattle with vegetation and photographs reporting strong cover of buffel grass. Stocking rates recommended are 5 ha/ AE for cattle.

4.3.2 Land Suitability for Cattle Grazing of Topsoil Stockpile Soil Samples

Topsoil stockpile samples were assessed against the existing rehabilitation commitments relevant to vegetation ecosystems and site-specific Post Mine Land Uses (PMLUs), cattle grazing as detailed in BHP, (2020a).

The assessment of the land suitability framework for cattle grazing on rehabilitation BHP, (2020a) may only be undertaken based on the soil sample data presented and excluded direct assessment of topography, surface condition and soil profile-based limitations such as water availability, soil physical factors, rockiness, slope and microrelief, water erosion, subsoil erosion and potentially acid forming materials. These limitations were assessed based on available data and desktop information as indirect assessed limitations.

This assessment data would at least provide further information in the suitability of the topsoil resource material onsite as presented in Table 4-11.

Table 4-11: Land Suitability, Limited Assessment, Cattle Grazing for Soil Samples

Limitation (Unit)	Soil Samples and Suitability Class					
	RM1	RM2	RM3	RM4	RM5	RM6
Water Availability (PAWC in ERD), Mm/0.6d	n/a ¹	n/a	n/a	n/a	n/a	n/a
Nutrient Supply P in 0.10m (mg/kg)	3	3	1	2	1	1
Nutrient Supply pH in 0.10m (pH Units, 1:5 H2O)	3	1	1	2	1	2
Soil Physical Factors (Surface soil structure)	n/a	n/a	n/a	n/a	n/a	n/a
Salinity EC in ERD (dS/m)	1	1	1	1	1	1
Rockiness (Fragments on surface)	n/a	n/a	n/a	n/a	n/a	n/a
Topography Gradient (Surface)	n/a	n/a	n/a	n/a	n/a	n/a
Topography Vertical Interval	n/a	n/a	n/a	n/a	n/a	n/a
Water Erosion ESP, excluding slope	1	1	1	1	1	1
Sub-soil Erosion, ESP at 0.50m	n/a	n/a	n/a	n/a	n/a	n/a
Potentially Acid Forming Materials pH <4.5	n/a	n/a	n/a	n/a	n/a	n/a
Suitability Class (Limited Assessment)	3	3	1	2	1	2

¹ – Not Assessed. Further review of the limitations not directly assessed is provided in Table 4-12.

Topsoil samples assessed reported no unsuitable limitations based on the limited assessment. Topsoil sample RM4 (Stockpile 1) was assessed as the most suitable for cattle grazing where RM1 (Stockpile 3) and RM2 (Stockpile 2) results were assessed as suitable. Reference site Q10 (Sites RM5 and RM6) indicate that the site is suitable for cattle grazing.

This information correlates with the soil/spoil weighted scoring system where all soil samples were considered 'Good', and the limitation was nutrient supply.

Review of the limitations unable to be assessed for SMUs A2 and B4 was attempted to assess the potential impact on the suitability class. This review included available data and applying these against the limitation. The assessment is presented in Table 4-12.

Table 4-12: Indirect Assessed Limitations Assessment, Cattle Grazing for Soil Samples

Indirect Limitation	Limitation Assessed	Limitation Result
PAWC	PAWC is estimated based on the texture assessed for each stockpile sample. (Lower clay percentage for Stockpile 2 i.e. Site RM3), against the soil texture table (The Queensland Department of Infrastructure, Local Government and Planning RPI Act Statutory Guideline 08/14, [2017]) to 0.60m.	Stockpile 1 (loam) was assessed as 36mm / 100mm (Class 4), Stockpile 2 (Loam based on RM3) was assessed as 36mm / 100mm (Class 4), and Stockpile 3 (Clay loam) was assessed as 48mm / 100mm (Class 3). The results may indicate that topsoil may be marginally unsuitable at 0.60m. It is noted that topsoil placement across the project site on existing SMU clay subsoils will increase the PAWC and cattle grazing land suitability. Therefore, it is not considered to be an unsuitable limitation.
Soil Physical Factors	Soil physical factors of the surface soil structure based on existing SMUs A2 and B4 indicate that texture contrast soils (SMU A2) may have some hard setting surface attributes.	The five stockpiles are considered the topsoil stripped of the two SMUs which are the majority of the disturbed area, mixed. These topsoil samples may be assessed no worse than the class 4 result of SMU A2 which is sometimes suitable for cattle grazing.
Rockiness	Rockiness relating to fragments on the surface may be assessed based on gravel percentage of the particle size analysis.	Gravel percentage ranges from Stockpile 1 (2%), Stockpile 2 (5%) and Stockpile 3 (3%). Stockpile 1 and 3 would be assessed as Class 1 with Stockpile 2 classed as Class 2. The results would unlikely change the current assessment in Table 4-12.
Topography	Topography relating to slope, microrelief (ripping furrows) are unlikely to impact the limited assessment.	Contour mapping review (Queensland Globe, 2021) implies that the majority of the land is likely gently undulating to undulating (less than 5% slope). Microrelief has been identified as part of the SMU DB2, located on the eastern portion of the site, consisting of 4 hectares. Review of satellite imagery indicates microrelief is not present.
Subsoil Erosion	Subsoil erosion which includes ESP levels at 0.5m may be assessed based on the ESP of the soil samples.	The highest ESP analytical results for the stockpiles are 0.87% (Sample RM3, Stockpile 2), well below 7% (Class 1). The results would unlikely change the current assessment in Table 4-12.
Potentially Acid Forming Materials	Potentially acid forming materials would likely have minimal influence on the suitability as pH levels are greater than 4.5.	No changes to the current assessment.

Review of the limitations that may not be assessed above indicates that the final suitability class assessed in Table 4-12 is likely to be indicative of the stockpile cattle grazing suitability. Soil physical factors, such as a hard setting surface may indicate a potential limitation based

on SMU A2 topsoil which would form a portion of the topsoil resource stockpiles, however amelioration recommendations in Section 4.5.3 may assist in managing hard setting surfaces.

As discussed in Section 3.4, assessment against the current ALE Guidelines and Regional Frameworks was unable to be completed due to limited data information and the nature of stockpile sampling not considered.

As listed in Tables 4-9 and 4-10, the limitations outlined in the suitability framework for the inland Fitzroy and Southern Burdekin Area are not able to be assessed. These include water erosion, erosion hazard, soil water availability, narrow moisture range, surface condition, rockiness (surface), microrelief and wetness which require an in-situ soil profile to at least 1.0m and laboratory data throughout.

4.4 Soil Resource Assessment – Existing SMUs

4.4.1 Existing SMUs – Topsoil Stripping Assessment

Existing SMUs onsite have had topsoil stripping depths assessed as described in Daunia EIS (2008). The Daunia EIS (2008) outlines that the key principle in assessing useable depths of topsoil for rehabilitation is its quality in comparison to the spoil requiring rehabilitation.

Table 4-13 outlines the recommended topsoil stripping depths, maximum stripping depths and reasoning. This information is presented on Figure 2.

Table 4-13: Stockpile and Soil Sample Summary.

SMU Code ¹	Recommended Typical Topsoil Stripping Depth (m)	Maximum Topsoil Stripping Depth (m)	Topsoil Stripping Recommendation
A2	0.15	n/a	Care while stripping to avoid the clayey, potentially dispersive subsoils
DB4	0.30	0.50	Very hard coarse subsoil below 30cm will probably set hard and shed water on rehabilitation
B4	0.30	n/a	Stripping limited to 0.30 m due to risk of saline/sodic subsoils being encountered at some sites.
B4v	0.40	n/a	Stripping limited to 0.40 m due to risk of saline/sodic subsoils being encountered at some sites.
DB2	0.20	0.40	No deeper due to hard, coarse subsoils

4.5 Materials Balance and Placement Strategy

The materials balance and placement strategy would utilise the desktop soil survey and soil characterisation information for rehabilitation-related suitability, recommendations for site specific activities and placement strategy to optimise the rehabilitation outcomes on site.

Each SMU identified and soil sample analysed would be assessed against the existing rehabilitation commitments relevant to vegetation ecosystems and site-specific Post Mine Land Uses (PMLUs), cattle grazing and woodland habitat where possible.

As discussed in section 4.2.9, all stockpile soils are assessed as suitable for rehabilitation for the project site. The following sections below outline recommendations for site-specific soil management.

4.5.1 Disturbance and non-disturbance Area of Project Site

To assess the required materials balance, the approximate disturbance area of the project site must be known. The project site disturbance areas requiring topsoil replacement, include the CHPP and supporting Infrastructure, the rail loop, hardstands, haul roads, dams, stockpiles (coal and topsoil), unsealed and sealed roads, totals 128 ha. The non-soil disturbed area of the site is 163 ha.

4.5.2 Total Topsoil Stockpile Volumes

The current stockpile volumes are outlined below in Table 4-14.

Table 4-14: Stockpile Volumes

Stockpile	Volume (m³)
Stockpile 1	85,472
Stockpile 2	49,686
Stockpile 3	6,924
Stockpile 4	1,515
Stockpile 5	1,381
Total	144,978

4.5.3 Stockpile Soil Amelioration and Fertilisation Review

Topsoil resource material may benefit from the following amelioration and fertiliser applications. An assessment summary of the stockpiles and their limitations is presented in Table 4-15 based on soil characterisation in Section 4.2.

Table 4-15: Stockpile Limitations

Stockpile #	Soil Samples	Potential Limitations
1	4	Dispersion may occur when saturated and disturbed Nitrate levels low Sulfate levels low CEC levels low
2	2, 3	Dispersion may occur when saturated and disturbed Nitrate levels low Sulfate levels low CEC levels low Macro nutrients low, K, Na,
3	1	Slaking and some dispersion pH >8 Nitrate levels low Sulfate levels low CEC levels low

Stockpile #	Soil Samples	Potential Limitations
		Macro nutrients low Na,

pH Amelioration

The topsoil samples were all within the recommended range for soil pH (1:5 water). No pH amelioration is recommended, however the application of some fertilisers may assist by reducing the pH slowly over time where it is more optimum for vegetation establishment and growth.

Salinity Amelioration

The soil samples were all within the recommended range for EC and EC_{SAT}.

Sodicity Amelioration

Reviewing the limitations of the stockpiles in Table 4-15, each of the samples was assessed as non-sodic (ESP <7) as shown in Table 4-16 and within the recommended range (Table 4-6), therefore no management for gypsum application is recommended.

Stockpile 3 did exhibit slaking and some dispersion during the EAT analysis, therefore it is recommended that the soil be placed on level plains or at most, less than a 3% slope. This would reduce erosion from rainfall events during placement.

Stockpiles 1 and 2 did not disperse, until the soil was fully saturated, placed into suspension and disturbed (mechanically shaken for 10 minutes). No further recommendation for the placement of soils, however it is advised that bare soils not be exposed for long periods of time.

Table 4-16: Stockpile ESP, EAT and Placement Recommendation

Stockpile #	Soil Samples	ESP (%)	EAT	Placement Recommendation
1	4	0.35	Slaking and some dispersion	Placement of soil resource on level plains or a maximum of <3% slope
2	2, 3	0.30, 0.87	Dispersion observed in aggregate/water suspension	Placement of soil resource not restricted but monitoring recommended on bare soils
3	1	0.31	Dispersion observed in aggregate/water suspension	Placement of soil resource not restricted but monitoring recommended on bare soils

Fertiliser Amelioration

All soil samples were reviewed for fertiliser amelioration against the recommended sufficiency levels for surface soils (BHP, 2020). The following is a summary of the review;

- Stockpile 1 reported sulfate levels below the recommended range, however the nitrate and phosphorus were acceptable;
- Stockpile 2 which consists of soil samples RM2 and RM3, nitrate levels were marginal for sample RM2 and well above the recommended range for sample RM3. It is assessed as acceptable for nitrate; and,
- The soil samples indicated nitrate and sulfate were not in the recommended range above 10 mg/kg for Stockpile 3.

A review of fertilisers which may assist in boosting the nitrogen levels included the following;

- Di-ammonium phosphate (DAP) at 18:20:2:0:1.5 (N:P:K:S); and,
- Mono-ammonium phosphate (MAP) at 10:21:9:0:1.5 (N:P:K:S).

The volume per hectare recommended rate is calculated for the following fertilisers and Stockpile 3. This was completed by assessing the difference in nitrate level reported and recommended by the NPKS values, multiplying by 100kg of fertiliser and dividing by the N level in the fertiliser. This is summarised in Table 4-17.

Table 4-17: Stockpile Fertiliser Rates. Nitrate Levels to Minimum Recommended Levels

Stockpile / Sample	Nitrate Level	Recommended Nitrate Level	Recommended Minimum DAP Rate	Recommended Minimum MAP Rate
3 / 1	7.6 mg/kg	10 mg/kg	13.3 kg/ha	24 kg/ha

As calculated, these recommended minimum rates would increase Stockpile 3 to the minimum recommended sufficiency levels for surface soils, BHP, (2020b).

Review of existing documentation (MEP, 2009) suggests that fertilisers application rate of 20 kg/ha would be appropriate for native bushland and 100-200 kg/ha for rehabilitation top pasture (no specific fertiliser type referenced). The native bushland value is comparable to the calculated recommended minimums; however fertiliser application rates may be adjusted and recommended for all stockpiles pending the final PMLU for the area i.e. increase application rates for pastures for cattle grazing.

It is recommended that the application of fertiliser occur during the ripping of soils to ensure that no material is lost by wind or washed away in a rainfall event. Further information regarding ripping may be found in Section 4.5.7.

Organic Matter Amelioration

Organic matter incorporated into the topsoil would increase organic levels, improve soil structure, increase cation exchange capacity, reduce erosion as well as increase water holding

capacity. In general, the addition of organic matter such as mulch, manures or compost greatly increases the soils rehabilitation capacity.

Topsoil sample RM2 of Stockpile 2 reported organic carbon levels below the recommended range. It is recommended that during topsoil placement of stockpile 2, organic matter be incorporated.

Application rates would vary for the type of organic matter; however some referenced application rates are provided below;

- Mulch (Straw) may be applied at a rate of 5 t/ha (NSW Government 2015);
- Manure may be applied at a rate of between 5-30 t/ha. This would depend on the type of manure. (MLA n.d.); and,
- Compost may be applied at 70-150 t/ha (Kelly 2006).

4.5.4 Topsoil Resource Material Recommendation Summary

The three soil stockpiles that have been sampled, assessed against various guidelines and assessed for amelioration based on Section 4.2 and 4.5. Table 4-18 summarises the limitations and amelioration recommendations of Section 4.5. Each stockpile sampled is suitable for use as a growth medium for rehabilitation use on the project site.

Table 4-18: Stockpile Potential Limitations and Amelioration Recommendations

Stockpile / Topsoil Sample	Potential Limitations	Amelioration Recommendations
1 / 4	Dispersion may occur when saturated and disturbed Sulfate levels low CEC levels low	No pH amelioration No salinity amelioration Placement of soil resource not restricted but monitoring recommended on bare soils Fertiliser may not be required for woodland habitat, however, may be to assist in pasture establishment The incorporation of organic matter may assist in CEC levels, organic carbon, soil structure and water retention
2 / 2,3	Dispersion may occur when saturated and disturbed Nitrate levels low Sulfate levels low CEC levels low Macro nutrients low, K, Na,	No pH amelioration No salinity amelioration Placement of soil resource not restricted but monitoring recommended on bare soils Fertiliser may not be required for woodland habitat, however, may be to assist in pasture establishment Organic matter is recommended to increase organic carbon levels
3 / 1	Slaking and some dispersion pH >8 Nitrate levels low Sulfate levels low CEC levels low Macro nutrients low Na,	No pH amelioration No salinity amelioration Placement of soil resource on level plains or a maximum of <3% slope Fertiliser may be applied to increase nitrogen levels for woodland habitat PMLU The incorporation of organic matter may assist in CEC levels, organic carbon, soil structure and water retention

4.5.5 Topsoil Placement Depth

Topsoil placement depth across areas requiring rehabilitation is recommended at a minimum placement depth of 0.10m. This minimum depth is in line with the Red Mountain Infrastructure Joint Venture, Topsoil Management Plan, BHP Billiton, 2017.

The recommended and minimum topsoil placement depths against the available stockpile volumes are shown in Table 4-19. It is assumed all areas that have disturbed topsoil will require topsoil placement. Cleared areas with minimal to no disturbance may not require topsoil placement, however additional in-situ sampling is recommended to assess the condition of topsoil in-situ.

Table 4-19: Stockpile Volumes

Total Volume (m3) Available for Rehabilitation	Required Topsoil Placement Volume at Minimum depth (m3 at 0.10m)	Deficit Variance (m3)
144,978	128,010	+ 16,968

At the minimum recommended topsoil placement, the approximate disturbance area may be completed covered with an additional 16,968 m³ remaining.

At the current topsoil stockpile resource volumes, it is suggested that the minimum depth be adhered to. This would require ongoing onsite inspection of topsoil placement, trained operators conducting the topsoil resource placement and survey work to ensure no unexpected deficit is created.

4.5.6 Topsoil Placement Sequence

Review of the topsoil resource material, there are minimal to no preferential recommended placement locations for the topsoil resource materials assessed.

Topsoil resource material shall be recovered from the stockpiles and placement of that material should occur to the disturbance areas closest to the stockpile. This would reduce handling time, haul distance of topsoil resource materials, movement of plant and machinery and ensure that placement work may occur in the shortest period i.e. reduce exposure to rainfall events.

The sequence of placement shall be one placement run of 0.10m of topsoil over the disturbed areas. It is recommended that Stockpile 3 be placed on level surfaces or a less than 3% slope, which is the majority of the site. Landforms with a slope equal to or greater than 3% are recommended to use Stockpile 1 and 2.

The following topsoil stockpile use in disturbance areas is recommended in Table 4-20.

Table 4-20: Topsoil Stockpile Disturbance Areas to be Targeted

Stockpile #	Disturbance Area to be Targeted	Suggested Areas of Disturbance
1	Disturbance areas directly to the south and east	Hardstands, sealed roads, unsealed roads, CHPP, haul roads
2	Disturbance areas directly to the south and west	Hardstands, sealed roads, unsealed roads, CHPP, haul roads
3	Disturbance areas directly to the south	Rail Loop
4,5	Disturbance areas within the rail loop	Laydown, tracks, infrastructure areas

4.5.7 In-situ Subsoil Suitability for Topsoil Placement

In-situ subsoils where disturbance has occurred, and topsoil resource has been stripped may require visual inspection and further characterisation to assess its suitability for topsoil resource placement.

The review of the desktop SMUs A2 and B4 in Section 4.1, their project site coverage and the majority of disturbance occurred on these two SMUs. The review of available data for A2 and B4 subsoils and potential limitations include the following;

- SMU A2
 - The clay subsoil (0.15m to 1.00m plus), is described as moderately dispersive according to laboratory analysis and typically highly dispersive according to observation, and,
 - Subsoil sample laboratory analysis (0.50-0.60m) indicates that soil is moderately dispersive (ESP at 8.6) and highly saline (EC at 1.0 dS/m).
- SMU B4
 - The entire soil profile could be used for mine site rehabilitation if required, although it is suggested that analysis for salt be conducted at depth, and,
 - Subsoil sample laboratory analysis (0.40-0.50m) indicates very low dispersive levels (ESP at 1.9) and low salinity (EC at 0.15 dS/m).

Areas of disturbance on the project site which are located on SMU A2 areas are recommended to be inspected for unfavourable conditions such as erosion (i.e. rill) or hard setting, crusting surfaces prior to topsoil placement.

Amelioration may include the application of gypsum at five tonnes per hectare (5 t/ha) prior to topsoil placement if visual observations of the surface are unfavourable or additional subsoil characterisation analysis reports ESP levels greater than 7 to 14%.

4.5.8 Seedbed Preparation

Seedbed preparation should ensure good contact between the soil and the seed. This requires a rough, crumbly surface which would ensure the seeds are able to penetrate the soil surface.

Ripping of the soil is generally recommended as it can create a good seedbed. Ripping of the surface using plant with agricultural harrows, scarifier or ripper tynes should provide the required result, prior to sowing of seed. Ripping of the soil should be between 0.10 to 0.20m deep, no deeper than 0.30m to prevent deep mixing of topsoil and subsoil. This allows the subsoils of the area to be roughened up as well as the topsoil.

4.5.9 Recommended Cover Vegetation

Cover vegetation would vary depending on the site specific PMLU, whether that is cattle grazing or woodland habitat. The following recommendations are based on BHP (2019), as this provides a general species list and sowing rates for pasture establishment.

Beef Cattle Grazing Vegetation Cover

Table 4-21 recommends the following cover materials specific for cattle grazing based on clay to lighter soils for rehabilitation (BHP, 2019).

Table 4-21: Recommended Cover Vegetation – Beef Cattle Grazing

Stockpile	Recommended Vegetation for Clay Soils	Recommended Vegetation for Lighter Texture Soils
1	-	Rhodes grass (<i>Chloris gayana</i>) Bisset creeping blue grass (<i>Bothriochloa insculpta</i>) Buffel grass (<i>Pennisetum ciliare</i>) Stylo (<i>Stylosanthes hamata</i>) Wynn cassia (<i>Chamaecrista rotundifolia</i>) Shiohie millet (<i>Echinochloa esculenta</i>) Black spear (<i>Heteropogon contortus</i>) Queensland blue grass (<i>Dicanthium sericeum</i>) Mitchell Grasses (<i>Astrelia spp.</i>) Forest Mitchell (<i>Bothriochloa erianthoides</i>) Kangaroo (<i>Themeda triandra</i>) Cotton Panic (<i>Digitaria brownie</i>)
2 ¹	Rhodes grass (<i>Chloris gayana</i>) Bisset creeping blue grass (<i>Bothriochloa insculpta</i>) Stylo (<i>Stylosanthes hamata</i>) Shiohie millet (<i>Echinochloa esculenta</i>) Black spear (<i>Heteropogon contortus</i>) Queensland blue grass (<i>Dicanthium sericeum</i>) Mitchell Grasses (<i>Astrelia spp.</i>) Forest Mitchell (<i>Bothriochloa erianthoides</i>) Kangaroo (<i>Themeda triandra</i>) Cotton Panic (<i>Digitaria brownie</i>)	
3	Rhodes grass (<i>Chloris gayana</i>) Bisset creeping blue grass (<i>Bothriochloa insculpta</i>) Bambatsi panic (<i>Panicum coloratum</i>) Purple pigeon (<i>Setaria incrassate</i>) Burgundy bean (<i>Macroptilium bracteatum</i>) Stylo (<i>Stylosanthes seabrana</i>) Shiohie millet (<i>Echinochloa esculenta</i>) Black spear (<i>Heteropogon contortus</i>) Queensland blue grass (<i>Dicanthium sericeum</i>) Mitchell Grasses (<i>Astrelia spp.</i>) Forest Mitchell (<i>Bothriochloa erianthoides</i>) Kangaroo (<i>Themeda triandra</i>) Cotton Panic (<i>Digitaria brownie</i>)	-

1 – Stockpile 2 two samples textures range from RM2 (Clay loam) and RM3 (Loam), therefore species recommended for both texture grades have been selected.

Woodland Habitat Vegetation

Table 4-22 recommends the following vegetation specific for native woodland for tree, shrubs and grass species for rehabilitation (BHP, 2019). No preference has been given to the vegetation species recommended based on topsoil stockpile resource but based on available desktop vegetation information of the area.

Table 4-22: Recommended Cover Vegetation –Woodland Habitat

Stockpiles	Recommended Tree / Shrubs	Recommended Grass Species
1, 2, 3	Poplar Box (<i>Euclayptus populnea</i>) Dawson Gum (<i>Eucalyptus cambageana</i>) Brigalow (<i>Acacia harpophylla</i>) Yellowwood (<i>Flindersia xanthoxyla</i>)	Queensland bluegrass (<i>Dicanthium sericeum</i>) Mitchell grasses (<i>Astrelbia spp.</i>) Black spear (<i>Heteropogan contortus</i>)

1 – Stockpile 2 two samples textures range from RM2 (Clay loam) and RM3 (Loam), therefore species recommended for both texture grades have been selected.

The manual (BHP, 2019) discusses through practice at other mines, topsoil application for the germination and establishment of native tree and shrub species is not recommended. The manual (BHP, 2019) indicates that best practice of direct seeding into a seedbed prepared in overburden material increases native species by reducing the competition of exotic species.

This is completed by the following methods;

- Alternating strips of topsoil and overburden without topsoil. Strips may be 10 to 25m wide and must be aligned along the contour,
- Topsoil on slopes and overburden without topsoil on benches, in a traditional batter and bench landform design, and,
- No topsoil at all.

These techniques have been used to achieve a satisfactory level of rehabilitation for the land use, woodland habitat.

GTE recommends that woodland habitat areas that have been cleared, but not disturbed may benefit from the best practice and methods outlined above. If areas are assessed as disturbed, topsoil placement should be considered at 0.10 m depth across the disturbance for woodland habitat.

4.5.10 Sowing Application

Sowing should be undertaken with the goal to apply the seed to the topsoil area as per the recommended sowing rate. The use of ground broadcast methods such as a drum seeder may be suitable for the project site. Other methods such as hydroseed trucks or by hand may be considered pending the size of the available area.

Sowing should occur in the warmer months of the year between September and March, ideally in November and January where the probability of rainfall is highest.

4.6 Rehabilitation Monitoring

Rehabilitation monitoring should be conducted in accordance with BHP, 2020a and reference to BHP, 2020b. This monitoring program, BHP, (2020a) provides the framework and methods to evaluate rehabilitation across the project site. This framework includes the minimum data requirements and data formats in which the level of monitoring details may be chosen based on the individual sites.

Reference site Q10 is recommended as part of the rehabilitation monitoring. As the site is located outside the disturbance areas and initial soil sampling results are available, it would be an established baseline site and allow continuing monitoring. The location would be used as a reference site for woodland habitat land suitability assessment.

5 CONCLUSION

The key conclusions of the SCS are as follows:

- Four SMUs and one variant were identified in the desktop review of the project site. These include A2 (Alluvial, sandy hard duplex soil), B4 (Friable Brigalow scrub soil, black cracking clay), B4v (Variant to B4, fine red/brown brigalow clay), Db2 (Linear gilgai on dark grey, brown clays) and DB4 (Moderately well-structured grey, brown cracking clays).
- Six samples were collected from the project site, four (RM1, RM2, RM3 and RM4) from three topsoil stockpiles (Stockpile 1, 2 and 3) and two (RM5 and RM6) from a reference site, Q10.
- Assessment of the topsoil samples was undertaken using external guidelines and technical report as well as internal BHP manuals. The topsoil samples reported minor limitations. All four topsoil samples scored 'Good' in the BHP Soil/Spoil weighted scoring system.
- Land suitability assessment was conducted for the desktop SMUs and available data for SMUs A2 and B4.

Previous agricultural assessments for SMUs on site reported SMU B4 had moderate limitations for rainfed cropping with all other SMUs reporting severe or extreme limitations. Four of the five SMUs were suitable for beef cattle grazing with SMU A2 reporting an unsuitable class.

Assessment of A2 and B4 against GALE, 2015 and Regional Frameworks, 2013 reported SMU A2 not suitable for the land management options with severe limitations, however SMU B4 reported moderate limitations, indicating it was suitable for Class A cropping.

A limited assessment of the topsoil samples for Land Suitability for cattle grazing as per BHP Rehabilitation Monitoring Program indicated negligible to moderate limitations. These limitations potentially outlined that soil physical condition of the surface may reduce the suitability of the topsoil resource material, however recommended amelioration would manage this. This suggests that with the suitable final landform, the topsoils are suitable to support cattle grazing.

- Total volume of topsoil resource material onsite is assessed as sufficient for the approximate disturbance area if the topsoil placement depth is 0.10m.
- Topsoil resources onsite is assessed as sufficient with amelioration recommendations including the application of fertiliser to stockpile 3, the topsoil placement of Stockpile 3 material on level plains, with a maximum of less than 3% slope and the incorporation of organic matter for stockpile 2.

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7 GLOSSARY OF TERMS

The following descriptions are of terms used in the text of this report.

Alluvial. Describes material, sand, silt, clay, gravel or other material deposited by, or in transit in, flowing water.

ASPAC. Australasian Soil and Plant Analysis Council.

Cation Exchange Capacity (CEC). The maximum positive charge required to balance the negative charge on colloids (clays and other charged particles). The units are milli-equivalents per 100 grams of material or centimoles of charge per kilogram of exchanger. CEC is often used as a measure of soil fertility and nutrient retention capacity.

CHPP. Coal Handling and Preparation Plant

Clay. A soil material composed of particles finer than 0.002 mm. When used as a soil texture group such soils contain at least 35% clay.

Dispersion. A process by which species in solution mix with a second solution, thus reducing in concentration. In the case of sodic soils it will predispose the soil material to lose structure and disseminate into the solution.

Duplex. Texture-contrast, an abrupt texture change between the topsoil and subsoil. Gradational texture gradually increases down the soil profile.

EIS. Environmental Impact Statement.

Electrical Conductivity (EC). The EC of water is a measure of its ability to conduct an electric current. The EC of soils will vary depending on the texture and amount of moisture held by the soil particles. Electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity.

Emmerson Aggregate Test. The test classifies the behavior of soil aggregates, when immersed, on their coherence in water.

Erosion. The displacement of soil, rock or dissolved material by wind or water flow from one location on the earth and then travels to another location.

Exchangeable Sodium Percentage (ESP). The amount of sodium as a proportion of all cations in a soil is termed the Exchangeable Sodium Percentage. It is calculated by dividing the exchangeable sodium by the cation exchange capacity (CEC), multiplied by 100. ESP values greater than 6% are considered sodic, with values greater than 15% considered very sodic. $ESP = (\text{Exchangeable sodium (meq/100g)} / \text{Cation exchange capacity (meq/100g)}) \times 100$.

Gradient. The rate of inclination of a slope. The degree of deviation from the horizontal.

Hectare (ha). A metric unit of square measure, equal 10,000 square metres.

Horizon. An individual soil layer, based on texture and colour, which differs from those above and below.

Loam. A medium textured soil of approximate composition 10-25% clay, 25-50% silt and >50% sand.

LSAT. Land Suitability Assessment Techniques.

Massive. Refers to the condition of the soil layer in which the layer appears to be as a coherent or solid mass which is largely devoid of peds.

Mbgl. Metres below ground level.

Microrelief. Refers to relief up to a few metres about the plane of the land surface with alternating mounds and depressions formed due to clay horizons shrinking and swelling with alternate drying and wetting cycles.

Millimetres (mm). Unit of measurement, one thousandth of a metre.

Metres (m). Unit of measurement, the SI base unit of length.

Mottle/s/ed. Areas of contrasting colour in the overall soil colour which are caused by anerobic conditions because of poor aeration. Usually an indicator of poor drainage and retention of water.

NATA. National Association of Testing Authority.

Ped. An individual natural soil aggregate. In an undisturbed state peds will group together to form larger aggregates.

pH. A logarithmic index for the concentration of hydrogen ions in an aqueous solution, which is used as a measure of acidity.

Profile. The solum. This includes the soil A and B horizons and is basically the depth of soil to weathered rock.

Reference Site. Baseline and continuing monitoring of unmined reference or analogue sites (often illustrating pre-mining conditions) provides for useful comparisons in benchmarking or quality control.

SMU. Soil Mapping Unit. Soils grouped into a single management unit on the basis of similar morphology, position on the landscape, substrate and chemistry.

Sodic. Also commonly referred to as a non-saline alkali soil. It is a soil that contains sufficient exchangeable sodium and does not contain appreciable quantities of soluble salts. A term given to soil with a level of exchangeable sodium cations greater than 10-15% of the soils cation exchange capacity (CEC), or soluble sodium cations greater than 10-15 times the square root of soluble calcium and magnesium cations.

Sodosol. Soils with strong texture contrast between A horizons and sodic B horizons which are not strongly acid.

Subsoil. Subsurface material comprising the B and C horizons of soils with distinct profiles. They often have brighter colours and higher clay content than topsoils.

Subsoil. Subsurface material comprising the B and C horizons of soils with distinct profiles. They often have brighter colours and higher clay content than topsoils.

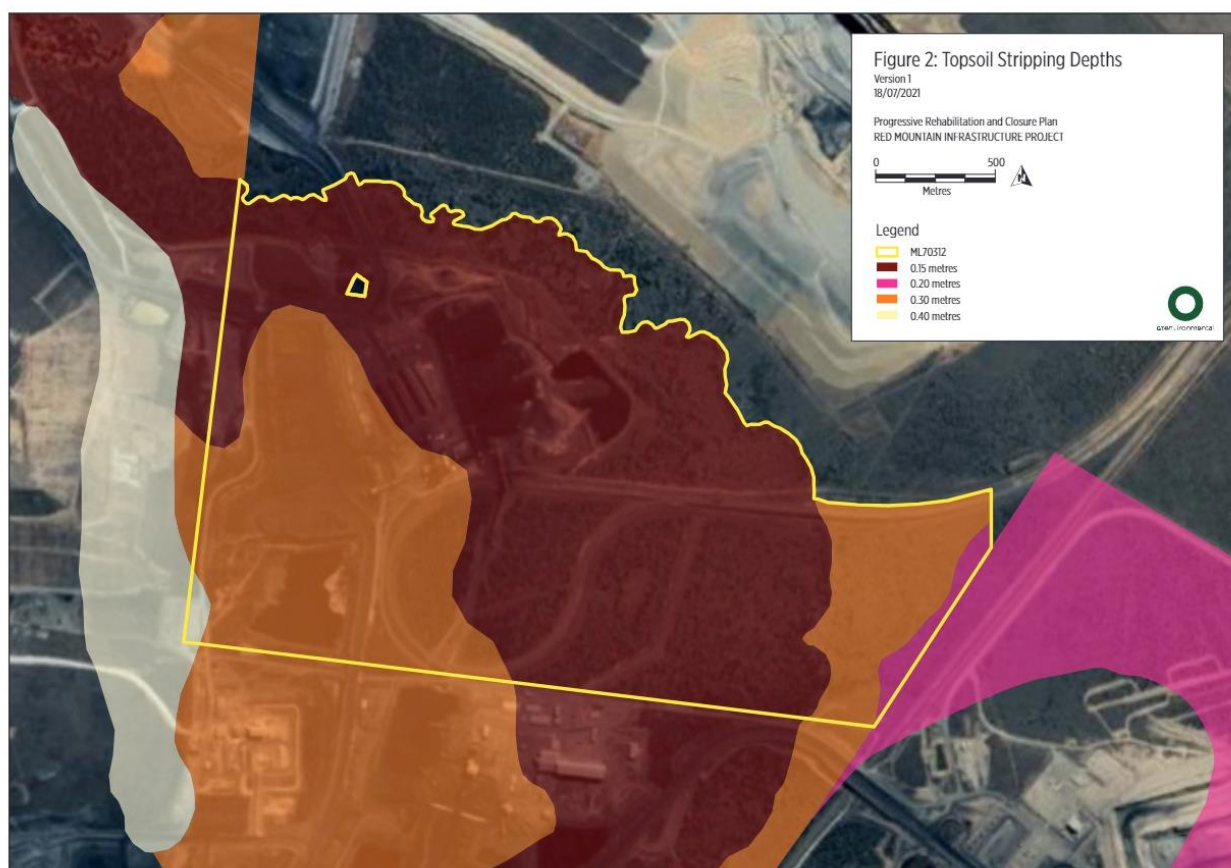
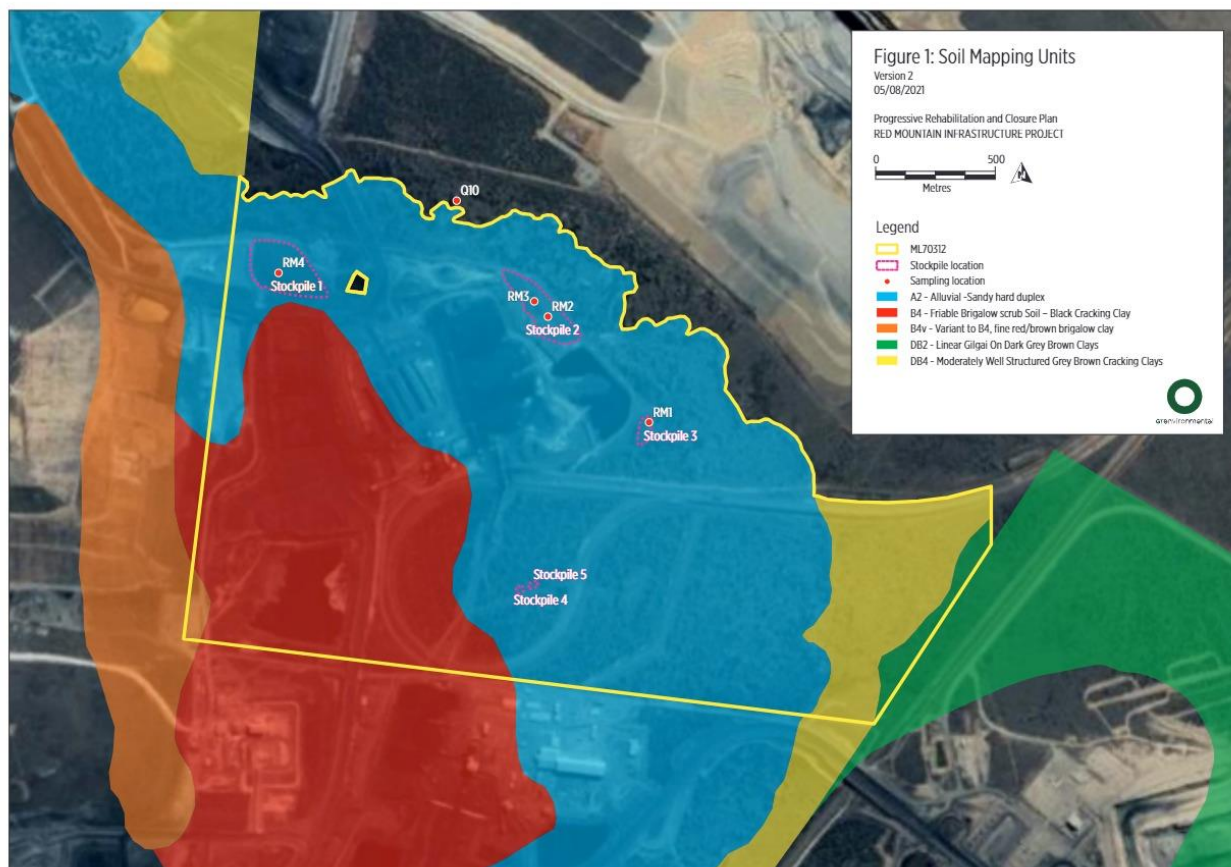
Texture. The size of particles in the soil. Texture is divided into six groups, depending on the amount of coarse sand, fine sand, silt and clay in the soil.

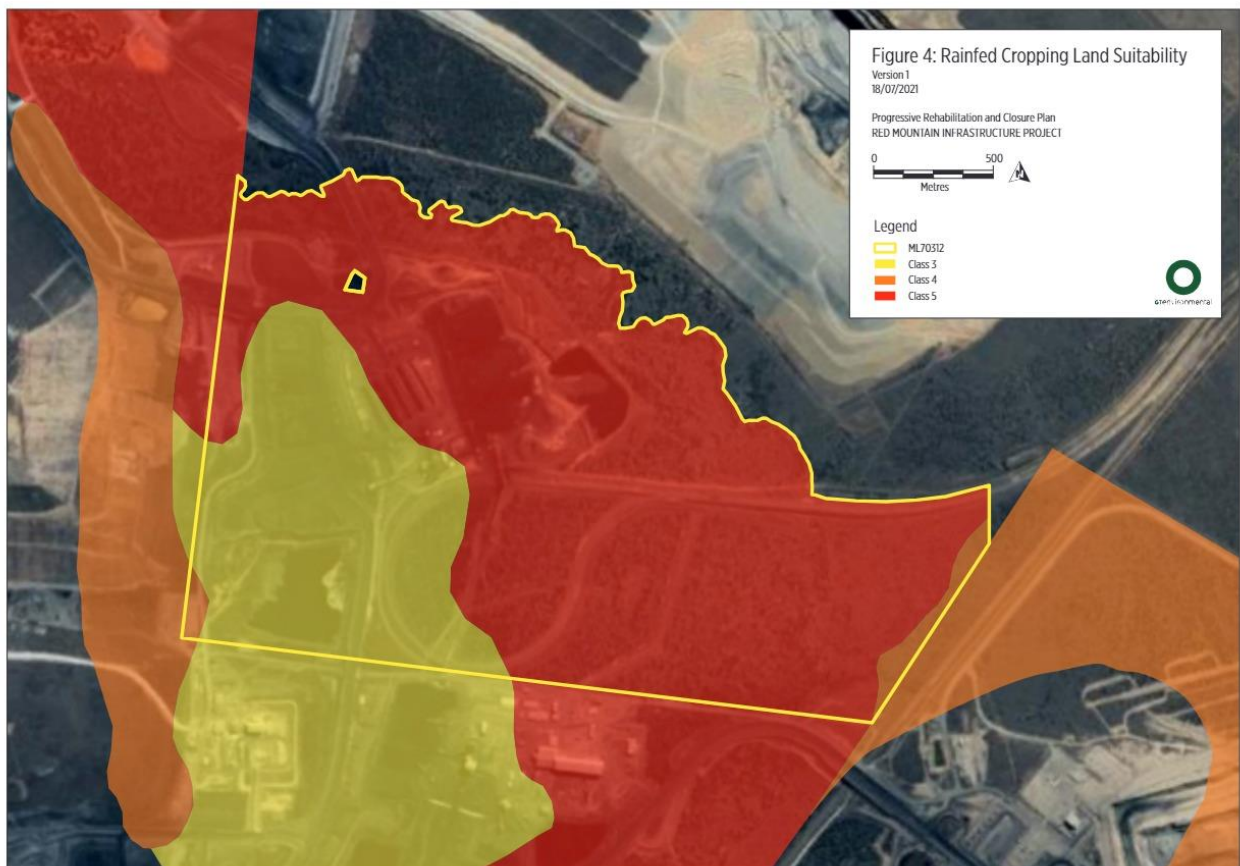
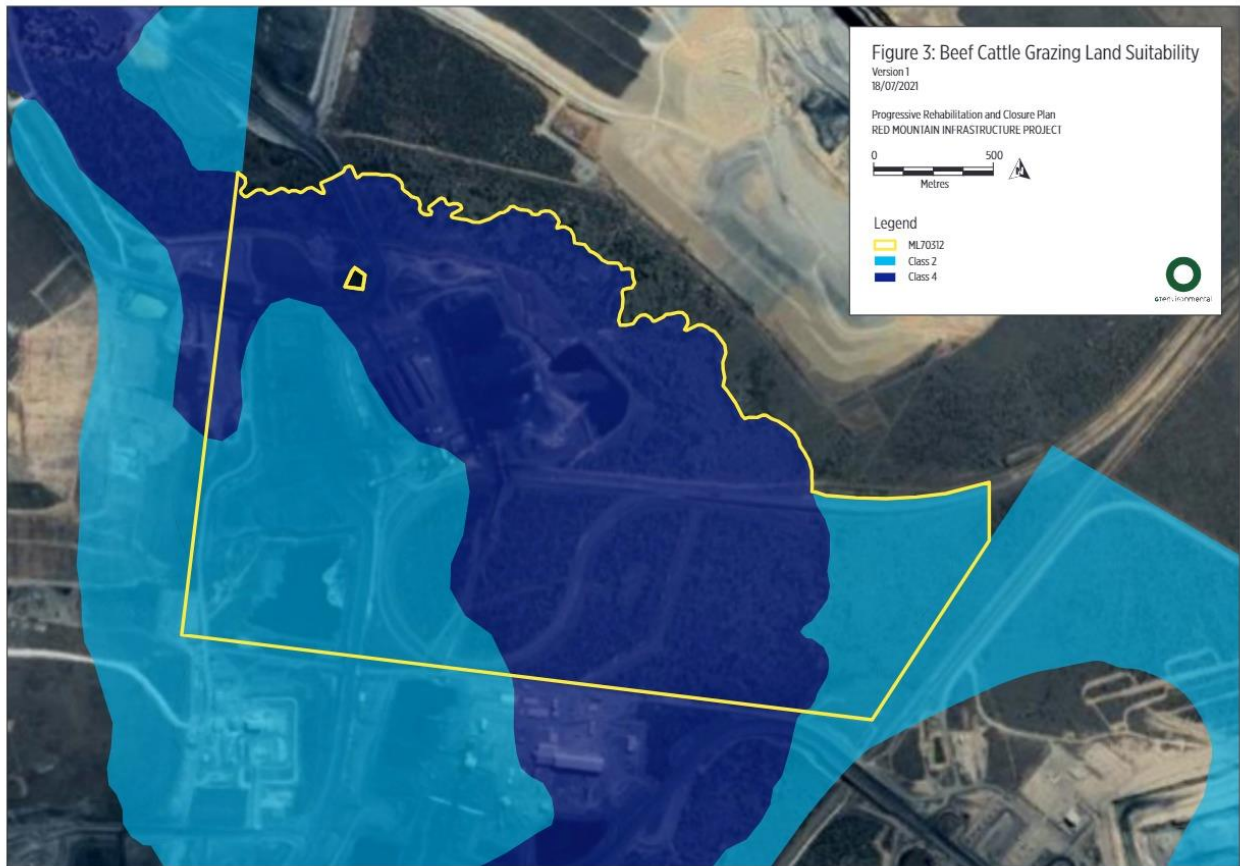
Topsoil. Part of the soil profile, typically the A1 horizon, containing material which is usually darker, more fertile and better structured than the underlying layers.

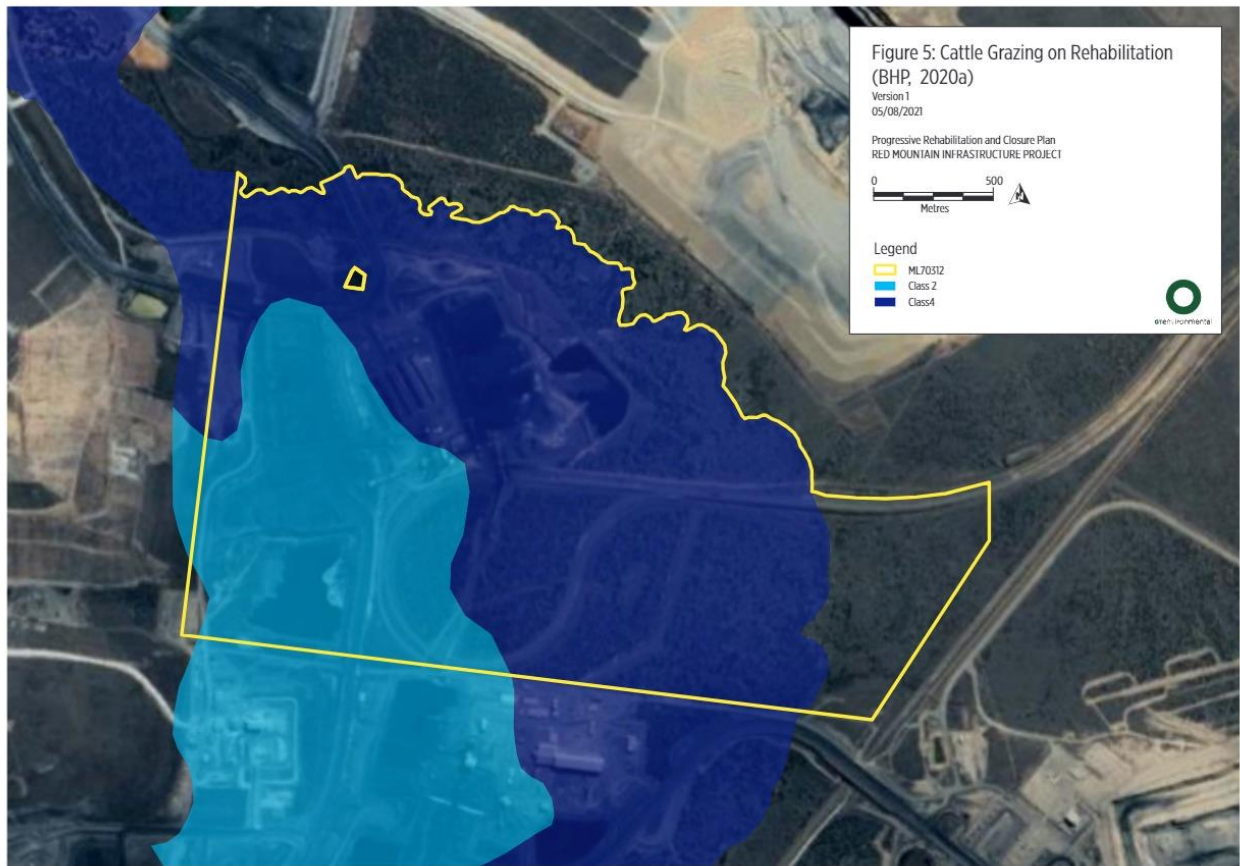
Vertosol. Soils that have a clay field texture of 35% or more clay throughout the solum except for thin, surface crusty horizons 0.03m or less thick, have open cracks at some time in most years that are at least 5mm wide and extend upward to the surface or to the base of any plough layer, self-mulching horizon, or thin, surface crusty horizon and at some depth in the solum have slicken sides and/or lenticular peds.

8 FIGURES

- | | |
|----------|--|
| Figure 1 | Soil Mapping Units |
| Figure 2 | Topsoil Stripping Depths |
| Figure 3 | Beef Cattle Grazing Land Suitability |
| Figure 4 | Rainfed Cropping Land Suitability |
| Figure 5 | Cattle Grazing for Rehabilitation (BHP, 2020a) |







9 APPENDICES

Appendix A Laboratory Certificates

Appendix B Appendix F.2 Land Suitability Methodology and
Assessment Extract

ESSA

ESSA Pty Ltd / by EAL NATA (ASPAC certified)

**For Info Refer ESSA Pty Ltd
PO Box 442 Sunnybank Q 4109**

Phone: 0403245560

email: e.s.s.a@bigpond.net.au

ReferencesK8329

Sheet 1 of 4:

Date Received: 21/06/2021

Date Completed: 03/07/2021

FINAL REPORT

**Project:ESSA 216823
Project - 21 RM June21 2021**

All results in this report relate only to the items tested. Results are expressed on an "as received basis".

Client Name: GT Environmental
Contact: Mr Reece Mc Cann
Sample Type: Soil

Number of samples: 6Tested

Soil Analysis Report
Batch Numbers:K8329

Client: GTE 21 RM- Results Page 1 of 3 _____

ESSA Ref	Field Ref	Soil pH	Soil EC	Soil Cl	Exch. Ca	Exch. Mg	Exch. K	Ech.Na	CEC	ESP	Ca/Mg	ECN
	depth (m)	H2O	dS/m	mg/kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%Na/CEC	Ratio	No
K8329/1	RM1	8.07	0.174	111	11	3.4	1.4	<0.065	16	0.31	3.2	2
K8329/2	RM2	7.46	0.083	53	5.3	2.5	0.79	<0.065	8.7	0.30	2.1	5
K8329/3	RM3	6.79	0.183	117	7.4	2.0	0.84	0.09	10	0.87	3.6	5
K8329/4	RM4	6.36	0.096	61	4.9	1.8	0.54	<0.065	7.4	0.35	2.7	5
K8329/5	RM5	7.47	0.103	66	23	5.4	1.5	0.16	30	0.54	4.3	5
K8329/6	RM6	6.10	0.034	22	5.6	1.6	0.55	<0.065	8.1	0.11	3.5	5

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ESSA Ref	field ref	Zinc	Mn	Iron	Cu	Boron	Si	Tot C	Org Matter	P Col.	NO3	NH4
	depth (m)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	mg/kg	mg/kg	mg/kg
K8329/1	RM1	1.7	8.2	18	1.2	0.44	19	1.1	1.8	12	7.6	0.89
K8329/2	RM2	<0.5	8.6	16	0.66	0.42	31	0.85	1.5	13	9.2	0.51
K8329/3	RM3	0.93	16	19	1.0	0.51	46	1.3	2.3	22	41	0.98
K8329/4	RM4	0.80	20	154	0.73	0.41	27	1.9	3.4	16	14	1.3
K8329/5	RM5	1.6	13	30	1.1	0.65	50	4.2	7.3	106	11	1.2
K8329/6	RM6	1.0	34	47	1.2	0.19	36	2.2	3.8	26	4.4	1.3

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Cu = Copper, Si = Silicon, P Col. = P by Colwell, NO3 = Nitrate N , NH4 = Ammonium N

ESSA Ref	field ref	Tot Sulfur	Soil pH CaCl2	Soil pH H2O	Tot N	SO4 S	C/N	TOT P	Color	Texture
	depth (m)	mg/kg	0.01M		%	mg/kg	Rat.	mg/kg	Munsell	Category
K8329/1	RM1	NA	6.7	8.07	0.07	2.4	16	312	7.5YR3/2	Clay Loam
K8329/2	RM2		4.2	7.46	0.05	9.3	19	190	7.5YR3/3	Clay Loam
K8329/3	RM3		10	6.79	0.08	8.9	16	225	7.5YR3/3	Loam
K8329/4	RM4		8.2	6.36	0.09	7.2	17	264	10YR3/2	Loam
K8329/5	RM5		5.3	7.47	0.30	3.3	16	657	10YR3/3	SiClayLoam
K8329/6	RM6		6.5	6.10	0.10	6.7	17	310	10YR3/2	SandyLoam

ESSA Ref	field ref	Moisture	Gravel	Sand	Sand	Silt	Silt	Clay	R1
	depth (m)	Content	> 2 mm	> 50 µm	> 20 µm	< 50 µm	< 20 µm	< 2 µm	Disp.
			<2mm	<2mm	<2mm	<2mm	<2mm	<2mm	Ratio
K8329/1	RM1	13	3	39	51	30	18	31	NA
K8329/2	RM2	11	5	55	64	21	12	24	
K8329/3	RM3	6	1	52	62	26	15	23	
K8329/4	RM4	10	2	63	72	23	14	14	
K8329/5	RM5	21	0	23	35	40	28	37	
K8329/6	RM6	5	4	65	73	18	10	17	

METHOD DESCRIPTIONS

Soil

Reference: K8329

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Methods used to Analyse Samples

Analyte	ALH*	Uncertainty %	LOG	Unit	Name	Method Description
pH	4A1	1.1	0.1	pH	pH	1.5 water extr, pH meter
EC	3A1	5.4	0.01	dS/m	Electrical conductivity	1.5 water extr, EC meter
Cl	5A2	10.0	10.0	mg/kg	Chloride	1.5 water extr, (AA) colorimetric
NO ₃ -N	7C2	8.7	1.0	mg/kg	Nitrate-nitrogen	1.5 water extr, (AA) colorimetric
NH ₄ -N	7C2	7.8	0.6	mg/kg	Ammonium-nitrogen	1M NaOH extr, (AA) colorimetric
Bicarb.P	9B2	18.8	1.0	mg/kg	Bicarb.ext.phosphorus	0.5M NaHCO ₃ @ pH 8.5, (AA) colorimetric
Exch.Ca	15B/C1	7.2	0.18	meq/100g	Exchangeable calcium	1M NH ₄ OAc @ pH 7.0/8.5 leach, AAS
Exch.Mg	15B/C1	4.7	0.31	meq/100g	Exchangeable magnesium	1M NH ₄ OAc @ pH 7.0/8.5 leach, AAS
Exch.Na	15B/C1	8.6	0.09	meq/100g	Exchangeable calcium	1M NH ₄ OAc @ pH 7.0/8.5 leach, AAS
Exch.K	15B/C1	4.8	0.02	meq/100g	Exchangeable calcium	1M NH ₄ OAc @ pH 7.0/8.5 leach, AAS
Org Matter	NA				Loss on Ignition	Trimesic Furnace
CEC	15B3	5.7	1.0	meq/100g	Cation Exchange Capacity	YNO ₃ + Ca(NO ₃) ₂ extr, (AA) colorimetric
ADMC	2A1	11.9	0.4	%	Air Dried Moisture Content	Gravimetric, oven dry @ 105C
R1	NA	20.2	NA		Dispersion Ratio	Ratio [Aqueous dispersible (Silt + Clay) Total (Silt + Clay)]
SO ₄ -S	10B3	11.5	0.6	mg/kg	Sulfate sulfur	Ca(OH) ₂ @ pH 4.0 extractable sulfate sulfur, ICPOES
Sand	no ref	22.1	1.0	%	Particle size: sand	Hydrometer, gravimetric & Sieve
Silt	no ref	16.8	1.0	%	Particle size: silt	Hydrometer, gravimetric
Clay	no ref	12.7	1.0	%	Particle size: clay	Hydrometer, gravimetric
PBI	Muddy				P Buffer Index	PBI Corrected for Colwell P

* Australian Laboratory Handbook of Soil and Water Chemical Methods (1992/2011)

Emerson No. 81289	No	Class	Non 1 to 9	Visual
Munsell Color Aust Soil Classification (lab)				Per Aust Soil Classification

Methods from Raymond and Lyons, 2011, Soil Chemical Methods - Australia CSIRO Publishing, Collingwood.
 Soluble Salts included in Exchangeable Cations - Except PRE-WASHED (if EC>0.3dS/m).

For Manager D E Baker BSc MA SSSI

Analytical Services:

Director and Principal Soil Scientist - ESSA Pty Ltd



D E Baker BSc
 Soil Science Leader and Soil Chemistry Specialist
 Adjunct Professional Fellow Southern Cross University
 Adjunct Professional Fellow Southern Cross University
 Chief Soil Chemistry Trainer Soil Science Australia (Nata)
 Hon. Life Member Soil Science Australia (National & Q)
 Certified Professional Practising Soil Scientist CPSS



QUALITY CONTROL DATA

Soil

Reference: K8329
Page: 4 of 4

* Australian Laboratory Handbook of Soil and Water Chemical Methods (1992/2011)

Test Method	Units		Acceptance Criteria	
			Actual Value	(Range)
pH	pH	B		5.0 - 5.3
EC	dS/m	B		0.27 - 0.32
Cl	mg/kg	B		10 - 35
NO ₃ -N	mg/kg	B		10 - 16
NH ₄ -N	mg/kg	NA		NA
Bicarb.P	mg/kg	B		51 - 75
Total Kjeldahl N	%	ASPAC 34	0.110	100 - 120
Total P	%	ASPAC 34	0.02	0.019 - 0.021
Organic Carbon	%	B		1.82 - 2.3
Ca (Exch. cations)pH7	meq/100g	B		6.96 - 8.04
Mg (Exch. cations)pH7	meq/100g	B		1.88 - 2.22
Na (Exch. cations)pH7	meq/100g	B		0.57 - 1.02
K (Exch. cations)pH7	meq/100g	B		1.209 - 1.411
Exch. Acidity	meq/100g			NA
EC-EC	meq/100g	A		NA
CEC	meq/100g	S12		58 - 73
ESP	%	A		NA
Coarse sand	%	B	17.0	17.3 - 22.4
Fine sand	%	B	22.0	20.0 - 25.7
Silt	%	B	16.0	10.5 - 19.8
Clay	%	B	44.0	37.9 - 48.9
R1		B		0.23 - 0.38
Emerson No. 81289	No		44208	Visual
Munsell Color Aust Soil Classification (lab) (1992)				Per Aust Soil Classification

Test Method	Units	Test Set	Acceptance Criteria	
			Actual Value	(Range)
DTPA-Cu	mg/kg	S8		2.37 - 3.28
DTPA-Zn	mg/kg	S8		3.15 - 3.81
DTPA-Mn	mg/kg	S8		97.7 - 149.0
DTPA-Fe	mg/kg	S8		24.3 - 32.6
0.33 Bar	%	G		32 - 51
15 Bar	%	G		23 - 30
Ca (Exch. cations)pH8.5	meq/100g	S12		27.7 - 35.4
Mg (Exch. cations)pH8.5	meq/100g	S12		22.88 - 24.5
Na (Exch. cations)pH8.5	meq/100g	S12		2.0 - 2.28
K (Exch. cations)pH8.5	meq/100g	S12		1.64 - 2.09

Code	Name	Notes	Sites
B4***	Friable Brigalow scrub soil	Deep well structured black cracking clay with granular surface mulch.	103, 104, 105, 107, 178 , 181
B4v** *	Variant to B4	Fine granular non-cracking red / brown Brigalow scrub soil.	102, 182, 197

* (**bold**) - sampling site

** (*italic*) – sites sampled in the 2004 soil survey.

*** These soil types were identified during the 2004 soil survey.

Table 4-2 Numbers of Sampling Sites and Sampling Techniques

Soil Type	Non-detailed sampling sites (number of)	Detailed sampling sites (number of)		Total Detailed sites (number of)
		A – auger	G –Exploration pits	
DB1	13	4	4	8
DB2	69	18	19	37
DB3	10	5	1	6
DB4	15	3	2	5
DB5	6	2	1	3
DB6	3	2	-	2
DE1	1	1	-	1
DD1	12	3	1	4
A2*	20	7	-	7
B4*	3	3	-	3
B4v*	3	-	-	-
TOTAL	155	(48)	(28)	76

* These soil types were identified during the 2004 soil survey. The number of sites is the total of the 2004 survey and may include sites within the Poitrel Mine area, outside of the Project Site.

4.3.1.5 Agricultural Land Suitability

Land within all of the Project Site has been used for beef cattle grazing for many years and has an extensive cover of Buffel Grass. There is no evidence of any past attempts at cropping within the Project Site. None of the of the soils exhibit good surface mulching characteristics, and all are relatively hard setting at the surface with quite hard blocky clays mostly within 40 cm of the surface. Unreliable and insufficient rainfall is also a significant limitation to ventures dependent on annual cropping.

The methodology used to identify agricultural suitability in this survey follows guidelines established by Land Resources Branch (1989), which is the basis for DME (1995), in addition to the work of Shields and Williams (1991) in the Kilcummin area.



Land suitability classification is based on specific land uses assessed using the following classes (based on Shields and Williams, 1991 and DME, 1995):

Class 1	Suitable land with negligible limitations and is highly productive requiring only simple management practices;
Class 2	Suitable land with minor limitations which either reduce production or require more than simple management practices to sustain the use;
Class 3	Suitable land with moderate limitations – Land which is moderately suited to a proposed use but which requires significant inputs to ensure sustainable use;
Class 4	Marginal land with severe limitations which make it doubtful whether the inputs required to achieve and maintain production outweigh the benefits in the long term; and
Class 5	Unsuitable land with extreme limitations that precludes its use.

The land suitability classification identifies the types and severity of limiting factors for each land use on the different soil types present. Details of limiting factors and their assessment follow.

Limiting factors

Land suitability class is determined by the highest ranking limiting factor or a combination of a number of factors. Normally, only the most severe two or three limiting factors would determine suitability and the remainder become irrelevant. For this reason, only the major limiting factors determining suitability are presented. In this survey, the main limiting factors (using the DPI&F nomenclature in brackets) which determined crop and grazing suitability class include one or more of the following:

- plant available water capacity (m)
- nutrient deficiency (n)
- salinity (s)
- soil physical factors (p)
- erosion (e)
- workability (k)
- microrelief (g)
- flooding (f)
- wetness (w)
- soil depth (pd)

All of the soils have been used for beef cattle grazing for many years with none of the Project Site having been cropped. Methods and assumptions used in making the suitability determinations are described in the following paragraphs.

4.3.1.6 Rainfed Cropping Suitability

This classification evaluates the broad acre potential for growing non-irrigated cash crops which would be mainly sorghum, wheat and sunflower. Only major limiting factors have been considered.

Plant Available Water Capacity (m)

Plant available water capacity (PAWC) is a significant soil property in this locality, as cropping is based on fallow storage of moisture in the soil profile. PAWC is the moisture stored in the soil profile that is available

to the plant and is classically defined as the moisture present between field capacity and permanent wilting point (15 bar). **Table 4-3** shows the criteria which Shields and Williams (1991) proposed for assessment of the moisture availability limitation for crops in this region.

Table 4-3 PAWC Criteria for Estimating Cropping Limitations

Limitation Level	PAWC (mm)	Depth of black cracking clay (effective rooting depth)	Predicted cropping success
2	>130	900 mm	70-75%
3	100-130	600 mm	40-70%
4	75-100	400 mm	<40%
5	<75	<400mm	<30%

PAWC for soil groups has been assessed from site specific chemistry and effective rooting depth estimations developed in accordance with guidelines of Bourne and Tuck (1991) and DME (1995). Effective rooting depth and PAWC estimations were further refined from observed field morphology which facilitated the alignment and comparison of PAWC profiles determined in Shaw and Yule (1978) and Shields and Williams (1991). Effective rooting depth is defined as the depth to which approximately 90 per cent of plant roots will extract water. It is normally limited either by the presence of underlying rock or other hard materials or by chemical or physical attributes within the subsoil that restrict root growth (QDPI 1990). Field morphology observations and chemical data used included soil texture and barriers to root growth such as high sodium, gravel, poor soil structure, high electrical conductivity and chloride.

PAWC suitability estimates for soils in the Project Site are shown in **Table 4-4** which indicates that the better structured Brigalow clays (DB4) and Brigalow scrub soil (B4 and B4v) hold sufficient water (80 - 125 mm), which plants may access unrestricted to at least 70 cm depth in most cases. The harder subsoils of DB6, and DE1 have a higher cropping limitation level of 4 which makes them marginal for dryland cropping. The prevailing climate would lower them into the unsuitable class for most years. All other soils do not have the moisture storage capacity along with effective plant rooting depth to sustain cropping.

Shields and Williams (1991) considered crops on land whose only major limitation was moisture (m3) would succeed on 60 to 70 per cent of years in this district, however clays with an m4 limitation would only succeed in 4 of every 10 years. Thus no land at the Project Site (or this locality) would be assigned to better than Class 3 because the whole Project Site has a water availability limitation of some degree.

Table 4-4 Estimated PAWC and Limitation Levels for Cropping and Grazing

Soil Unit	Description	Est. effective rooting depth (cm)	PAWC (mm)	Dryland cropping	Grazing
DB1	Red Brown Brigalow Upland Clays	40 – 50	60 - 80	5	3
DB2	Linear Gilgai On Dark Grey Brown Clays	50 - 60	70 - 90	5	2
DB3	Alluvial Clay Plains on Dark Cracking Clays	50 - 60	70 - 90	5	2
DB4	Moderately Well Structured Grey Brown Cracking Clays	60 - 80	90-120	3	2
DB5	Shallow, Gravelly Red Brown Sandy Clays	30 – 40	60 - 70	5	4
DB6	Cracking Clays With Poplar Box and Brigalow	40 - 60	70 - 90	4	3
DE1	Mt Coolibah Uplands With Brown Clay over sandstone	50 - 70	80 - 100	4	2
DD1	Open Downs With Grassland On Dark Cracking Clays	30 - 40	60 - 70	3	2
A2	Alluvial -Sandy hard duplex	40 - 50	70-80	5	4
B4 and B4v	Friable Brigalow scrub soil	40 - 80	80 - 125	3	2

Susceptibility to water erosion (e)

The risk of soil loss from water erosion magnifies with increased slope gradient combined with water velocity when land is devoid of vegetation. During the 2004 and 2008 soil survey within the Project Site, little evidence of erosion was observed under a grazing use.

Soils such as the shallower sandy clays (DB1 and DB5) have increased risk of erosion if exposed.

Severity of water erosion is also a major limiting factor in the B4 unit which offers better potential for cropping. With proper management practices the water erosion limitation level assigned was 3.

Nutrient deficiency (n)

Shields and Williams (1991) states that soil nutrient deficiency has not been recognised as a major problem for crop production on traditionally cultivated soils in the Central Highlands. The levels of nutrient deficiency found in the survey are similarly not considered severe. The major soil types have levels of limitation between 2 and 3.

Salinity (s)

This refers to the reduction in dry matter yield as a result of soluble salt in the soil profile. It also contributes to reduced water availability limitation. Increasing salinity in the soil profile (below 30 cm) was evidenced across the Mountain Coolibah Uplands (DE1), Grassland Plains (DD1), Alluvial-sandy duplex (A2) and Brigalow scrub soil (B4v) soil units. Salinity has been incorporated into effective rooting depth estimations which directly affects PAWC and hence suitability for these two soil units.

Microrelief (g)

Microrelief refers to relief up to a few metres about the plane of the land surface (McDonald *et al.* 1984). The microrelief limitation effect is due to uneven cultivation and impeded trafficability of machinery. As microrelief (which occurs mainly on DB2 soils) is only 10 to 20 cm deep, little effect on cropping could be expected. Linear gilgai also present in the dark clays of the B4 variant but would also have little effect on machinery.

Topography (t)

Topography is assessed in terms of slope and micro-relief. Slope may limit the effective and safe use of machinery and contribute to erosion hazard. Topography is a minor factor at the Project Site as most of the land is undulating with a slope range of 1 to 3 per cent. Some drainage patterns and rises (e.g. DB3 – Alluvial Plains (including drainage lines) present limitations to cropping from topographic effects.

Soil Physical Factors (p)

This limitation deals with conditions which determine sufficient seed contact with moist soil to prevent desiccation prior to germination and establishment. One such condition applies to clay soils which have a narrow moisture content suitable for cultivation, as they are susceptible to compaction and smearing when wetter than the plastic limit. Trafficability is also limited by high clay content and moisture retention on the clay soils. Clay soils have potential to compact with resulting structure decline under cultivation but it would not be severe enough to preclude production on the B4 clay soils. The lowest limitation assigned for soil physical factors was a p2 limitation for the B4 scrub soils.

Rainfed Cropping Land Suitability Summary

The suitability and major limiting factors of each soil type for rainfed cropping is shown in **Table 4-5**.

Table 4-5 Rainfed Cropping Land Suitability

Soil Unit	Description	Cropping	
		Major Limitations and Severity	Class
DB1	Red Brown Brigalow Upland Clays	moisture – m5 nutrients – n2 erosion – e4 soil physical factors – p3	5
DB2	Linear Gilgai On Dark Grey Brown Clays	moisture – m5 nutrients – n2 erosion – e4 micro relief – g2 soil physical factors – p2	5
DB3	Alluvial Clay Plains on Dark Cracking Clays	moisture – m5 soil physical factors – p2 nutrients – n2 erosion – e2	5
DB4	Moderately Well Structured Grey Brown Cracking Clays	moisture – m3/4 workability – k2 erosion – e3 nutrients – n2	3

Soil Unit	Description	Cropping	
		Major Limitations and Severity	Class
DB5	Shallow, Gravelly Red Brown Sandy Clays	moisture – m5 nutrients – n3 workability – k5 erosion – e3	5
DB6	Cracking Clays With Poplar Box and Brigalow	moisture – m4 soil physical factors – p3 nutrients – n2	4
DE1	Mt Coolibah Uplands With Brown Clay over sandstone	moisture – m4 erosion – n4 nutrients – n2 soil physical factors – p3	4
DD1	Open Downs With Grassland On Dark Cracking Clays	moisture – m2 nutrients – n3 erosion – e3 soil depth – pd3 flooding – f5	5
A2	Alluvial -Sandy hard duplex	moisture – m5 workability – k4 soil physical factors – p3 nutrients – n2	5
B4 and B4v	Friable Brigalow scrub soil – black cracking clay	moisture – m3 erosion – e3 nutrients – n2 soil physical factors – p2	4

4.3.1.7 Beef Cattle Grazing Suitability

The assessment process follows that used by Shields and Williams (1991). Apart from the addition of vegetation regrowth (v) as a limiting factor, the same limitations performance criteria assessed for cropping were also used for suitability for grazing of improved Buffel grass pastures.

Class 1 to 3 land is considered suitable for significant pasture improvement, class 4 offers marginal potential for pasture improvement, and class 5 is not suitable for improvement and restricted to grazing of native pastures with low productivity. Major limiting factors are assigned a severity rating (1 to 5) with the most severe being the overall suitability class for that soil type.

Most of the soil types are considered to be at least class 3 grazing lands, with the exception of DB5 (Shallow, Gravelly Red Brown Sandy Clays) and A2 (Alluvial -Sandy hard duplex). Variations in grazing suitability class occur through more severe limitations from restricted soil water availability, erosion susceptibility, vegetation regrowth and fertility. Much of the Project Site would be prone to degradation from erosion caused by overstocking pressure, however land management practices appear to have been very sound and very dense pasture cover on all soils in the Project mining area was noted at the time of the survey.

The Project Site does not have significant limitations to a grazing use on most soil types provided sound management practices are incorporated. This is the use that the land is currently put to, and overall the land is in good condition. The majority of the Project Site has been cleared for improved pasture and the Buffel grass is well established and in good condition.

Plant Available Water Capacity (m)

Pasture production occurs in a shallower root zone than cropping systems, and 60 cm of rooting depth in clay soils is considered to be adequate for pastures to achieve maximum production (Shields and Williams, 1991). Limitation levels for grazing are shown in **Table 4-6**.

Table 4-6 Land Suitability for Cattle Grazing – Effects of PAWC (Shields and Williams 1991)

Land Suitability Class					
Limitation	1	2	3	4	5
Moisture (M)	PAWC>125mm	PAWC 100-125mm	PAWC 75-100mm	PAWC 50-75mm	PAWC<50mm

Nutrient deficiency (n)

These were rated using DME (1995) from soil analysis data of surface horizons. Shields and Williams (1991) state that a major limiting factor to pasture production in northern Australia is reduced pasture quality as a result of deficiencies in nitrogen and phosphorus. Other elements which also play key roles are potassium and calcium.

Salinity (s)

This refers to the reduction in dry matter yield as a result of soluble salt in the soil profile. It also contributes to reduced water availability. Significant increasing salinity in the soil profile (below 20-40 cm) was evidenced in some of the Brigalow soils.

Soil Physical Factors (p)

Physical factors refer to restrictions in the establishment and vigour of pastures as a result of soil surface condition and are typically related to size of surface aggregates which affects tendencies to seal and hard-set. Shields and Williams (1991) consider the establishment and spread of most pasture species is restricted on hard-setting surface soils such as sandy loam to clay loam textures which are almost non-existent in the Project Site.

Overall within the Project Site, the extensive development of Buffel grass is testimony that soil physical factors are generally not limiting to pasture establishment.

Susceptibility to Water Erosion (e)

Few areas showing any significant water erosion were observed in the Project Site. Based on soil analytical data (dispersion, Ca to Mg ratios) in addition to slope limits of DME (1995), most of the undulating Brigalow clay soil types described have some limitation levels due to susceptibility to erosion although not significant. See **Table 4-7**.

Table 4-7 Land Suitability for Cattle Grazing – Effects of Slopes

Limitation rating					
	1	2	3	4	5
Cracking clays	<3% slope	Slopes 3-6%	Slopes 6-9%	Slopes 9-15%	>15%
Sodic rigid soils	<1% slope	Slopes 1-3%	Slopes 3-6%	Slopes 6-12%	>12%

Vegetation regrowth (v)

Shields and Williams (1991) consider that regrowth can be a serious limitation to establishment and persistence of improved pastures in Brigalow and eucalyptus woodlands. The major unit where vegetation regrowth appeared to be significant was in the alluvial Brigalow unit DB3 and the Brigalow scrub unit B4.

Microrelief (g), Wetness (w) Flooding (f)

These limitations in the grazing context were considered to be relatively minor and would not contribute any significant weighting in the classification of grazing land suitability in the Project Site apart from a small area of DB2 (minor melon hole variant) which may be expected to reduce the overall stocking rate potential.

Beef Cattle Grazing Suitability Summary

Table 4-8 provides estimates of limitations and overall land suitability class for each of the soil units.

Table 4-8 Grazing Land Suitability

Soil Unit	Description	Grazing	
		Major Limitations and Severity	Class
DB1	Red Brown Upland Clays	moisture – m3 erosion – e3 nutrients – n2	3
DB2	Linear Gilgai On Dark Grey Brown Clays	moisture – m2 erosion – e2 nutrients – n1	2
DB3	Alluvial Clay Plains of Dark Cracking Clays	moisture – m2 erosion – e1 nutrients – n2 vegetation regrowth – v2	2
DB4	Moderately Well Structured Grey Brown Cracking Clays	moisture – m2 erosion – e2 nutrients – n1	2
DB5	Shallow, Gravelly Red Brown Sandy Clays	moisture – m4 nutrients – n2 erosion – e3	4
DB6	Cracking Clays With Poplar Box And Brigalow	moisture – m3 nutrients – n2 erosion – e2	3
DE1	Mt Coolibah Uplands With Brown Clay	moisture – m2 nutrients – n1 erosion – e2	2
DD1	Open Downs With Grassland On Dark Cracking Clays	moisture – m2 salinity – s1 nutrients – n2 erosion – e2 flooding – f2	2

Soil Unit	Description	Grazing	
		Major Limitations and Severity	Class
A2	Alluvial -Sandy hard duplex	moisture – m4 nutrients – n3 soil physical factors – p2	4
B4 and B4v	Friable Brigalow scrub soil – black cracking clay	moisture – m2 nutrients – n2 vegetation regrowth – v2	2

4.3.1.8 Pre-Mine Land Suitability Summary

The land suitability of the proposed Project area is shown in **Table 4-9**.

Table 4-9 Land Suitability Classes – Pre Mining

Soil Unit	Description	Cropping Class	Grazing Class	Preferred use
DB1	Red Brown Upland Clays	5	3	Grazing on improved pasture.
DB2	Linear Gilgai On Dark Grey Brown Clays	5	2	Grazing on improved pasture
DB3	Alluvial Clay Plains of Dark Cracking Clays	5	2	Grazing on improved pasture
DB4	Moderately Well Structured Grey Brown Cracking Clays	3	2	Grazing with opportunistic forage possible some years
DB5	Shallow, Gravelly Red Brown Sandy Clays	5	4	Low density grazing on improved or native pasture
DB6	Cracking Clays With Poplar Box And Brigalow	4	3	Grazing on native and improved pasture
DE1	Mt Coolibah Uplands With Brown Clay	4	2	Grazing on improved pastures
DD1	Open Downs With Grassland On Dark Cracking Clays	5	2	Grazing on native pasture
A2	Alluvial -Sandy hard duplex	5	4	Grazing on native pastures
B4 and B4v	Friable Brigalow scrub soil – black cracking clay	4	2	Excellent grazing land.

Pre-mine land suitability for cropping and grazing is shown in **Figure 4-5** and **Figure 4-6** respectively.

4.3.1.9 Good Quality Agricultural Land

The 'Planning Guidelines: The Identification of Good Quality Agricultural Land' (DLGP and DPI, 1993) has established four Classes of agricultural land for Queensland.

Class Description
Class A Crop land - Land that is suitable for current and potential crops with limitations to production which range from none to moderate levels.
Class B Limited crop land - Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.
Class C Pasture land - Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment.
Class D Non-agricultural land - Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage.

The Planning Guidelines classify the following land classes as being good quality agricultural land (GQAL):

- Class A crop land;
- Class B crop land for particular crops of local significance; and
- Class C pasture land in areas where pastoral industries are the major primary industry and improved or high quality native pastures prevail.

The GQAL mapped by NRW for the vicinity of the Project Site is provided in **Figure 4-7**, which indicates that the Project Site comprises 480 ha of class A land and 2,870 ha of class C land. However, the NRW mapping is broadscale and requires site specific survey to confirm the mapped GQAL classifications. In the case of the Daunia Project, the soil surveys indicate that the Project Site comprises land that may be considered by DPI&F as GQAL, as follows:

- Class A – 480 ha that has moderate limitations to cropping
- Class B – 200 ha that has severe limitations to cropping
- Class C – 2,670 ha that is suitable for improved or high quality native pastures.



Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
ml: 70312

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

Disclaimer

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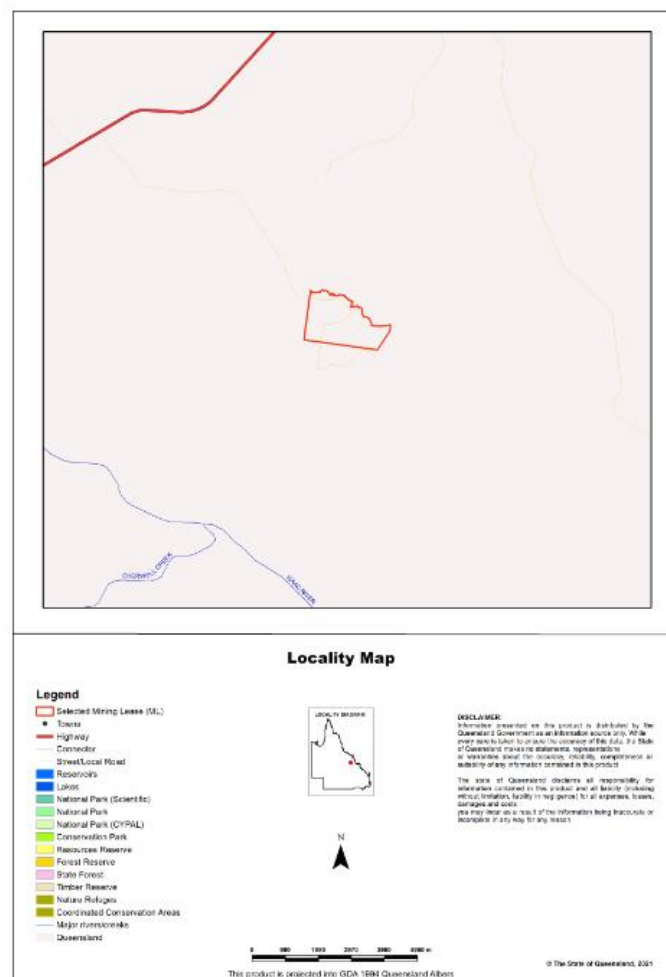
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Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI ml: 70312

Size (ha)	290.5
Local Government(s)	Isaac Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Northern Bowen Basin
Catchment(s)	Fitzroy



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;
- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;
- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;
- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;
- Regulated vegetation under the *Vegetation Management Act 1999* that is:
 - Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;
 - Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;
 - Category R areas on the regulated vegetation management map;
 - Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;
 - Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;
- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;
- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Queensland Wetland Environmental Values under the Environment Protection Regulation 2019;
- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;
- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
1c Protected Areas- special wildlife reserves	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	83.84 ha	28.9%
7b Special least concern animals	1.33 ha	0.5%
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	48.84 ha	16.8%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	3.26 ha	1.1%
8d Regulated Vegetation - Essential habitat	93.63 ha	32.2%
8e Regulated Vegetation - intersecting a watercourse **	2.8 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

(no results)

1c. Protected Areas - special wildlife reserves

(no results)

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

(no results)

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Values are present

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
<i>Boronia keysii</i>		V	None
<i>Calyptorhynchus lathamii</i>	Glossy black cockatoo	V	None
<i>Casuarus casuarus johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	Core
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Melaleuca irbyana</i>		E	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Phascolarctos cinereus</i>	Koala - outside SEQ*	V	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Taudactylus pleione</i>	Kroombit tinkertoad	E	None
<i>Xeromys myoides</i>	Water Mouse	V	None

*For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.

Threatened (endangered or vulnerable) wildlife species records

(no results)

Special least concern animal species records

Scientific name	Common name	Migratory status
<i>Tachyglossus aculeatus</i>	short-beaked echidna	

*Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL).
Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

<https://www.qld.gov.au/environment/plants-animals/species-list/>

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

<https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/>

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

<https://environment.ehp.qld.gov.au/regional-ecosystems/>

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.2/11.3.1/11.3.25	E-subdom	rem_end
11.4.9	E-dom	rem_end
11.5.3/11.4.9	E-subdom	rem_end

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Not applicable

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Regulated vegetation map category	Map number	RVM rule
R	8553	4

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

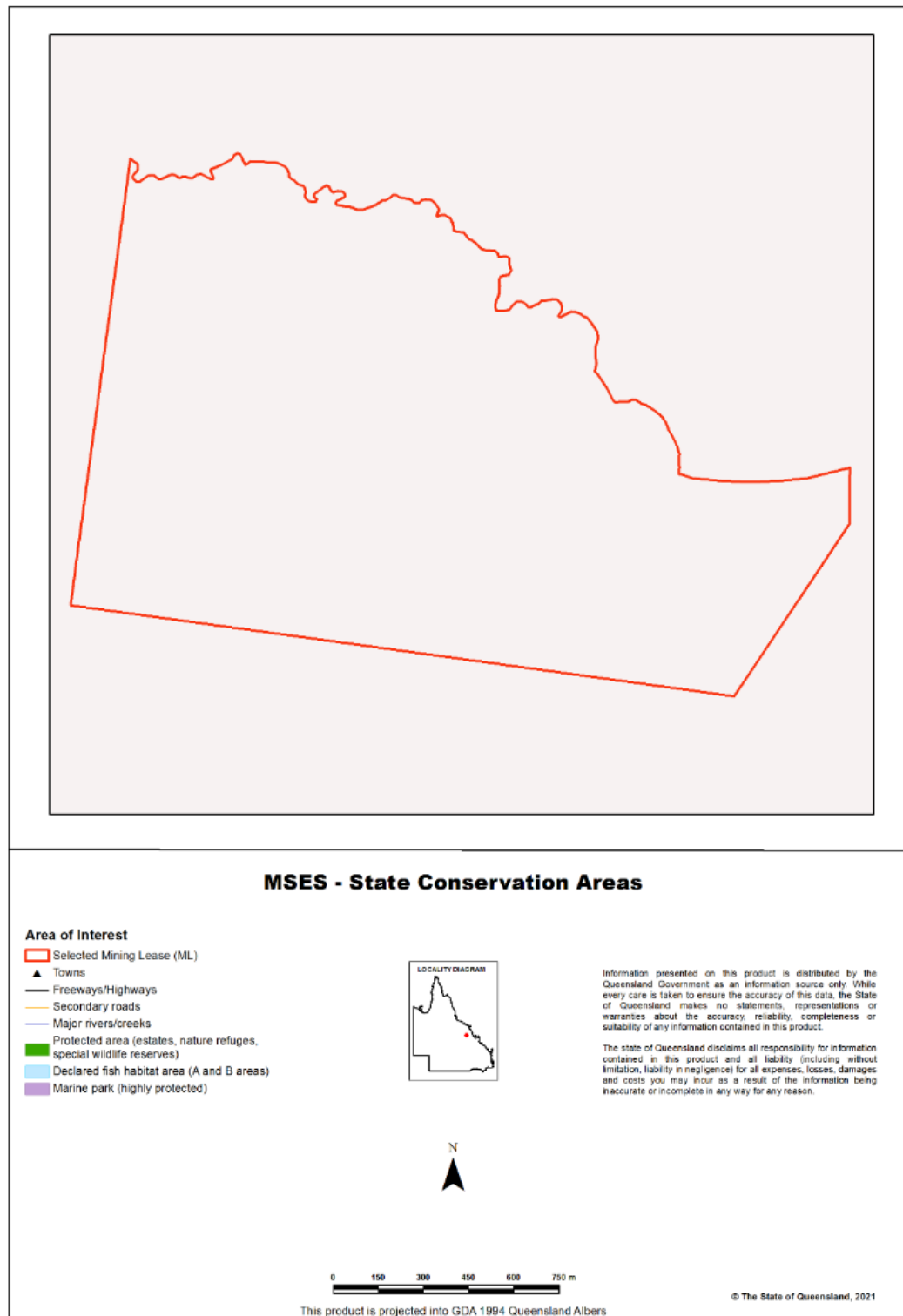
9a. Legally secured offset areas - offset register areas

(no results)

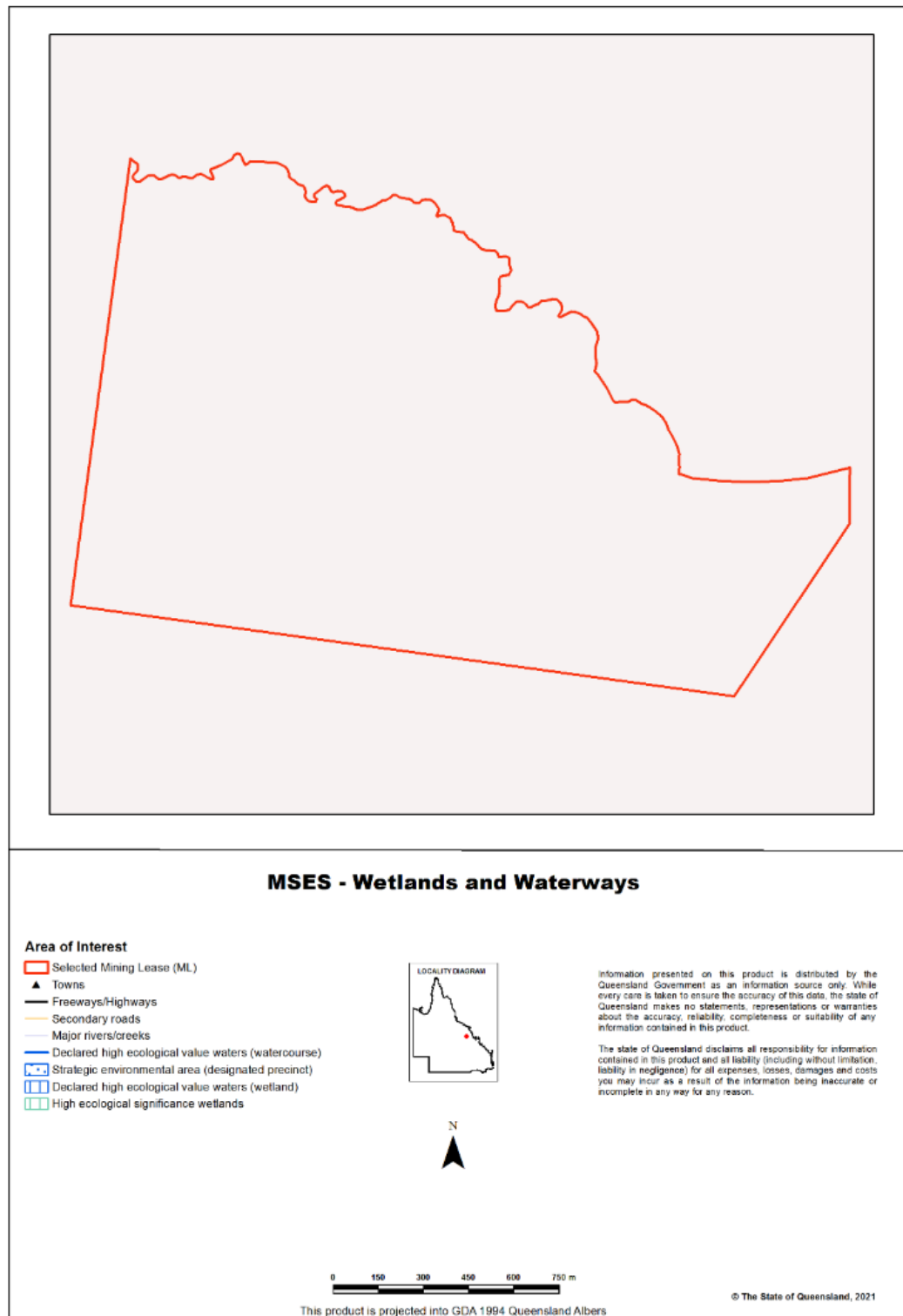
9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

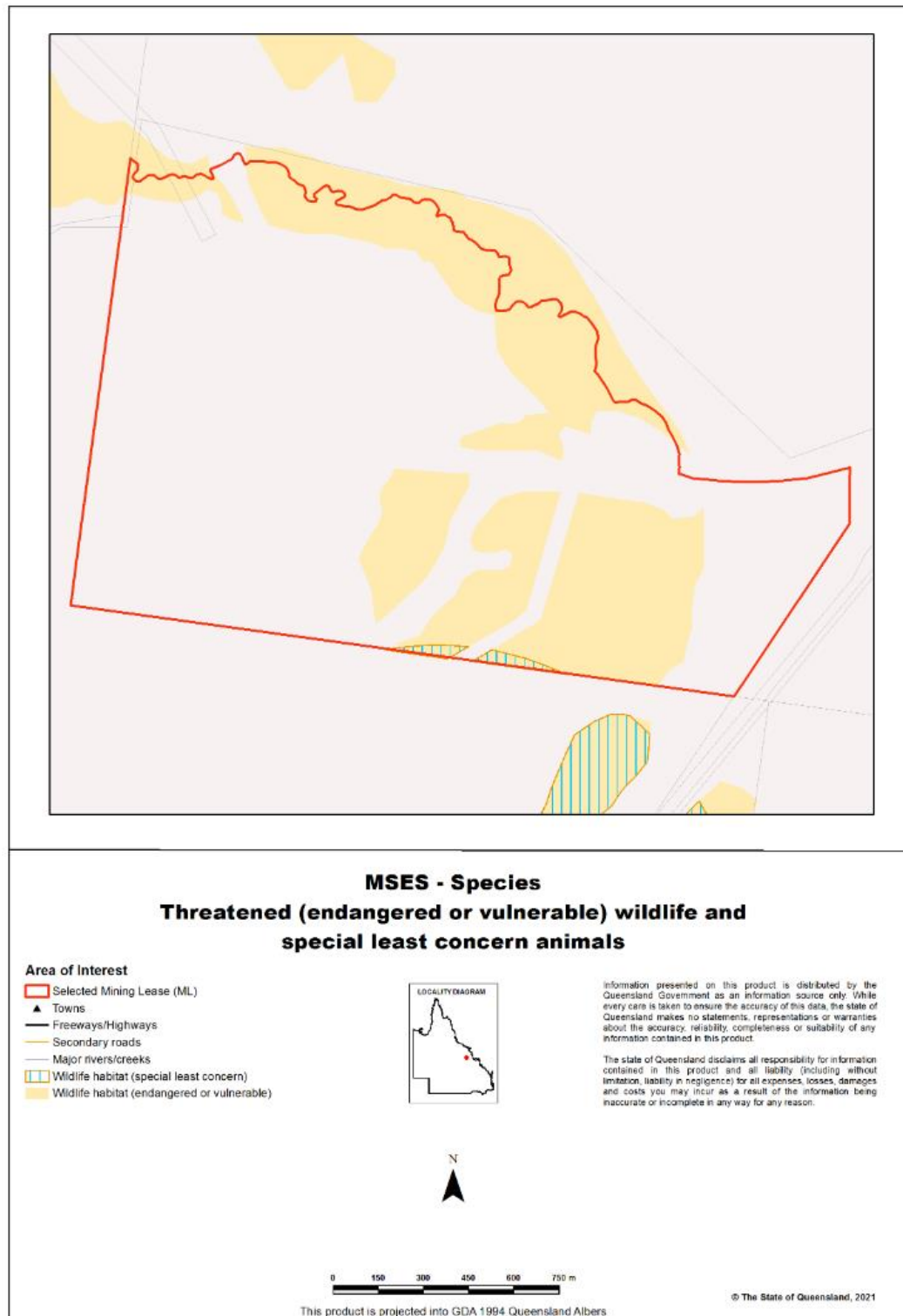
(no results)

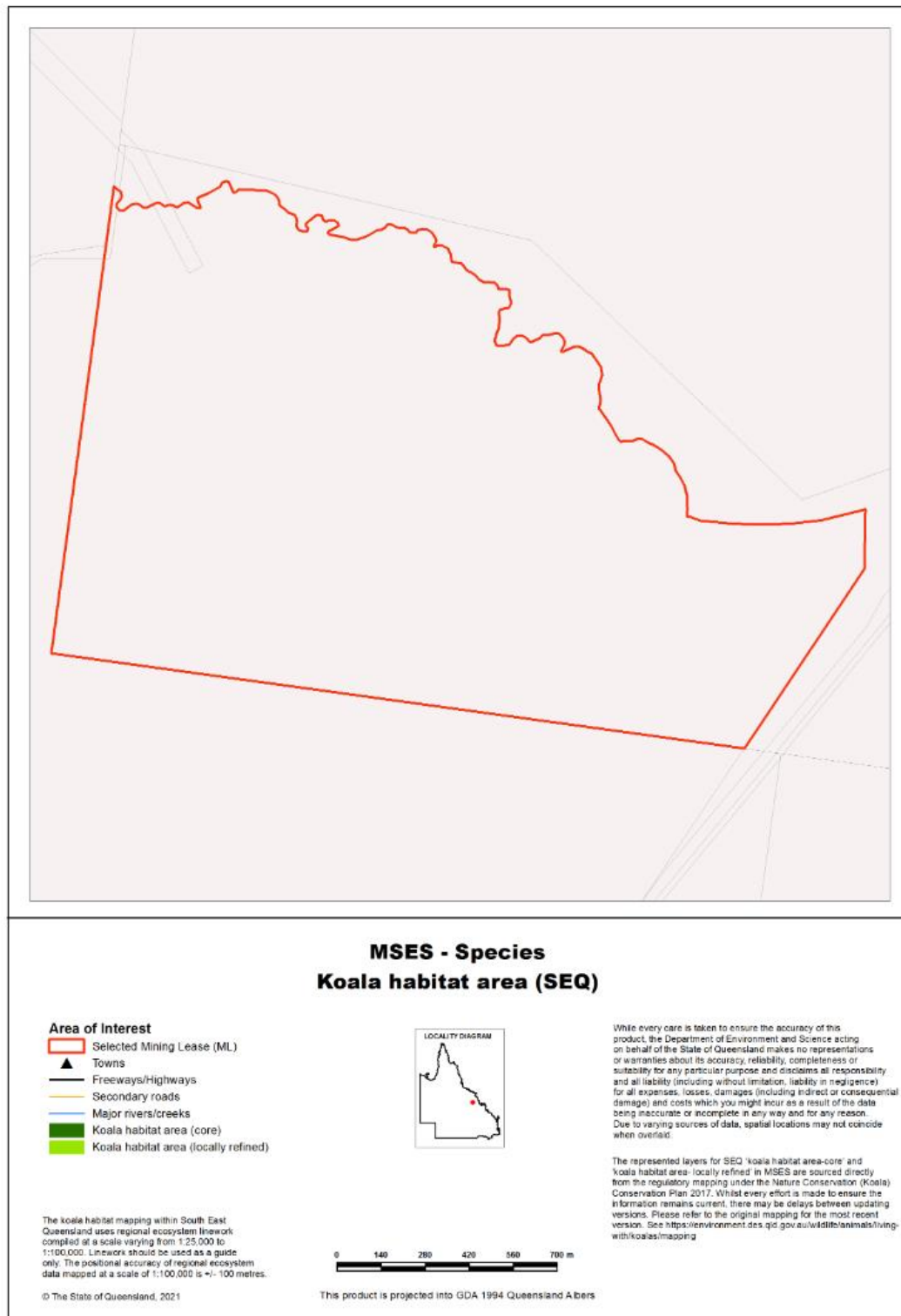
Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

Map 1 - MSES - State Conservation Areas

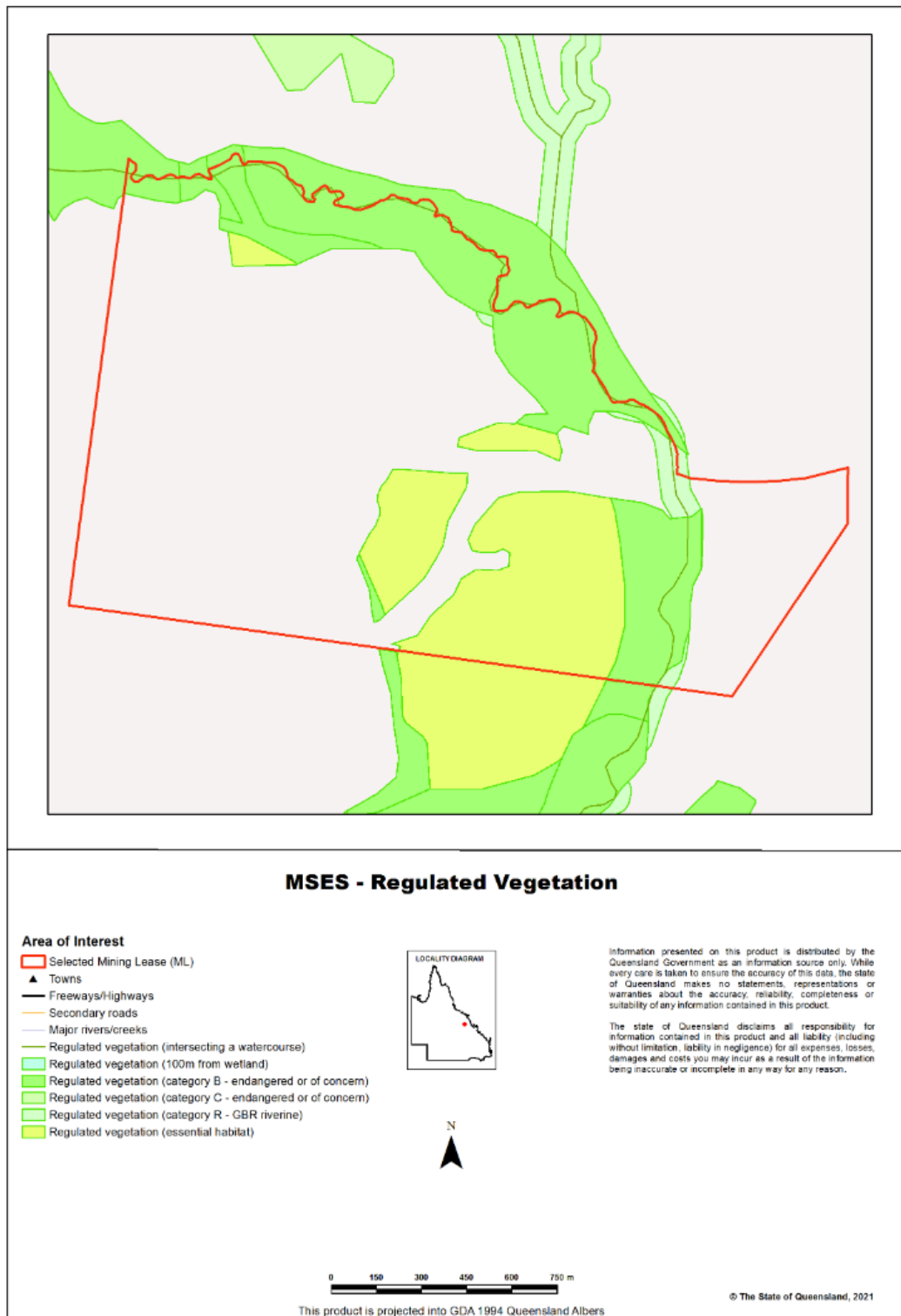
Map 2 - MSES - Wetlands and Waterways

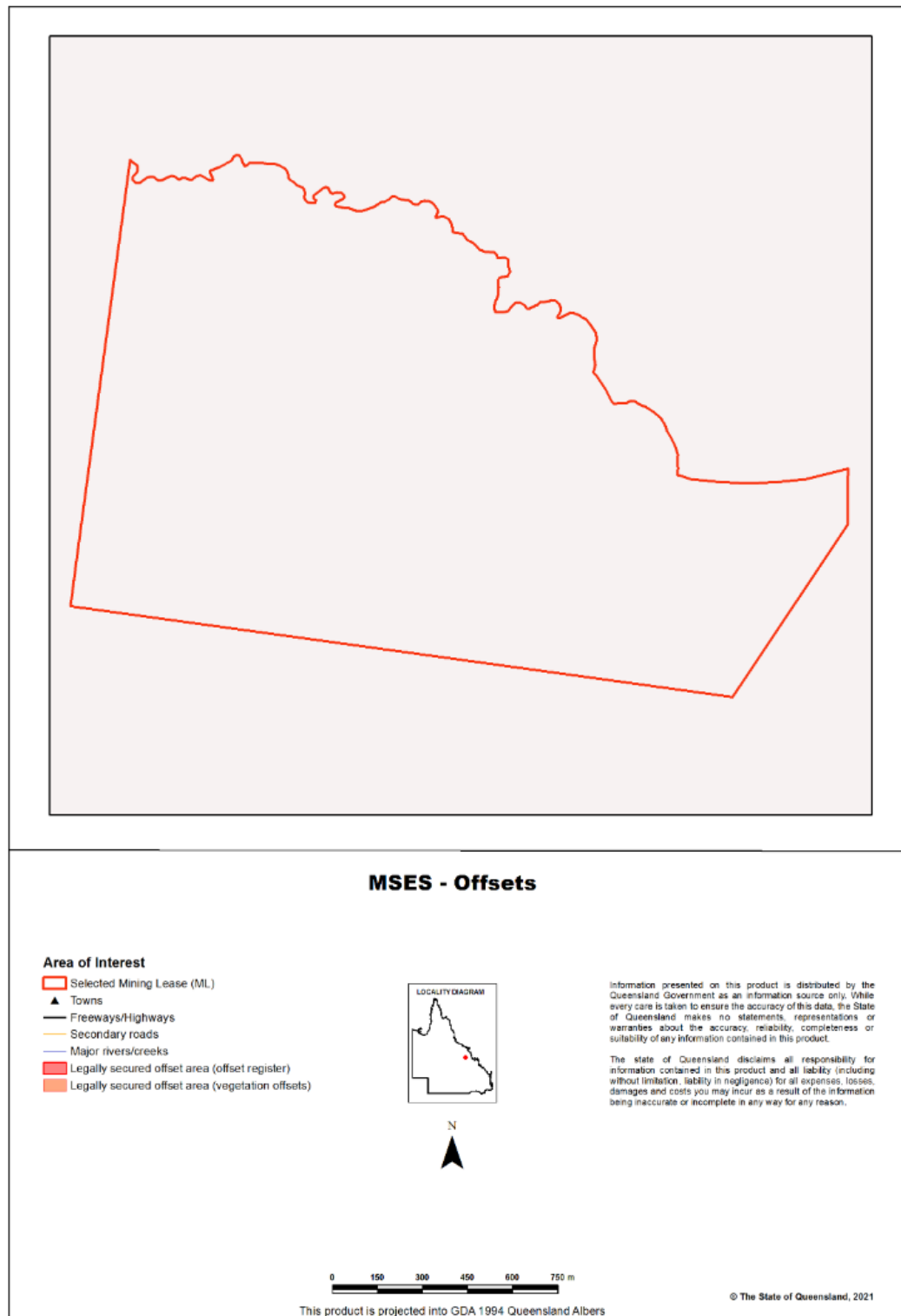


Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals

Map 3b - MSES - Species - Koala habitat area (SEQ)

Map 4 - MSES - Regulated Vegetation



Map 5 - MSES - Offset Areas

Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

<http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html> .

Appendix 2 - Source Data

The datasets listed below are available on request from:

<http://qldspatial.information.qld.gov.au/catalogue/custom/index.page>

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	current QSpatial data (http://qldspatial.information.qld.gov.au)
Protected Areas-Estates, Nature Refuges, Special Wildlife Reserves	- Protected areas of Queensland - Nature Refuges - Queensland - Special Wildlife Reserves- Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 5) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- <i>Environmental Protection Act 1994</i>
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- <i>Vegetation Management Act 1999</i>



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
ml: 70312

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the input coordinates.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no matters of interest have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Resources website <https://www.dnrme.qld.gov.au/>

Please direct queries about these reports to: Queensland.Herbarium@qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Area of interest details: ml: 70312

Size (ha)	290.5
Local Government(s)	Isaac Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Northern Bowen Basin
Catchment(s)	Fitzroy

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	9.66	3.32
Of concern	33.7	11.6
No concern at present	40.83	14.06
Total remnant vegetation	84.18	28.98

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2020) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Resources website.

<https://www.dnrme.qld.gov.au/>

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
11.3.1	Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains	Endangered	8.42	2.9
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	31.59	10.87
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Of concern	2.11	0.72
11.4.9	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	Endangered	1.23	0.42
11.5.3	Eucalyptus populnea +/- E. melanophloia +/- Corymbia clarksoniana woodland on Cainozoic sand plains and/or remnant surfaces	No concern at present	40.83	14.06
non-remnant	None	None	206.31	71.02

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
11.3.1	Pre-clearing 780000 ha; Remnant 2019 77000 ha	25a	None	Low
11.3.2	Pre-clearing 1914000 ha; Remnant 2019 503000 ha	17a	Contains palustrine wetland (e.g. in swales).	Low
11.3.25	Pre-clearing 797000 ha; Remnant 2019 514000 ha	16a	Riverine wetland or fringing riverine wetland.	Low
11.4.9	Pre-clearing 999000 ha; Remnant 2019 90000 ha	25a	Contains palustrine wetland (e.g. in swales).	Low
11.5.3	Pre-clearing 979000 ha; Remnant 2019 370000 ha	17a	None	Low
non-remnant	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented; No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
11.3.1	Habitat for threatened fauna species including painted honeyeater, <i>Grantiella picta</i> particularly in subregion 35 (Oliver et al. 2003).
11.3.2	Habitat for threatened flora species <i>Homopholis belsonii</i> . This ecosystem is also known to provide suitable habitat for koalas (<i>Phascolarctos cinereus</i>).
11.3.25	Shown to be associated with a high fauna species richness in the Taroom area (Venz et al. 2002). Within parts of the Fitzroy catchment, this RE is known habitat for the threatened freshwater turtle <i>Rheodytes leukops</i> . Known to be important habitat for other riparian freshwater turtle species. This ecosystem is also known to provide suitable habitat for koalas (<i>Phascolarctos cinereus</i>).
11.4.9	Potential habitat for NCA listed species: <i>Cadellia pentastylis</i> , <i>Solanum adenophorum</i> , <i>Solanum dissectum</i> , <i>Solanum elaeagnifolium</i> , <i>Solanum johnsonianum</i> , <i>Xerothamnella herbacea</i>
11.5.3	Potential habitat for NCA listed species: <i>Sannantha brachypoda</i>
non-remnant	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at:

<https://publications.qld.gov.au/dataset/redd/resource/>

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	206.31	71.02
16a	Open forest and woodlands dominated by <i>Eucalyptus camaldulensis</i> (river red gum) (or <i>E. tereticornis</i> (blue gum)) and/or <i>E. coolabah</i> (coolabah) (or <i>E. microtheca</i> (coolabah)) fringing drainage lines. Associated species may include <i>Melaleuca</i> spp., <i>Corymbia tessellaris</i> (carbeen), <i>Angophora</i> spp., <i>Casuarina cunninghamiana</i> (riveroak). Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded. (land zone 3) (MGD, BRB, GUP, CHC, MUL, DEU, EIU, NWH, SEQ, [NET, WET]) (All bioregions except CYP and CQC)	2.11	0.72

BVG (1 Million)	Description	Area (Ha)	% of AOI
17a	Woodlands dominated by <i>Eucalyptus populnea</i> (poplar box) (or <i>E. brownii</i> (Reid River box)) on alluvium, sand plains and footslopes of hills and ranges. (land zones 3, 5, 10, 9, 4, 11, 12, [8]) (BRB, MUL, DEU, MUL, EIU)	72.42	24.93
25a	Open forests to woodlands dominated by <i>Acacia harpophylla</i> (brigalow) sometimes with <i>Casuarina cristata</i> (belah) on heavy clay soils. Includes areas co-dominated with <i>A. cambagei</i> (gidgee) and/or emergent eucalypts (land zones 4, 9, 3, 11, 7, 12, [5, 8]) (BRB, MUL, MGD, DEU, [SEQ])	9.66	3.32

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

The descriptions are compiled using site survey data from the Queensland Herbarium's CORVEG database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2020 (PDF)* section 3.3 of:

<https://publications.qld.gov.au/dataset/redd/resource/>

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

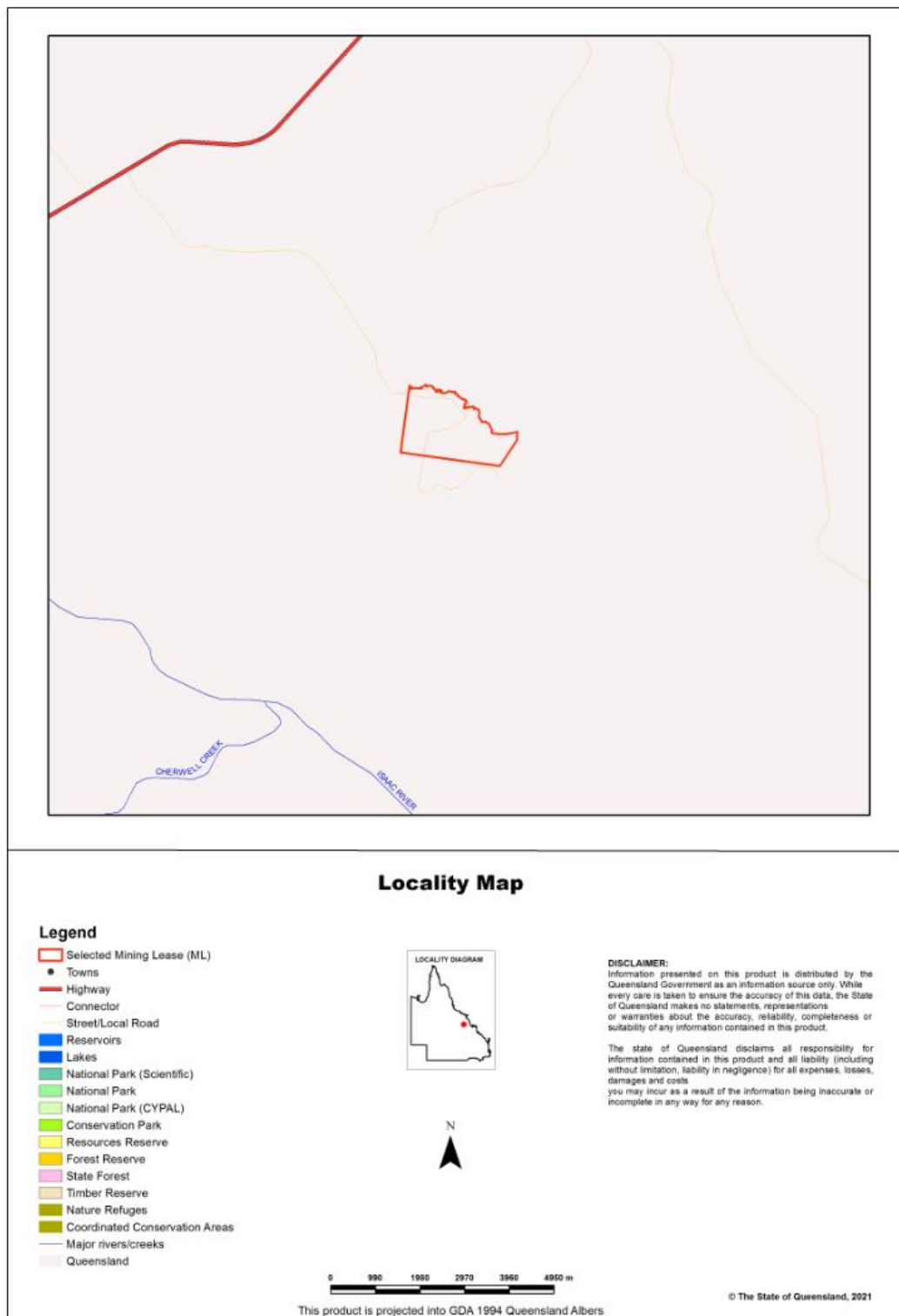
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

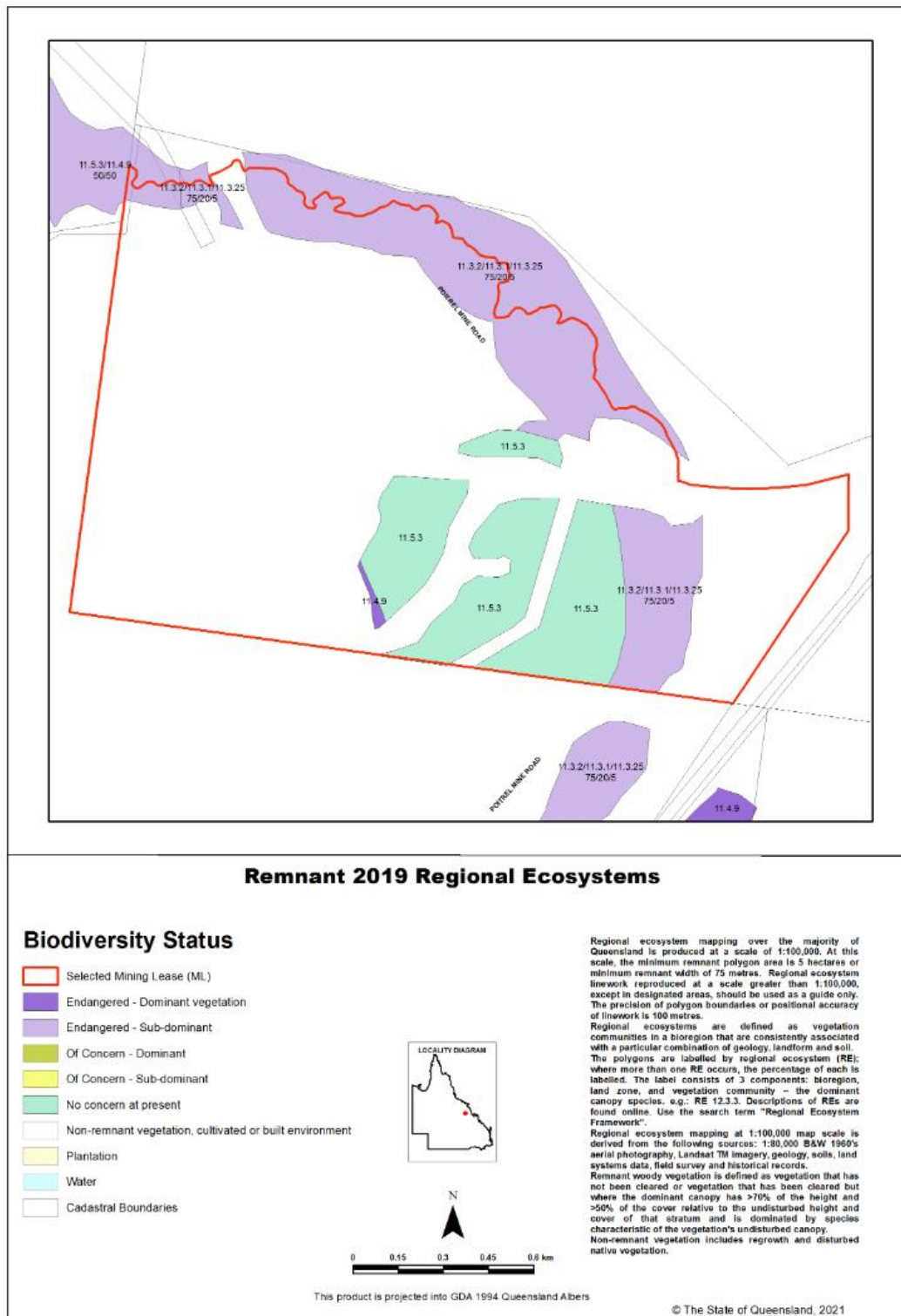
Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.3.1	Available	Available
11.3.2	Available	Available
11.3.25	Available	Available
11.4.9	Available	Available
11.5.3	Available	Available
non-remnant	Not currently available	Not currently available

Maps

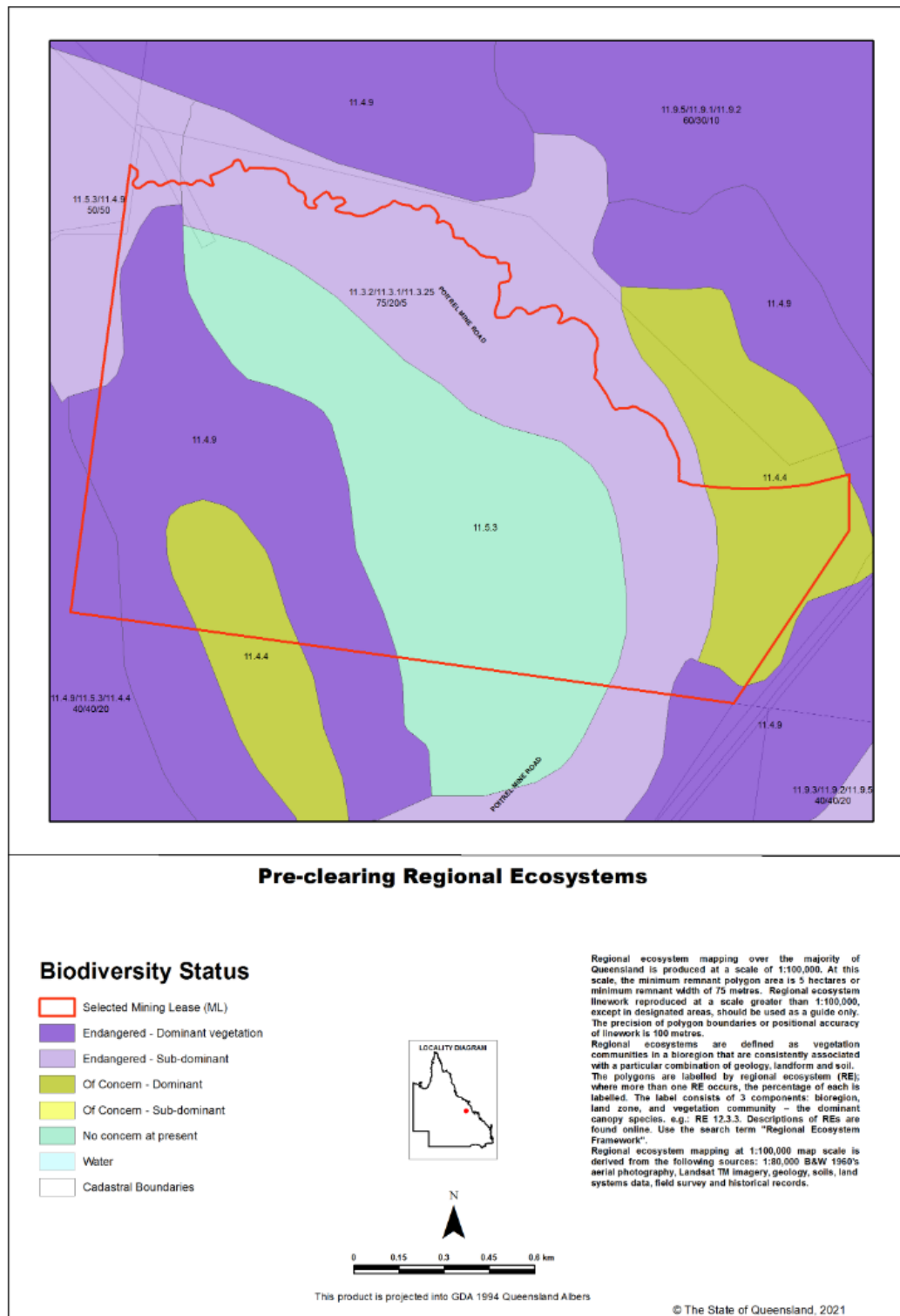
Map 1 - Location

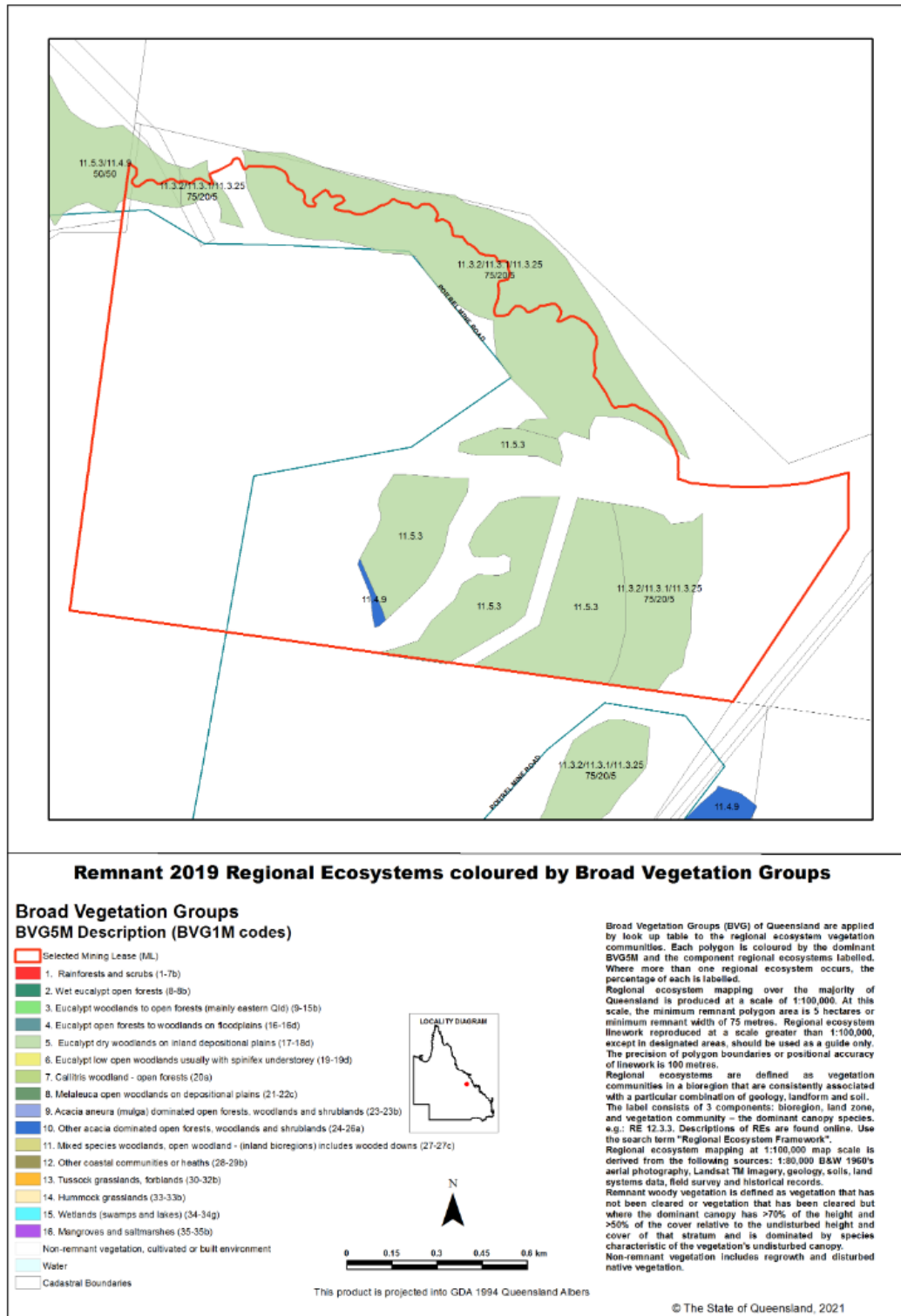


Map 2 - Remnant 2019 regional ecosystems

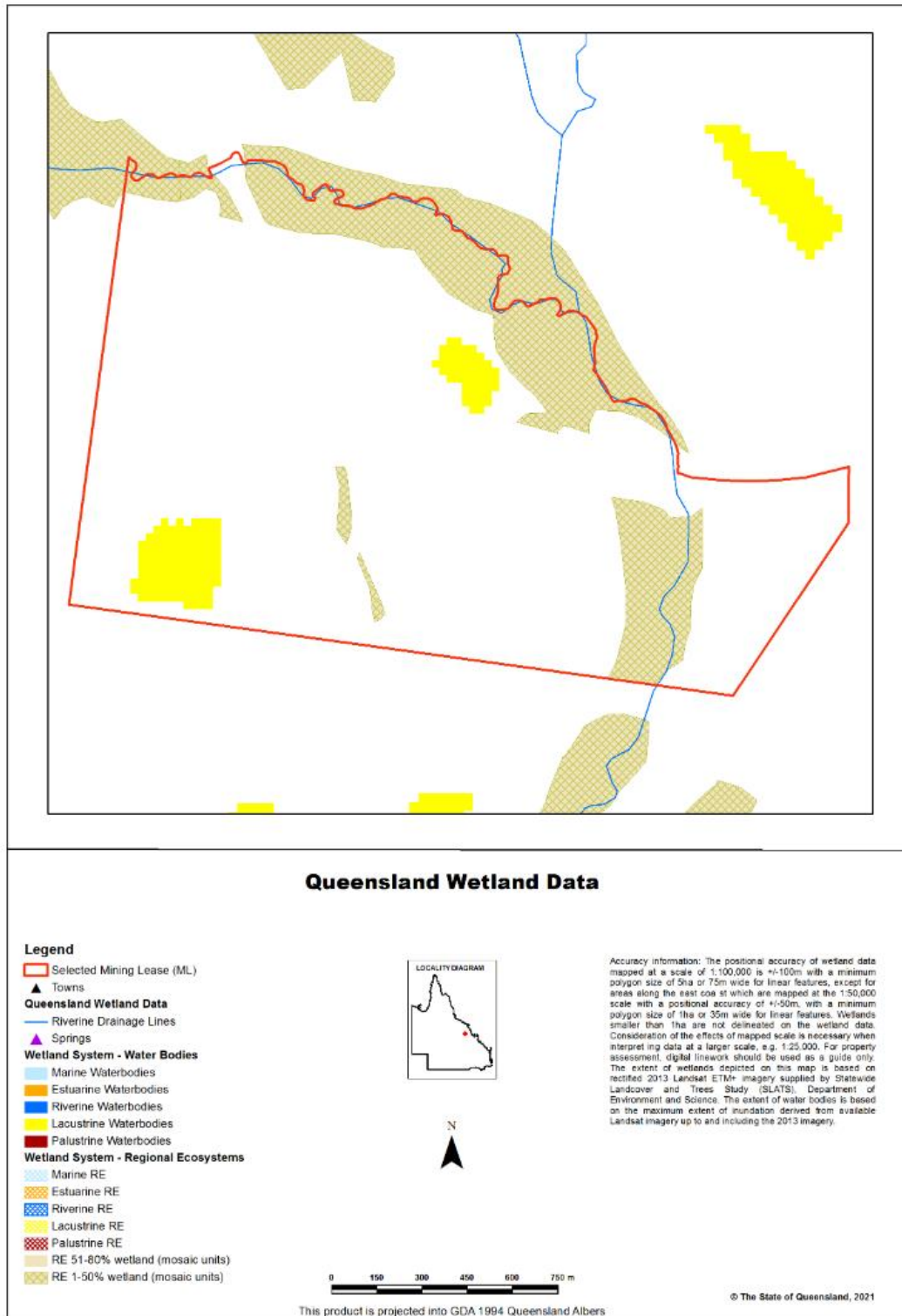


Map 3 - Pre-clearing regional ecosystems



Map 4 - Remnant 2019 regional ecosystems by BVG (5M)

Map 6 - Wetlands and waterways



Links and Other Information Sources

The Department of Environment and Science's Website -

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/>

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

The methodology for mapping regional ecosystems can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

Technical descriptions for regional ecosystems can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

Benchmarks can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

<http://dds.information.qld.gov.au/dds/>

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

<http://www.dnrm.qld.gov.au/mapping-data/queensland-globe>

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<https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4>

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/download/>

- Regional Ecosystem Description Database

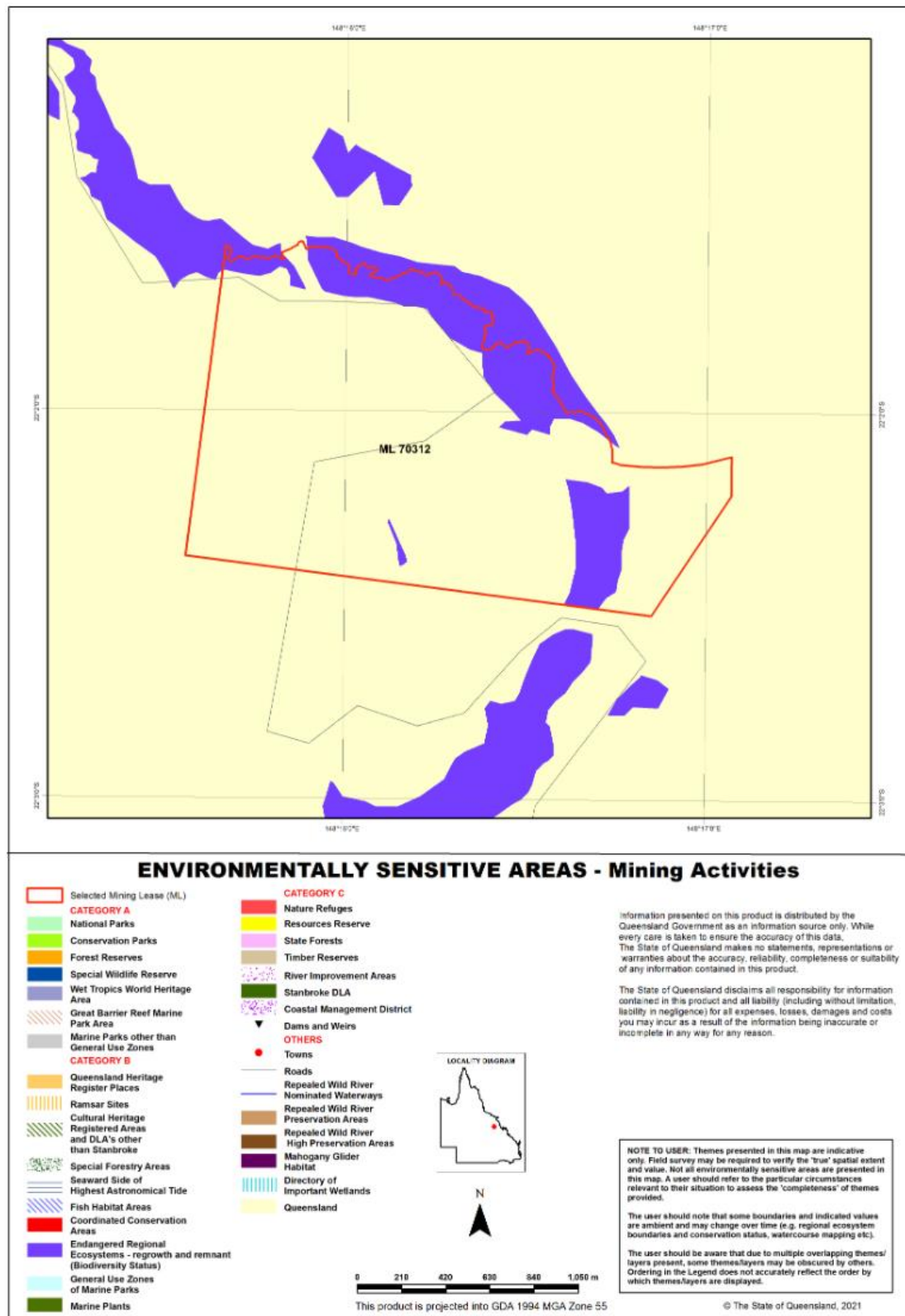
The datasets listed below are available for download from:

<http://dds.information.qld.gov.au/dds/>

- Biodiversity status of pre-clearing and 2019 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- <i>Vegetation Management Act 1999</i>



WildNet Records Conservation Significant Species List



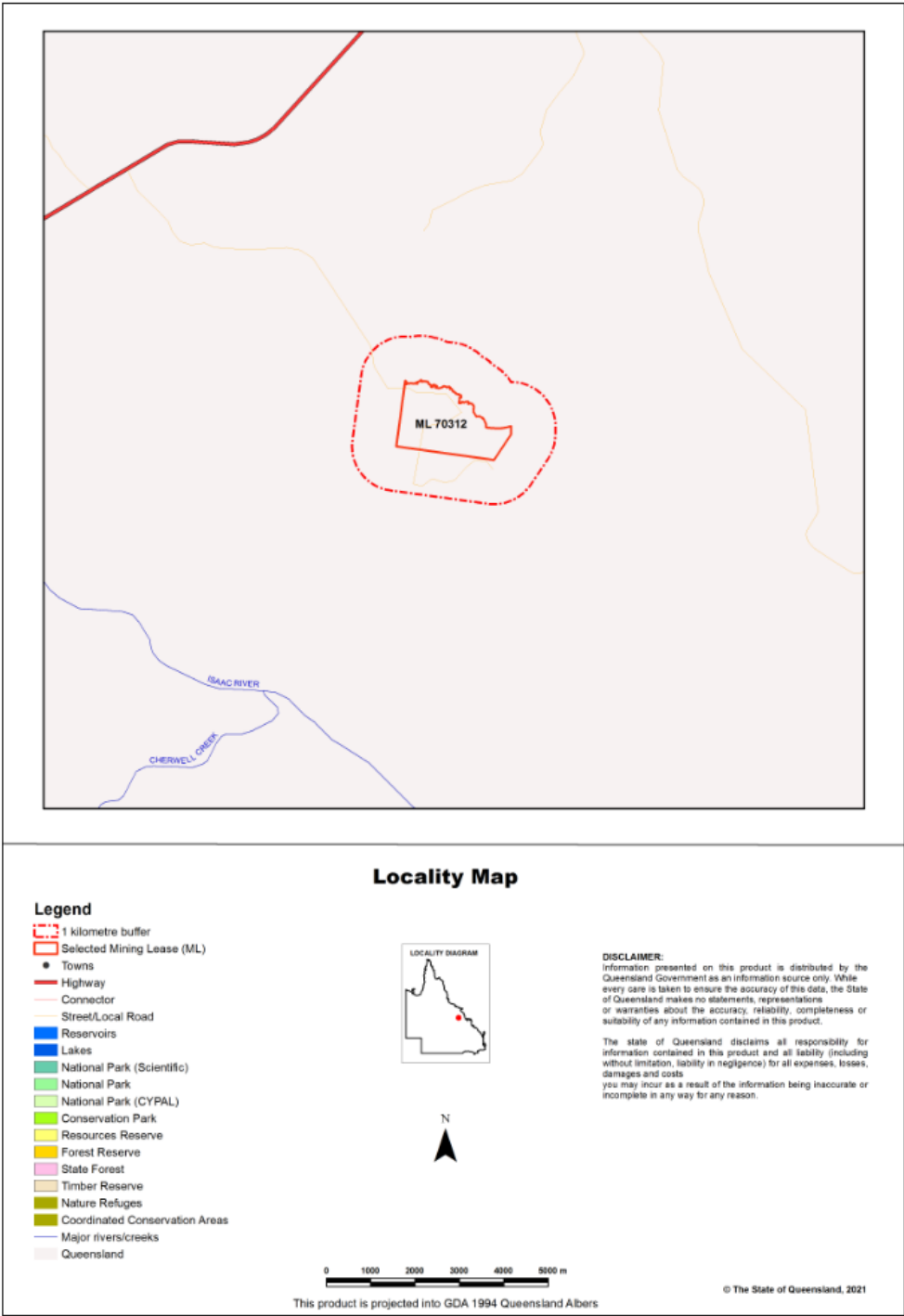
For the selected area of interest 290.5ha ml: 70312

Current as at 11/08/2021

WildNetCSSpeciesList



Map 1. Locality Map



Summary Information

The following table provides an overview of the area of interest ml: 70312.

Table 1. Area of interest details

Size (ha)	290.5
Local Government(s)	Isaac Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Northern Bowen Basin
Catchment(s)	Fitzroy

Protected Area(s)

No estates or reserves are located within the area of interest.

World Heritage Area(s)

No World Heritage Areas are located within the area of interest.

Ramsar Area(s)

No Ramsar Areas are located within the area of interest.

Conservation Significant Species List

Introduction

This report is derived from a spatial layer generated from the [WildNet database](#) managed by the Department of Environment and Science. The layer which is generated weekly contains the WildNet wildlife records that are not classed as erroneous or duplicate, that have a location precision equal to or less than 10000 metres and do not have a count of zero.

Conservation significant species are species listed:

- as [threatened](#) or near threatened under the Nature Conservation Act 1992;
- as threatened under the [Environment Protection and Biodiversity Conservation Act 1999](#) or
- [migratory species](#) protected under the following international agreements:
 - o Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
 - o China-Australia Migratory Bird Agreement
 - o Japan-Australia Migratory Bird Agreement
 - o Republic of Korea-Australia Migratory Bird Agreement

The WildNet dataset is constantly being enhanced and the taxonomic and status information revised. If a species is not listed in this report, it does not mean it doesn't occur there and listed species may also no longer inhabit the area. It is recommended that you also access other internal and external data sources for species information in your area of interest (Refer Links and Support).

Table 2 lists the species recorded within the area of interest and its one kilometre buffer.

Table 2. Conservation significant species recorded within the area of interest and its one kilometre buffer

No species found within the area of interest.

Taxon Id: Unique identifier of the taxon from the WildNet database.

NCA: Queensland conservation status of the taxon under the *Nature Conservation Act 1992* (Least Concern (C), Critically Endangered (CR), Endangered (E), Extinct (EX), Near Threatened (NT), Extinct in the Wild (PE), Special Least Concern (SL), and Vulnerable (V)).

EPBC: Australian conservation status of the taxon under the *Environment Protection and Biodiversity Conservation Act 1999* (Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Vulnerable (V), and Extinct in the Wild (XW)).

Specimens: The number of specimen-backed records of the taxon.

Records: The total number of records of the taxon.

Last record: Date of latest record of the taxon.

Links and Support

Other sites that deliver species information from the [WildNet database](#) include:

- [Species profile search](#) - access species information approved for publication including species names, statuses, notes, images, distribution maps and records
- [Species lists](#) - generate species lists for Queensland protected areas, forestry areas, local governments and areas defined using coordinates
- [Biomaps](#) - view biodiversity information, including WildNet records approved for publication, and generate reports
- [Queensland Globe](#) - view spatial information, including WildNet records approved for publication
- [Qld wildlife data API](#) - access WildNet species information approved for publication such as notes, images and records etc.
- [Wetland Maps](#) - view species records, survey locations etc. approved for publication
- [Wetland Summary](#) - view wildlife statistics, species lists for a range of area types, and access WildNet species profiles
- [WildNet wildlife records - published - Queensland](#) - spatial layer of WildNet records approved for publication generated weekly
- [Generalised distribution and densities of Queensland wildlife](#) - Queensland species distributions and densities generalised to a 10 km grid resolution
- [Conservation status of Queensland wildlife](#) - access current lists of priority species for Queensland including nomenclature and status information
- [Queensland Confidential Species](#) - the list of species flagged as confidential in the WildNet database.

Please direct queries about this report to the [WildNet Team](#).

Other useful sites for accessing Queensland biodiversity data include:

- [Useful wildlife resources](#)
- [Queensland Government Data](#)
- [Atlas of Living Australia \(ALA\)](#)
- [Online Zoological Collections of Australian Museums \(OZCAM\)](#)
- [Australia's Virtual Herbarium \(AVH\)](#)
- [Protected Matters Search Tool](#)

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government, to the maximum extent permitted by law, makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



Appendix 7 **Elliot Whiteing (November 2021): Red Mountain Infrastructure PRCP
Community Consultation Plan and Community Consultation Register**

BHP

RMI PRC Plan CCP

Progressive Rehabilitation and Closure Planning – Red Mountain Infrastructure

Community Consultation Plan

November 2021

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Definitions

Consultation	Community consultation is a key component of the PRC Plan and is intended to ensure that anyone impacted by proposed rehabilitation and closure activities at the site has an opportunity to provide input to the planning process (PRC Plan Guideline, DES, 2019).
CCP	Community consultation plan, required to be submitted with the PRC Plan.
LoA	Life of Asset
EP Act	Environmental Protection Act 1994 (Qld)
EIS	Environmental Impact Statement – primary approval document for major projects under the State Development and Public Organisations Act 1971 and EP Act.
DES	Department of Environment and Science, DES is responsible for assessing PRC Plans and schedules.
DNRME	Department of Natural Resource Mining Energy
MERFP Act	Mineral and Energy Resources (Financial Provisioning) Act 2018 (Qld)
NUMA	Non-use management area - means an area of land the subject of a PRC Plan that cannot be rehabilitated to a stable condition after all relevant activities for the PRC Plan carried out on the land have ended. Land is in a stable condition if— (a) the land is safe and structurally stable; and (b) there is no environmental harm being caused by anything on or in the land; and (c) the land can sustain a post-mining land use.
PMLU	Post-mining land use – means the purpose for which the land will be used after all relevant activities for the PRC Plan carried out on the land have ended.
PRC Plan	Progressive rehabilitation and closure plan PRC Plans must include a detailed description of how and where mining activities will be carried out, how consultation was undertaken and considered in development of a PRC Plan, and any risks of not being able to rehabilitate the land to a stable condition.
PIE	Public Interest Evaluation - The MERFP Act introduces requirements for a PIE to be carried out for any EA applications that include a NUMA in a PRC Plan schedule.
RMI	Red Mountain Infrastructure, which comprises the coal processing and transport infrastructure supporting Poitrel Mine (BHP) and Millennium Coal Mine (MetRes).

1. Introduction

This document represents the Community Consultation Plan (CCP) to be delivered as part of the Red Mountain Infrastructure (RMI) Progressive Rehabilitation and Closure Plan (PRC Plan). It includes:

- consultation requirements for PRC Planning;
- the objectives and desired outcomes for community consultation in PRC Planning for RMI;
- the consultation process and program, including proposed frequency of consultation;
- information to be released for community consultation; and
- how community feedback will be considered in PRC Plan updates.

This CCP has been compiled by Elliott Whiteing, with community consultation assistance provided by BHP team members. Implementation of the consultation requirements as part of ongoing rehabilitation and closure planning for the site will continue to be led by the BHP Corporate Affairs team.

2. Community consultation requirements

2.1. Regulatory requirements

The Department of Environment and Science (DES) *Guideline - Progressive rehabilitation and closure plans* (DES, 2019) provides that 'community consultation is a key component of the PRC Plan and is intended to ensure that anyone impacted by proposed rehabilitation and closure activities at the site has an opportunity to provide input to the planning process'. The DES Guideline requires that the applicant must attempt to consult all relevant members of the community, noting that 'the community may include, but are not limited to:

- affected landholders (such as underlying and adjoining land holders, and holders of land necessary for access to the land to which the proposed PRC Plan relates);
- Traditional owners;
- Local government; and
- local community groups'.

The Queensland Government's *Information sheet ESR/2019/5101 Version 1 : Community consultation for Progressive Rehabilitation and Closure Plan (November 2021)* states that community members to be included in consultation must have a genuine, demonstrable and legitimate interest in:

- the land where the activity will occur;
- the land adjacent to where the activity will occur; or
- the land/amenities surrounding where the activity will occur that are likely to be impacted by the activity.

Genuine interest may include direct impact interest, (e.g. underlying and adjacent land holders), land use interest (e.g. overlapping tenure holders, or local government), cultural interest (e.g. Traditional owners), or heritage, environmental, recreational or health interests (e.g. state or local government or relevant community groups).

A PRC Plan must include:

- details of the consultation undertaken by the applicant in developing the proposed PRC Plan including any relating to the existing EA;
- details of how the applicant will undertake ongoing consultation in relation to the rehabilitation to be carried out under the plan;
- how stakeholders have been consulted in the Plan's development; and
- the outcomes of that consultation i.e. how stakeholder inputs have informed the outcomes stated in the PRC Plan.

However, it is noted that RMI's PRC Plan - and therefore this CCP - have been prepared under the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (MERFP Act) *transitional arrangements*. RMI operates under EA EPML00819113 which includes approved rehabilitation requirements for post-mining land uses (PMLUs). Under Section 126C(1)(d) of the EP Act, a PRC Plan is required to state how the PMLU is consistent with the outcomes of consultation with the community (DES, 2019). Where there are land outcomes identified in a land outcome document (LOD) (such as an EA), the applicant must include the details of any previous community consultation undertaken (see Section 3.1). The public notification requirements, under Chapter 5, Part 4 of the EP Act, do not apply to pre-approved PMLUs.

2.2. Community Consultation Plan

In order to comply with section 126C(1)(c)(iv) of the EP Act, the PRC Plan must include a CCP detailing how ongoing consultation will be undertaken in relation to the rehabilitation to be carried out under the PRC Plan. The CCP must include details of:

- the objectives for community consultation;
- engagement type;
- proposed consultation frequency;
- what information will be released for community consultation; and
- how feedback/comments will be considered.

The DES *PRCP Guideline* notes that ongoing community consultation is expected to continue throughout the stages of the mine life so that progressive rehabilitation and the socio-economic and environmental impacts related to mine closure can be discussed with the community. Consultation is required prior to any PRC Plan schedule amendments that are likely to impact the community, and the consultation register needs to be updated when this consultation is undertaken.

3. Consultation on RMI PRC Plan

3.1. Approach followed

RMI comprises the infrastructure supporting Poitrel Mine (BMC), Daunia Mine (BMA) and Millennium Coal Mine (MetRes). It is located on land owned by BMC within Mining Lease (ML) 70312, within the Isaac Regional Council (IRC) local government area (LGA). Barada Barna people are the Traditional owners of the land on which RMI is located. Surrounding land uses including agricultural use (grazing), utilities, coal mining and gas exploration. The nearest regional centre is Moranbah, which is located approximately 20 km to the west.

BHP engaged with DES regarding PMLUs as part of RMI's EA application process in 2019. ML70312 on which RMI operates is owned by BMC as freehold land, and rehabilitation requirements reflect the EA commitments.

BHP engages with neighbouring landholders regularly on land management and lease/licence issues, and on operational matters (such as air quality monitoring) as required.

BHP has had three meetings with the IRC where PRC planning was a focus (December 2020, April 2021 and September 2021). The meetings have focussed on PRCP requirements, the schedule for BHP assets' PRC Plans including RMI, approved PMLUs as documented and approved in site EAs, and the Council's preferred consultation mechanisms going forward. These meetings have resulted in agreement that BHP and IRC will work towards a shared understanding of future challenges, opportunities and community aspirations that are relevant to mine rehabilitation and closure.

During September 2021, BHP also met with Barada Barna Aboriginal Corporation (BBAC) who represent the traditional owners of land within ML 70312. BBAC's feedback included a request to work together with BHP to understand how they can get involved in rehabilitation execution activities.

Consultation undertaken as part of PRC Plan preparation for RMI also included:

- a phone call to the IRC CEO, a letter to IRC regarding the RMI PRC Plan, and an invitation for further discussion with Council about their involvement in PRC Plan consultations
- letters to two landowners whose properties are adjacent to RMI, one landowner whose property is not adjacent but accommodates the access road to RMI and two landholders who are affected by or adjacent to Daunia or Poitrel Mines;
- a letter to utility owners/operators and the owners of overlapping tenures (gas exploration) within and adjacent to ML 70312, including Aurizon, Queensland Rail, Powerlink and Arrow Energy;
- a letter to the owners of adjacent mining operations which include MetRes (Millennium), Poitrel Mine (BMC), Daunia Mine (BMA), Whitehaven Coal, Stanmore Resources and Pembroke Resources; and
- a letter to the Department of Natural Resources Mines and Energy (DNRME) Deputy Director-General Georesources and Manager Native Title Services and Coal Hub.

The following information was provided to affected stakeholders:

- the nature of RMI operations, its approved activities and location;
- PRC plan requirements and timing for PRC Plan development;
- the Life of Asset and timeframe for closure (as known) for RMI, Poitrel Mine and Daunia Mine;
- a high-level rehabilitation schedule;
- approved PMLUs;
- the divestment review process for BMC assets;
- a commitment to future consultation regarding PRC Planning for Poitrel Mine and Daunia Mine; and
- contact details for the relevant BHP team (e.g. for landholders, the Land Access and Management team) for further information, discussion or feedback.

Affected stakeholders have acknowledged the information distributed as well as BHP's commitment to ongoing communication, with no further feedback received.

The following information was provided to interested stakeholders including BHP employees, families, community members and groups through the Community Connect newsletter which is a bi-monthly newsletter distributed to more than 20,000 letterboxes throughout the Bowen Basin.

- progressive rehabilitation as a key focus;
- PRC Plan requirements and purpose;
- timing for PRC Plan development; and
- commitment to ongoing consultation, and contact details for further information.

3.2. Community consultation register

A community consultation register has been provided as part of the PRC Plan in compliance with section 126C(1)(c)(iii) of the EP Act and includes:

- identification of community members and stakeholders;
- previous engagements with the community;
- consultation date(s);
- consultation type;
- information provided to the community;
- issues raised/discussed by the community;
- how issues have been considered;
- decisions/ outcomes of engagement; and
- commitments made by BHP.

The community consultation register will be a live instrument for recording future consultation on RMI's PRC Plan.

4. Future consultation approach PRC Plan implementation

4.1. Stakeholder analysis

BHP is committed to consultation on the PRC Plan and Schedule with affected and interested stakeholders. The stakeholder analysis for this plan considered RMI, Daunia Mine and Poitrel Mine, as the three assets share common stakeholders.

Affected stakeholders were determined in accordance with the International Council for Mining and Metals (ICMM) Community Development Toolkit (ICMM, 2012) guiding questions and include stakeholders who:

- reside within the project area;
- have cultural or historical ties to the area;
- may be socially or economically impacted by closure or rehabilitation;
- will benefit from closure; or
- will be responsible for implementing measures to mitigate negative impacts.

The following stakeholders were identified as having a genuine interest in the land where the activity occurs, the land adjacent to where the activity occurs, or the land/amenities surrounding where the activity occurs, and will be consulted during the PRC Plan implementation period:

- traditional owners;
- agricultural landholders whose properties underlie or are adjacent to the three assets;
- the owners of adjacent mining operations;
- the owners of overlapping tenures;
- the owners of utility assets within RMI;
- IRC, as the local government; and
- RMI's operating contractor and workforce.

Table 1 identifies affected stakeholders and associated relevant issues with respect to PRC Planning.

Table 1: Identified affected stakeholders for the RMI PRC Plan

Stakeholders	Details	Issues
Traditional owners	Barada Barna people were engaged in the management of Aboriginal cultural heritage through a Cultural Heritage Management Plan for RMI, originally developed by the Millennium Coal Mine to achieve its duty of care obligation under the Aboriginal Cultural Heritage Act 2003. Barada Barna people's native title to areas of land within the Isaac, Central Highlands and Mackay LGAs was determined by the Native Title Tribunal in June 2016. Barada Barna People are represented by BBAC. BHP is in regular communication with BBAC.	• Cultural heritage impacts • Impacts on Native Title e.g. within stock routes or associated with the Isaac River • Post-mining land use and landform / landscape • Future access to and ownership of land • Environmental management /stewardship • Employment and business opportunities in exploration, environmental management and monitoring, rehabilitation
Adjacent and affected property owners - RMI	There are two landowners whose properties are adjacent to RMI, and one landholder whose property is not adjacent to- but accommodates the access road to RMI, Daunia Mine and Poitrel Mine. Mavis Downs is located to the east of RMI (and Daunia Mine) and Poitrel (the property) is located to the west. The access road to RMI is on a property called Wotonga. BHP has constructive working relationships with all underlying and adjacent landowners.	• Water access – underground and surface water allocations • Environmental management /stewardship • Post-mining land use and landform/land scape • Rehabilitation schedule • Future access to and ownership of land
Underlying and adjacent property owners – Daunia and Poitrel Mines	Poitrel Mine and Daunia Mine have compensation agreements with two landowners whose properties are affected by mining. The two properties are Winchester Downs and Olive Downs. Adjacent landholders to Poitrel Mine and Daunia Mine include the owner of Mavis Downs and the former owners of Daunia (the property).	

Stakeholders	Details	Issues
Utility owners	Aurizon operates the TLO and rail loop which are owned by Queensland Rail and are located on land leased from BHP. Powerlink owns the Daunia Mine overhead and underground power lines. IRC has a road reserve (an unused 'paper road') within the southern part of Daunia Mine. BHP engages with utility owners as required, i.e. issue-specific or transactional engagement.	- Impact on assets/asset value - Rehabilitation of impacts on assets - Service disruptions and mitigations - Crossing/interface agreements
Adjacent BHP mine managers	Poitrel Mine is adjacent to RMI to the south-west, and utilises infrastructure at RMI. Daunia Mine is adjacent to RMI to the south-east, and utilises the TLO and rail loop.	- Any impacts on the use of land within overlapping tenures - Water access - CHPP access - TLO and rail loop access - Stakeholder (including employee/contractor) perceptions about closure
Adjacent mining tenure - RMI	MetRes is the new owner of Millennium Coal Mine, which had been in care and maintenance but recently re-commenced operations (in September 2021). At this time, Millennium Coal Mine also re-commenced utilisation of RMI's processing and train load out facilities.	- Access to RMI processing capacity - TLO access - Tailings disposal
Adjacent mining tenures - Poitrel and Daunia Mines	Whitehaven Coal and Stanmore Resources hold tenements to the south and east of Daunia Mine and Poitrel Mine. Pembroke Resources has rights to a rail corridor alongside the existing Norwich Park Branch Line.	- Future land use and ownership - Access to rail corridor land
Overlapping tenure holders	Arrow Energy holds an Authority to Prospect which overlaps RMI and Daunia Mine's MLs.	Future land use and tenure
Local Government	BHP has a long established and cooperative relationship with IRC. BHP and IRC meet at least six monthly. BHP has had three recent briefings with Council regarding PRC Plan requirements (December 2020, April 2021 and November 2021). As noted above, IRC has a road reserve (an unused 'paper road') within the southern part of Daunia Mine, and has interests in stock routes such as along the Isaac River.	- Local employment - Stock route (Isaac River) - Effects on Council services and infrastructure - Environmental management /stewardship - Rehabilitation progress - Post-mining landforms - Management of closure impacts on employment and businesses - Alignment of rehabilitation plans with local and regional planning goals - Economic transformation (towards post-mining) and community sustainability

Stakeholders	Details	Issues
RMI operators/workforce	Sedgman Pty. Ltd. has operated RMI since 2007, using a contract workforce.	• Timing of closure • Rehabilitation obligations • Employment continuity • Loss of employment/contracting opportunities at closure

Interested stakeholders include:

- other agricultural landholders whose properties are within a 5-6 km radius of RMI (this includes one landholder whose property accommodates the access road to RMI);
- BHP employees and contractors, particularly those at RMI, Daunia Mine and Poitrel Mine;
- businesses supplying RMI (who in future may be affected stakeholders, however no closure impacts are expected for at least ten years);
- community members and groups; and
- State agencies and elected representatives.

Table 2 identifies interested stakeholders and associated relevant issues.

Table 2: Identified interested stakeholders for the RMI PRC Plan

Stakeholders	Details	Issues
BHP employees and contractors • Poitrel Mine personnel • Daunia Mine personnel	BHP communicates regularly with its personnel through various means. Information on PRC Planning and its relevance to RMI has been provided on-site by managers.	• Job opportunities • Loss of jobs with closure • Closure planning in context with other mining industry changes (e.g. autonomous haulage) • Workers' conditions • Sustainability of communities that are dependent on mining
Businesses	C-Res and BHP's procurement team have relationships with an extensive network of small business suppliers, including Indigenous businesses. As there is no likelihood of RMI's PRC Planning having a significant effect on businesses during the next ten years, business are considered interested rather than affected stakeholders at this point. There is potential to engage Traditional owners and other Indigenous businesses in e.g. rehabilitation services as part of a broader portfolio-wide or business-wide program.	• Opportunities to participate in supply chain (e.g. exploration, environmental management, rehabilitation) • Economic transformation (towards a post-mining landscape) • Economic and community sustainability • Loss of supply opportunities with closure
Community members and groups	The Moranbah community is the closest to RMI, Poitrel Mine and Daunia Mine - at approximately 20 kms to the west. Community members and groups in Moranbah and throughout the Bowen Basin have been provided with information about PRC Planning through Community Connect, a	• Local employment and business opportunities • With closure, loss of jobs and supply opportunities • Community and regional sustainability • Environmental management • Future use of mined land

Stakeholders	Details	Issues
	regular newsletter with extensive coverage throughout the Isaac LGA.	
State government - DNRME - DES - Office of the Minister for Environment, Great Barrier Reef, Science and the Arts - Member for Burdekin	Corporate Affairs conducts as-needed engagement with Ministers and Members of Parliament, and will provide briefings on PRC planning as part of regular engagements. DNRME's Deputy Director-General Georesources and Director Native Title Services and Coal Hub have been kept informed on PRC Planning.	- Legislative compliance - Resource development - Employment opportunities - Public interest - Environmental management - Economic transformation (towards post-mining) - Financial assurance - Environmental risk management - Future land use and landform

4.2. Objectives and outcomes

Consultation as part of implementing the RMI PRC Plan will be informed by the objectives and outcomes shown in Table 3. BHP will monitor progress against these objectives as part of annual PRC Plan monitoring and reporting processes.

Table 3: PRC Plan consultation objectives and outcomes

Consultation Objectives	Consultation Outcomes
Engage key stakeholders in identifying community objectives and aspirations for post-mining land use and landform, and social value opportunities	Strong relationships with key stakeholders with landholders, BBAC, IRC and local communities identifies strategic planning objectives, aspirations for land use and landform planning post-mining, and opportunities for social value to be considered in PRC Planning
Demonstrate transparency regarding BHP's PRC intentions and timeframes to BHP personnel and local communities	BHP personnel and a wide range of stakeholders within Isaac LGA communities have access to information about PRC Planning and implementation for RMI, and have opportunities to provide feedback on rehabilitation and closure outcomes
Cooperate with IRC, utility owners and adjacent mining and energy tenement owners as part of PRC Planning	IRC, utility owners and adjacent mining and energy tenement owners have information about RMI's closure planning to enable them to manage their assets and interests

4.3. Existing consultation mechanisms

Communities and stakeholders within the Isaac LGA will experience multiple demands for their participation in PRC Planning over the next few years. To minimise additional demands on communities and stakeholders, BHP will utilise its existing community consultation mechanisms for PRC consultation wherever possible, as described in Table 4.

Table 4: Using existing BHP consultation mechanisms

Mechanism	Mechanism and frequency
Landholder meetings	BHP's Land Management team engage regularly with landholders within and near MLs. Consultation with landowners within and adjacent to RMI will be conducted throughout the life of the PRC Plan through regular meetings on site or in Moranbah.

IRC meetings	Twice yearly meetings are held with IRC. The meetings have a fluid agenda based on key topics/issues at the time. As a minimum, updates on PRC Planning will be offered as an agenda item for bi-annual briefings, by agreement with Council.
Traditional Owner meetings	Bi-monthly meetings are generally held with Barada Barna People. The Indigenous Affairs and Cultural Heritage team will be provided with information to support consultation with Traditional owners which may include site-specific or broader PRC Planning issues.
Community Connect newsletter	This monthly newsletter is distributed to more than 20,000 letterboxes throughout the Bowen Basin and will include updates on PRC Planning.
Coal Connect	This weekly electronic employee newsletter will provide updates on PRC Planning as relevant.
Moranbah Smart Transformation Advisory Council	The Moranbah STAC and Dysart STACs generally meet monthly. There is an opportunity to seek feedback on closure planning issues from STAC members.

5. Consultation program

Table 5 outlines the program for consultation as part of RMI's future PRC Plan implementation, including consultation objectives; community members addressed by each objective; engagement type; and proposed frequency of consultation.

Section 6 describes the information to be released to the community, and Section 7 describes how feedback or comments will be considered.

Table 5: Consultation program for PRC Plan implementation

Consultation objective:	Engage key stakeholders in identifying community objectives and aspirations for post-mining land use and landform, and social value opportunities	
Community members	Engagement type	Proposed Consultation Frequency
Landowners and lessees within and adjacent to RMI, Poitrel Mine and Daunia Mine MLs	Advise landowners, lessees, BBAC and IRC in writing when the PRC Plan is approved and provide a copy of the PRC Plan to them.	Once-off
Traditional owners – Barada Barna People (BBAC)	Meet with directly affected and adjacent landholders, BBAC and IRC to provide an update on the PRC plan and progress with rehabilitation, and invite their inputs and feedback on: - the approved PMLUs and post-mining landforms, including any particular values or opportunities in specific disturbed areas - rehabilitation methods which would optimise future grazing opportunities, land management or water storage - shared value initiatives, e.g. infrastructure retention, capacity building, environmental management, or research partnerships - rehabilitation methods, schedule and progress towards milestones.	As requested, or as agreed with individual representatives/agencies
IRC	As part of biannual meetings with IRC, and addressing BHP's portfolio rather than individual assets: - provide an update on the status of the PRC Plans and rehabilitation, and forecast upcoming PRC Plan consultation for BHP assets - seek to understand Council's strategic analysis and planning for Isaac LGA and the RMI project area - share information to support understanding of challenges, opportunities and community aspirations of relevance to mine closure and rehabilitation - co-operate if advocacy is required to achieve better PRC Planning outcomes in the Isaac LGA.	Bi-annually, or as agreed with IRC
Community members	Meet with the landholder accommodating the road access to RMI, Daunia and Poitrel Mines to consult on the rehabilitation of the road and surrounding areas, and reflect their feedback in ongoing planning requirements.	Two years prior to closure, subsequent consultation to be agreed
	Participate in Council, community or industry-led initiatives which aim to harness social value from mine closure and rehabilitation planning, and/or work towards from economic transformation/transition.	As invited
	In cooperation with BBAC and other First Nations within Isaac LGA, and on a portfolio-wide basis: - communicate the pipeline of opportunities relating to rehabilitation work and land management - develop a shared understanding of business capabilities relevant to closure and rehabilitation works - plan and implement an Indigenous business capability development program to match rehabilitation opportunities, if this is required.	Once-off process
	Via Smart Transformations Advisory Committees, and/or PRC Plan-specific workshops or focus groups, seek the involvement of community members and groups in articulating community aspirations for rehabilitation, PMLUs and economic transformation.	Once-off, portfolio-wide process

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Consultation objective:	Demonstrate transparency regarding BHP's PRC intentions and timeframes to BHP personnel and local communities	
Community members	Engagement type	Proposed Consultation Frequency
BHP employees and contractors	Keep the RMI workforce updated (via Coal Connect, a weekly email newsletter to personnel) if there are changes to the PRC plan	Ongoing engagement process
Moranbah community members and groups	Using Community Connect (BHP's monthly community newsletter) and community forums such as interagency meetings, partnership meetings and community and business networks, provide community updates on PRC Planning (RMI-specific as relevant and portfolio wide)	Ongoing engagement process
Local businesses and BHP suppliers	Provide information about the pending closure of RMI and potential future supply opportunities as part of closure and rehabilitation to local businesses and BHP suppliers via C-RES	Two years prior to closure, subsequent consultation to be agreed
Elected representatives and Government agencies	Provide updates via letters and/or meetings on PRC Planning to: - Office of the Minister for Resources (Queensland) - Office of the Minister for Environment, Great Barrier Reef, Science and Youth Affairs (Queensland) - Shadow Minister for Resources - Shadow Minister for Environment, Great Barrier Reef, Science and Youth Affairs Resources - Member for Burdekin (Queensland Parliament) - DES PRCP Team - Director, Native Title Services and Coal Hub, Department of Resources - Deputy Director-General Georesources, Department of Resources - Assistant Secretary Assessments and Governance Branch, DAWE	As requested, or as agreed with individual representatives /agencies

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Consultation objective	Cooperate with IRC, utility owners and adjacent mining and energy tenement owners as part of PRC Planning	
Community members	Engagement type	Proposed Consultation Frequency
Poitrel Mine and Daunia Mine	Involve internal BHP stakeholders in PRC planning processes to build capacity for community consultation on PRC Planning issues and support effective delivery of PRC Plans.	Ongoing
Arrow Energy	Write to advise Arrow Energy of any substantive changes to RMI's closure or rehabilitation schedule, and consult with Arrow Energy Holdings regarding their interests in areas of overlapping tenure within RMI.	As requested, or as agreed with company representatives.
Queensland Rail and Aurizon	Maintain correspondence with Queensland Rail and Aurizon regarding progressive rehabilitation activities as they affect the Norwich Park Branch Railway, and undertake consultation regarding the decommissioning of the train load out facility/rail interface.	As requested, or as agreed with individual representatives /agencies
MetRes	Maintain correspondence with MetRes regarding RMI's closure and rehabilitation schedule, including advice regarding closure scheduling in accordance with contractual agreements between BHP and MetRes.	As required, and then two years prior to closure
Other adjacent/nearby mining operations	Advise Whitehaven Coal, Stanmore Resources and Pembroke Resources in writing if there are any substantive changes to the closure and rehabilitation schedule in future iterations of the PRC Plan. At a business level, BHP will participate in industry and research partnerships of relevance to PRC planning and rehabilitation.	As requested, or as agreed with individual representatives /mining operations
DoR	Provide updates on PRC planning to the Director Native Title Services and Coal Hub, Rockhampton and the Deputy Director General, Department of Resources, in writing or through regular meetings.	As requested, or as agreed with DoR representatives

6. Information to be released for community consultation

Whilst many stakeholders in the Isaac LGA and broader Mackay-Isaac-Whitsunday Region are well-educated about mining operations, there is less understanding of planning for life-of-mine, rehabilitation and closure planning. The CCP recognises the following social context:

- talk of closure planning will lead to community concerns, requiring careful and consistent messaging;
- PRC Plan consultations by a range of companies for a variety of assets will represent considerable cumulative demands on stakeholders, and a coordinated, strategic approach will be required to manage consultation fatigue; and
- community members are becoming increasingly aware of climate change and the impacts of resource activities and energy policies on the environment. Accordingly, community and stakeholder expectations with regards to mine rehabilitation need to be understood.

Information to be released for community consultation will include:

- the rationale and scope for PRC Planning;
- the approved activities and PMLUs for RMI;
- on-site activities and areas of disturbance;
- proposed rehabilitation methods, schedule and milestones; and
- opportunities for community consultation as part of the PRC Plan's implementation.

Where required, communication tools could include:

- a holding statement for general enquiries;
- frequently asked questions and answers (FAQs) and a PRC Planning fact sheet available to support consultation activities;
- face to face and virtual meetings; and
- updates and fact sheets about PRC Planning for BHP assets through Community Connect.

7. How feedback/comments will be considered

As noted in the DES *PRCP Guideline*, in addition to the annual return requirements that relate to EAs, if a PRC Plan and Schedule applies to the activities, the annual return must also include an evaluation of the effectiveness of the PRC Plan and Schedule, including the environmental management carried out under the schedule, for the year to which the annual return relates.

BHP will monitor and report on the progress and outcomes of progressive rehabilitation activities against rehabilitation milestones provided in the PRCP Schedule. This monitoring will aim to demonstrate a successful rehabilitation trajectory towards achievement of the approved PMLU, and/or to inform corrective action where required, which will be reported as part of annual returns.

Information about rehabilitation progress will also be delivered as part of the consultation methods detailed in Table 5, and any feedback will be considered in any PRC Plan updates.

The PRC Plan Consultation Register will also be updated as community consultation activities outlined in Table 5 are completed. All stakeholder feedback recorded in the Consultation Register will be considered in framing and detailing future PRC Plan amendments for RMI. This may include feedback on, for example:

- vegetation species most suitable to the approved PMLUs;
- rehabilitation methods to protect cultural heritage and achieve optimal use for the PMLUs;
- the rehabilitation schedule;
- water management (e.g. availability for beneficial use as part of the PMLUs, or adjacent uses); and/or
- development of business capacity programs to equip local and Indigenous businesses for rehabilitation works.

BHP has sought IRC's views on consultation options to involve Council in future PRC Plan consultation for BHP assets. BHP will utilise Council's preferred options to seek inputs on, for example, community aspirations for PMLU and social value opportunities.

8. PRC Plan CCP review

Review of the PRC Plan will be undertaken as legislatively required. Review and update of the CCP, incorporating community feedback to date, will be aligned to any PRC Plan updates.

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Red Mountain Infrastructure

Progressive Rehabilitation and Closure Plan

Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste

12 September 2021

Final Rev 0.

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Executive Summary

This report serves to document and discuss the environmental geochemical characteristics of mineral waste materials for the Red Mountain Infrastructure (RMI) area (the project), as supporting information for the progressive rehabilitation and closure plan (PRCP) for the project.

The objective of the assessment is to evaluate the geochemical nature of mineral waste produced at RMI and identify relevant environmental challenges/opportunities that may be associated with producing, handling, storing and/or disposing these materials to inform appropriate rehabilitation and management strategies.

RMI is immediately surrounded on all sides by mining operations: Millennium Coal Mine (Millennium Coal Pty Ltd) to the west, north and east; Daunia Coal Mine (BHP Mitsubishi Alliance Pty Ltd [BMA]) to the south and southeast and Poitrel Coal Mine (PTM) (BHP Mitsui Coal Pty Ltd [BMC]) to the southwest.

RMI is an infrastructure area only – providing coal handling and processing activities for PTM and Millennium Mine, and rail loadout facilities for Daunia Mine. The key facilities at RMI comprise a coal handling and preparation plant (CHPP), ROM pad, product coal stockpile, process water dam (PWD), environment dam (ED), tailings drying cells, haul roads and Rail Loop with loadout facility. All of these facilities are associated with mineral waste and are discussed in this report.

Current activities of relevance to this waste characterisation report comprise:

1. Short-term storage of ROM coal on the ROM pad (ROM coal awaiting processing at the CHPP);
2. ROM coal processing at the CHPP. The CHPP produces two mineral waste types:
 - a. Coarse reject. Sent off site for disposal. A small proportion of coarse rejects have been used at RMI for bunds at the ROM pad, product coal stockpile and haul roads.
 - b. Tailings (see below);
3. Short-term storage of tailings within in-ground tailings drying cells (to 'dewater' the tailings), prior to being excavated after approximately 3-4 days and sent off site to PTM for disposal;
4. Short-term storage of Product Coal on the product coal stockpile, awaiting off-site transport by rail;
5. Water management and sediment control utilising two dams:
 - a. Process water dam (PWD): collecting surface water run-off and sediment from the western side of the site and providing water for use in the CHPP and dust control on site. The PWD is also an authorised water release point, subject to water release conditions as stipulated in the EA; and,
 - b. Environment dam (ED): collecting surface water run-off and sediment from the eastern side of the site, and transferring water to the PWD. The ED is also an authorised water release point, subject to water release conditions as stipulated in the EA.

At the cessation of operations coaly and carbonaceous mineral waste (e.g. remnant coal on the ROM pad, remnant tailing in the dewatering cells, sediment in the dams) will be excavated, removed off-site and disposed into mine spoil at PTM. For the purposes (and in the context of) rehabilitation and closure of mineral waste facilities, the only mineral waste remaining on site in significant quantities will be the ROM pad base and haul roads, portion of which will be used to fill/cap/cover other site facilities as necessary (subject to a contaminated land assessment being undertaken prior to earthworks).

Historical documentation suggests that clean, unweathered, Permian-age waste from PTM was used to construct the ROM pad extension (RMJV, 2014), while no information is available to confirm the source for the construction material for the original ROM pad base or haul roads. For the purpose of this assessment, it is assumed that waste for the construction of the original ROM pad and haul roads was sourced from the neighbouring mines (PTM and/or Millennium Mine).

No samples have been collected from within the ROM pad, however the BHP Coal Geochemical Database contains detailed geochemical data for overburden/interburden material from PTM (and other Rangal Coal Measures sites), which is considered representative of ROM pad and haul road bulk material. Note that the Millennium mine is adjacent to PTM, with mining occurring within the same formations as those mined at PTM. It is

very unlikely that geochemical properties of materials mined from the two sites would be different in any significant way.

In this context the geochemical characteristics and potential hazards associated with mineral waste materials on site are discussed by type:

- General spoil – assumed to comprise a mix of weathered and fresh sandstone, siltstone, mudstone and sedimentary materials within the ROM pad base, haul roads, and also provides the base material for the site. However, to introduce a level of conservatism in the risk assessment we have assumed that a small proportion (5%) of this waste may be comprising carbonaceous spoil.
- Coaly and carbonaceous material – comprises coal, tailings, coarse rejects and dam sediment. These are the surface materials currently on the ROM pad, product coal stockpile, tailings drying cells, etc. This material is not expected to be remaining on-site following remediation in any material quantity.

Geochemical Characteristics of Spoil

Environmental geochemical data for overburden and interburden (spoil) from PTM (215 samples) has been used as proxies to infer the geochemical and physical properties of the ROM pad base and haul roads at RMI. Key results are summarised in the sections below.

Potential for acid and metalliferous drainage (AMD)

Spoil, representing the ROM pad base and haul roads, is expected to generate pH-neutral to alkaline contact water (run-off and seepage). Available geochemical data shows the following:

- The total sulphur (S) concentration of this material is very low, with a maximum total S concentration of 0.18% (90th percentile = 0.03%). As such, and combined with generally moderate to high acid neutralising capacity (ANC) values (median 29 kilograms of sulphuric acid per tonne of rock [kg H₂SO₄/t]), all samples but two were classed as non-acid forming (NAF). Two samples (out of 215 samples) had an uncertain (UC) classification and have been conservatively sub-classified as '*uncertain – potentially acid forming*' [UC(PAF)].
- Total metal and metalloid concentrations are generally very low compared to average element abundance in soil in the earth's crust.
- Soluble multi-element results indicate that leachate from spoil material is expected to contain low concentrations of soluble metals and metalloids.

Based on the results, non-carbonaceous overburden has a negligible potential to generate acid/acidic drainage (AD) and/or neutral metalliferous drainage (NMD). Due to the very low total S (and negligible sulphide) concentrations, the potential for Saline Drainage (SD) (sulphate-derived salinity from sulphide oxidation) is also negligible.

Potential for saline drainage (SD) from salt dissolution

Spoil has electrical conductivity (EC_{1:5}) values ranging from 85 to 493 microSiemens per centimetre (µS/cm), with median and 90th percentile values of 271 and 377 µS/cm, respectively. On this basis, spoil in the ROM pad base and haul roads is expected to generate low-salinity contact water (run-off and seepage) [oxidative and non-oxidative salinity].

Sodicity potential

Spoil samples had relatively low cation exchange capacity (CEC) values and high exchangeable sodium percentage (ESP) values, resulting in all samples being classified as 'strongly sodic' with potential for dispersion. Emerson Aggregate Class testing found all samples to be dispersive (Class 3) or likely to suffer from 'some dispersion' (Class 2). As such spoil materials are inferred to be sodic with potential for dispersion.

Geochemical Characteristics of Coaly and Carbonaceous Mineral Waste

Environmental geochemical data for 102 coaly and carbonaceous samples from RMI, representing tailings and coarse rejects, coal collected from the CHPP, drill-hole core from PTM representing general spoil, and in-situ

surface samples, were collected and tested to support this project. Key results are summarised in the sections below.

Potential for acid and metalliferous drainage (AMD)

Coaly and carbonaceous material, represented by surface materials currently on the ROM pad, product coal stockpile Pad, dam sediments, coarse rejects from the CHPP and tailings from the tailings drying cells and CHPP, are expected to generate pH-neutral to alkaline contact water (run-off and seepage).

These materials have a wide total S distribution – particularly the tailings samples, which have a 90th percentile total S of 1.25% (75th percentile = 1.01 %). The other coaly and carbonaceous types (e.g. coal, rejects, surface and sediment materials at RMI) have lower total S values (generally), with a combined 75th percentile total S value of 0.36 %. The sulphide concentration of coaly and carbonaceous materials was relatively low – typically about 35-40 % of the total S concentration.

Based on the results, about 80 % of samples were classified as NAF, and 11% classified as NAF-S (i.e. NAF with total S >1%). The remaining 9 % of samples were classified as potentially acid forming – low capacity (PAF-LC) – indicating that the large majority of coaly and carbonaceous materials (as bulk materials) have low potential to generate acid/acidity.

Total metal and metalloid concentrations are very low compared to average element abundance in soil in the earth's crust. A small number of samples were enriched with respect to one or more of Mo, S and/or Te. The level of 'enrichment' displayed from a relatively small number of samples is not cause for concern.

Soluble multi-element results indicate that leachate from coaly and carbonaceous material is expected to contain low concentrations of soluble metals and metalloids – similar to spoil materials.

While total S concentrations are higher (generally) than spoil materials, the total S concentration of coaly and carbonaceous materials is still relatively low (median = 0.28%; 75th percentile = 0.51%, which is consistent with the 75th percentile total S concentration for coal from the PTM coal quality database). Due to the low total S concentrations, the potential for Saline Drainage (sulphate-derived salinity from sulphide oxidation) is also low.

Coaly and carbonaceous material (as a bulk material) is considered to have a low potential to generate AMD.

Potential for saline drainage (SD) from salt dissolution

Excluding surface and sediment materials sampled in April 2021 (Gp4 materials), all other coaly and carbonaceous materials have relatively low EC_{1:5} values, with median and 90th percentile values of 224 and 468 µS/cm, respectively. The Gp4 surface samples had a very wide range of EC_{1:5} values, ranging from 434 to 2080 µS/cm, with no clear distinction between the various surface sample types. The higher salinity/EC values observed in some surface (and dam sediment) coaly and carbonaceous samples were consistent with the brackish salinity / EC observed in dam water from the ED and PWD, and thus may be associated with accumulation of salts from evaporation of water used for dust suppression.

On this basis, most coaly and carbonaceous material has the potential to generate relatively low-salinity contact water (run-off and seepage), however some surface material may be more saline due to ongoing surface evaporation processes.

Sodic potential

Coaly and carbonaceous materials were not assessed for sodicity and dispersion potential as these materials will be removed from site and disposed at PTM. Remnant coaly and carbonaceous materials do not report to final landform surfaces (or near-surfaces) and are not directly used as revegetation and rehabilitation materials.

Geochemical Source-Pathway-Receptor (SPR) Assessment

A source hazard geochemical assessment was applied to the two source material groups/types. The source hazard score is a formula devised by the authors that takes into account the propensity (ability) to generate AMD, the AMD capacity (severity) and the quantity (volume/tonnage) of AMD that could be produced. For general spoil the AMD source hazard score was 'Highly Unlikely'. For coaly and/or carbonaceous material the AMD source hazard score

was 'Unlikely'. When combined, the AMD hazard score for the final landform (i.e. rehabilitated site) at closure is **Highly Unlikely** and the likelihood for AMD generation from the final landform is also **Highly Unlikely**.

The majority of the existing coaly and carbonaceous source material will be removed during decommissioning and rehabilitation, therefore will not be a 'source' at closure. Despite the 'Unlikely' AMD source hazard posed by this material, there may be potential for 'land contamination' beneath existing coaly and/or carbonaceous storage facilities. To manage this potential hazard, a contaminated land detailed site investigation will be undertaken at the end of the operational life RMI to guide the final excavation depth to mitigate and manage potential contamination.

A conceptual environmental geochemical model (source-pathway-receptor (SPR) model (CDM Smith, 2021a) for RMI (within the mining lease) identified potential environmental receptors and likely pathways to those receptors. The nearest surface water feature is New Chum Creek, located at the site boundary (the creek forms the northern and eastern boundary). The nearest groundwater receptor was the unconfined aquifer below the site. Outside of the mining lease, the nearest homestead is located over 7 km from RMI and, as such, its' consideration as a receptor is implausible.

The risk assessment considered the potential AMD and SD (non-oxidative) risks posed by the final landform (rehabilitated ROM pad, haul roads, CHPP area etc. and limited amounts of diffused remnant coaly / carbonaceous waste) to the above receptors, with respect to likelihood of impacting the receptor and severity of impact. The risk rating is **'Low'**.

Management Measures

The assessment has found that the environmental risks posed by mineral wastes currently on site at RMI and likely to be present at closure are low. As such, no specific AMD management measures (e.g. compaction, segregation, alkaline amendment or capping systems) are required to manage mineral waste materials during rehabilitation and closure – other than the mineral waste and water management measures as described in this section.

It is noted that coaly and carbonaceous mineral waste is planned to be excavated/removed off site to neighboring PTM for disposal during decommissioning – leaving the bulk ROM pad base and haul roads to be used for backfilling tailing cells and dams, and general site cover material if required. Final rehabilitation requirements will also be supported by a contaminated land detailed site investigation undertaken at the end of the RMI operational life.

Decommissioning and rehabilitation activities related to mineral waste

Proposed mineral waste management and rehabilitation activities of relevance to this waste characterisation report comprise the following actions (subject to an appropriate 'contaminated land' assessment being undertaken at each facility to determine if any excavation/capping/cover required):

- **CHPP:** Demolish and remove the CHPP. Dispose surface coaly and carbonaceous mineral waste material off-site within spoil at PTM. Cover with suitable soil material, rip then seed;
- **Tailings dewatering cells:** Excavate remnant tailings from the in-ground tailings dewatering cells and dispose coaly and carbonaceous mineral waste material off site within spoil at PTM. Backfill the former in-ground cells with suitable material, cover with soil, rip then seed;
- **ROM pad:** Remove/scrape surface coaly and carbonaceous mineral waste from the ROM pad and dispose off-site within spoil at PTM. ROM pad material will be used to provide cover and backfill material for the remainder of the site where required – after which the former ROM pad (final landform) will be reshaped, ripped and seeded.
- **Coal Stockpile:** Remove/scrape surface coaly and carbonaceous mineral waste material from the Coal Stockpile pad and dispose off-site within spoil at PTM. Cover with suitable soil material, rip and seed.
- **PWD:** Dewater, then excavate sediment and dispose the sediment off-site within spoil at PTM. Backfill the former PWD with suitable material, cover with soil, rip then seed;
- **ED:** Dewater, then excavate sediment and dispose the sediment off-site within spoil at PTM. Backfill the former ED with suitable material. Cover with soil, rip then seed;

- Haul Roads and other non-specific mineral waste areas: Remove/scrape coaly and carbonaceous surface mineral waste and dispose off-site within spoil at PTM. Reshape, cover with soil, rip then seed.

Water management

The final landform at RMI will free-drain into drainage channels - predominantly New Chum Creek. The post-closure landform comprises three main surface water catchments:

- North of the rail loop and former ROM pad: sloping towards the east towards New Chum Creek. Approximately 135 ha.
- Within the rail loop and south of the rail loop: sloping south-east towards New Chum Creek. Approximately 115 ha.
- West and south of the former ROM pad: sloping towards the south from the former/rehabilitated ROM pad towards PTM mining areas. Approximately 45 ha.

Post-closure of RMI CHPP operations, the rail loop and load out facility will continue to be utilised by Daunia Mine until completion of operations at Daunia Mine, after which the rehabilitation of the rail loop and load-out facility is scheduled. Upon decommissioning of the rail loop, the fill material and the culvert will be removed from the 100m buffer zone along New Chum Creek and the disturbed areas rehabilitated to the post mining land uses (PMLUs) of woodland and water course, reinstating pre-operational flow regimes within this area of New Chum Creek.

Glossary of Terms

Key terms and definitions as used in this report are listed below:

AMD: acid and metalliferous drainage. AMD includes acid drainage (AD), pH-neutral and metalliferous drainage (NMD) and sulphide-derived saline drainage (SD) – and/or any combination of these.

CHPP: Coal handling and preparation plant.

Coarse reject: Also called rejects. Gravel and cobble-sized carbonaceous rock material produced during coal washing. Coarse reject is typically associated with the roof, floor and partings of a coal seams and is separated from ROM coal in the CHPP. Coarse reject produced at RMI is disposed within spoil dumps at neighbouring Poitrel Mine (PTM), either as a discrete waste or co-disposed with dewatered tailings.

Fine reject: Also called tailings. Very fine to fine grained clay and coaly/carbonaceous material produced during coal washing. Fine reject is associated with coal seams and is separated from ROM coal in the CHPP. Fine reject produced at RMI is dewatered at RMI (in tailings dewatering cells), then the dewatered tailings are disposed within spoil dumps at neighbouring Poitrel Mine (PTM), either as a discrete waste or co-disposed with coarse reject.

Interburden: non-carbonaceous or carbonaceous mine waste located between coal seams. In this report the term 'Overburden' shall be used to define overburden and interburden.

Mineral waste: material comprising mine spoil, ± coarse/fine reject (dewatered), ± waste coal. Sometimes called 'mine waste' or 'mining waste'.

Mixed plant reject (MPR): a mixture of coarse reject and 'dewatered' fine reject.

Overburden: non-carbonaceous or carbonaceous mineral waste located above (overburden proper) or between (interburden) coal seams. Carbonaceous overburden is generated during mining of non-ore material and may be represented by sedimentary units (non-coal) rich in organic carbon. Carbonaceous overburden does not include coarse reject, seam floor, seam roof or coal partings. Overburden reports to spoil dumps.

PRCP: Progressive rehabilitation and closure plan.

Product Coal: Coal produced from the CHPP after being washed/processed. Coal that is ready for sale.

RMI: Red Mountain Infrastructure. The name of the site subject to this PRCP.

ROM: Run-of-Mine. The term given to mined coal before being processed at the CHPP.

ROM pad: The location where ROM coal is temporarily stored pending processing at the CHPP.

Spoil: mineral waste comprising non-ore (non-ROM) material such as overburden/interburden and waste coal. Within this report, unless stated otherwise, spoil is considered a bulk material with no distinction made between carbonaceous and non-carbonaceous overburden.

Spoil dump: in-pit or out-of-pit landform containing mine waste.

Waste coal: sub-economical coal that reports directly to the spoil dumps as waste (i.e. not ROM coal). Waste coal can be fresh or oxidised. All oxidised and coked (cindered) coal is waste.

1 Introduction and Context

This report serves to document and discuss the environmental geochemical characteristics of mineral waste materials associated with Red Mountain Infrastructure (RMI) area (the project), as defined under the current Environmental Authority (EA) EPML00819113. In this report the term 'mineral waste' refers to all geologic material generated by or associated with RMI during the course of mining, handling and processing coal.

It is a requirement of a Progressive Rehabilitation and Closure Plan (PRCP) that mineral waste is adequately characterised such that appropriate rehabilitation strategies can be selected and implemented. The PRCP guidance document: "*Guideline – Progressive Rehabilitation and Closure Plans*" (DES, 2021) outlines the requirements and considerations for producing a PRCP, including documenting the relevant aspects of mineral waste characterisation for the purposes of PRCPs.

It needs to be stated that RMI is not a mine, and therefore does not generate mine spoil (waste rock) or have open pits that would require rehabilitation. However, RMI operates on a mining lease by providing coal handling and coal processing activities to neighbouring Poitrel Mine (PTM) and Millennium returning coal processing waste (dewatered tailings and coarse reject) back to PTM and Millennium for disposal amongst mine spoil.

As such, RMI is subject to PRCP legislation. However, it must be recognised that the circumstances surrounding mineral waste characterisation and assessment at RMI – for the purposes of PRCP – are somewhat different to what would be considered necessary for a mine that produces significant quantities of waste rock or spoil.

1.1 Approach

The general approach includes the following key steps:

- Briefly describe the current/existing background information for RMI of relevance to the generation and ultimate storage/disposal of mineral waste materials;
- Document the methodology used to characterise mineral waste materials (samples);
- Present and discuss the geochemical results;
- Describe the potential environmental geochemical hazards with respect to mineral waste materials;
- Present the AMD Source-Pathway-Receptor risk assessment undertaken on the mineral waste materials;
- Outline the management and rehabilitation measures proposed for mineral waste materials; and
- Outline a forward work plan to address any gaps identified from the assessment.

1.2 Objective

At the cessation of operations, all remnant mineral waste associated with coal handling and processing will be removed and disposed off-site – leaving only non-coaly material on site. As such, the objective of the assessment is to evaluate the geochemical nature of non-coaly materials currently located on site and identify relevant environmental issues/opportunities that may be associated with handling and storing these materials on site long term to inform appropriate rehabilitation and management strategies during and post-closure.

However, a high-level summary discussing the geochemical properties of coaly/carbonaceous waste has been included in this report for completeness and document current knowledge. For the same reason, samples from the process water and environment dam (sediment and water) have been collected and analysed, with results reported herein.

2 Background

2.1 Site Overview

RMI is located within the northern region of the Bowen Basin approximately 22 kilometers (km) east-southeast of Moranbah in Central Queensland. The site is immediately surrounded on all sides by mining operations: Millennium Coal Mine (Millennium Coal Pty Ltd) to the west, north and east; Daunia Mine (BHP Mitsubishi Alliance Pty Ltd [BMA]) to the south and southeast and PTM (BHP Mitsui Coal Pty Ltd [BMC]) to the southwest.

RMI is an infrastructure area only – providing coal handling and processing activities for PTM and rail loadout facilities for BMAs Daunia Mine. The key operating facilities at RMI are shown in **Figure 1**, and comprise a CHPP, ROM pad, product coal stockpile, process water dam (PWD), environment dam (ED) and Rail Loop with loadout facility, drying cells and haul roads. All of these facilities are associated with mineral waste and are discussed in this report.

Also shown on **Figure 1** are geochemical and water quality sampling locations, groundwater monitoring locations and New Chum Creek – which is the only surface water feature in the immediate area (apart from the two dams on site) and approximates the mining lease boundary on the northern side of the site.

Current activities of relevance to this waste characterisation report comprise:

1. Short-term storage of ROM coal on the ROM pad (ROM coal awaiting processing at the CHPP);
2. ROM coal processing at the CHPP. The CHPP produces two mineral waste types:
 - a. Coarse reject. Sent off site for disposal. A small proportion of coarse rejects have been used at RMI for bunds at the ROM pad, product coal stockpile and haul roads.
 - b. Tailings (see below);
3. Short-term storage of tailings within in-ground tailings drying cells (to 'dewater' the tailings), prior to being excavated after approximately 3-4 days and sent off site to PTM for disposal;
4. Short-term storage of Product Coal on the product coal stockpile, awaiting off-site transport by rail;
5. Water management and sediment control utilising two dams:
 - a. Process water dam (PWD): collecting surface water run-off and sediment from the western side of the site and providing water for use in the CHPP and dust control on site; and
 - b. Environment dam (ED): collecting surface water run-off and sediment from the eastern side of the site, and transferring water to the PWD. The ED is also an authorised water release point, subject to water release conditions as stipulated in the EA.

Proposed mineral waste management and rehabilitation activities of relevance to this waste characterisation report comprise the following actions (subject to an appropriate 'contaminated land' assessment being undertaken at each facility to determine if any excavation/capping/cover required):

- CHPP: Demolish and remove the CHPP. Dispose surface coaly and carbonaceous mineral waste material off-site within spoil at PTM. Cover with suitable soil material, rip then seed;
- Tailings dewatering cells: Excavate remnant tailings from the in-ground tailings dewatering cells and dispose coaly and carbonaceous mineral waste material off site within spoil at PTM. Backfill the former in-ground cells with suitable material, cover with soil, rip then seed;
- ROM pad: Remove/scrape surface coaly and carbonaceous mineral waste from the ROM pad and dispose off-site within spoil at PTM. ROM pad material will be used to provide cover and backfill material for the remainder of the site where required – after which the former ROM pad (final landform) will be reshaped, ripped and seeded.
- Coal Stockpile: Remove/scrape surface coaly and carbonaceous mineral waste material from the Coal Stockpile pad and dispose off-site within spoil at PTM. Cover with suitable soil material, rip and seed.

- PWD: Dewater, then excavate sediment and dispose the sediment off-site within spoil at PTM. Backfill the former PWD with suitable material, cover with soil, rip then seed;
- ED: Dewater, then excavate sediment and dispose the sediment off-site within spoil at PTM. Backfill the former ED with suitable material. Cover with soil, rip then seed;
- Haul Roads and other non-specific mineral waste areas: Remove/scrape coaly and carbonaceous surface mineral waste and dispose off-site within spoil at PTM. Reshape, cover with soil, rip then seed.

As outlined above, at cessation of operations remnant coaly/carbonaceous mineral waste located on site (e.g. remnant coal on the ROM pad) will be removed off-site and disposed into mine spoil at PTM, as required. Therefore, for the purposes (and in the context of) rehabilitation and closure of mineral waste facilities, it's assumed that coaly/carbonaceous waste will have been removed from the site. The ROM pad base will remain on site, and if feasible, some of this material may be used to fill/cap/cover other site facilities as necessary (subject to a contaminated land detailed site investigation being undertaken prior) with the remaining in-situ ROM pad base rehabilitated, as required.



Figure 1: RMI layout showing sampling locations

BMC RMI PRCP:Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste

2.2 Baseline Information

2.2.1 Topography

The regional topography of the Bowen Basin is dominated by flat to gently sloping landforms and low rolling hills. The pre-mining topography of the site was generally low relief, dominated by gently sloping landscape towards the south-east. The average slope across site was 1.5% with an average slope elevation of 230 mRL.

The site is influenced by the topography of the surrounding coal operations with Millennium Mine spoil dumps directly to the north and the west, and PTM spoil dumps to the south-west.

2.2.2 Climate

RMI is located in a semi-arid climatic zone, which is characterised by high summer temperatures, warm dry winters and a distinct wet and dry season. Weather data was collected at the Moranbah Water Treatment Plant (Station No. 034038) between 1972 and 2012 and since 2012 it has been collected at the Moranbah Airport (Station No. 034035). The Moranbah weather stations are located about 20km west of RMI.

Maximum temperatures range from 24°C in June/July to 35°C in December/January, with minimum temperatures ranging from 9°C in July to 22°C in January^{1,2}. Rainfall occurs in any month, though it is more prevalent in the summer months of December, January and February. The average annual rainfall (and averaged between the two weather stations) is approximately 570 mm per year. The evaporation rate is highest in the summer months - mean daily rate of 8.2mm in January, and lowest in the cooler months - mean daily rate of 3.6mm in June. The mean monthly rate of evaporation is 78mm. The annual average rate of evaporation is 2,373mm, which greatly exceeds the annual rainfall, a characteristic of semi-arid environments.

2.2.3 Geology

There is no mining on site. The site is located within the Bowen Basin in Central Queensland. The Bowen Basin is part of a connected group of Permian-Triassic basins in eastern Australia that includes the Sydney and Gunnedah Basins. The Bowen Basin contains large reserves of Permian coals.

The site is situated within the Fort Cooper Coal Measures (FCCM), which comprise typical basin-fill sedimentary units including mudstones, siltstones, sandstones and coal seams (sub-economic), with the upper 10-15m (approximately) being weathered. The FCCM underly (i.e. sit beneath) the Rangal Coal Measures, which are the coal measures being mined at neighbouring Daunia, PTM and Millennium mines.

2.2.4 Surface Water / Hydrology

RMI is located within the Isaac River catchment, which is part of the Fitzroy River Basin. The site is drained by New Chum Creek, which approximates the northern and north-eastern mining lease boundary between RMI and Millennium Mine (Figure 1). The headwaters of New Chum Creek are northwest of the site on the far side of Millennium Mine, from where it flows in a generally south-easterly direction through Millennium Mine, along the northern boundary of RMI, across the eastern end of RMI into Daunia Mine, south and along the eastern side of PTM and continuing southwards into the Isaac River, approximately nine (9) km straight line distance (~12 km creek line distance) from RMI. The New Chum Creek catchment area is 51 km² and RMI covers 6 % of this catchment (CDM Smith, 2021a).

New Chum Creek is ephemeral, and the seasonal variability in flows is evident with many months recording zero stream flow. Most flow is during the wet season (November to February).

Surface water run-off and sediment on site are captured by the process water dam (PWD) and the environment dam (ED). Approximately one quarter of the PWD catchment is located within RMI mining lease area, with the remainder being from Millennium Mine. The PWD supplies water to the CHPP and is also used for dust suppression on site.

The ED captures surface water run-off from the northern and eastern side of the site north of (outside of) the rail loop. The ED is an authorised water release point under the EA, subject to water quality conditions being met,

¹ Accessed from the Bureau of Meteorology (1972-2012)

² Accessed from www.willyweather.com.au (2012-2020)

however in most years no water is released, with water typically only released in very 'wet' years. For example, no water has been released from the ED since BMC took full ownership in 2018.

Water samples from the ED and PWD were collected in April 2021 to understand the current water quality of these facilities. The results, presented in Appendix A, show that the water quality is very similar between both dams and has the following general average characteristics: pH-alkaline (pH 8.3), brackish (EC 1335 $\mu\text{S}/\text{cm}$ / 788 mg/L total dissolved solids), sodium chloride (NaCl)-dominated water type with low soluble metals concentrations.

2.2.5 Groundwater / Hydrogeology

The following hydrogeological information is summarised from the hydrogeological conceptual model report prepared for the project (CDM Smith, 2021a).

There are few shallow and deep groundwater monitoring sites located within or very close to RMI that provide hydrogeological information. The locations of groundwater bores/wells in the vicinity of RMI are shown on Figure 1.

Conceptually, two hydro-stratigraphic units have been postulated to exist in the vicinity of the activity area: a shallow alluvial aquifer locally associated with New Chum Creek; and a Permian aquifer (coal seams and sediments) associated with the FCCM (CDM Smith, 2021a). The primary source of groundwater at RMI occurs within the FCCM aquifer. Regionally, groundwater generally flows from north-northeast to south-southwest, with some local deviation at RMI due to inferred groundwater mounding below the PWD.

Permian Strata (FCCM)

The FCCM aquifer is considered a fractured rock aquifer due to its competent sandstone/siltstone/mudstone geological units. As such, groundwater flow is dependent on the nature and interconnection of fracture networks. Groundwater flow through the coal seams may contain more primary porosity and facilitate groundwater flow through a porous media in addition to preferential pathways through fractures (secondary porosity). Such a scenario is common throughout the Bowen Basin in Permian coal measures. The dual porosity of the FCCM aquifer suggests that groundwater flow paths are likely to be heterogeneous and challenging to accurately predict – particularly at RMI where the site is surrounded by mine pits and similar activities that influence groundwater flow directions.

Alluvial Strata

It is plausible for a transient perched aquifer system to exist within the alluvial sediments associated with New Chum Creek, however this is unconfirmed (no monitoring bores are screened within this formation). The sediments are comprised of relatively coarse (i.e. sandy) alluvium derived from re-worked bedrock material. Depending on the hydraulic conductivity of underlying units the alluvial 'aquifer' may be a perched system (where the underlying units have very low hydraulic conductivity), or it may be connected to the regional water table (FCCM) where the regional groundwater system is shallower further to the south (i.e. off-site).

If a perched (alluvial) groundwater system exists, infiltrating creek water is likely to leak through the shale/mudstone geological units to join the deeper primary water table within the FCCM aquifer.

2.2.6 Potential Environmental and Human Health Receptors

Excluding workers at RMI and neighbouring mines/industries, the nearest potential human health receptor is an unnamed homestead/dwelling located 7.5 km north of RMI at Peak Downs Highway, which is upstream of the site. The next nearest homesteads are 'Annandale' and 'Winchester', located approximately 10.8 km and 13.5 km, respectively from RMI. All three locations are a long way from the site and are implausible receptors.

The nearest potential surface water environmental receptor is New Chum Creek, which forms a large part of the northern and north-eastern boundary of the site (Figure 1). At its nearest point (to key mineral waste facilities), New Chum Creeks is located approximately 250 m east of the Coal Stockpile pad and approximately 100 m east of the environment dam.

The presence of groundwater dependent ecosystems (GDEs) at or near RMI is unclear. Recharge to the local groundwater system is primarily through local infiltration via rainfall, and infiltration from New Chum Creek (during wet season flow). There is potential for terrestrial GDEs to be associated with a perched alluvial aquifer beneath and close to New Chum Creek (refer to Section 2.2.5). However, a thick unsaturated zone at RMI provides a viable

source of soil moisture for use by vegetation during dry periods, rather than vegetation communities sourcing water directly from groundwater or from the capillary fringe immediately above the water table. As such, riparian vegetation communities are less likely to be terrestrial GDEs.

2.2.7 Acid and Metalliferous Drainage

A preliminary assessment of acid and metalliferous drainage (AMD) characteristics of mineral waste materials has been undertaken on recently collected samples, and available data from the BHP Coal Geochemical Database. Refer to Sections 3, 4 and 5.

2.2.8 Salinity, Sodicty and Dispersion

A preliminary assessment of salinity characteristics of mineral waste materials has been undertaken on recently collected samples from PTM, and available data from the BHP Coal Geochemical Database. An assessment of sodicity and dispersion characteristics of potential final landform materials has also been undertaken, using exchangeable cation and Emerson Class data from overburden/interburden samples from PTM (data obtained from the BHP Coal Geochemical Database). Refer to Sections 3, 4 and 5.

2.2.9 Spontaneous Combustion

Under the right moisture and atmospheric (oxygen) conditions, stockpiled or disposed coal with high sulphide concentrations (including highly coaly/carbonaceous 'non-coal' materials) can self-heat and potentially self-combust (spontaneous combustion).

No mineral waste materials have been assessed for spontaneous combustion potential, however the potential for spontaneous combustion is considered to be very low due to the very low sulphide concentrations. There are no known issues with spontaneous combustion at RMI. Refer to Section 5.3 for further detail.

3 Assessment Methodology

3.1 Information Review

Geological information is available from groundwater bores located within and close to the RMI mining lease area (provided in CDM Smith, 2021a), and from historical exploration drill-holes located within and close to RMI (BHP Coal Geobank Database). This information was reviewed to understand the stratigraphy and lithology of the site.

The ROM pad and haul road material will be used to backfill the dams and create the final landform at RMI. Detailed construction information for the ROM pad is not available, however it is known to be constructed from overburden/interburden (spoil) from the neighbouring mines (PTM and/or Millennium Mine); for the ROM pad extension the Red Mountain Joint Venture CHPP Environmental Management Plan 2014, states that clean, non-AMD-generating unweathered Permian-age overburden was used for the construction of the extension. It is assumed that waste for the construction of the original ROM pad was sourced from the neighbouring mines (PTM and/or Millennium Mine). No samples have been collected from within the ROM pad, however the BHP Coal Geochemical Database contains detailed geochemical data for 215 samples of overburden/interburden from PTM (and other Rangal Coal Measures sites), which is representative of the ROM pad bulk material.

The BHP Coal Geochemical Database also has geochemical data for tailings and reject samples collected from the CHPP. Additionally, environmental geochemical data is available from coal samples from PTM drill-holes, which is representative of coal material. This existing information (93 samples) was reviewed to understand the geochemical characteristics of spoil (representing final landform material) and coal and coal waste material of relevance to RMI.

3.2 Sampling

To supplement existing geochemical information, a RMI specific geochemical sampling program targeting ROM coal, coal and dam sediments and water samples (PWD and ED) was undertaken by BHP to augment the available data set for the PRCP. The aim was to understand the environmental geochemical characteristics of surface coaly

and carbonaceous materials and associated run-off for material currently present on-site. Generally speaking, coaly/carbonaceous materials are perceived as potentially higher AMD potential compared to non-carbonaceous spoil material, and thus the added effort to characterise these material domains, albeit they will all be removed from site at closure.

The following 12 solid samples and three (3) water samples were collected in April 2021, from the locations shown on Figure 1:

Solid Samples (grab samples)

- Surface coal and coaly material from the ROM pad (5 samples)
- Surface coal and coaly material from the Coal Stockpile (2 samples)
- Dewatered tailings (DWT) from the tailings dewatering cells (1 sample)
- Sediment from the PWD (2 samples)
- Sediment from the ED (2 samples)

Water Samples

- Water from the PWD (1 sample)
- Water from the ED (1 sample)
- Decant water from the tailings dewatering cells (1 sample)

3.3 Laboratory Testwork [grab samples]

Solid Samples

The solid samples (collected April 2021) underwent similar testwork methods as for tailings, reject and overburden samples from the BHP Coal Geochemical Database.

All 12 new solid samples underwent initial 'stage 1' tests comprising:

- pH and electrical conductivity (EC) on 1:5 w:v water extracts (on pulps [85% passing 75 microns]). The dewatered tailings (DWT) sample was tested on an 'as received' size fraction, which is already very fine-grained;
- Total sulphur (total S);
- Total sulphate (SO₄);
- Sulphide (chromium reducible sulphur – Scr);
- Acid neutralising capacity (ANC) [AMIRA, 2002];
- Total carbon (total C), and organic carbon (C-org).

From the total S and ANC results, maximum potential acidity (MPA) and net acid producing potential (NAPP) was calculated. The SO₄ and Scr data was used with total S to calculate organic sulphur (S-org) and understand the sulphur speciation. The carbon suite was used to understand the carbon speciation – in particular – to understand the proportion of organic carbon present.

Based on the results of the initial tests, selected samples were subjected to the following tests:

- pH and EC on 1:2 w:v water extracts (on fine crush [100% passing 2.4mm]);
- Acid buffering characterisation curve (ABCC) - a test to determine the proportion of ANC that's in a readily-available form and to provide an indication of the mineralogy of the neutralising material;
- Net Acid Generation (NAG) [single addition] - a test that encourages the oxidation of a sample to determine if acid can be produced, and how much acid could be produced;

- Extended boil net acid generation test (NAG Extended) – A NAG test is a test that encourages the oxidation of a sample to determine if acid can be produced, and how much acid could be produced. The NAG Extended test is a refinement of the NAG test to resolve uncertainty due to potential organic acid interference (where non-acid generating organic acids can provide false positive results in the NAG test);
- Total metals and metalloids by 2-acid (aqua regia) digest with analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and/or Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) and Flow Injection Mercury System (FIMS);
- Deionised water extract leach procedure – a 1 hour end-over-end bottle leach at 1:5 w:v (solid:water) ratio using de-ionised water, with filtered leachate analysed for:
 - Major and minor ions [calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), SO₄, chloride (Cl) and fluoride (F)];
 - Alkalinity [total alkalinity, bicarbonate (HCO₃) and carbonate (CO₃)];
 - Acidity (pH dependent);
 - Soluble metals and metalloids [approximately 28 elements by ICP-MS, ICP-AES and FIMS].
- Saline water extract leach procedure – a 1 hour end-over-end bottle leach at 1:5 w:v (solid:water) ratio using saline water (2 g/L NaCl), with filtered leachate analysed for the same suite of soluble analytes as listed above.

Laboratory test work was undertaken by ALS Environmental (ALS) Brisbane, using National Association of Testing Authorities (NATA) accredited methods (where such accreditation exists).

The Acid-Base Account (ABA) method was used to assess the acid-neutralising and acid-generating characteristics of the samples. The total and water-soluble element data was used to indicate the potential for the samples to leach metals and metalloids (under existing pH and oxygen [redox] conditions) at concentrations that could warrant further investigation (in an 'assumed worst-case' leaching scenario).

Water Samples

All three water samples were analysed for:

- pH and EC (field and laboratory);
- Major and minor ions [Ca, Mg, Na, K, SO₄, Cl and F];
- Alkalinity [total alkalinity, HCO₃ and CO₃];
- Acidity (pH dependent);
- Dissolved (filtered) metals and metalloids [approximately 28 elements by ICP-MS, ICP-AES and FIMS];
- Total (unfiltered) metals and metalloids [same suite as for dissolved];
- Nitrogen species: total nitrogen (total N), ammonia (NH₃), nitrite (NO₂), nitrate (NO₃), total kjeldahl nitrogen (TKN);
- Total phosphorous (total P);
- Reactive phosphorous (reactive P);
- Total dissolved solids (TDS) – low level; and
- Total suspended solids (TSS) – low level.

Laboratory test work was undertaken by ALS Environmental (ALS) Brisbane, using National Association of Testing Authorities (NATA) accredited methods (where such accreditation exists).

3.4 Geochemical Source Hazard Assessment

3.4.1 Source Materials

The only remaining source material at RMI will be ROM pad and haul road bulk material, which is comprised of overburden/interburden from neighboring mines. It is understood, that, pending the results of a contaminated land detailed site investigation, spoil from the ROM pad base and haul roads may also be used for rehabilitation activities at RMI.

Although all other materials (e.g. tailings, rejects, coal, dam sediments) will be removed during decommissioning and rehabilitation, the geochemical characteristics of these materials are discussed in this report to provide context to the current (existing) geochemical hazards at site, and hazards and risks these existing coaly and carbonaceous materials may pose with respect to rehabilitation. Additionally, and as discussed further throughout this report, it is conservatively assumed that some minor amount of coaly and/or carbonaceous material may remain on site at closure.

The materials assessed for this project are grouped as follows, with number of samples (*n*) shown:

- Grp1: Tailings from the CHPP (*n*=35)
- Grp2: Coarse rejects from the CHPP (*n*=27)
- Grp3: Coal from PTM drill-hole samples, representing ROM coal and Product coal (*n*=29)
- Grp4: Coaly and carbonaceous surface and sediment samples from RMI (*n*=11)
- Grp5: General spoil (overburden and interburden from PTM drill-hole samples), representing ROM pad bulk material and site base material (i.e. haul road fill), which will be used to assist with rehabilitation activities where required and/or rehabilitated in their current locations (*n*=215)

3.4.2 AMD Classification

Sample classification of mineral waste materials follows some general rules; however, the classification has to take into account the site-specific geochemical characteristics that may influence the classification criteria.

Samples were classified, with respect to acid generation, using NAPP, ANC/MPA ratio and total S (and NAG data, where available) into three broad categories:

- NAF Non-acid forming
- Uncertain Those samples with inconclusive results, leading to a degree of uncertainty about their ability to generate acid; and
- PAF Potentially acid forming

Within these three broad categories, the sample classification was refined as follows:

NAF (NAF):

NAPP <0 kg sulphuric acid per tonne of sample (kg H₂SO₄/t) and ANC/MPA ratio ≥2 and S ≤1 %
or
NAPP <0 kg H₂SO₄/t and NAGpH ≥4.5 and S ≤1 %

NAF-Sulfur (NAF-S):

NAPP <0 kg H₂SO₄/t and ANC/MPA ratio ≥2 and S >1 %
or
NAPP <0 kg H₂SO₄/t and NAGpH ≥4.5 and S >1 %

PAF – Low Capacity (PAF-LC):

NAPP ≥0 and <10 kg H₂SO₄/t and ANC/MPA ratio <2 and S ≤1 %
or
NAPP ≥0 and <10 kg H₂SO₄/t and NAGpH <4.5

PAF:

NAPP ≥ 10 kg H₂SO₄/t and ANC/MPA ratio < 2
 or
 NAPP ≥ 10 kg H₂SO₄/t and NAGpH < 4.5

Uncertain (UC): Any conflicting or unaccounted for result (and will be conservatively classed PAF until shown otherwise).

3.4.3 Salinity Classification

Classifying whether a sample/material is non-saline, highly saline, or somewhere in between will depend upon the methods used to measure soil salinity. Soil salinity data is obtained from a 1:5 (w:v) [and 1:2 w:v] water extract procedure typically on pulp samples (pulping the sample minimises the potential to underestimate salinity on sandy samples/materials). The salinity classes below (DME, 1995) are based on a 1:5 w:v method. These salinity classes [in units of microSiemens per centimeter ($\mu\text{S/cm}$)] are to be used as a general indicative guide as follows:

Very Low: less than 150 $\mu\text{S/cm}$

Low: 150 to 450 $\mu\text{S/cm}$

Medium: 450 to 900 $\mu\text{S/cm}$

High: 900 to 2000 $\mu\text{S/cm}$

Very High: greater than 2000 $\mu\text{S/cm}$

3.4.4 Sodicity and Dispersion Classification

Materials likely to report to final landforms are broadly classified with respect to sodicity on the basis of the exchangeable sodium percentage (ESP) value, as follows (Northcote and Skene, 1972; Isbell, 2002):

Non-Sodic: ESP less than 6%

Sodic: ESP between 6% and 14%

Strongly Sodic: ESP greater than 14%

The sodicity will depend upon a range of factors, such as clay mineralogy, soil sodium concentration, soil salinity and irrigation water (rainwater) chemistry, which may enhance or limit that potential for soil to be sodic or become sodic over time. Therefore, values of 6% ESP and 14% ESP to represent soils as being sodic or strongly sodic are used as a *general guide* only and should not be taken as definitive. Sodidity assessments only apply to materials likely to report to final landform surfaces – in this case, e.g. spoil material from the ROM pad.

Sodicity information is broadly used to understand potential revegetation and dispersion aspects, and is supported by Emerson Aggregate Class test information, which provides a direct measure of soil slaking and dispersion.

3.4.5 AMD Hazard Scoring

Estimating the AMD hazard is the first step in estimating the geochemical risk associated with potential sulphide oxidation of mineral wastes. BHP has developed an internal procedure to standardise the AMD hazard assessment to maintain consistency across all sites and material domains, with the process described below.

AMD hazard scores (Table 1) are estimated by analysing three key components, which are used to describe the geochemical hazard of a source material/landform:

1. Propensity to generate AMD;
2. AMD capacity; and
3. AMD quantity.

AMD Propensity is the geochemical propensity of a given material type to generate AMD. The propensity to generate AMD is determined based on the proportion of samples that have expressed potential for AMD as determined from laboratory test-work and the subsequent assessment – the higher the percentage of materials that can generate AMD within a sample set, the greater the AMD propensity.

Table 1: AMD hazard scoring matrix

Component	Rating	Category	Definition
<u>Propensity for AMD generation</u> All material types/domains - Spoil - Coaly & Carbonaceous	1	Implausible	IMPLAUSIBLE: Geochemical properties suggest that the vast majority of the material has a negligible potential for AMD generation (< 5% of the samples identified at potential for AMD in the samples set)
	5	Plausible	PLAUSIBLE: Geochemical properties suggest that significant proportion of the material may have potential for AMD generation (5-40% of the samples identified at potential for AMD in the samples set)
	7	Expected	EXPECTED: Geochemical properties strongly suggest that the material has a high potential for AMD generation but has not yet been observed in the field (lag time) -- (>40% of the samples identified at potential for AMD in the samples set)
	15	Certain	CERTAIN: AMD issues have been observed in the field
<u>AMD Capacity</u> All material types/domains - Spoil - Coaly & Carbonaceous	1	Low	LOW: Source has a negligible potential for AMD generation with PAF samples having 75 th percentile total S <0.1%
	3	Moderate-Low (NMD)	MODERATE LOW: Dominant AMD sources contain material that will likely generate neutral metalliferous (NMD) or saline drainage (related to sulphide oxidation, SD). Assumed to be bulk NAF but sulphide bearing, with NAF samples having 75 th percentile total S >1%
	5	Moderate	MODERATE: Dominant AMD sources with 75 th percentile total S concentration ranging 0.2-0.5% and with potential to generate acidic drainage (AD).
	7	Moderate-High	MODERATE HIGH: Dominant AMD sources with 75 th percentile total S ranging 0.5-1% and with potential to generate acidic drainage (AD)
	10	High	HIGH: Dominant potential AMD sources with 75 th percentile total S >1% and with potential to generate acidic drainage (AD)
<u>AMD Quantity</u> - Spoil All of site	1	Low	LOW: All material rated LOW for AMD capacity; or less than 5% of waste is rated MODERATE-LOW for AMD Capacity
	3	Moderate-Low	MODERATE-LOW: <5% of mineral waste rated as MODERATE for AMD capacity
	5	Moderate	MODERATE: >5% of mineral waste rated as MODERATE or MODERATE-LOW for AMD capacity
	7	Moderate-High	MODERATE-HIGH: <5% of mineral waste rated as MODERATE-HIGH or HIGH for AMD capacity
	10	High	HIGH: >5% of mineral waste rated as MODERATE-HIGH or HIGH for AMD capacity

AMD Capacity represents the 'severity' of AMD generation, with total S concentrations used as a proxy for scoring this component, which represents a conservative approach as some sulphur is associated with non-acid generating minerals. For example, the higher the total S concentration in materials with potential for AMD, the higher the hazard, the higher the score. Furthermore, the AMD capacity also takes into account the type of drainage a source material can produce, i.e. acidic drainage (AD), neutral and metalliferous drainage (NMD) and/or saline drainage (SD), where discrimination or prediction is possible. The various drainage types should be differentiated (where the data allows) to reflect the difference in impact severity and difficulty to manage or treat. For example, on an equal quantity basis, AD is likely going to cause more severe impacts than NMD or SD and therefore is assigned a higher score.

As a first approximation the AMD Capacity of each material type is estimated based on 75th percentile value of the total S concentration for the samples classified as PAF. This is a conservative assumption as not all total S is associated with reactive minerals and choosing the S-75th percentile value to assess the AMD capacity will attract a higher AMD Capacity scoring. For example, if two material types had the same proportion of samples with the same propensity for AMD, but one has a higher total S concentration associated with PAF materials, then this sample would receive a higher AMD Capacity score. The tool is also applied to NMD/SD type waste in the same

manner. Leach tests can be used to further assess the nature of the AMD drainage to be expected from each material type.

AMD Quantity is the amount of material (tonnages) that has the potential to generate AMD. The greater the tonnage of AMD generating material the greater the hazard scoring.

The AMD Quantity scores are assigned to material types for each landform. RMI will only have one landform at closure – comprised of general spoil. During closure, visible coaly and carbonaceous material (including dam sediments) will be removed from site and disposed as required. As such, these materials have a theoretical quantity score of zero. However, to introduce a level of conservatism in the risk assessment we have assumed that a very small proportion (5%) of this waste may not be removed from site at closure (i.e. non-visible, difficult location to clean up, etc.). The final landform at RMI will be developed using bulk material from the ROM pad and haul roads (after scraping and excavating remnant coaly material), pending on the outcome of the contaminated land detailed site assessment to be conducted at closure. The ROM pad is constructed of some potential Tertiary- and/or Permian-age spoil. The ROM pad bulk material has an estimated quantity of approximately 3.7 Mm³.

3.4.6 AMD Likelihood Ranking

AMD likelihood ranking (Table 2) is estimated by analysing two key components:

1. AMD source material hazard rating; and
2. AMD landform domain hazard rating.

AMD source material hazard rating: Describes the likelihood for AMD generation by the respective material type. It is estimated from the weighted combined scores of each component used to describe the AMD source hazard:

1. Propensity to generate AMD. Assigned a 50% weighting (weighting = 1);
2. AMD capacity. Assigned a 25% weighting (weighting = 0.5); and
3. AMD quantity. Assigned a 25% weighting (weighting = 0.5)

AMD landform domain hazard rating: Describes the likelihood for AMD generation by landform domain. It is estimated from the AMD source material hazard scores for each material type assumed to be present within that specific landform. At RMI there will only be one landform domain – spoil (non-carbonaceous).

To support the assessment of the AMD closure risks, the AMD hazard scores as determined in Section 3.4.4 are assigned likelihood rankings as consistent as possible with those of BHPs 'Risk Management – Our Requirements' Likelihood ranking (BHP, 2019), with the corresponding likelihood factor used for the Closure risk assessment update (Table 2).

Table 2: AMD hazard ranking and landform AMD likelihood ranking

AMD Hazard Ranking	Landform AMD Likelihood Ranking
0 - 5	Highly Unlikely: Highly unusual; may occur in extreme circumstances
5 - 10	Unlikely: Known to occur, but only rarely
10 - 15	Probable: May occur
15 - 20	Likely: Could easily occur
>20	Highly Likely: Expected to occur

For landforms with AMD hazard rated 10-20, a conservative likelihood ranking of 'likely' and a likelihood factor of 1 should initially be assigned, if no kinetic data are available to provide a time frame for AMD generation. This likelihood ranking can be revised as more data becomes available, such as field data, kinetic data, etc.

4 Results

The environmental geochemical test-work results are presented around the material groups listed below, as defined in Section 3.4 – noting that at closure only Group 5 (Gp5) material will remain on site – with materials represented by Groups 1 to 4 removed from site and disposed of according to the RMI milestones:

- Gp1: Tailings from the CHPP ($n=35$), stored within in-ground cells for few days (short-term storage to enable dewatering) prior to removal during operation to PTM.
- Gp2: Coarse rejects from the CHPP ($n=27$), stored off site (at PTM or at other mine sites based on the site of origin of the raw coal).
- Gp3: Coal from PTM drill-hole samples, assumed to be representing ROM coal and Product coal ($n=29$), short-term storage prior to processing or shipment off site.
- Gp4: Grab samples of coaly (ROM coal) and carbonaceous surface and sediment samples sourced directly from RMI ($n=11$), to be removed from site at the end of operation.
- Gp5: General spoil (overburden and interburden from PTM drill-hole samples ($n=215$)), representing ROM pad and haul road bulk material, which will be used to support rehabilitation activities at RMI and/or stored in the final ROM pad landform.

4.1 Acid-Base Accounting (Potential for AMD)

Acid-base accounting (ABA) is a theoretical balance between the potential for a sample to generate acid and neutralise acid, and is expressed in units of kilograms of sulphuric acid per tonne of sample ($\text{kg H}_2\text{SO}_4/\text{t}$).

The ABA results for the samples that underwent geochemical characterisation are statistically summarised in Table 3 and discussed in the following sections. Full ABA results tables can be provided on request.

Sulphur, Sulphide and Maximum Potential Acidity

Total S concentrations in the Gp5 (general spoil) samples ranged from less than 0.01% to 0.18%, with negligibly low median and 90th percentile total S values of 0.01% and 0.03%, respectively. The total S concentration of spoil samples were much lower than the other material types (Figure 3) – particularly the tailings samples (Gp1), which had a much wider range of total S values (90th percentile of 1.25%). Sulphide-sulphur (as Scr) was analysed in most of the Gp1 to Gp4 samples – due to the higher total S values in these material types – with Scr accounting for about 40% (on average) of the total S concentration in these samples (Figure 4).

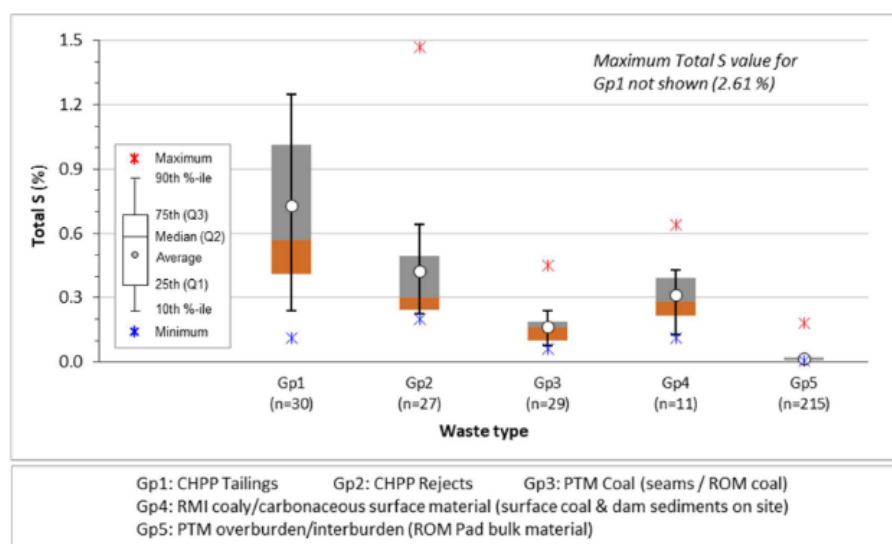


Figure 3: Sulphur (S) distribution of mineral wastes

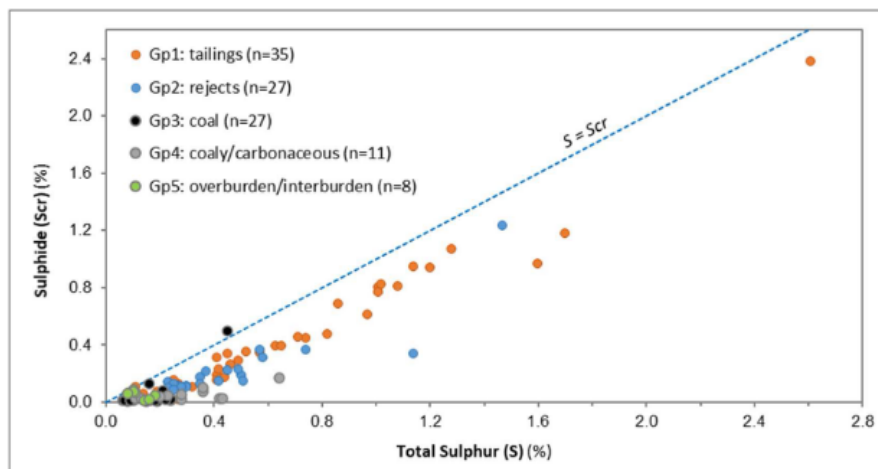


Figure 4: Sulphide (Scr) versus total sulphur (S) of mineral wastes

Due to the very low total S (and Scr) values for Gp5 spoil samples, the MPA for these samples was correspondingly low – with a maximum MPA of 5.5 kg H₂SO₄/t and 90th percentile MPA value of <1 kg H₂SO₄/t. As such, ROM pad bulk material – represented by the Gp5 spoil samples – is expected to have negligible potential to generate acid/acidity and negligible potential to release sulphate-derived salinity from sulphide oxidation.

The higher total S values for the coaly and carbonaceous materials (Gp1 to Gp4) produced a range of MPA values, however the generally low total S concentrations of these materials (as evident in Figure 3) produces correspondingly low MPA values. The highest MPA values (generally) are from the tailings samples, with median and 90th percentile MPA values of 18 and 38 kg H₂SO₄/t, respectively.

For context, total S data from the PTM coal quality database were reviewed. Data from 5947 samples (for the period 1970 to 2019) have a median total S value of 0.36% and 75th percentile value of 0.43%. These values are generally comparable to the total S values in most of the coaly and carbonaceous material types (Gp2 to Gp4), although the tailings samples (Gp1) tended to have higher total S values, albeit from a much smaller database compared to the coal quality database. This indicates that coaly and carbonaceous material at RMI, excluding tailings, is expected to have generally low sulphur (and correspondingly low MPA). Tailings have higher sulfur and sulfide concentrations, generally, compared to other coaly and carbonaceous materials.

Table 3. ABA results statistics for RMI key material domains

		Total S*	Scr	ANC	MPA**	NAPP	ANC/MPA	NAGpH
		%		kg H2SO4/t			ratio	pH units
Gp1 Tailings	Count (n)	35	35	35	35	35	35	17
	Maximum	2.61	2.38	172.0	79.9	6.7	35.3	9.9
	90th %-ile	1.25	0.96	120.8	38.2	-21.3	11.2	9.6
	75th %-ile (Q3)	1.01	0.79	113.0	30.9	-35.3	5.5	8.7
	Median (Q2)	0.57	0.35	77.1	17.5	-59.7	3.8	8.3
	25th %-ile (Q1)	0.41	0.16	57.0	12.6	-79.5	3.0	8.2
	10th %-ile	0.24	0.08	42.3	7.3	-99.0	1.9	8.1
	Minimum	0.11	0.02	23.0	3.4	-140.8	0.8	5.5
Gp2 Rejects	Count (n)	27	27	27	27	27	27	10
	Maximum	1.47	1.23	150.0	45.0	11.5	22.3	8.4
	90th %-ile	0.64	0.35	111.4	19.7	-12.4	9.7	8.4
	75th %-ile (Q3)	0.50	0.22	75.9	15.2	-22.8	8.1	8.4
	Median (Q2)	0.30	0.13	49.0	9.2	-40.0	4.3	8.2
	25th %-ile (Q1)	0.25	0.10	36.7	7.5	-65.0	3.2	8.2
	10th %-ile	0.23	0.04	24.0	6.9	-86.6	2.0	8.1
	Minimum	0.20	0.02	11.2	6.1	-143.3	0.5	7.9
Gp3 Coal	Count (n)	29	27	29	29	29	29	1
	Maximum	0.45	0.50	492.0	13.8	4.0	267.8	2.7
	90th %-ile	0.24	0.07	173.8	7.4	-0.7	35.0	-
	75th %-ile (Q3)	0.19	0.02	36.8	5.8	-9.7	13.4	-
	Median (Q2)	0.16	0.02	19.8	4.9	-14.9	4.3	-
	25th %-ile (Q1)	0.10	0.01	14.0	3.1	-34.0	2.6	-
	10th %-ile	0.08	0.01	10.4	2.4	-168.1	1.1	-
	Minimum	0.06	0.01	1.8	1.8	-490.2	0.3	2.7
Gp4 Coaly & carbonaceous surface materials & sediments	Count (n)	11	11	11	11	11	11	0
	Maximum	0.64	0.17	46.0	19.6	9.6	10.5	-
	90th %-ile	0.43	0.11	35.4	13.2	4.1	6.9	-
	75th %-ile (Q3)	0.39	0.07	29.3	11.9	-1.0	5.6	-
	Median (Q2)	0.28	0.04	24.2	8.6	-15.6	2.8	-
	25th %-ile (Q1)	0.22	0.03	13.0	6.6	-23.0	1.1	-
	10th %-ile	0.13	0.03	10.0	4.0	-32.0	0.7	-
	Minimum	0.11	0.02	9.1	3.4	-39.0	0.5	-
Gp5 General spoil (representing ROM pad bulk material)	Count (n)	215	8	215	215	215	215	8
	Maximum	0.18	0.09	466.0	5.5	1.9	3043.3	7.4
	90th %-ile	0.03	0.08	131.8	0.8	-12.5	715.8	7.3
	75th %-ile (Q3)	0.02	0.07	67.4	0.6	-18.8	265.6	7.1
	Median (Q2)	<0.01	0.06	28.3	0.2	-28.1	139.8	7.0
	25th %-ile (Q1)	<0.01	0.04	19.3	0.2	-67.0	63.9	6.1
	10th %-ile	<0.01	0.02	14.0	0.2	-131.6	23.0	4.0
	Minimum	<0.01	0.02	3.0	0.2	-465.8	0.6	3.1

* Total S values less than laboratory limit of reporting (LOR) were assigned a value of 0.75xLOR for statistical calculations.

** MPA calculated from total S.

Acid Neutralising Capacity

The ANC for the Gp5 (spoil) samples ranged from 3 to 466 kg H₂SO₄/t, with median and 10th percentile values of 28 and 14 kg H₂SO₄/t, respectively (i.e. 90% of Gp5 samples had ANC values greater than 14 kg H₂SO₄/t). As evident in Figure 5, the coaly and carbonaceous mineral waste types (Gp1 to Gp4) also had wide ranging ANC values. However, it is worth noting that median ANC values are fairly consistent across all sample groups, but coal and rejects tend to have higher ANC compared to spoil.

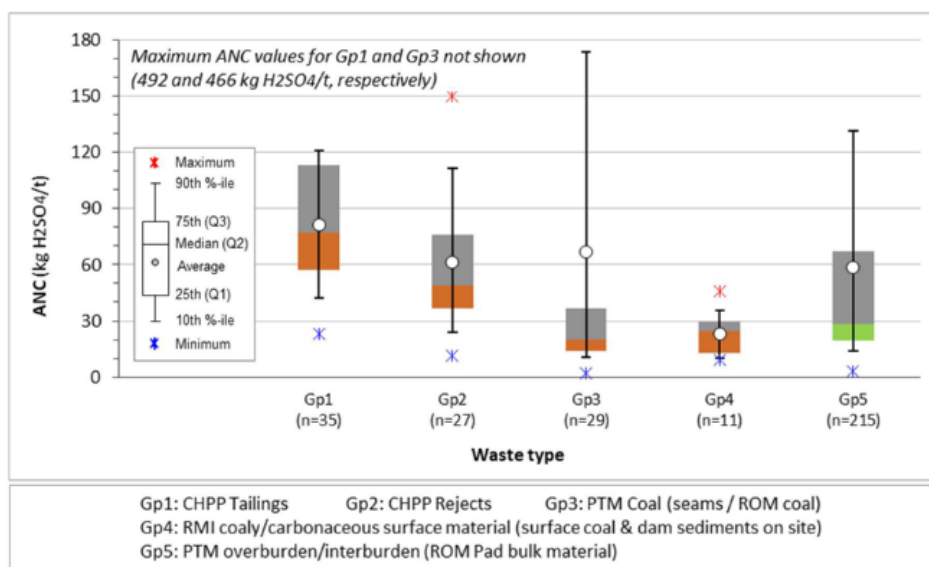


Figure 5: Acid neutralising capacity (ANC) distribution of mineral wastes

Several samples within each material group were submitted to ABCC test to assess the proportion of ANC that may be 'readily available' under field condition. This tests also provides some indication of what carbonate minerals are providing the ANC. 'Ready availability' is regarded as the proportion of ANC that is available for buffering reaction at pH 4.5. ABCC data is available for 6 tailings samples (Gp1), 2 reject samples (Gp2), three PTM coal drill-hole samples (Gp3), 7 coaly & carbonaceous surface samples (Gp4) and 38 PTM overburden/interburden drill-hole [spoil] samples (Gp5).

The results are summarised in Table 4, which showed that the proportion of ANC likely available under field conditions for all groups Gp1-Gp3 is elevated with median availability at approximately 90%; coaly and carbonaceous waste collected at RMI (Gp4) and spoil (Gp5) had a median field availability of approximately 40% and 50% respectively.

The shape of the ABCC curves (the reaction rate) can also be used to infer likely carbonate mineralogy based on standard curves/data for different carbonate minerals at varying ANC values. For the tailings, rejects and coal samples, calcite (CaCO₃) and dolomite (CaMg(CO₃)₂) appear to be the dominant carbonate minerals, which is typical for Rangal Coal Measures (and FCCM) in this part of the Bowen Basin. The spoil samples tended to be dominated by a mix of dolomite and Fe (iron) dolomite, whereas the surface coaly and carbonaceous (and sediment) samples were predominantly dominated by Fe-dolomite. The important consideration here is that the spoil materials (Gp5) – which represent ROM pad bulk material, which will be used to backfill dams and tailings dewatering cells at closure – has at least 50% of the ANC in a readily available form.

Mineralogical analysis on selected samples by quantitative x-ray diffraction (QXRD) has confirmed that calcite or ankerite (Fe-dolomite) are the dominant carbonate minerals, with lesser amounts of siderite (FeCO₃) and, in some samples, rhodochrosite (MnCO₃). Siderite and rhodochrosite do not provide any net ANC.

Table 4. Available acid neutralising capacity

Material Type	Proportion of ANC @ pH4.5	Key Carbonate Mineral(s)
Gp1: Tailings (n=6)	100%; 97%; 90%; 82%; 100%; 24%. Median = 93%	Calcite & Dolomite
Gp2: Coarse rejects (n=2)	86% and 100%. Median = 93%	Calcite & Dolomite
Gp3: Coal (n=3)	90%; 100%; 69%. Median = 90%	Calcite & Dolomite
Gp4: Coaly and carbonaceous surface (n=7)	92%; 9%; 33%; 54%; 40%; 12%; 60%. Median = 40%	Calcite & Dolomite; minor Fe-dolomite
Gp5: Spoil (overburden and interburden) (n=38)	19% to 100%. 25%ile = 41%; Median = 52% ; 75%ile = 84%	Dolomite and Fe-dolomite

ANC / MPA Ratio

Generally, samples with an ANC/MPA mass ratio greater than two are considered to have a negligible/low risk of acid generation and a high factor of safety in terms of potential for acid drainage (AD) (DIIS, 2016; INAP, 2009³). The results show that almost all Gp5 (spoil) samples have an ANC/MPA ratio greater than two, and 97 % of Gp5 samples have ANC/MPA ratios greater than five (Figure 6). Due to the negligible total S concentration, samples with ANC/MPA ratios greater than two are also unlikely to generate NMD/SD.

Most tailings (Gp1), rejects (Gp2) and coal (Gp3) samples also had ANC/MPA ratios greater than two. Half of the Gp4 samples (surface coaly samples and sediment samples) had ANC/MPA ratios less than two.

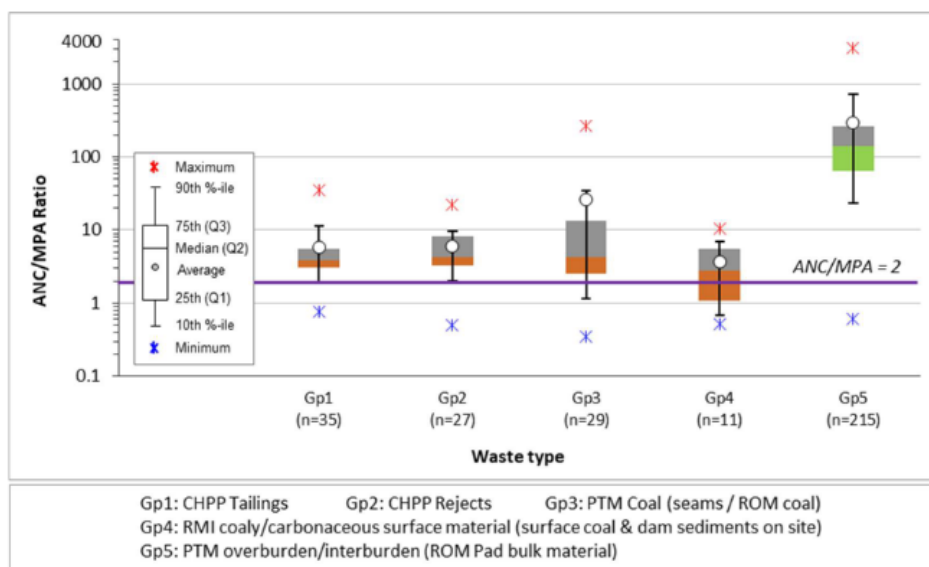


Figure 6: Ratio of acid neutralising capacity to maximum potential acidity (ANC/MPA) distribution of mineral wastes

Net Acid Producing Potential and Net Acid Generation Capacity

Based on the very low MPA and generally significantly higher ANC values, the calculated NAPP values (NAPP calculated from total S) were predominantly negative for most samples of all material types (Figure 7), indicating a greater proportion of neutralising capacity (ANC) compared to potential acidity (MPA). For the Gp5 (overburden/

³ INAP (2009) considers that mine materials with an ANC/MPA ratio greater than 2 are likely to be NAF unless significant preferential exposure of sulphide minerals occurs along fracture planes, in combination with insufficiently reactive ANC.

interburden) samples the NAPP values ranged from -466 to +1.9 kg H₂SO₄/t, with median and 75th percentile NAPP values of -28 and -18 kg H₂SO₄/t.

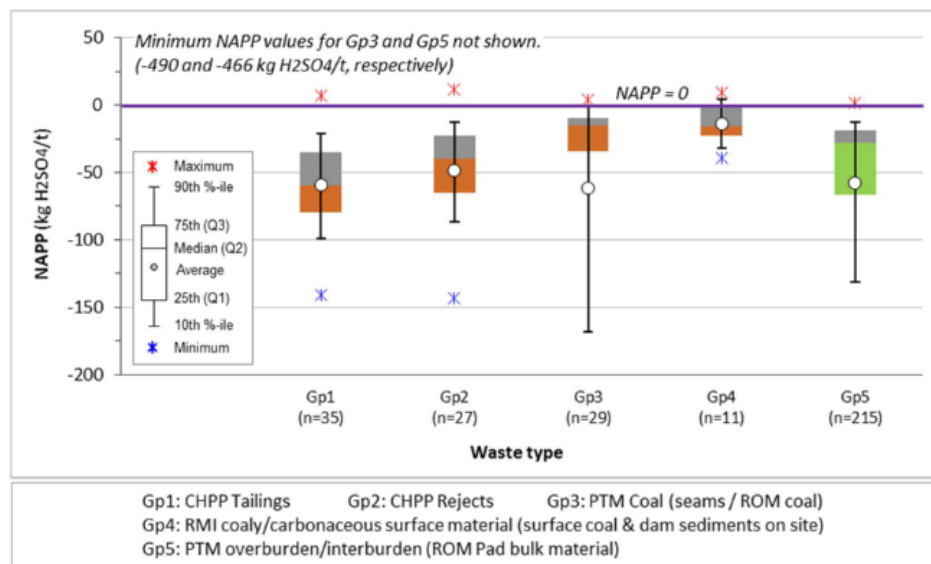


Figure 7: Net acid producing potential (NAPP) distribution of mineral wastes

NAG test results are sometimes used in conjunction with NAPP values in determining the acid classification of samples – particularly where some uncertainty surrounds the classification of the samples. The calculated NAPP value assumes that all sulfur (or sulfide) will oxidise to generate acid (MPA) and that all neutralising material in a sample is in a readily available form to neutralise any acid that could be generated (ANC). Unlike the theoretical basis of the NAPP test, in a NAG test a sample is encouraged to oxidise by reaction with hydrogen peroxide and any acid generated through oxidation may be consumed by neutralising components in the sample. Any remaining acidity is measured and expressed as kg H₂SO₄/t. Samples with NAGpH values greater than pH 4.5 are considered to be NAF. Samples with NAGpH values less than or equal to pH 4.5 (ie. acid-generating) would also be expected to have measurable NAG capacity (ie. NAG capacity >0.1 kg H₂SO₄/t). As a guide, NAG capacity values between 0.1 and 5 kg H₂SO₄/t are considered 'low capacity' (AMIRA, 2002).

NAG test data is available for eight (8) Gp5 samples – those samples displaying some degree of uncertainty based on the ANC, S and ANC/MPA results. The results showed that 6 of the 8 samples tested had NAGpH values greater than pH 4.5 and, as such, were considered to be NAF. Two samples had NAGpH values just below pH 4.5, however both samples were described as highly carbonaceous. Highly carbonaceous (and coaly) samples commonly have high organic carbon concentrations, which can generate organic acid during a NAG test. As such, it is likely the NAG test for these two highly carbonaceous samples was generating organic acid – which provides a low pH (below pH 4.5), however organic acid is not an environmental risk. These two samples have an 'uncertain' (UC) classification, however have been conservatively sub-classified as UC(PAF).

AMD Classification

The ABA results presented in this section have been used to assign an AMD classification to the samples, following the classification criteria outlined in Section 3.4, and summarised in Table 5.

Table 5. AMD classification

Material Type	NAF	NAF-S	Uncertain	PAF-LC	PAF
	Number (and %) of samples				
Gp1: Tailings (<i>n</i> =35)	24 (69%)	9 (26%)	-	2 (5%)	-
Gp2: Coarse rejects (<i>n</i> =27)	24 (89%)	2 (7%)	-	1 (4%)	-
Gp3: Coal (<i>n</i> =29)	25 (86%)	-	-	4 (14%)	-
Gp4: Coaly and carbonaceous surface (<i>n</i> =11)	8 (73%)	-	-	3 (27%)	-
Gp5: Spoil (overburden and interburden) (<i>n</i> =215)	213 (99%)	-	2 (1%) UC(PAF)	-	-

The results in Table 5 show that virtually all spoil (overburden/interburden) material (Gp5) – which represents the bulk of the ROM pad material – is classified as NAF and clearly has negligible potential to generate acid/acidity and has negligible potential to release sulphate-derived salinity from sulphide oxidation.

Of the coaly and carbonaceous materials (represented by 102 samples from Gp1 to Gp4), about 80% of samples were also classified as NAF, with the remaining 20% of coaly and carbonaceous samples classified as NAF-S (i.e. NAF with total S >1%) or PAF-LC, with the latter class indicating that most coaly and carbonaceous materials (as bulk materials) pose limited risk of developing acid/acidity if allowed to freely oxidise.

4.2 Total Metals and Metalloids

Element Enrichment

Total element results are available for a range of samples of each material group (Gp1 to Gp5). The total concentration result for each element were compared to average element abundance in soil in the earth's crust (Bowen, 1979) to measure how the total elemental concentrations in the samples compare against average elemental concentrations in unmineralized soil (worldwide). Such a comparison is undertaken to identify samples that contain what may be regarded as 'elevated' concentrations of metals and metalloids to identify potential element of concerns. However, enrichment in any metals/metalloids in the solids, does not translate to enhanced leachability or mobilization and/or bioavailability of that specific element.

From the comparison with average crustal abundance in rocks a geochemical abundance index (GAI) was calculated. The GAI quantifies an assay result for a particular element in terms of the average abundance for that element (in sedimentary rocks). The index, based on a log 2 scale, is expressed in seven integer increments (0 to 6), which correspond to enrichment factors from 0 to over 96 times average crustal abundance, as shown in Table 6.

Table 6. Geochemical abundance index (GAI)

GAI	Enrichment factor	GAI	Enrichment factor
0	Less than 3-fold enrichment	4	24 to 48-fold enrichment
1	3 to 6-fold enrichment	5	48 to 96-fold enrichment
2	6 to 12-fold enrichment	6	Greater than 96-fold enrichment
3	12 to 24-fold enrichment		

As a general rule, a GAI greater than or equal to three indicates enrichment compared to unmineralised soil that may warrant further investigation to assess their mobility under laboratory conditions.

Elements identified as enriched may not necessarily be a concern for revegetation and rehabilitation, human and animal health or drainage water quality. Similarly, if an element is not enriched it does not mean it would not be mobilised, because under some conditions (e.g. low pH, reducing conditions) the geochemical behavior of metals/metalloids such as Al, As, Cu, Cd and Zn can change (i.e. become less or more mobile).

The multi-element (solid) test results are presented in Appendix A for CHPP tailings samples (Gp1) [n=12], CHPP reject samples (Gp2) [n=1], PTM coal samples (Gp3) [n=12], coaly and carbonaceous RMI surface samples (Gp4) [n=11] and spoil (overburden/interburden) samples (Gp5) [n=51]. The results are compared to background concentrations for each element, based on average elemental abundance in soil in the earth's crust to determine the GAI.

The GAI values show that all materials have generally low metal and metalloid enrichment. Eleven (11) spoil (Gp5) samples were significantly enriched (GAI = 3) with respect to tellurium (Te); one coal (Gp3) sample was significantly enriched with respect to S; and three tailings samples (Gp1) were significantly (GAI = 3) enriched with respect to one or more of molybdenum (Mo), S and/or Te. The level of 'enrichment' displayed from a relatively small number of samples is not cause for concern.

A frequency distribution plot of GAIs for elements that are generally regarded as more important environmentally is presented as Figure 8.

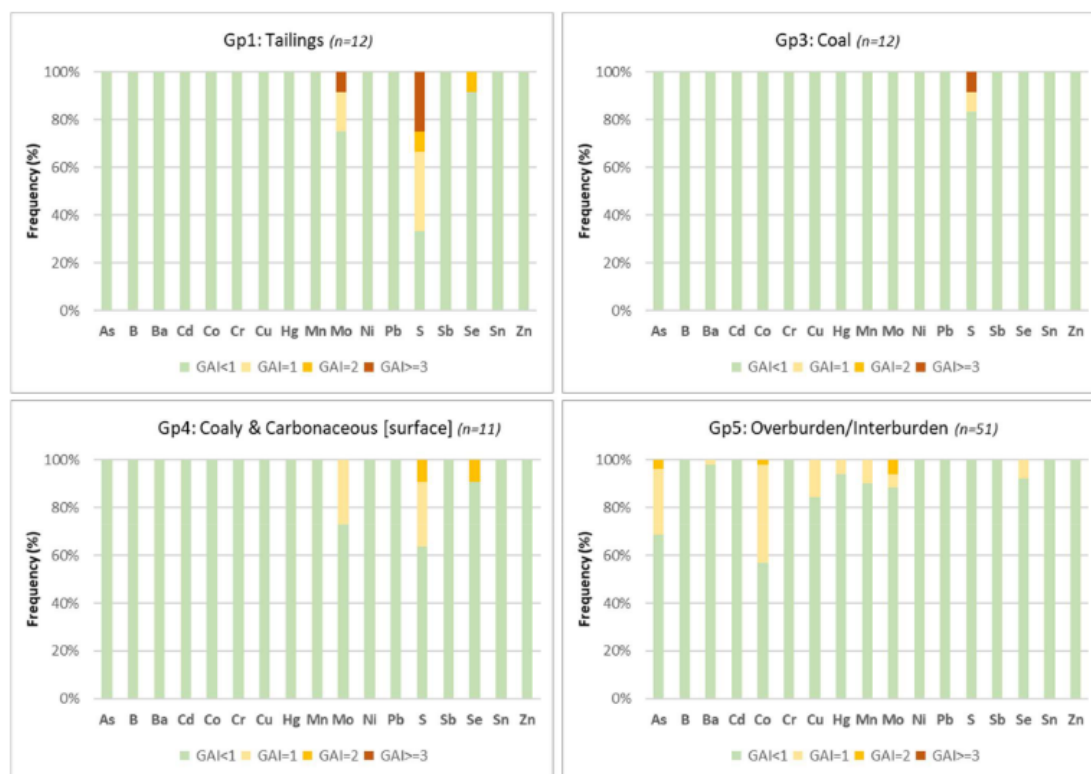


Figure 8: Frequency distribution of GAIs for environmentally important elements in mineral wastes

4.3 Initial Solubility

The same samples that underwent total metal and metalloid analysis also underwent short-term leach tests (1:5 w:v [solid:water]), with the results presented in Appendix A. For most samples the leaching tests were performed on pulped samples (85% passing 75 μm in diameter), which means the available surface area for dissolution/solubility and/or geochemical reaction is very high. Some tailings and rejects samples underwent testing on a slightly coarser pulp (100% passing 212 μm in diameter).

Electrical Conductivity and pH

Spoil samples – representing final landform materials (Gp5) – have 'Low' soil electrical conductivity ($\text{EC}_{1:5}$) values ranging from 85 to 493 $\mu\text{S}/\text{cm}$ [with median, 75th and 90th percentile values of 271, 319 and 377 $\mu\text{S}/\text{cm}$, respectively]. As evident in Figure 9, the RMI surface and dam sediment samples (Gp4) had 'High' $\text{EC}_{1:5}$ values – considerably higher than the $\text{EC}_{1:5}$ values of other coaly and carbonaceous materials (which were broadly similar to the Gp5 spoil samples). The higher salinity/EC values observed in some surface (and dam sediment) coaly and carbonaceous samples were consistent with the brackish salinity / EC observed in dam water from the ED and PWD, and thus may be associated with accumulation of salts from evaporation of water used for dust suppression.

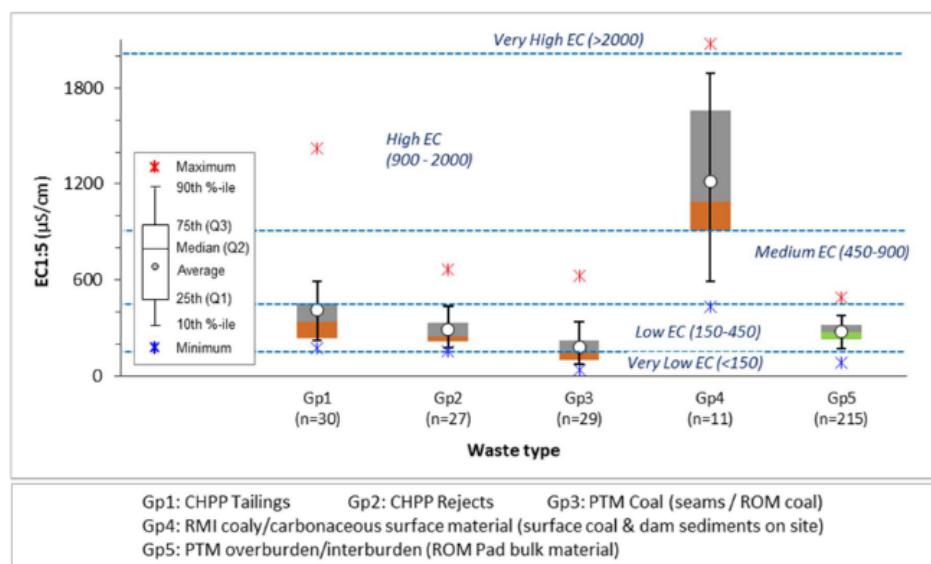


Figure 9: Electrical conductivity (EC) distribution of mineral wastes

The samples generally had pH-neutral to alkaline soil $\text{pH}_{1:5}$ values (Figure 10), classifying all sample groups as 'High' to 'Very High' soil pH. The Gp4 RMI surface samples had slightly lower $\text{pH}_{1:5}$ values compared to the other coaly and carbonaceous materials.

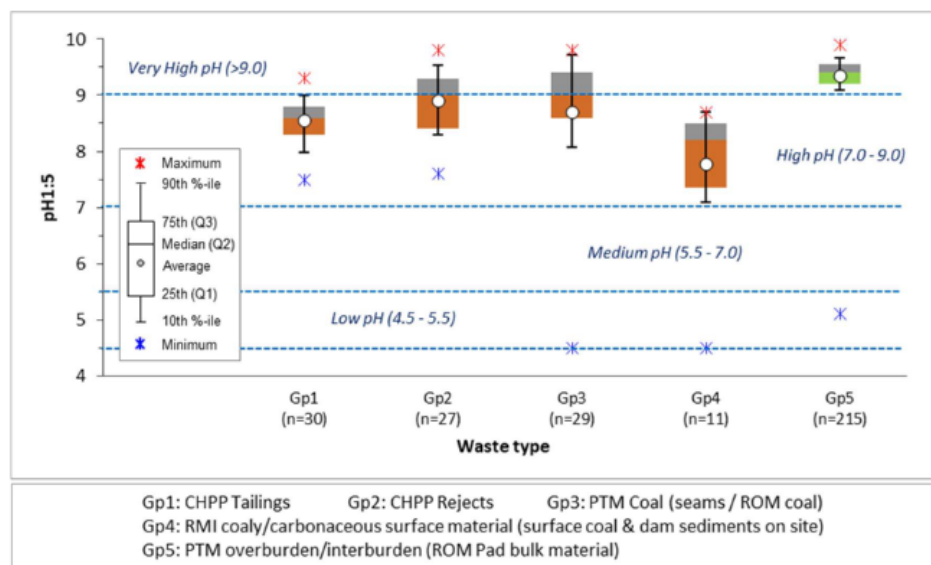


Figure 10: pH distribution of mineral wastes

Soluble Metals and Metalloids

The leach testwork results (Appendix A) show that metals and metalloids are mobilised at low concentration and at values within the range typical for Permian- and Tertiary-age Bowen Basin materials (overburden/interburden and coaly/carbonaceous materials). For most samples, the soluble metals and metalloids are at concentrations below or marginally above the laboratory limit of reporting (LOR), including elements typically highly soluble under pH-neutral to alkaline conditions, such as arsenic (As), manganese (Mn) and selenium (Se).

It is important to note that the soluble metal/metalloid results presented in this report represent an 'assumed worst case' scenario. The leaching was undertaken on a pulped sample – therefore these samples have a very high surface area compared to similar material in the field.

4.4 Cation Exchange Capacity, Sodicity and Dispersion of Potential Landform Cover Material

Potential sodicity and dispersion information is available for 47 spoil (overburden/interburden) samples from PTM – representing bulk material within the ROM pad and haul roads. The data, presented in Appendix A, comprises exchangeable cation concentrations and Emerson Class results.

The cation exchange capacity (CEC) ranges from 3.9 to 18 milliequivalents per 100 grams (meq/100g), with a low median CEC value of 7.8 meq/100g. The exchangeable sodium percentage (ESP) results range from 22% to 59%, with a median ESP of 33%.

To put these results into context, an ESP value of 6% or greater generally indicates that soil material is regarded as sodic and may be prone to dispersion (Isbell, 2002) and soil with an ESP value greater than 14% is regarded as strongly sodic (Northcote and Skene, 1972). However, other important factors such as clay mineralogy, soil sodium concentration, soil salinity and irrigation water (rainwater) chemistry may enhance or limit that potential for soil to be sodic or become sodic over time. Therefore, the sodicity ratings (Appendix A) are a *general guide* only and should not be taken as definitive.

All samples tested have ESP values greater than 14% and are regarded as 'strongly sodic'. As all samples are strongly sodic, mineral waste represented by these samples can be expected to have potential for dispersion.

The same 47 samples also underwent Emerson Aggregate Class tests to determine whether these samples were dispersive. Emerson Aggregate Class tests are a direct measure of soil dispersion, whereas ESP values are used as an indirect measure of the potential for a sample to have structural stability problems and hence may be dispersive.

The results (Appendix A) show that the samples tested were dispersive to varying degrees. Nine samples were classified as 'dispersive' [remoulded dispersion] (Class 3) and the remaining 36 samples had 'some dispersion' [slaking] (Class 2). These results are consistent with the dispersion predictions from the CEC and ESP results.

The results suggest that the ROM pad and haul road bulk material is likely to be strongly sodic, and dispersive to varying degrees – with little distinction between lithology or degree of weathering.

These exchangeable cation (and Emerson Aggregate Class) results are common (if not typical) for Permian and Tertiary sedimentary material in Queensland based on the authors' significant experience in the region, and are expected to be very similar to soils outside the site.

5 Discussion

5.1 AMD Potential

Spoil (ROM pad bulk material)

Spoil, represented by the ROM pad and haul road base, is expected to generate pH-neutral to alkaline contact water (run-off and seepage).

The total S concentration of this material is very low, with a maximum total S concentration of 0.18% (90th percentile = 0.03%). As such, and combined with moderate to high ANC values (median 29 kg H₂SO₄/t), almost all samples of this type were classified as NAF. Two samples (out of 215 samples) had an 'uncertain' classification, however are expected to be NAF and were sub-classified as UC(NAF).

Total metal and metalloid concentrations are generally very low compared to average element abundance in soil in the earth's crust. A small number of samples were enriched in Te with respect to average crustal abundance in soil, however this level of enrichment in Te from a small number of samples is not a cause for concern.

Soluble multi-element results indicate that leachate from spoil material is expected to contain low concentrations of soluble metals and metalloids.

Based on the results, spoil has a negligible potential to generate acid/acidic drainage (AD) and/or NMD. Due to the very low total S (and negligible sulphide) concentrations, the potential for Saline Drainage (SD) (sulphate-derived salinity from sulphide oxidation) is also negligible. Salinity is discussed in Section 5.2.

Spoil material representing ROM pad and haul road bulk material is considered to have a **Low** potential to generate AMD.

Coaly and Carbonaceous Material (coal, tailings, rejects, dam sediments)

Coaly and carbonaceous material, represented by surface materials currently on the ROM pad and product coal stockpile Pad, dam sediments, coarse rejects from the CHPP and tailings from the tailings drying cells and CHPP, are expected to generate pH-neutral to alkaline contact water (run-off and seepage).

These materials have a wide total S distribution – particularly the tailings samples, which have a 90th percentile total S of 1.25% (75th percentile = 1.01%). The other coaly and carbonaceous types (e.g. coal, rejects, surface and sediment materials at RMI) have generally lower total S values, with a combined 75th percentile total S value of 0.36%. The sulphide (as Scr) concentration of these materials was relatively low – typically about 35-40% of the total S concentration.

Based on the results, about 80% of samples were classified as NAF, and 11% classified as NAF-S (i.e. NAF with total S >1%). The remaining 9% of samples were classified as PAF-LC – indicating that the large majority of coaly and carbonaceous materials (as bulk materials) pose limited risk of developing acid drainage.

Total metal and metalloid concentrations are very low compared to average element abundance in soil in the earth's crust. A small number of samples were enriched with respect to one or more of Mo, S and/or Te, however this level of 'enrichment' from only few of samples is not cause for concern.

Soluble multi-element results indicate that leachate from coaly and carbonaceous material is expected to contain low concentrations of soluble metals and metalloids – similar to spoil materials.

Based on the results, a small proportion of coaly and carbonaceous material has a low potential to generate AMD in an uncontrolled and unmitigated environment, such as laboratory conditions. Total S concentrations in all combined coaly/carbonaceous materials (Gp 1 to Gp4) are generally higher than spoil materials, however the total S concentration of combined coaly and carbonaceous materials is still relatively low (median = 0.28%; 75th percentile = 0.51%, which is consistent with the 75th percentile total S concentration for coal from the PTM coal quality database). Due to the low total S concentrations, the potential for Saline Drainage (sulphate-derived salinity from sulphide oxidation) is also low.

All coaly and carbonaceous material (as a bulk material) is considered to have a **Low** potential to generate AMD.

5.2 Salinity, Sodicity and Dispersion Potential

Spoil (ROM pad bulk material)

Overburden/Interburden (spoil) samples from PTM – representing bulk material within the ROM pad and haul road – have $EC_{1.5}$ values ranging from 85 to 493 $\mu S/cm$ [with median and 90th percentile values of 271 and 377 $\mu S/cm$, respectively]. On this basis, spoil is expected to generate low-salinity contact water (run-off and seepage). Due to the very low total S concentrations, the potential for sulphate-derived salinity (from sulphide oxidation) is negligible.

Spoil samples had relatively low CEC values and high ESP values, resulting in all samples being classified as 'strongly sodic' with potential for dispersion. Emerson Aggregate Class testing found all samples to be dispersive or likely to suffer from 'some dispersion'. As such spoil materials are expected to be sodic with potential for dispersion. The management of this material is discussed in Section 7.

Coaly and Carbonaceous Material (coal, tailings, rejects, dam sediments)

Excluding surface and sediment materials sampled in April 2021 (Gp4 materials), all other coaly and carbonaceous materials have relatively low $EC_{1.5}$ values, with median and 90th percentile values of 224 and 468 $\mu S/cm$, respectively. The Gp4 surface samples had a very wide range of $EC_{1.5}$ values, ranging from 434 to 2080 $\mu S/cm$, with no clear distinction between the various surface sample types. The higher salinity/EC values observed in some surface (and dam sediment) coaly and carbonaceous samples were consistent with the brackish salinity /EC observed in dam water from the ED and PWD.

On this basis, most coaly and carbonaceous material has the potential to generate relatively low-salinity contact water (run-off and seepage), however some surface material is more saline and is likely contributing to the brackish water in the ED and PWD. Due to the low total S concentrations, the potential for sulphate-derived salinity (from sulphide oxidation) is low.

5.3 Spontaneous Combustion Potential

No mineral waste materials (representative of ROM pad bulk material or coal and carbonaceous materials) have been assessed for spontaneous combustion potential.

The very low total S (and negligible sulphide) concentration of spoil material (as a bulk material) ensures negligible reactivity. As such, the potential for spontaneous combustion of mineral waste (as a bulk material – representing material requiring rehabilitation at closure) is considered to be negligible.

As discussed in Section 4, coal from PTM has relatively low total S concentrations (75th percentile = 0.50%), therefore any remnant coaly or carbonaceous material would also be expected to have very low potential for spontaneous combustion – especially if mixed within the bulk of non-carbonaceous spoil waste material.

6 AMD Risk Assessment

6.1 Source Hazard Assessment

Spoil (ROM pad bulk material)

While the exact source and composition of the current ROM pad and haul road (bulk material) material is largely unconfirmed, it is known to be at least partially constructed from unweathered Permian spoil from PTM, with potential additional contributions from Millennium Coal Mine. This spoil is considered to be overwhelmingly comprised of non-carbonaceous material. However, to allow for some conservatism, it has been assumed that 5% of the materials stored in the ROM pad base are represented by carbonaceous interburden/overburden. This assumption is supported by the drill-hole logs of the three PTM holes tested for this project, where from a total of 334 m of drilling only 3 m (or 1% of the meterage logged) comprised carbonaceous overburden/interburden, and by the review of over 18,000 m of drilling logs for boreholes located in the proximity of PTM pits highwalls, suggesting that approximately 4% of the stratigraphic units logged were associated with carbonaceous waste.

The ROM pad and Haul Road bulk fill will be used in rehabilitation activities on site (as per RMI Milestones) with the remainder re-shaped in-situ to form a final landform. The hazard scoring and likelihood for AMD generation of this source material (either used as general fill and / or as an in-situ landform) is outlined in Table 7.

The assessment found that the AMD source hazard for general spoil (overburden/interburden) was scored as 'Highly Unlikely' and potential coaly and/or carbonaceous materials associated with the ROM pad base was scored as 'Unlikely'. As such, the ROM pad landform – which is almost entirely comprised of non-carbonaceous general spoil – had an AMD hazard score of '**Highly Unlikely**', with AMD generation from the ROM pad landform rated as '**Highly Unlikely**'.

Should a small proportion of coaly and carbonaceous materials/sediments remain on the surface after rehabilitation is complete – which is plausible – such material would comprise a very small proportion of any final rehabilitated site surface and would not influence the overall geochemical characteristics of the bulk spoil (landform) material.

Table 7. AMD hazard scoring for source materials and likelihood for AMD generation from the final landform

Landform Components	Material quantity (Mbcm)	% of PAF samples* by material type	Vol. of PAF material (Mbcm)	Mass of PAF material (Mt)*	Comment	AMD propensity	AMD capacity rating	AMD quantity rating	AMD source hazard score	Landform domain AMD hazard score	Likelihood for AMD generation from landform
ROM pad bulk material comprised of: General spoil (overburden & interburden)	3.53	0.9% (2 of 215 samples)	0.032	0.044	No PAF samples. Two 'uncertain' samples conservatively assigned as UC(PAF). Total S is very low (75th percentile = 0.02%). Conservatively assumed to comprise at least 95% of all mineral waste at closure.	1 Implausible	1 Low	1 Low	2 Highly unlikely	1.3 Highly Unlikely	Overwhelmingly NAF with very low total S, excess neutralising capacity, low salinity and low soluble metals/metalloids.
Coaly and/or carbonaceous material	0.18	10% (10 of 102 samples)	0.018	0.025	Coaly and carbonaceous overburden has 10 PAF-LC samples. AMD capacity is based on a 75th percentile S value of 0.51%. Assumes all coaly/carb. material is disposed (mixed with) general spoil. Assumes that all sulphur is reactive, which is a conservative approach (testwork suggests that only 40% - median value - of total S is associated with sulphide minerals)	5 Plausible	3 Moderate-Low	1 Low	7 Unlikely		The hazard for AMD generation in spoil is linked to a conservatively assumed 5% proportion of coaly and carbonaceous material mixed in with spoil. The hazard for AMD generation from the final landform: HIGHLY UNLIKELY. The likelihood for AMD generation from the final landform: HIGHLY UNLIKELY.
Total	3.7 *	3.8% (12 of 317 samples)	<0.02	<0.1							

* Conservatively assumes that coaly and carbonaceous material are included in the ROM pad base equating to 5% of the final landform volume.

6.2 Geochemical Source-Pathway-Receptor Assessment

Conceptual Site Model

The conceptual site model for RMI is very simple, reflecting the simple final landform. Rehandled spoil from the current ROM pad and haul road base (pending on contaminated land detailed site assessment) will be used to backfill excavated dams (ED and PWD), backfill the excavated tailings drying cells and generally cover and backfill other site areas as required, with the remainder re-shaped into a final landform.

The source-pathway-receptor (SPR) model for RMI at closure is shown in Figure 11 (CDM Smith, 2021a), based on the nearest environmental receptors to RMI. As mentioned in Section 2.2.6, the nearest potential human health receptors (excluding mine workers at Daunia, PTM and Millennium mines) are located more than 7 km away from RMI and, as such, are 'implausible' as potential receptors.

The source hazard assessment (Section 6.1) found that the ROM pad landform – which is almost entirely comprised of non-carbonaceous general spoil – had an AMD hazard score of '**Highly Unlikely**', with AMD generation from the ROM pad landform rated as '**Highly Unlikely**'. The BHP (2019) Risk Matrix (Table 8) has been adopted to assess the risks associated with SPR.

Table 8: Risk matrix for SPR assessment

Risk Rating = Likelihood x Severity		Severity				
		S1	S2	S3	S4	S5
Likelihood	Highly Likely	Medium	Medium to High	High	High	High
	Likely	Low to Medium	Medium	Medium to High	High	High
	Probable	Low	Low to Medium	Medium	Medium to High	High
	Unlikely	Low	Low	Low to Medium	Medium	Medium to High
	Highly Unlikely	Low	Low	Low	Low to Medium	Medium

In reference to the Risk Matrix (Table 8), the SPR assessment includes the likelihood of the event occurring, the severity of the event (should it occur) and the calculated risk rating (likelihood x severity).

The risk rating for the mineral waste closure landform with respect to each plausible receptor and potential impact mechanism is shown in Table 9, which shows that all receptors are at low risk of environmental impact from mineral waste with respect to AMD (including acid/acidity, NMD and SD) and non-oxidative salinity.

The 'Low' risk rating was assigned with consideration for the following key aspects:

- **Source materials hazard:** The ROM Pad base is comprised predominantly of non-carbonaceous overburden/interburden with an assumed small proportion of coaly and carbonaceous material. Non-carbonaceous overburden/interburden from Tertiary/ Permian-age material in the Bowen Basin is widely recognised as posing a low AMD risk. Operational placement and rehandling of the waste during rehabilitation and reshaping will ensure extensive co-mingling of all waste types. All materials have low EC values, with release of (non-oxidative) salinity rated as a low-hazard. The low total S and excess ANC of the waste results in a 'Highly Unlikely' hazard score for AMD generation (refer above).
- **Pathways:** The closest surface water receptor is located greater than 100 meters away from the final reshaped ROM pad. The water table occurs approximately 20m below the site surface within the unconfined FCCM. Coaly and/or carbonaceous waste facilities (e.g. tailings drying cells) will not be left on site. It is unlikely that any AMD or saline drainage will report to surface water or groundwater pathways.

- Receptors: Receptors identified in this qualitative assessment include ephemeral creeks, the unconfined groundwater aquifer and people living in the homesteads near the project area, of which there are no homesteads located within several kilometers of the site. Due to the geochemical nature of the materials remaining on site, the likelihood of undiluted salinity or AMD (if any) to reach and impact on surface water or groundwater receptors has been rated highly unlikely.
- The overall rating of the Source assessment showed that the risk rating for AMD or salinity to impact receptors is Low, based on:

Hazards: 'Highly Unlikely' for AMD generation and 'Highly Unlikely' for ability to release significant salinity

Pathways: 'Unlikely' to 'Highly Unlikely' for AMD and SD to report to surface water or groundwater pathways

Receptors: 'Highly Unlikely' for pathways to connect receptors to sources of AMD

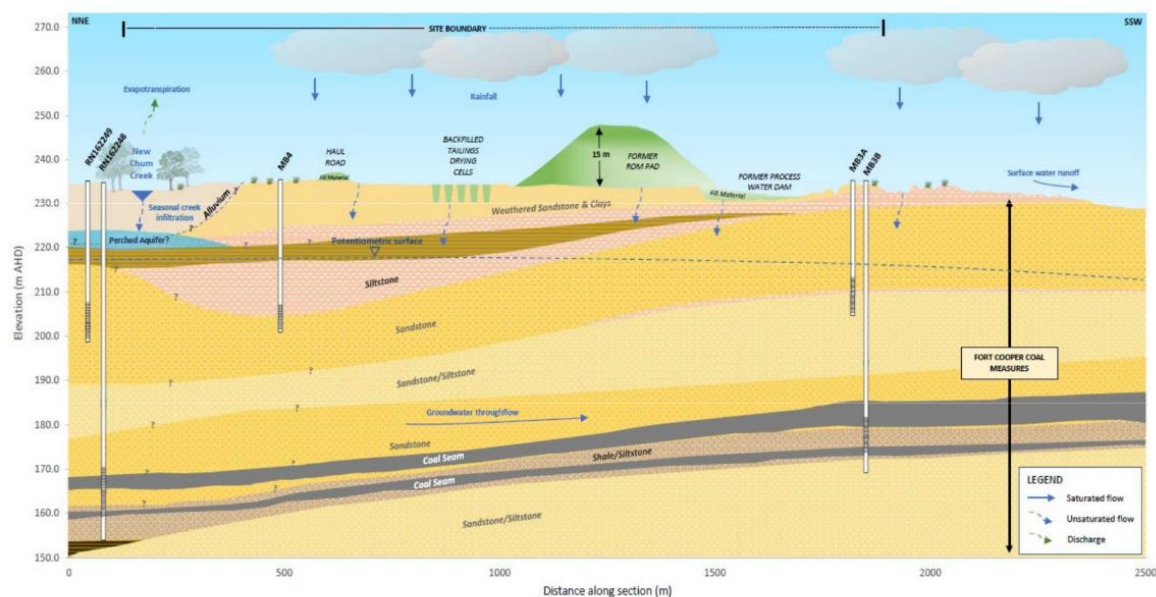


Figure 11: Source-Pathway-Receptor (SPR) conceptual site model at closure
(CDM Smith, 2021a)

Table 9: Source-Pathway-Receptor (SPR) assessment post-closure

Source	Pathway	Receptor	Event (potential harm)	Likelihood of Event	Severity of Event	Risk Rating
General spoil from re-handled and/or in situ reshaped (post-closure) Comprised of predominantly weathered and fresh non-carbonaceous overburden, with 5% carbonaceous waste (assumed) Conservatively assume that some (<5% surface cover) fresh coaly and carbonaceous material may remain as a diffuse surface source. Materials have low EC. AMD source hazard: Highly Unlikely Salinity (non-oxidative) source hazard: Highly Unlikely	Surface water run-off into ephemeral drainages. Distance = 100 m to receptor (north & east) Potential for AMD to enter pathway: Unlikely Potential for salt (non-oxidative) >900 $\mu\text{S}/\text{cm}$ to enter pathway: Unlikely	Ephemeral creek (New Chum Creek @ ML boundary) Potential for AMD to reach receptor: Unlikely Potential for salt (non-oxidative) >900 $\mu\text{S}/\text{cm}$ to reach receptor: Unlikely	Acid/acidic drainage Low pH water impacting surface water Neutral metalliferous drainage Metals impacting surface water Saline drainage (from sulphide oxidation) Salt (sulphate) impacting surface water Saline drainage (non-oxidative) Salt impacting surface water	Unlikely	S1	Low
	Surface water run-off into ephemeral drainages. Distance = 500 m to receptor (southwest) Potential for AMD to enter pathway: Unlikely Potential for salt (non-oxidative) >900 $\mu\text{S}/\text{cm}$ to enter pathway: Unlikely	Ephemeral creek (un-named; southwest of site). Potential for AMD to reach receptor: Unlikely Potential for salt (non-oxidative) >900 $\mu\text{S}/\text{cm}$ to reach receptor: Unlikely	Acid/acidic drainage Low pH water impacting surface water Neutral metalliferous drainage Metals impacting surface water Saline drainage (from sulphide oxidation) Salt (sulphate) impacting surface water Saline drainage (non-oxidative) Salt impacting surface water	Unlikely	S1	Low
	Seepage / percolation into groundwater, including recharge from alluvial aquifer (base of New Chum Creek). Water table approx. 20 m below site surface. Site infrastructure does not intersect water table. Existing coaly and carbonaceous storage facilities will be removed (eg. dam sediments, tailings drying cells) Potential for AMD to enter pathway: Unlikely Potential for salt (non-oxidative) >900 $\mu\text{S}/\text{cm}$ to enter pathway: Unlikely	Groundwater: unconfined aquifer Potential for AMD to reach receptor: Unlikely Potential for salt (non-oxidative) >900 $\mu\text{S}/\text{cm}$ to reach receptor: Unlikely	Acid/acidic drainage Low pH water impacting groundwater Neutral metalliferous drainage Metals impacting groundwater Saline drainage (from sulphide oxidation) Salt (sulphate) impacting surface water Saline drainage Salt impacting groundwater	Unlikely	S1	Low
				Unlikely	S1	Low
				Unlikely	S1	Low
				Unlikely	S1	Low
				Unlikely	S1	Low
				Unlikely	S1	Low
				Unlikely	S1	Low
				Unlikely	S1	Low
				Unlikely	S1	Low
				Unlikely	S1	Low

7 Management and Rehabilitation Measures

The assessment has found that the environmental risks posed by mineral wastes currently on-site at RMI and likely to be present at closure are low. As such, no specific AMD management measures (e.g. compaction, segregation, special handling, alkaline amendment or capping systems) are required to manage mineral waste materials during rehabilitation and closure – other than the measures detailed in the PRCP.

It is noted that coaly and carbonaceous mineral waste is planned to be excavated/removed off-site to neighboring PTM for disposal during decommissioning – leaving the bulk ROM pad base and haul roads to be used for backfilling tailing drying cells and dams, and general site cover material if required. Final rehabilitation requirements will also be supported by a contaminated land detailed site investigation undertaken at the end of the RMI operational life.

Decommissioning and rehabilitation activities related to mineral waste

Proposed mineral waste management and rehabilitation activities of relevance to this waste characterisation report comprise the following actions (subject to an appropriate 'contaminated land' assessment being undertaken at each facility to determine if any excavation/capping/cover required):

- CHPP: Demolish and remove the CHPP. Dispose surface coaly and carbonaceous mineral waste material off-site within spoil at PTM. Cover with suitable soil material, rip then seed;
- Tailings dewatering cells: Excavate remnant tailings from the in-ground tailings dewatering cells and dispose coaly and carbonaceous mineral waste material off site within spoil at PTM. Backfill the former in-ground cells with suitable material, cover with soil, rip then seed;
- ROM pad: Remove/scrape surface coaly and carbonaceous mineral waste from the ROM pad and dispose off-site within spoil at PTM. ROM pad material will be used to provide cover and backfill material for the remainder of the site where required – after which the former ROM pad (final landform) will be reshaped, ripped and seeded.
- Coal Stockpile: Remove/scrape surface coaly and carbonaceous mineral waste material from the Coal Stockpile pad and dispose off-site within spoil at PTM. Cover with suitable soil material, rip and seed.
- PWD: Dewater, then excavate sediment and dispose the sediment off-site within spoil at PTM. Backfill the former PWD with suitable material, cover with soil, rip then seed;
- ED: Dewater, then excavate sediment and dispose the sediment off-site within spoil at PTM. Backfill the former ED with suitable material. Cover with soil, rip then seed;
- Haul Roads and other non-specific mineral waste areas: Remove/scrape coaly and carbonaceous surface mineral waste and dispose off-site within spoil at PTM. Reshape, cover with soil, rip then seed.

Water management

The final landform at RMI will free-drain into drainage channels - predominantly New Chum Creek. The post-closure landform comprises three main surface water catchments:

- North of the rail loop and former ROM pad: sloping towards the east towards New Chum Creek. Approximately 135 ha.
- Within the rail loop and south of the rail loop: sloping south-east towards New Chum Creek. Approximately 115 ha.
- West and south of the former ROM pad: sloping towards the south from the former/rehabilitated ROM pad towards PTM mining areas. Approximately 45 ha.

Post-closure of RMI CHPP operations, the rail loop and load out facility will continue to be utilised by Daunia Mine until completion of operations at Daunia Mine, after which the rehabilitation of the rail loop and load-out facility is scheduled. Upon decommissioning of the rail loop, the fill material and the culvert will be removed from the 100m

buffer zone along New Chum Creek and the disturbed areas rehabilitated to the post mining land uses (PMLUs) of woodland and water course, reinstating pre-operational flow regimes within this area of New Chum Creek.

8 Forward Work Program

The environmental geochemical characterisation and assessment of mineral waste samples outlined in this report is considered to be representative of the mineral waste materials likely to require rehabilitation at closure – including materials currently on site that will be removed off site for disposal. However, BHP will undertake further sampling of likely mineral waste materials (and subsequent characterisation and assessment of those samples) from RMI during decommissioning – to validate the findings of the current assessment, ensure the risks are understood and the management measures are commensurate with the risks. Where required, management measures will be revised and implemented.

9 References

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Appendix A

Results Tables

Table A1: Water quality results – environment dam, process water dam, Tailings Cell Decant

Location:	Environmental Dam	Process Water Dam	Tailings Cell Decant	Location:	Environmental Dam	Process Water Dam	Tailings Cell Decant	Location:	Environmental Dam	Process Water Dam	Tailings Cell Decant
Date:	19-Apr-21	19-Apr-21	19-Apr-21	Date:	19-Apr-21	19-Apr-21	19-Apr-21	Date:	19-Apr-21	19-Apr-21	19-Apr-21
pH	8.31	8.21	8.48	Dissolved elements			Total elements				
EC (µS/cm)	1390	1280	3160	Ag	<0.001	<0.001	<0.001	Ag	<0.001	<0.001	<0.001
TDS	826	750	1800	Al	<0.01	<0.01	0.01	Al	0.21	0.09	0.2
TSS	15	10	49	As	0.006	0.005	0.024	As	0.007	0.006	0.024
Alk [^] - Total	216	236	235	B	0.08	0.05	0.23	B	0.08	0.07	0.25
Alk [^] - HCO ₃	212	236	214	Ba	0.108	0.096	0.102	Ba	0.105	0.093	0.112
Alk [^] - CO ₃	3	<1	21	Be	<0.001	<0.001	<0.001	Be	<0.001	<0.001	<0.001
Alk [^] - OH	<1	<1	<1	Bi	<0.001	<0.001	<0.001	Bi	<0.001	<0.001	<0.001
Acidity	<1	2	<1	Cd	<0.0001	<0.0001	<0.0001	Cd	<0.0001	<0.0001	<0.0001
SO ₄	114	83	345	Co	<0.001	<0.001	0.001	Co	<0.001	<0.001	0.002
Cl	281	254	723	Cr	<0.001	<0.001	<0.001	Cr	<0.001	<0.001	<0.001
F	0.3	0.3	0.6	Cu	0.001	<0.001	0.001	Cu	0.001	<0.001	0.005
Ca	46	54	50	Fe	<0.05	<0.05	<0.05	Fe	0.24	0.10	0.54
Mg	33	34	45	Hg	<0.0001	<0.0001	<0.0001	Hg	<0.0001	<0.0001	<0.0001
Na	212	181	547	Li	0.032	0.026	0.096	Li	0.036	0.026	0.098
K	4	3	8	Mn	<0.001	<0.001	0.002	Mn	0.011	0.02	0.032
NH ₃ as N	<0.01	<0.01	0.09	Mo	0.024	0.02	0.094	Mo	0.033	0.027	0.118
NO ₂ as N	<0.01	<0.01	<0.01	Ni	0.001	<0.001	0.003	Ni	0.001	0.001	0.005
NO ₃ as N	<0.01	<0.01	<0.01	Pb	<0.001	<0.001	<0.001	Pb	<0.001	<0.001	<0.001
NO _x as N	<0.01	<0.01	<0.01	Sb	0.003	0.002	0.007	Sb	0.003	0.002	0.008
TKN	0.2	0.2	0.8	Se	<0.01	<0.01	0.01	Se	<0.01	<0.01	0.01
Total N	0.2	0.2	0.8	Sn	<0.001	<0.001	<0.001	Sn	0.002	<0.001	<0.001
Total P	0.02	0.04	0.07	Sr	1.28	1.18	3.37	Sr	1.22	1.12	3.25
Reactive P	<0.01	0.02	0.01	Th	<0.001	<0.001	<0.001	Th	<0.001	<0.001	<0.001
				Ti	<0.01	<0.01	<0.01	Ti	<0.01	<0.01	<0.01
				Tl	<0.001	<0.001	<0.001	Tl	<0.001	<0.001	<0.001
				U	0.002	0.002	0.006	U	0.002	0.002	0.007
				V	<0.01	<0.01	<0.01	V	<0.01	<0.01	<0.01
				Zn	<0.005	<0.005	0.005	Zn	0.005	<0.005	0.028

All results mg/L except EC (µS/cm) and pH. ^ Alkalinity and acidity as CaCO₃.

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Table A2: Total element concentrations

Group	Weath.	Description	Seam	Sample ID	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge
					mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg
Gp1	Fresh	Tailings		WE12/09/20	0.036	0.39	3.14	<10	128.5	0.43	0.287	3.24	0.059	5.43	2.11	8.83	1.82	28.9	2.71	1.93	0.063
Gp1	Fresh	Tailings		WE06/10/20	0.029	0.4	2.66	<10	494	0.42	0.285	2.07	0.069	7.31	2.49	6.93	1.74	31.3	1.96	1.95	0.071
Gp1	Fresh	Tailings		WE27/10/20	0.035	0.42	3.7	<10	85.2	0.41	0.278	1.95	0.063	7.33	3.11	5.74	2.17	28.3	1.88	1.73	0.057
Gp1	Fresh	Tailings		WE17/11/20	0.021	0.4	2.32	<10	45.7	0.31	0.176	3.13	0.088	6.79	2.68	7.64	0.782	27.1	1.69	1.78	0.078
Gp1	Fresh	Tailings		RMI_WC12_PWT1	0.052	0.49	5.75	<10	182	0.65	0.309	0.37	0.083	9.1	4.04	4.4	3.92	41.3	1.14	1.88	0.035
Gp1	Fresh	Tailings		U/F 9/09/2019	0.056	0.46	3.2	<10	156	0.49	0.193	5.72	0.12	4.95	3.69	6.04	1.26	26.9	2.4	1.96	0.068
Gp1	Fresh	Tailings		U/F 17/09/2019	0.056	0.48	2.59	<10	150	0.44	0.194	3.93	0.104	4.29	3.44	6.19	1.58	31.1	2.24	2.11	0.072
Gp1	Fresh	Tailings		RM11/10 UF	0.023	0.58	3.27	<10	142	0.41	0.177	3.96	0.086	8.98	4.24	5.97	0.85	21.4	3	2.41	0.105
Gp1	Fresh	Tailings		PTM UF 11/12/19	0.035	0.5	3.41	<10	76.5	0.48	0.197	4	0.09	5.43	3.51	4.89	2.15	28.9	1.41	1.795	0.046
Gp1	Fresh	Tailings		RM UF 11/12/19	0.039	0.71	3.51	<10	256	0.67	0.26	2.12	0.077	8.06	5.66	5.25	3.5	31.4	2.17	2.24	0.047
Gp1	Fresh	Tailings		RM17/12/20 UF	0.04	0.59	3.79	<10	850	0.48	0.208	1.68	0.079	8.16	5.34	4.61	2.34	30.1	2.12	1.85	0.042
Gp1	Fresh	Tailings		PTM C1	<0.1	7.68	2.5	<10	164	0.3	0.2	5.20	<0.1	3.2	2.4	4	1	23.2	1.571	1.4	1
Gp2	Fresh	Rejects		WE10/11/20	0.036	0.41	2.69	<10	74.6	0.38	0.182	3.93	0.07	6.81	2.74	7.62	1.07	41	0.87	1.37	0.072
Gp3	Fresh	Coal	L	171773_80.49-81.37m	0.024	0.46	0.47	<10	19.9	0.24	0.112	0.56	0.057	2.72	0.8	2.43	0.111	20.9	0.56	1.495	0.233
Gp3	Fresh	Coal	Carb. Mudstone; coaly	L	171773_82.84-83.03m	0.096	0.34	5.26	<10	201	0.84	0.522	0.1	0.044	2.24	2.41	1.53	3.82	59	0.39	0.783
Gp3	Fresh	Coal	Coal & carb. mudstone	V3	171773_109.02-109.16m	0.058	0.29	0.54	<10	146	0.5	0.249	0.1	0.036	3.21	3.01	1.43	4.84	31.1	0.063	0.306
Gp3	Fresh	Coal	L3	171870_75.3-76.2m	0.029	0.23	0.28	<10	29.3	0.28	0.238	0.13	0.039	3.21	0.663	2.58	1.97	32.8	0.227	0.712	0.054
Gp3	Fresh	Coal	L4	171870_76.31-77.04m	0.027	0.3	0.59	<10	23.6	0.31	0.147	0.31	0.05	7.77	1.958	2.54	1.055	27.7	0.117	0.495	0.112
Gp3	Fresh	Coal; minor carb. clayst.	V1	171870_93.16-94.3m	0.016	0.21	0.21	<10	22.3	0.17	0.081	0.9	0.029	5.62	1.005	3.53	0.201	17.95	2.3	0.618	0.117
Gp3	Fresh	Coal	V2	171870_94.67-95.05m	0.019	0.19	0.21	<10	38.4	0.2	0.151	0.06	0.033	14	2.33	3.75	0.602	24.9	0.34	0.336	0.071
Gp3	Fresh	Coal; minor carb. clayst.	V3	171870_95.55-96.06m	0.027	0.28	2.04	<10	82.3	0.45	0.178	3.64	0.032	14.9	5.38	4.45	0.92	20.9	1.04	0.472	0.053
Gp3	Fresh	Coal	L12	171876_77.48-78.4m	0.013	0.24	0.25	<10	13.3	0.23	0.143	0.38	0.054	2.39	0.545	3.14	0.092	22.2	0.44	1.125	0.113
Gp3	Fresh	Coal	V1	171876_78.44-97.62m	0.089	0.65	1.11	<10	303	0.83	0.278	1.28	0.144	4.51	1.355	1.38	2.27	26.8	0.177	0.895	0.01
Gp3	Fresh	Coal	V1	171876_98.78-99.28m	0.006	0.31	0.23	<10	31.4	0.17	0.065	0.57	0.026	3.85	0.641	1.52	0.198	6.66	5.13	0.971	0.165
Gp3	Fresh	Coal	V3	171876_100.62-101.08m	0.014	0.22	0.13	<10	65	0.24	0.101	2.74	0.022	19.15	4.7	2.63	0.371	8.11	6.79	0.602	0.109
Gp4	Fresh	Coaly and carb.		RMI_WC01_RDM1	0.029	0.39	2.65	<10	79.3	0.33	0.144	0.8	0.054	5.82	4.97	9.72	1.805	24.1	1.07	0.957	0.093
Gp4	Fresh	Coaly and carb.		RMI_WC01_RDM2	0.034	0.51	3.19	<10	144	0.5	0.189	1.61	0.076	5.6	4.97	11	1.615	29	1.44	1.55	0.076
Gp4	Fresh	Coaly and carb.		RMI_WC03_RDM3	0.017	0.31	3.17	<10	171	0.29	0.139	0.8	0.044	5.37	2.83	3.57	0.883	19.95	1.17	1.085	0.102
Gp4	Fresh	Coaly and carb.		RMI_WC04_RDM4	0.011	0.2	0.8	<10	69	0.29	0.098	0.37	0.052	3.41	1.525	4.57	0.388	14.45	0.61	0.83	0.168
Gp4	Fresh	Coaly and carb.		RMI_WC05_RDM5	0.058	0.21	3.22	<10	888	0.39	0.187	0.24	0.071	7.04	2.74	1.78	2.64	29.4	0.31	0.357	0.074
Gp4	Fresh	Coaly & carb., clay, silt		RMI_WC06_PWD1	0.044	1.2	5.88	<10	138	0.91	0.24	1.01	0.076	11.65	14.05	23.4	2.04	39.6	2.85	4.3	0.05
Gp4	Fresh	Coaly & carb., clay, silt		RMI_WC07_PWD2	0.059	0.39	3.97	<10	316	0.44	0.189	0.66	0.076	5.03	6.15	4.82	0.968	28.6	0.91	1.155	0.05
Gp4	Fresh	Coaly and carb.		RMI_WC08_PCstock1	0.016	0.21	1.03	<10	34.1	0.19	0.104	0.44	0.029	3.58	1.68	3.64	0.237	15.4	0.32	0.456	0.11
Gp4	Fresh	Coaly and carb.		RMI_WC09_PCstock2	0.01	0.15	0.56	<10	28.7	0.17	0.092	0.3	0.034	2.04	1.09	1.97	0.211	13.3	0.164	0.424	0.111
Gp4	Fresh	Coaly & carb., clay, silt		RMI_WC10_BD1	0.043	1.16	5.75	10	127.5	0.86	0.277	0.87	0.048	10.55	9.83	17.4	1.655	31	1.92	3.8	0.038
Gp4	Fresh	Coaly & carb., clay, silt		RMI_WC11_BD2	0.046	1.52	6.39	10	141	1.03	0.275	0.77	0.049	11.75	13.6	25.6	2.47	36.6	2.5	5.26	0.043
Gp5	Fresh	Siltstone; minor sandst.		171773_21-21.2m	0.122	10.3	2.71	<10	174	2.29	0.521	0.27	0.027	35.9	18.45	44.9	8.34	44.5	4.5	25.3	0.12
Gp5	Fresh	Claystone		171773_23.6-23.8m	0.079	9.76	2.86	<10	229	2.37	0.402	0.28	0.03	58.5	11.95	48.3	11.25	46	3.97	23.6	0.1
Gp5	Fresh	Sandstone; minor siltst.		171773_28.2-28.4m	0.083	8.57	18.2	<10	185	1.34	0.266	2.51	0.278	46.6	18.95	41.2	3.23	36.2	2.84	17.35	0.09
Gp5	Fresh	Siltstone		171773_33.3-33.7m	0.042	6.12	26.9	<10	125	1.01	0.174	5.85	0.328	41.5	17.65	53.6	2.61	19.59	1.9	13.3	0.15
Gp5	Fresh	Siltstone; minor sandst.		171773_39.5-39.7m	0.083	10.3	2.4	<10	267	2.36	0.612	0.27	0.03	40.4	12.35	43.4	14	42.5	3	28.6	0.14
Gp5	Fresh	Siltstone		171773_51-51.2m	0.078	8.52	28.4	<10	257	2.11	0.332	0.63	0.073	59.1	19.55	48.4	7.16	43	6.04	20.7	0.08
Gp5	Fresh	Sandstone, medium		171773_54.71-54.91m	0.018	0.81	2.94	<10	110.5	0.69	0.11	1.79	0.224	30.5	8.94	10.85	0.927	12.75	2.34	2.92	0.65
Gp5	Fresh	Sandstone, coarse, silty		171773_56.21-56.41m	0.018	0.81	2.94	<10	110.5	0.69	0.11	1.79	0.224	30.5	8.94	10.85	0.927	12.75	2.34	2.92	0.65

Table A2 (cont.): Total element concentrations

Group	Weath.	Description	Seam	Sample ID	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge
					mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg
Gp5	Fresh	Sandst. & siltst.; calcitic		171773_76-28-76.48m	0.059	8.46	18.5		810	1.78	0.263	2.54	0.103	53.5	20.3	79	3.33	30.1	5.77	21	0.07
Gp5	Fresh	Siltstone; with mudst.		171773_78-29-76.36m	0.069	0.73	9.68	<10	73.2	0.88	0.596	0.45	0.095	23.7	8.36	9.63	1.565	56.2	0.47	2.26	0.045
Gp5	Fresh	Sandstone, fine-med.		171773_87.5-87.7m	0.033	7.17	17.75		244	1.22	0.112	2.79	0.058	39.5	16.05	48.1	3.23	18.7	3.71	16	0.09
Gp5	Fresh	Sandstone; some siltst.		171773_101.7-101.93m	0.061	7.64	29		378	1.54	0.171	4.6	0.112	48.3	13.75	52.4	5.88	38.6	5.22	17.35	0.1
Gp5	Fresh	Tuff; partly carb.		171773_103.98-104.18m	0.098	1.03	0.29	<10	319	1.26	0.439	0.25	0.123	3.73	2.02	7.54	4.96	46.2	0.76	2.98	0.021
Gp5	Fresh	Mudstone; clayey bands		171773_105.8-106m	0.154	1.09	16.2	<10	290	1.25	0.614	0.2	0.193	5.18	45.4	9.44	3.97	64.4	1.27	3.29	0.043
Gp5	Fresh	Mudstone; part carb.		171773_108.5-108.7m	0.107	10.3	2.64		590	2.31	0.513	0.21	0.117	60.6	9.24	37.3	19.35	53.2	2.88	25.6	0.11
Gp5	Fresh	Mudstone		171773_109.35-109.43m	0.081	0.99	4.72	<10	380	1.3	0.411	0.24	0.064	4.99	2.05	6.4	7.25	41	0.58	2.87	0.037
Gp5	Fresh	Sandstone & Siltstone		171870_17.29-18.1m	0.092	9.45	3.29		510	1.92	0.288	1.5	0.095	60.1	16.35	64.8	7.45	85.8	3.98	21.4	<0.05
Gp5	Fresh	Sandstone; part clayey		171870_22.66-23.2m	0.068	10.35	2.78		245	2.29	0.309	0.55	0.131	63.8	14.9	56.3	12.55	45.4	4.53	23.8	<0.05
Gp5	Fresh	Siltstone; minor sandst.		171870_30.87-33.92m	0.088	10.85	2.05		255	2.02	0.362	0.77	0.123	60.9	18.4	52.6	7.81	59.9	4.78	21.2	<0.05
Gp5	Fresh	Sandstone, fine		171870_41.99-42.65m	0.068	10.05	2.61		248	1.88	0.319	0.59	0.088	54.9	18.95	57.4	6.89	51.1	4.56	22.3	<0.05
Gp5	Fresh	Siltstone; minor sandst.		171870_45.35-48.23m	0.084	9.77	8.23		308	2.19	0.332	0.53	0.066	63.9	18.35	57.9	7.78	51.3	4.95	21.4	<0.05
Gp5	Fresh	Siltstone; minor sandst.		171870_57.28-58.92m	0.097	10.75	2.55		308	2.06	0.397	1.49	0.126	66	17.3	57.4	7.27	55	4.29	23.8	<0.05
Gp5	Fresh	Siltst.; sandst.; calcite		171870_67.32-69.13m	0.1	10.35	14.3		277	2.14	0.336	1.76	0.138	65.5	17.55	61.9	5.53	57.1	4.29	23.1	<0.05
Gp5	Fresh	Claystone		171870_76.2-76.31m	0.137	0.57	1.03	<10	141	1.13	0.681	0.39	0.065	11.3	2.64	5.55	5.91	72.6	0.45	2.43	0.04
Gp5	Fresh	Sandstone; with siltst.		171870_79.08-81.08m	0.081	10.65	24.4		389	1.99	0.253	0.48	0.174	76.3	21.6	71.2	6.8	59.3	1.5	23.7	<0.05
Gp5	Fresh	Sandstone; with siltst.		171870_85.51-86.36m	0.06	8.48	23.7		379	1.49	0.178	1.13	0.107	49.2	16.55	87.9	5.74	60.1	1.62	18.5	<0.05
Gp5	Fresh	Mudstone		171870_91.77-92.35m	0.113	0.89	17.85	<10	264	1.25	0.477	0.56	0.139	13.85	31.1	7.86	2.95	49.6	3.11	2.75	0.035
Gp5	Fresh	Siltstone		171870_94.3-94.67m	0.135	0.64	12.05	<10	295	1.15	0.546	0.23	0.188	5.79	25.4	4.42	3.74	64.8	1.73	1.535	0.022
Gp5	Fresh	Claystone		171870_96.06-96.2m	0.126	0.98	0.18	<10	293	1.46	0.524	1.39	0.066	6.62	1.96	5.86	2.75	113	1.43	2.79	0.026
Gp5	Weath.	Sandstone, med.-coarse		171876_23.42-23.69m	0.039	6.19	2.51		133	1.14	0.141	7.9	0.381	39.8	13.4	57	2.88	22.7	3.18	13.1	0.12
Gp5	Weath.	Sandstone, medium		171876_24.3-24.5m	0.177	5.66	2.96		164	1.05	0.125	4.02	0.112	44.8	16.45	69.8	2.61	18.3	3.76	12.95	0.08
Gp5	Weath.	Claystone		171876_26.9-27.08m	0.15	8.86	4.27		590	3.05	0.353	0.18	0.012	37	9.84	47.4	16	43.9	3.09	26	0.11
Gp5	Weath.	Sandstone, med.-coarse		171876_27.12-27.35m	0.056	9.24	4.12		640	3.35	0.369	0.34	0.007	40.9	11.55	49	14.6	39.7	3.99	23.5	0.11
Gp5	Fresh	Siltstone; minor sandst.		171876_34-34.2m	0.104	9.18	2.28		180	2.16	0.269	0.15	0.01	52.8	19.5	59.4	6.52	71.2	4.61	22.1	0.1
Gp5	Fresh	Siltst.; minor sandst.		171876_39.8-40m	0.055	9.84	2.84		286	2.45	0.322	0.12	0.045	55.2	9.25	53.9	11.9	38.6	2.59	23.1	0.09
Gp5	Fresh	Sandstone; minor siltst.		171876_43.3-45.5m	0.085	9.95	2.03		199	1.84	0.382	0.77	0.086	53.1	17.25	49.5	5.69	44.6	4.21	22.8	0.11
Gp5	Fresh	Sandstone; minor siltst.		171876_53.52-2m	0.041	6.97	22.1		151	1.17	0.177	3.67	0.28	40.7	16.95	57.3	2.86	23.1	3.26	15.2	0.1
Gp5	Fresh	Sandstone; some siltst.		171876_58.4-58.6m	0.142	11.15	2.9		279	2.37	0.515	0.28	0.013	44.4	15.7	41.2	8.49	52.1	3.63	25.9	0.11
Gp5	Fresh	Siltstone; with sandst.		171876_64-64.2m	0.065	7.38	10.95		247	2.5	0.252	2.32	0.304	63.7	26.5	48.7	4.69	35.9	9.98	16.5	0.16
Gp5	Fresh	Sandstone; with siltst.		171876_69.2-69.4m	0.051	7.06	5.08		233	1.88	0.213	4.9	0.269	52.3	30	54.3	2.79	23.9	9.77	15.7	0.08
Gp5	Fresh	Mudstone		171876_76.8-77m	0.07	14.75	5.78		238	3.09	0.865	0.22	0.091	19.85	7.35	47.5	5.33	53.2	0.73	38.1	<0.05
Gp5	Fresh	Mudstone		171876_81.81-82.04m	0.101	11.5	3.45		480	2.14	0.451	0.13	0.056	37.7	1.445	33.9	15.95	63.7	0.67	30.1	0.05
Gp5	Fresh	Sandstone, med.-coarse		171876_96.08-2m	0.045	7.82	15.95		398	1.38	0.131	1.77	0.089	42.5	19.2	58.4	3.45	23.1	2.26	17.65	0.1
Gp5	Fresh	Sandst.; minor siltst.		171876_99-90.2m	0.019	0.71	19.7	<10	197.5	0.89	0.062	11.55	0.035	14.75	17.25	10.45	0.794	9.32	7.02	1.87	0.049
Gp5	Fresh	Siltstone; minor sandst.		171876_94-94.2m	0.076	8.05	14.85		470	2.06	0.274	0.88	0.108	52.5	13.05	45.4	8.46	50	6.11	19.25	0.16
Gp5	Fresh	Mudstone		171876_100.09-100.35m	0.112	10.45	1.74		740	2.3	0.581	0.2	0.015	45.7	2.17	34.2	35.3	63.7	1.47	27.6	0.11
Gp5	Fresh	Tuff		171876_101.47-101.61m	0.071	10.3	0.28		700	2.87	0.887	1.85	0.078	62.6	1.575	5.2	7.19	4.31	2.68	24.4	0.1
Gp5	Fresh	Carb. Mudstone; coaly		171773_83.91-84.19m	0.076	0.26	4.66	<10	1070	0.76	0.274	0.18	0.094	3.4	2.61	1.1	5.82	46.3	0.052	0.35	0.052
Gp5	Fresh	Carb. Mudstone		171773_103.5-103.8m	0.12	1.39	12.2	<10	277	1.26	0.496	0.33	0.149	15.35	30.9	11.6	3.68	51.8	2.9	4.48	0.047
Gp5	Fresh	Carb. Mudstone; coaly		171870_77.04-77.82m	0.097	0.33	3.34	<10	120.5	0.82	0.415	0.12	0.152	2.82	4.33	3.97	4.27	55.2	0.3	0.613	0.02
Gp5	Fresh	Carb. Siltstone		171876_99.28-99.57m	0.138	0.65	15	<10	399	1.21	0.529	0.25	0.182	4.89	25.7	3.63	3.38	58.7	1.96	1.4	0.012

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Table A2 (cont.): Total element concentrations

Group	Weath.	Description	Seam	Sample ID	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S
					mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	%
Gp1	Fresh	Tailings		WE2/20/20	0.133	0.063	0.054	0.05	1.83	5.8	0.3	390	1.86	0.022	0.031	5.88	0.089	8.51	5.04	0.0005	1.55
Gp1	Fresh	Tailings		WE6/10/20	0.122	0.045	0.036	0.05	2.52	5	0.28	369	1.64	0.044	0.026	5.63	0.091	9.5	4.66	0.0005	0.26
Gp1	Fresh	Tailings		WE27/10/20	0.116	0.055	0.031	0.05	2.71	5.5	0.21	397	3.02	0.033	0.023	5.95	0.04	6.72	5.49	0.0005	0.28
Gp1	Fresh	Tailings		WE17/11/20	0.097	0.048	0.033	0.03	2.33	5.3	0.25	415	1.45	0.032	0.043	6.63	0.071	6.68	2.31	0.0005	0.1
Gp1	Fresh	Tailings		RMI_WC12_PWT1	0.113	0.056	0.041	0.11	3.44	3.9	0.16	189.5	10.25	0.063	0.019	8.43	0.025	13.7	8.9	0.0006	0.03
Gp1	Fresh	Tailings		U/F9/09/2019	0.103	0.066	0.068	0.05	1.74	7.2	0.47	366	1.66	0.026	0.021	7.08	0.066	9.93	4.47	0.0004	0.94
Gp1	Fresh	Tailings		U/F17/09/2019	0.111	0.06	0.058	0.06	1.45	7.3	0.57	311	1.95	0.032	0.03	6.2	0.069	8.82	5.23	0.0005	1.49
Gp1	Fresh	Tailings		RMI11/10 UF	0.125	0.054	0.049	0.04	3.2	8	0.34	534	1.13	0.02	0.027	6.48	0.112	29.2	3.14	0.0004	0.13
Gp1	Fresh	Tailings		PTMUF11/12/19	0.123	0.039	0.052	0.08	2.06	7	0.21	294	5.09	0.031	0.017	8.47	0.034	8.56	6.02	0.0004	0.37
Gp1	Fresh	Tailings		PTMUF11/12/19	0.106	0.055	0.042	0.12	3.09	8	0.32	417	1.48	0.077	0.018	8.58	0.051	11.75	8.78	0.0005	0.07
Gp1	Fresh	Tailings		RMI17/10 UF	0.118	0.041	0.028	0.09	2.92	7.3	0.27	426	1.68	0.043	0.035	7.82	0.034	10.35	6.97	0.0004	0.18
Gp1	Fresh	Tailings		PTM1C1	<1	<0.1	<0.1	0.32	0.8	2.2	0.60	360	1.6	0.04	<0.1	4.3	0.051	14.4	2.7		0.249
Gp2	Fresh	Rejects		WE10/11/20	0.105	0.039	0.029	0.04	2.24	6.6	0.25	244	2.07	0.025	0.041	5.96	0.085	6.92	3.07	0.0007	0.15
Gp3	Fresh	Coal	L	171773_80-45-81.37m	0.09	0.051	0.025	<0.01	0.877	14.9	0.34	27.5	0.24	0.02	0.01	1.1	0.079	0.999	0.007		0.19
Gp3	Fresh	Coal	L	171773_80-44-83.03m	0.19	0.091	0.033	0.05	1.45	5.5	0.04	56	0.06	0.003	0.028	5.06	0.011	1.75	0.0005		0.02
Gp3	Fresh	Coal	L	171773_109-02-109.18m	0.135	0.017	0.021	0.1	1.465	1.6	0.12	162	0.12	0.063	0.039	3.26	0.001	12.25	7.88	0.006	0.02
Gp3	Fresh	Coal	L3	171870_75-376-2m	0.111	0.036	0.025	0.06	1.245	4.1	0.05	29.1	0.36	0.023	0.024	1.49	0.03	7.9	4.75	0.0003	0.03
Gp3	Fresh	Coal	L4	171870_76-317-074m	0.082	0.044	0.011	0.03	3.27	5	0.03	10	0.27	0.024	0.036	2.9	0.121	5.83	2.51	0.0004	0.03
Gp3	Fresh	Coal; minor carb. clast.	V1	171870_93-16-94-3m	0.062	0.018	0.01	0.22	1.21	2.6	0.36	374	1.16	0.025	0.034	1.55	0.014	3.53	1.095	0.0004	0.03
Gp3	Fresh	Coal	V2	171870_94-67-95-05m	0.076	0.019	0.018	0.04	4.7	1.2	0.05	407	0.12	0.019	0.029	3.2	0.003	5.58	2.18	0.0003	0.02
Gp3	Fresh	Coal; minor carb. clast.	V3	171870_95-55-96-06m	0.112	0.02	0.029	0.07	5.22	3.4	0.74	276	0.58	0.057	0.041	5.66	0.005	10.3	3.64	0.0004	0.02
Gp3	Fresh	Coal	V4	171870_96-78-82-4m	0.021	0.024	<0.01	0.01	0.999	4.9	0.06	40	0.07	0.005	0.006	0.076	0.006	6.424	0.001		0.02
Gp3	Fresh	Coal	V1	171870_97-44-97-62m	0.115	0.074	0.05	0.18	1.855	5.3	0.11	65.2	0.71	0.132	0.015	2.85	0.017	15.55	8.84	0.0015	0.02
Gp3	Fresh	Coal	V1	171876_98-78-99-28m	0.041	0.023	0.006	0.02	1.465	3.9	0.32	99.0	0.08	0.022	0.02	0.69	0.03	1.735	0.97	0.0002	0.03
Gp3	Fresh	Coal	V3	171876_100-62-101.08m	0.052	0.021	0.013	0.03	6	4.7	0.49	1685	0.19	0.033	0.023	3.83	0.049	3.56	1.43	0.0004	0.02
Gp4	Fresh	Coal and carb.		RMI_WC01_RM01	0.088	0.029	0.018	0.07	2.54	4.1	0.36	252	4.5	0.136	0.038	13.2	0.027	6.08	5.15	0.0005	0.08
Gp4	Fresh	Coal and carb.		RMI_WC02_RM02	0.093	0.038	0.029	0.08	2.1	5.7	0.33	339	1.97	0.147	0.023	12.65	0.075	7.75	5.27	0.0006	0.13
Gp4	Fresh	Coal and carb.		RMI_WC03_RM03	0.081	0.03	0.022	0.04	1.92	3.6	0.13	308	2.85	0.023	0.028	8.82	0.057	4.92	3.04	0.0005	0.13
Gp4	Fresh	Coal and carb.		RMI_WC04_RM04	0.096	0.035	0.024	0.06	2.06	4.9	0.15	344	2.45	0.027	0.028	14.4	0.057	1.23	3.81	0.0005	0.13
Gp4	Fresh	Coal and carb.		RMI_WC05_RM05	0.111	0.039	0.019	0.07	2.68	1.4	0.07	98.2	0.27	0.063	0.055	4.27	0.017	7.9		0.0005	0.16
Gp4	Fresh	Coal & carb. clay, silt		RMI_WC06_FW01	0.082	0.023	0.039	0.16	4.31	8.3	0.5	324	0.79	0.121	0.056	27.49	0.049	12.55	11.6	0.0004	0.08
Gp4	Fresh	Coal & carb. clay, silt		RMI_WC07_FW02	0.066	0.042	0.029	0.06	1.81	3.1	0.18	157.5	1.53	0.087	0.038	9.65	0.046	8.45	4.43	0.0008	0.23
Gp4	Fresh	Coal and carb.		RMI_WC09_PCT0K1	0.054	0.026	0.016	0.02	1.25	2.7	0.08	62.1	0.83	0.045	0.036	2.83	0.046	4.04	1.195	0.0005	0.07
Gp4	Fresh	Coal and carb.		RMI_WC09_PCT0K2	0.049	0.015	0.013	0.01	0.664	3.2	0.07	18.1	0.59	0.176	0.022	1.49	0.035	3.17	0.947	0.0003	0.29
Gp4	Fresh	Coal & carb. clay, silt		RMI_WC10_B01	0.094	0.023	0.035	0.18	3.84	7.8	0.39	291	1.97	0.108	0.057	20.9	0.047	10.45	11.1	0.0004	0.13
Gp5	Fresh	Siltstone		171773_21-21-2m	0.065	0.035	0.02	0.21	2.31	1.5	0.05	356	0.58	0.036	0.02	1.4	0.005	1.05	0.0005		0.02
Gp5	Fresh	Siltstone		171773_21-21-2m	4.7	0.005	0.007	1.66	14.4	51.4	0.85	29.5	0.23	0.251	0.101	29.5	0.089	28.6	69.4	<0.0004	0.01
Gp5	Fresh	Claystone		171773_23-623-8m	4.47	<0.005	0.073	21.8	28.6	37.8	0.8	286	0.27	0.174	10.65	26	0.043	27.1	133.5	<0.0004	0.01
Gp5	Fresh	Sandstone; minor siltst.		171773_28-228-4m	3.6	0.018	0.055	0.67	21.2	39.8	0.56	1010	0.96	0.533	7.94	24.4	0.044	20.2	28.4	<0.0004	0.01
Gp5	Fresh	Siltstone		171773_33-533-7m	1.72	0.005	0.046	0.74	18.55	26.7	0.38	2320	3.4	0.393	6.72	24.6	0.046	37.3	30.5	<0.0004	0.01
Gp5	Fresh	Siltstone; minor sandst.		171773_39-539-7m	4.47	<0.005	0.077	2.25	18.25	39.4	0.77	173	0.22	0.178	9.4	28.5	0.024	21	125	<0.0004	0.01
Gp5	Fresh	Siltstone		171773_51-51-2m	4.03	<0.005	0.069	1.56	27.2	28.3	1.07	879	0.18	0.366	9.2	31.8	0.092	18.4	90.9	<0.0004	0.01
Gp5	Fresh	Sandstone; siltstone		171773_54-154-91m	1.05	0.005	0.02	0.21	2.31	1.5	0.05	356	0.58	0.036	0.02	1.4	0.005	1.05	0.0005		0.02
Gp5	Fresh	Sandst.; siltst. calciclit.		171773_65-65-3m	3.55	0.007	0.061	1.1	15.6	15.9	1.09	1470	0.12	0.347	7.73	30.9	0.035	36.6	21.4	<0.0004	0.01

Table A2 (cont.): Total element concentrations

Group	Weath.	Description	Seam	Sample ID	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S
					mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	%
Gp5	Fresh	Sandst. & siltst.; calcitic		171773_76.28-76.48m	4.64	0.041	0.068	0.82	25.5	34.4	0.64	973	1.29	0.318	9.69	28.5	0.08	21.3	43.4	<0.0004	0.03
Gp5	Fresh	Siltstone; with mudst.		171773_78.29-78.36m	0.165	0.07	0.076	0.06	9.68	9.2	0.14	160	0.8	0.044	0.05	10.05	0.015	21.7	4.73	<0.0002	0.02
Gp5	Fresh	Sandstone, fine-med.		171773_87.5-87.7m	2.56	0.024	0.039	1.42	18.85	16.9	1.24	791	0.58	1.21	6.04	23.6	0.067	10.35	60.2	<0.0004	0.02
Gp5	Fresh	Sandstone, some siltst.		171773_101.7-101.93m	3.07	0.043	0.053	1.61	22.7	24.2	1.47	1060	0.83	0.834	8.87	28.6	0.085	12.95	72.9	<0.0004	0.02
Gp5	Fresh	Tuff, partly carb.		171773_109.98-104.18m	0.096	0.067	0.059	0.21	1.51	12.4	0.25	54	0.32	0.148	0.006	5.49	0.002	21.2	11.55	<0.0003	0.02
Gp5	Fresh	Mudstone; clayey bands		171773_108.8-106m	0.137	0.139	0.077	0.21	2.16	12.6	0.26	197.5	5.64	0.123	0.009	53	0.003	32	11.4	0.0005	0.12
Gp5	Fresh	Mudstone; part carb.		171773_108.5-108.7m	4.76	0.05	0.075	2.69	27.2	33.8	0.79	299	0.4	0.566	9.44	23.4	0.036	26.4	143.5	<0.0004	0.03
Gp5	Fresh	Mudstone		171773_109.35-109.43m	0.097	0.019	0.046	0.18	2.09	15.4	0.19	40.5	0.15	0.154	0.012	12.2	0.003	15.75	12.35	0.0004	0.01
Gp5	Fresh	Sandstone & Siltstone		171870_17.29-18.1m	4.13	0.005	0.068	1.76	28.9	31.4	0.72	769	0.39	0.241	8.83	37.3	0.037	19.55	101.5	<0.0004	0.02
Gp5	Fresh	Mudstone; part clayey		171870_22.66-23.2m	4.17	<0.005	0.069	1.95	31.2	31.1	0.78	2110	0.41	0.239	8.65	27.1	0.039	28	131	<0.0004	0.01
Gp5	Fresh	Siltstone; minor sandst.		171870_30.87-33.92m	4.36	<0.005	0.068	1.48	29.7	41.1	0.81	775	0.3	0.366	8.82	31.2	0.055	20.2	91.3	<0.0004	0.01
Gp5	Fresh	Sandstone, fine		171870_41.99-42.65m	3.91	0.011	0.065	1.32	26.5	34.9	0.79	793	0.43	0.411	7.9	30.6	0.053	19.95	82.5	<0.0004	0.01
Gp5	Fresh	Siltstone; minor sandst.		171870_45.35-48.23m	4.28	0.005	0.068	1.93	31.7	26.6	0.93	700	0.83	0.434	9.69	36.2	0.085	27.6	112	<0.0004	0.02
Gp5	Fresh	Siltstone; minor sandst.		171870_57.36-58.92m	4.79	0.005	0.069	1.84	32.6	34.2	0.89	741	0.33	0.463	10.05	32.4	0.081	22.3	98.5	<0.0004	0.01
Gp5	Fresh	Siltst.; sandst.; calcite		171870_67.33-69.13m	4.68	0.025	0.071	1.35	31.9	35	0.69	846	0.48	0.287	9.67	34	0.084	22.6	76.1	<0.0004	0.02
Gp5	Fresh	Claystone		171870_76.2-76.31m	0.288	0.06	0.053	0.2	4.34	5.5	0.08	41.2	0.69	0.08	0.044	6.2	0.112	29	13.8	0.0009	0.05
Gp5	Fresh	Sandstone; with siltst.		171870_79.08-81.08m	4.16	0.095	0.082	1.77	35	25.9	0.55	177.5	1.74	0.73	8.79	47.1	0.068	20.2	85.7	0.0005	0.05
Gp5	Fresh	Sandstone, with siltst.		171870_85.51-86.36m	3.22	0.042	0.047	1.91	23.8	12.2	0.71	253	1.46	1.05	6.98	45.9	0.065	16.2	83.3	0.0005	0.03
Gp5	Fresh	Mudstone		171870_91.77-92.35m	0.059	0.114	0.056	0.25	5.28	7.8	0.38	766	2.56	0.128	0.006	40.7	0.043	21.5	11.7	0.0006	0.07
Gp5	Fresh	Siltstone		171870_94.3-94.67m	0.106	0.131	0.061	0.25	2.37	4.8	0.14	255	8.58	0.159	0.007	30.2	0.01	26.3	12.35	0.0005	0.09
Gp5	Fresh	Claystone		171870_96.06-96.2m	0.101	0.042	0.081	0.2	2.22	12.1	0.57	249	1.37	0.172	0.005	7.45	0.012	30	9	0.0006	0.02
Gp5	Weath.	Sandstone, med.-coarse		171876_23.42-23.69m	2.63	<0.005	0.044	0.71	18.2	22	0.45	3580	0.37	0.391	5.95	27	0.082	16.95	41.2	<0.0004	<0.01
Gp5	Weath.	Sandstone, medium		171876_24.3-24.5m	2.62	<0.005	0.036	0.63	20.1	16.8	0.5	1880	0.41	0.473	5.92	25.3	0.057	14.05	36.5	<0.0004	0.01
Gp5	Weath.	Claystone		171876_26.9-27.08m	4.71	<0.005	0.068	1.48	17.6	22.6	0.59	881	0.28	0.128	10.8	20.5	0.015	19.5	158.5	<0.0004	0.02
Gp5	Weath.	Claystone		171876_27.12-27.35m	4.43	<0.005	0.071	1.54	17.75	25.5	0.66	164.5	0.9	0.125	9.89	23.8	0.027	21.4	143.5	<0.0004	0.02
Gp5	Fresh	Siltstone; minor sandst.		171876_34.34-2m	4.14	<0.005	0.059	1.77	26.6	27	0.83	285	0.24	0.352	8.91	34.2	0.027	13.05	104.5	<0.0004	0.01
Gp5	Fresh	Siltst.; minor sandst.		171876_39.8-40m	4.7	<0.005	0.078	2.36	26.7	30.8	0.67	79	0.25	0.235	11.5	27.5	0.018	16.55	142	<0.0004	0.01
Gp5	Fresh	Sandstone; minor siltst.		171876_45.3-45.5m	4.36	0.007	0.078	1.2	25.2	43.9	0.85	537	0.33	0.481	9.33	27.6	0.063	19.75	68.2	<0.0004	0.01
Gp5	Fresh	Sandstone; minor siltst.		171876_52.5-52.2m	3.23	0.009	0.042	0.87	18.65	21.2	0.58	951	0.67	0.522	7.29	27.4	0.058	19.05	40.6	<0.0004	0.01
Gp5	Fresh	Sandstone; some siltst.		171876_58.4-58.6m	4.7	0.015	0.07	1.72	21	48.3	0.79	333	0.26	0.356	9.26	24.9	0.067	14.25	87.4	<0.0004	0.01
Gp5	Fresh	Siltstone; with sandst.		171876_64.64-2m	3.38	0.009	0.055	1.2	29.1	23.2	1.24	3090	0.37	0.345	7.4	30	0.185	28.5	70.3	0.0004	0.03
Gp5	Fresh	Sandstone; with siltst.		171876_69.2-69.4m	3.49	0.014	0.052	0.72	24.7	28	1.1	2310	0.51	0.376	7.55	28.8	0.185	25.8	41	<0.0004	0.01
Gp5	Fresh	Mudstone		171876_76.8-77m	7.7	0.082	0.122	0.6	8.18	168	0.2	56.8	4.12	0.108	19.7	26.5	0.021	31.4	32	<0.0004	0.01
Gp5	Fresh	Mudstone		171876_81.81-82.04m	4.07	0.046	0.08	2.19	31.1	34.1	0.33	301.1	0.5	0.152	10.1	8.66	0.013	16.9	126	<0.0004	0.03
Gp5	Fresh	Sandstone, med.-coarse		171876_86.86-2m	2.82	0.053	0.054	1.71	20.5	13.8	0.91	434	0.64	0.974	6.98	22.1	0.077	13.15	68.7	<0.0004	0.02
Gp5	Fresh	Siltst.; minor sandst.		171876_90.90-2m	0.059	0.022	0.016	0.2	5.83	7.9	2.19	1830	0.45	0.075	0.005	20.9	0.086	6.84	7.34	<0.0002	<0.01
Gp5	Fresh	Sandstone; minor sandst.		171876_94.94-2m	3.4	0.038	0.058	2.03	25.5	19	0.85	1390	0.59	0.552	7.07	27.5	0.098	15.65	97.9	0.0005	0.03
Gp5	Fresh	Mudstone		171876_100.09-100.35m	4.03	0.027	0.073	3.67	23.2	12.3	0.6	99.5	0.35	0.277	8.7	10.15	0.017	19.8	190.5	0.0004	0.04
Gp5	Fresh	Tuff		171876_101.47-101.61m	4.58	0.063	0.046	3.06	33	33.3	1.3	399	0.81	0.293	10.5	7.92	0.01	48.5	108	0.0004	0.03
Gp5	Fresh	Carb. Mudstone; coaly		171773_83.91-84.19m	0.153	0.045	0.03	0.11	1.385	1.4	0.05	14.8	0.41	0.046	0.031	4	0.001	12.1	11.35	0.0011	0.11
Gp5	Fresh	Carb. Mudstone		171773_103.5-103.8m	0.078	0.112	0.059	0.26	5.92	15.8	0.49	651	3.31	0.133	0.007	38.4	0.06	20.6	12.95	0.0004	0.08
Gp5	Fresh	Carb. Mudstone; coaly		171870_77.04-77.82m	0.237	0.048	0.034	0.16	1.335	2.3	0.06	61.3	0.59	0.068	0.055	8.01	0.001	18.2	10.35	0.0011	0.05
Gp5	Fresh	Carb. Siltstone		171876_99.28-99.57m	0.091	0.139	0.065	0.25	2.19	4.1	0.13	319	8.92	0.188	0.004	31.1	0.01	25.6	10.75	0.0005	0.09

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Table A2 (cont.): Total element concentrations

Group	Weath.	Description	Seam	Sample ID	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Gp1	Fresh	Tailings		WE12/09/20	0.379	5.54	0.683	0.7	127	<0.005	0.095	1.51	0.001	0.015	0.504	16	0.758	8.67	29.8	4.28
Gp1	Fresh	Tailings		WE06/10/20	0.24	4.07	0.599	0.67	96.6	<0.005	0.056	1.695	0.001	0.01	0.396	13.1	0.251	6.3	23.1	3.85
Gp1	Fresh	Tailings		WE27/10/20	0.28	3.26	0.413	0.67	95.2	<0.005	0.055	1.735	0.001	0.01	0.388	13	0.236	4.88	19.8	4.02
Gp1	Fresh	Tailings		WE17/11/20	0.18	4.19	0.558	0.45	98.7	<0.005	0.03	1.5	0.001	0.004	0.313	11.3	1.385	6.08	27.5	3.16
Gp1	Fresh	Tailings		RMI_WC12_DWT1	0.292	2.99	0.415	0.47	80.5	<0.005	0.052	1.93	0.001	0.018	0.453	17.2	0.028	3.78	34.1	3.7
Gp1	Fresh	Tailings		U/F9/09/2019	0.813	8.48	0.733	0.8	232	<0.005	0.169	1.635	0.004	0.014	0.79	22.7	0.025	9.99	31.8	4.11
Gp1	Fresh	Tailings		U/F17/09/2019	0.916	6.3	0.743	0.72	183	<0.005	0.168	1.395	0.005	0.007	0.798	22.2	0.08	8.26	30.9	4.19
Gp1	Fresh	Tailings		RMI11/10/UF	0.195	7.51	1.18	0.68	134	<0.005	0.044	2.07	0.009	0.002	0.584	29.2	0.017	10.05	21	4.23
Gp1	Fresh	Tailings		PTM/UF10/11/19	0.216	6.07	0.385	0.4	125.5	<0.005	0.061	1.45	0.001	0.008	0.458	15.4	0.019	7.76	27.6	4.51
Gp1	Fresh	Tailings		RMI UF11/12/19	0.387	4.12	0.522	0.47	182	<0.005	0.052	1.12	0.002	0.011	0.423	18.9	0.029	6.56	44.8	3.57
Gp1	Fresh	Tailings		RMI17/12/20/UF	0.227	2.89	0.411	0.42	173.5	<0.005	0.046	1.72	0.002	0.005	0.39	15.3	0.009	5.16	34.2	3.97
Gp1	Fresh	Tailings		PTM C1	0.4	<1	0.7	0.7	210	<0.5	1.3	0.0018	<0.1	1	15	6	9	24.5	1.8	
Gp2	Fresh	Rejects		WE10/11/20	0.258	4.17	0.343	0.9	153.5	<0.005	0.036	1.48	0.001	0.002	0.426	11.3	2.8	7.89	22.1	4.22
Gp3	Fresh	Coal	L	V1718770_96_401-37m	0.122	2.3	0.212	0.24	43.5	<0.005	0.038	1.19	0.001	<0.001	0.203	10.7	0.005	15.9	11.2	2.06
Gp3	Fresh	Coal	L	V1718770_96_404-83.03m	0.205	1.81	0.758	0.2	119.7	<0.005	0.036	1.19	0.001	0.002	0.203	10.7	0.005	15.9	11.2	2.06
Gp3	Fresh	Coal	coal & carb. mudstone	V1718770_109_023-109.16m	0.23	2.03	0.263	0.3	112.5	<0.005	0.043	1.025	0.001	0.001	0.242	6.7	0.009	1.425	10.5	4.71
Gp3	Fresh	Coal	L3	V1718770_75_3-76.2m	0.093	1.7	0.668	0.33	35.5	<0.005	0.039	1.65	0.001	0.001	0.306	7.1	0.007	3.51	5.7	3.51
Gp3	Fresh	Coal	L4	V1718770_76_31-77.04m	0.071	1.74	0.407	0.19	62.2	<0.005	0.027	1.805	0.001	0.001	0.403	11	0.012	4.67	9.4	2.76
Gp3	Fresh	Coal	minor carb. clayst.	V1718770_91_16-94.3m	0.06	1.385	0.169	0.35	43.6	<0.005	0.014	1.015	0.001	<0.001	0.142	5.4	0.056	2.51	9.7	1.98
Gp3	Fresh	Coal	V2	V171870_94_67-95.05m	0.049	1.61	0.204	0.35	32.8	<0.005	0.024	1.995	0.001	<0.001	0.378	12.2	0.022	4.95	4.7	2.76
Gp3	Fresh	Coal	minor carb. clayst.	V1718770_95_55-96.06m	0.053	2.76	0.408	0.55	24.8	<0.005	0.036	2.45	0.001	<0.001	0.405	12.7	0.018	5.12	25.2	3.62
Gp3	Fresh	Coal	V2	V171876_76_78-82.4m	0.052	1.78	0.26	0.32	31.2	<0.005	0.023	1.98	0.001	<0.001	0.378	12.2	0.022	4.95	4.7	2.76
Gp3	Fresh	Coal	V1	V171876_97_47-62.76m	0.096	3.2	0.346	0.61	254	<0.005	0.089	1.31	<0.001	0.004	0.315	9.7	0.002	3.29	6.4	3.1
Gp3	Fresh	Coal	V1	V171876_98_78-99.28m	0.043	1.415	0.139	0.12	34.8	<0.005	0.012	0.698	0.001	<0.001	0.091	4.6	0.008	3.09	12.4	1.07
Gp3	Fresh	Coal	V171876_100_62-101.08m	0.111	1.935	0.208	0.19	218	<0.005	0.024	1.545	0.001	<0.001	0.342	11.5	0.023	7.2	38.8	19.1	
Gp4	Fresh	Coaly and carb.		RMI_WC01_RM01	0.168	2.4	0.431	0.23	84.5	<0.005	0.031	1.12	0.002	0.003	0.226	13.5	0.013	3.06	21.7	6.99
Gp4	Fresh	Coaly and carb.		RMI_WC02_RM02	0.231	3.66	0.519	0.37	100.5	<0.005	0.04	1.57	0.001	0.002	0.337	16.3	0.038	6.39	31.3	3.42
Gp4	Fresh	Coaly and carb.		RMI_WC03_RM03	0.154	2.72	0.492	0.23	57.9	<0.005	0.034	1.245	0.001	0.001	0.291	10.6	0.011	4.37	17	2.58
Gp4	Fresh	Coaly and carb.		RMI_WC04_RM04	0.186	2.8	0.48	0.18	142.5	<0.005	0.036	1.245	0.001	0.001	0.291	10.6	0.011	4.37	17	2.58
Gp4	Fresh	Coaly and carb.		RMI_WC05_RM05	0.126	1.775	0.396	0.17	48.2	<0.005	0.05	1.22	0.001	0.001	0.282	8.7	0.006	2.63	23.8	3.34
Gp4	Fresh	Coaly & carb., clay, silt		RMI_WC06_FWD1	0.402	6.51	2.81	0.72	94.8	<0.005	0.037	2.88	0.003	0.004	0.542	42.1	0.119	8.19	60.9	3.85
Gp4	Fresh	Coaly & carb., clay, silt		RMI_WC07_PWD02	0.271	3.2	0.842	0.3	155	<0.005	0.046	1.355	0.002	0.004	0.907	15.7	0.029	5.81	29.8	2.85
Gp4	Fresh	Coaly and carb.		RMI_WC08_PCT001	0.105	1.44	0.443	0.14	36.3	<0.005	0.023	0.879	0.003	<0.001	0.217	9.1	0.009	4.01	39.2	1.86
Gp4	Fresh	Coaly and carb.		RMI_WC09_PCT002	0.074	1.03	0.314	0.1	28.1	<0.005	0.02	0.695	0.001	<0.001	0.156	6.8	0.005	3.69	7.7	1.66
Gp4	Fresh	Coaly & carb., clay, silt		RMI_WC10_B01	0.34	5.62	0.684	0.67	158	<0.005	0.037	2.51	0.003	0.017	0.571	37.6	0.018	7.83	90.4	3.69
Gp5	Fresh	Siltstone, minor sandst.		RMI_WC11_B01	0.637	10.9	0.563	0.29	192.5	<0.005	0.037	2.51	0.003	0.017	0.571	37.6	0.018	7.83	90.4	3.69
Gp5	Fresh	Siltstone, minor sandst.		V171773_21-21.2m	0.67	10.9	0.699	2.58	97.2	0.73	0.62	0.529	0.339	0.639	0.5	137.5	1.9	21.5	10.5	147
Gp5	Fresh	Siltstone		V171773_26-28.8m	0.8	19.05	0.75	2.83	103	0.79	0.056	1.26	0.492	0.793	30.1	131.5	19.5	23	83.9	149
Gp5	Fresh	Sandstone, minor siltst.		V171773_28-28.4m	0.97	16.7	0.177	0.88	137	0.56	0.041	8.61	0.484	0.252	2.44	118	1.575	22.6	68.6	140
Gp5	Fresh	Siltstone		V171773_35-53.7m	0.62	12.9	0.079	1.76	155	0.48	0.029	5.79	0.439	0.249	1.81	118.5	1.41	22	46.3	99.4
Gp5	Fresh	Siltstone, minor sandst.		V171773_35-59.7m	0.75	19.5	0.067	2.51	132.5	0.67	0.044	10.25	0.495	0.288	2.41	125.5	1.845	18	77.8	161.5
Gp5	Fresh	Siltstone		V171773_51-51.2m	0.68	19.1	0.061	2.31	131	0.66	0.045	10.2	0.438	0.551	2.73	116	1.84	31.4	108	143
Gp5	Fresh	Sandstone, medium, siltst.		V171773_54-71.84-91m	0.513	9.94	0.016	2.31	385	<0.005	0.013	3.85	0.004	0.042	0.59	28.5	0.009	32.2	9.94	5.07
Gp5	Fresh	Sandstone, siltst. & calcitr		V171773_54-71.84-91m	0.513	9.94	0.016	2.31	385	<0.005	0.013	3.85	0.004	0.042	0.59	28.5	0.009	32.2	9.94	5.07

Table A2 (cont.): Total element concentrations

Group	Weath.	Description	Seam	Sample ID	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Ti	U	V	W	Y	Zn	Zr
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Gp5	Fresh	Sandst. & siltst.; calcitic		171773_76.28-76.48m	0.88	17.8	0.112	2.24	189	0.67	0.042	11.4	0.609	0.297	2.91	148.5	1.88	27.5	100.5	177.5
Gp5	Fresh	Siltstone; with mudst.		171773_78.29-78.36m	0.369	6.08	0.779	0.88	58.4	<0.005	0.115	4.73	0.003	0.011	0.466	21.1	0.001	5.64	36	6.2
Gp5	Fresh	Sandstone, fine-med.		171773_87.5-87.7m	0.63	15.2	0.039	1.45	337	0.41	0.019	6.02	0.412	0.379	1.51	114	0.933	19.8	60.8	97.5
Gp5	Fresh	Sandstone; some siltst.		171773_101.7-101.93m	0.59	13.75	0.183	1.88	397	0.47	0.032	7.09	0.407	0.442	1.9	104.5	1.24	21.2	74.4	114
Gp5	Fresh	Tuff; partly carb.		171773_103.98-104.18m	0.113	3.56	0.449	0.57	275	<0.005	0.059	1.89	0.001	0.033	0.419	15.4	0.001	2.94	71.9	9
Gp5	Fresh	Mudstone; clayey bands		171773_105.8-106m	1.875	5.05	1.115	0.79	225	<0.005	0.11	2.08	0.001	0.031	0.45	23.6	0.006	5.14	104.5	4.79
Gp5	Fresh	Mudstone; part carb.		171773_108.5-108.7m	0.6	18.35	0.48	1.67	421	0.69	0.098	11.65	0.431	0.875	2.9	140.5	1.93	25.8	101	167.5
Gp5	Fresh	Mudstone		171773_109.35-109.43m	0.048	4.55	0.237	0.8	292	<0.005	0.047	2.13	0.001	0.013	0.422	18.1	0.002	3.46	28.9	3.32
Gp5	Fresh	Sandstone & Siltstone		171870_17.29-18.1m	0.7	17.7	0.054	4.89	113	0.69	0.041	10.45	0.486	0.577	2.64	122	4.13	22	89	141.5
Gp5	Fresh	Sandstone; part clayey		171870_22.66-23.2m	0.74	18.95	0.047	2.83	134	0.66	0.043	10.55	0.531	0.825	2.63	127	3.17	25.5	92.8	144.5
Gp5	Fresh	Siltstone; minor sandst.		171870_30.87-33.92m	0.73	18.45	0.074	2.76	141.5	0.67	0.05	10.75	0.561	0.544	2.71	132	2.27	25.9	100.5	154
Gp5	Fresh	Sandstone, fine		171870_41.99-42.65m	0.85	18.45	0.067	3.04	136	0.6	0.045	11.05	0.515	0.534	2.87	123	4.65	22.6	97.6	134
Gp5	Fresh	Siltstone; minor sandst.		171870_45.35-48.23m	1.16	18.95	0.123	3.05	143.5	0.73	0.049	10.85	0.519	0.593	2.63	125	2.39	28.4	102.5	150.5
Gp5	Fresh	Siltstone; minor sandst.		171870_57.26-58.92m	1	19.7	0.066	2.97	184.5	0.73	0.055	11.15	0.593	0.563	3.18	128.5	2.31	27.3	100.5	164.5
Gp5	Fresh	Siltst.; sandst.; calcite		171870_67.32-69.13m	0.79	19.45	0.124	3.23	171	0.75	0.056	11.3	0.562	0.47	2.83	125	2.55	28.6	98.2	162.5
Gp5	Fresh	Claystone		171870_76.3-76.31m	0.409	3.4	1.195	0.5	139	<0.005	0.104	5.98	0.002	0.044	0.497	11.2	0.01	6.96	12.3	10.85
Gp5	Fresh	Sandstone; with siltst.		171870_79.08-81.08m	1.09	20.7	0.216	2.87	298	0.64	0.055	9.15	0.585	0.545	2.45	166.5	3.87	28.9	129	145
Gp5	Fresh	Sandstone; with siltst.		171870_85.51-86.36m	0.76	16.2	0.106	3.47	317	0.51	0.04	7.24	0.476	0.522	1.88	152.5	8.35	22.5	87	110.5
Gp5	Fresh	Mudstone		171870_91.77-92.35m	0.659	4.68	0.554	0.62	222	<0.005	0.1	2.55	0.001	0.023	0.355	22	0.011	7.73	83.2	2.32
Gp5	Fresh	Siltstone		171870_94.3-94.67m	0.565	4.64	0.898	0.64	249	<0.005	0.095	2.28	<0.001	0.019	0.476	14.5	0.008	6.99	95.6	3.38
Gp5	Fresh	Claystone		171870_96.06-96.2m	0.092	4.97	0.39	1.35	319	<0.005	0.054	4.33	0.001	0.014	0.751	23.2	0.002	4.67	45.9	3.27
Gp5	Weath.	Sandstone, med.-coarse		171876_23.42-23.69m	0.47	12	0.077	1.6	161.5	0.43	0.034	6	0.353	0.215	1.51	109.5	1.2	19	51.4	96.2
Gp5	Weath.	Sandstone, medium		171876_24.3-24.5m	0.61	11.8	0.054	1.6	121.5	0.42	0.028	6.28	0.347	0.189	1.7	104.5	1.21	17.95	58.2	94.3
Gp5	Weath.	Claystone		171876_26.9-27.08m	0.93	18.75	0.053	2.63	100.5	0.77	0.042	10.5	0.531	1.02	2.12	129	2.03	16.75	58.3	170.5
Gp5	Weath.	Claystone		171876_27.12-27.35m	0.92	17.9	0.048	2.56	118	0.71	0.041	8.97	0.495	0.996	2.4	123.5	2.04	21.1	70.6	157.5
Gp5	Fresh	Siltstone; minor sandst.		171876_34.54-2m	0.72	19	0.045	2.35	110	0.65	0.041	9.58	0.479	0.567	2.43	112	1.52	20.5	96.2	144.5
Gp5	Fresh	Siltst.; minor sandst.		171876_39.8-40m	0.9	18.4	0.071	3.07	123.5	0.84	0.057	12.2	0.521	0.795	2.8	146.5	2.11	20.3	62.9	164
Gp5	Fresh	Sandstone; minor siltst.		171876_45.3-45.5m	0.68	19.2	0.059	2.31	131	0.67	0.054	11.65	0.554	0.425	2.39	128.5	1.86	22	103	156
Gp5	Fresh	Sandstone; minor siltst.		171876_52.82-2m	1.71	14.1	0.205	1.85	176.5	0.53	0.03	7.97	0.439	0.283	1.85	107.5	1.4	21.4	67.3	115.5
Gp5	Fresh	Sandstone; some siltst.		171876_58.4-58.6m	0.76	19.8	0.086	2.41	160	0.66	0.085	11	0.541	0.713	2.76	138	1.885	21.1	96.5	165
Gp5	Fresh	Siltstone; with sandst.		171876_64.64-2m	0.69	19.65	0.166	1.75	170.5	0.54	0.042	9.04	0.413	0.397	2.43	115	1.47	39.9	136	131.5
Gp5	Fresh	Sandstone; with siltst.		171876_69.2-69.4m	0.49	20.2	0.097	1.64	226	0.51	0.031	8.86	0.455	0.244	2.35	120	1.4	40.9	119	138
Gp5	Fresh	Mudstone		171876_76.8-77m	1.12	19.35	0.522	5.63	118	1.47	0.126	20.4	0.793	0.36	5.13	124	3.31	16.75	77.4	277
Gp5	Fresh	Mudstone		171876_81.81-82.04m	0.62	14.25	0.378	3.02	260	0.8	0.106	11.95	0.539	0.826	2.62	97.2	1.87	13.1	23.5	151.5
Gp5	Fresh	Sandstone, med.-coarse		171876_86.86-2m	0.6	14.2	0.043	1.57	328	0.47	0.02	6.77	0.503	0.498	1.63	121	1.14	18.85	109.5	103
Gp5	Fresh	Sandst.; minor siltst.		171876_90.90-2m	0.138	5.73	0.025	0.19	639	<0.005	0.01	2.58	0.001	0.055	0.288	34.5	0.021	8.01	27.3	3.82
Gp5	Fresh	Siltstone; minor sandst.		171876_94.94-2m	0.51	16.23	0.221	1.74	298	0.51	0.062	8.23	0.403	0.575	2.12	123.5	1.38	24.6	73.8	121.5
Gp5	Fresh	Mudstone		171876_100.09-100.35m	0.49	15.1	0.671	2.89	458	0.69	0.095	12.15	0.442	1.31	2.82	104.5	2.63	19.2	14.1	145
Gp5	Fresh	Tuff		171876_101.47-101.61m	0.2	4.44	0.245	5.07	595	1.31	0.015	25.6	0.157	0.644	7.33	15.8	1.815	25.8	32.9	110.5
Gp5	Fresh	Carb. Mudstone; coaly		171773_83.91-84.19m	0.094	2.62	0.226	0.24	120.5	<0.005	0.046	1.11	0.001	0.014	0.236	5.2	0.007	1.87	41.4	4.99
Gp5	Fresh	Carb. Mudstone		171773_103.5-103.8m	0.872	5.16	0.501	0.63	244	<0.005	0.103	3.08	0.001	0.034	0.385	32.5	0.009	8.67	98.9	2.91
Gp5	Fresh	Carb. Mudstone; coaly		171870_77.04-77.82m	0.214	2.67	0.289	0.35	96.1	<0.005	0.066	1.01	0.002	0.024	0.286	6.9	0.015	1.175	31.1	8.74
Gp5	Fresh	Carb. Siltstone		171876_99.28-99.57m	1.295	4.53	0.884	0.55	301	<0.005	0.098	2.45	<0.001	0.022	0.449	14.6	0.011	5.65	76.5	2.78

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Table A3: Soluble major ions, pH, electrical conductivity and metal/metalloid concentrations in water extracts

Group	Weath.	Description	Sample ID	pH	EC	Alk. Total	Alk. HCO3	Alk. CO3	Acidity	Sol. SO4	Sol. Cl	Sol. F	Sol. Ca	Sol. Mg	Sol. Na	Sol. K	Sol. Al	Sol. As	Sol. B	Sol. Ba	Sol. Be	Sol. Bi	Sol. Cd	Sol. Co
Gp1	Fresh	Tailings	WE 22/09/20	7.5	785	4510	4510	<1.0	18.2	504	12		159	38	15	2	<0.02	<0.002	<0.2	0.02	<0.002	<0.002	<0.002	<0.002
Gp1	Fresh	Tailings	WE 06/10/20	8.5	245	4310	4250	61.3	<1.0	64	22	0.3	9	6	39	3	<0.02	<0.002	<0.2	0.057	<0.002	<0.002	<0.002	<0.002
Gp1	Fresh	Tailings	WE 27/10/20	8.7	235	4820	4790	30.7	<1.0	63	23	0.29	6	4	45	3	0.02	0.005	<0.2	0.09	<0.002	<0.002	<0.002	<0.002
Gp1	Fresh	Tailings	WE 17/11/20	8.7	224	4520	4400	123	<1.0	51	33	0.2	7	4	47	2	0.07	<0.002	<0.2	0.063	<0.002	<0.002	<0.002	<0.002
Gp1	Fresh	Tailings	Reject Thick 22/2 DS	8.3	325	2960	2960	<1		130	16		36	12	28	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	Tailings V1	8.8	220	5100	5060	36		36	18		8	6	44	<2		<0.02	<0.2	0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	Poitrel Tailings Q4FY17	8.3	284	2600	2600	<1		84	16		28	12	26	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_Tail_Q1FY18	8.2	420	2220	2220	<1		140	56		34	14	64	2		0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_Tail_Q2FY18	8.4	273	366	348	17.6		96	4		20	8	34	2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_CHPPTA	8.6	365	812	794	18.2		120	20		12	10	60	2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_CHPPTA	8.7	306	6120	6080	35.4		60	26		8	6	46	2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_CHPPTA	8.5	569	3820	3800	17.2		176	52		20	14	80	2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_CHPPTA	8.4	254	2000	2000	<1		68	12		22	8	18	4		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_CHPPTA	7.9	564	616	616	<1		230	24		56	22	42	4		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_CHPPTA	8.6	463	5000	5000	<1		130	58		22	12	54	4		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_CHPPTA	9.0	441	308	308	<0.2		112	62		16	10	64	2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_CHPPTA	8.8	399	596	596	<1		90	44		14	6	56	2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	PTM_VS_PWE_CHPPTA	8.9	174	584	566	17.2		16	12		6	2	24	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp1	Fresh	Tailings	U/F 17/09/2019	7.7	997	7100	7100	<1	55.6	482	24	0.196	152	32	48	8	<0.02	<0.002	<0.2	0.012	<0.002	<0.002	<0.002	<0.002
Gp1	Fresh	Tailings	RM UF 11/12/19	9.0	483	2820	2740	68.6	<1	62	54	0.55	14	4	94	6	0.02	0.008	<0.2	0.118	<0.002	<0.002	<0.002	<0.002
Gp1	Fresh	Tailings	RML_WC12_DWT1	8.2	1420	62	52	9	<1	19	31	0.2	<1	<1	52	1	0.03	0.032	<0.05	0.042	<0.001	<0.001	<0.0001	<0.001
Gp2	Fresh	Rejects	Plant Reject L13	9.1	163	132.6	107.6	25		48	8		6	4	30	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	Reject V1	9.6	247	3380	3320	72		24	10		<2	<2	58	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	Poitrel Reject Q4FY17	8.2	456	702	702	<1		198	8		46	18	32	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_Rej_Q1FY18	8.4	389	414	404	10.8		156	4		28	12	32	2		0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_Rej_Q2FY18	8.3	663	1934	1934	<1		224	80		44	16	86	4		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_CHPPRJ	9.5	404	420	384	36.4		100	20		<2	<2	78	2		0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_CHPPRJ	8.8	562	1054	1054	<1		258	14		68	18	34	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_CHPPRJ	9.2	307	892	842	51.6		64	20		4	<2	58	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_CHPPRJ	9.8	335	324	272	52.4		48	18		<2	<2	74	<2		0.12	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_CHPPRJ	8.4	202	87.6	87.6	<1		58	12		10	6	28	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_CHPPRJ	9.6	218	120.8	120.8	<1		20	14		<2	<2	48	<2		0.1	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_CHPPRJ	9.0	238	21.6	21.6	<0.2		68	22		10	4	44	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_CHPPRJ	8.9	333	228	224	3.6		116	14		10	4	56	2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	PTM_VS_PWE_CHPPRJ	9.4	151	188.8	188.8	<1		16	20		4	<2	44	<2		<0.02	<0.2	<0.2	<0.02	<0.02	<0.02	<0.02
Gp2	Fresh	Rejects	WE 10/11/20	8.4	214	8030	8000	30.7	<1.0	86	10	0.2	20	7	31	4	<0.02	<0.002	<0.2	0.019	<0.002	<0.002	<0.002	<0.002

Table A3 (cont.): Soluble major ions, pH, electrical conductivity and metal/metalloid concentrations in water extracts

[illegible]

All results mg/L except EC ($\mu\text{S}/\text{cm}$) and pH. Alkalinity and acidity as CaCO_3 .

Table A3 (cont.): Soluble major ions, pH, electrical conductivity and metal/metalloid concentrations in water extracts

Group	Wash	Description	Seam	Sample ID	pH	EC	Alk. Total	Alk. HCO3	Alk. CO3	Acidity	Sol. Ca	Sol. Cl	Sol. F	Sol. Ca Mg	Sol. Na	Sol. K	Sol. Al	Sol. Si	Sol. B	Sol. Ba	Sol. Sr	Sol. Cd	
Gp3	Fresh	Coal	L	171773_78-49-81.37m	8.6	143	306	245	<1.0	<1.0	3.0	3.2	<1	<2	43	3	0.02	<0.002	<0.023	<0.002	<0.002	<0.002	
Gp3	Fresh	Carb. Mudstone; coaly	L	171773_78-84-83.03m	9.2	181	180	162	18	<4.0	4.0	11	<2	<2	43	3	0.1	0.161	<0.009	<0.002	<0.002	<0.002	
Gp3	Fresh	Coal & carb. mudstone	V3	171773_109-02-109.16m	9.7	196	144	904	53.6	<1.0	4	3	<2	27	22	0.38	0.016	<0.003	<0.002	<0.002	<0.002		
Gp3	Fresh	Coal	L	171870_75-3-76.2m	4.5	272	74	74	<1	<1	34	14	<2	5	21	2	0.02	<0.002	<0.081	<0.002	<0.002	<0.002	
Gp3	Fresh	Coal	L4	171870_76-37-77.04m	4.5	160	23	23	<1	<1	617	17	<2	<2	17	2	0.04	0.008	<0.046	<0.002	<0.002	<0.002	
Gp3	Fresh	Coal; minor carb. clayst.	V1	171870_93-16-94.3m	8.5	72	567	567	<1	<1	2	8	<2	<2	22	2	0.08	<0.002	<0.057	<0.002	<0.002	<0.002	
Gp3	Fresh	Coal	V2	171870_94-67-95.05m	8.4	82	182	182	<1	<1	3	7	<2	<2	22	2	0.13	0.004	<0.002	<0.002	<0.002	<0.002	
Gp3	Fresh	Coal; minor carb. clayst.	V8	171870_95-55-96.06m	9.7	197	7780	7780	54	<1	4	7	<2	<2	54	3	0.23	0.046	<0.044	<0.002	<0.002	<0.002	
Gp3	Fresh	Coal	L12	171876_78-49-48m	8.9	112	549	549	54	<1.0	<2	27	7	<2	30	2	0.06	<0.002	<0.039	<0.002	<0.002	<0.002	
Gp3	Fresh	Coal	V1	171876_97-77-87.62m	9.8	339	720	684	36	<1.0	5	4	<2	<2	72	5	0.33	0.025	<0.018	<0.002	<0.002	<0.002	
Gp3	Fresh	Coal	V1	171876_98-76-89.28m	9.1	70	873	855	18	<1.0	2	8	<2	6	25	3	0.08	<0.002	<0.049	<0.002	<0.002	<0.002	
Gp3	Fresh	Coal	V3	171876_100-62-101.08m	9.4	138	1020	989	18	<1.0	18	1	<2	<2	32	3	0.08	<0.002	<0.049	<0.002	<0.002	<0.002	
Gp4	Fresh	Coaly and carb.	RML_WC02_ROM2	8.3	1160	46	46	<1	<1	252	329	0.3	35	22	244	8	0.03	0.007	0.5	0.139	<0.001	<0.001	
Gp4	Fresh	Coaly and carb.	RML_WC02_ROM2	8.4	1500	116	116	<1	<1	2	220	364	0.3	54	21	254	11	0.01	0.005	0.1	0.09	<0.001	<0.001
Gp4	Fresh	Coaly and carb.	RML_WC03_ROM3	8.6	2080	42	42	<1	<1	<1	259	546	0.3	35	18	373	7	0.05	0.006	0.08	0.138	<0.001	<0.001
Gp4	Fresh	Coaly and carb.	RML_WC04_ROM4	4.5	1890	3	3	<1	<1	9	1020	26	0.4	217	102	75	1	0.38	<0.001	0.18	0.075	<0.001	<0.001
Gp4	Fresh	Coaly and carb.	RML_WC05_ROM5	8.7	589	42	42	<1	<1	<1	120	72	0.4	14	6	95	6	0.05	0.013	0.07	0.074	<0.001	<0.001
Gp4	Fresh	Coaly & carb, clay, silt	RML_WC06_PWD1	8.7	872	96	96	<1	<1	<1	132	98	0.8	11	10	138	10	0.03	0.004	0.1	0.039	<0.001	<0.001
Gp4	Fresh	Coaly & carb, clay, silt	RML_WC07_PWD2	7.1	1090	77	77	<1	<1	3	379	74	0.6	65	34	121	6	<0.01	<0.001	0.08	0.035	<0.001	<0.001
Gp4	Fresh	Coaly and carb.	RML_WC08_PtCStock1	7.3	434	65	65	<1	<1	2	163	23	0.4	29	14	68	2	0.02	<0.001	<0.05	0.018	<0.001	<0.001
Gp4	Fresh	Coaly and carb.	RML_WC09_PtCStock2	7.4	1820	29	29	<1	<1	2	1570	13	0.2	232	71	356	4	<0.01	<0.001	0.05	0.05	<0.001	<0.001
Gp4	Fresh	Coaly & carb, clay, silt	RML_WC10_ED1	8.2	971	78	78	<1	<1	1	288	77	0.6	34	16	101	11	0.01	0.002	0.12	0.068	<0.001	<0.001
Gp4	Fresh	Coaly & carb, clay, silt	RML_WC11_ED3	8.9	692	89	89	<1	<1	1	103	67	0.7	37	21	117	12	0.03	0.002	0.12	0.068	<0.001	<0.001
Gp5	Fresh	Siltstone; minor sandst.	RML_WC12_2m	9.6	290	576	450	126	<1.0	<1.0	24	<2	<2	83	1	0.1	0.02	<0.002	<0.002	<0.002	<0.002		
Gp5	Fresh	Claystone	171773_23-6-33.8m	9.2	363	810	702	108	<1.0	<1.0	21	<2	<2	68	14	0.16	<0.002	<0.002	<0.002	<0.002	<0.002		
Gp5	Fresh	Sandstone; minor siltst.	171773_28-2-28.4m	9.4	283	3690	3580	108	<1.0	<1.0	14	<2	<2	52	5	0.23	0.234	<0.002	<0.002	<0.002	<0.002		
Gp5	Fresh	Siltstone	171773_33-3-33.7m	9.6	240	9350	9180	170	<1.0	<1.0	7	<2	<2	45	4	0.23	0.555	<0.003	<0.002	<0.002	<0.002		
Gp5	Fresh	Siltstone; minor sandst.	171773_39-5-39.7m	9.6	271	666	630	36	<1	<1	<2	<2	<2	48	5	0.18	<0.002	<0.003	<0.002	<0.002	<0.002		
Gp5	Fresh	Siltstone	171773_51-51.2m	9.5	238	315	297	18	<1.0	<1.0	3	10	<2	<2	46	5	0.23	0.013	<0.009	<0.002	<0.002	<0.002	
Gp5	Fresh	Sandstone, medium	171773_54-71.54.91m	9.5	105	44200	44000	170	<1.0	<1.0	3	5	<2	<2	36	6	0.16	0.024	<0.002	<0.002	<0.002	<0.002	
Gp5	Fresh	Sandst. & siltst.; calcitic	171773_65-65.2m	9.5	222	792	756	36	<1.0	<1.0	8	<2	<2	44	5	0.2	0.289	<0.013	<0.002	<0.002	<0.002		
Gp5	Fresh	Sandst. & siltst.; calcitic	171773_76-76.28.4m	9.4	118	3420	3400	18	<1.0	<1.0	17	8	<2	<2	41	5	0.16	0.201	<0.081	<0.002	<0.002	<0.002	
Gp5	Fresh	Siltstone; fine-med.	171773_78-29.736m	9.2	209	450	432	18	<1.0	<1.0	14	8	<2	<2	44	2	0.07	0.122	<0.028	<0.002	<0.002	<0.002	
Gp5	Fresh	Sandstone, finest.	171773_87-5-87.7m	9.7	315	360	342	18	<1.0	<1.0	18	<2	<2	67	4	0.17	0.295	<0.012	<0.002	<0.002	<0.002		
Gp5	Fresh	Siltstone; coarse siltst.	171773_101-7-101.29m	9.6	200	6800	6800	170	<1.0	<1.0	16	<2	<2	72	3	0.17	0.12	<0.002	<0.002	<0.002	<0.002		
Gp5	Fresh	Tuff, partly calc.	171773_93-98-104.18m	9.4	163	738	720	18	<1.0	<1.0	10	<2	<2	31	2	0.34	0.007	<0.003	<0.002	<0.002	<0.002		
Gp5	Fresh	Mudstone; clayw/haus	171773_105-10-106m	9.0	173	333	315	18	<1.0	<1.0	51	8	<2	<2	38	2	0.18	0.184	<0.003	<0.002	<0.002	<0.002	

All results mg/l, except EC ($\mu\text{S}/\text{cm}$) and pH. Alkalinity and acidity as CaCO_3 .

Table A3 (cont.): Soluble major ions, pH, electrical conductivity and metal/metalloid concentrations in water extracts

Group	Weath.	Description	Seam	Sample ID	pH	EC	Alk. Total	Alk. HCO ₃	Alk. CO ₃	Acidity	Sol. SO ₄	Sol. Cl	Sol. F	Sol. Ca	Sol. Mg	Sol. Na	Sol. K	Sol. Al	Sol. As	Sol. B	Sol. Ba	Sol. Be	Sol. Bi	Sol. Cd
Gp5	Fresh	Mudstone; part carb.		171773_108.5-108.7m	9.5	168	152	98.8	53.6	<1.0	13	6		<2	<2	46	<2	0.26	0.028	<0.2	0.006	<0.002	<0.002	<0.002
Gp5	Fresh	Mudstone		171773_109.35-109.43m	9.5	118	531	513	18	<1.0	9	5		<2	<2	24	<2	0.66	0.314	<0.2	0.004	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone & Siltstone		171870_17.29-18.1m	9.2	346	1510	1480	36	<1	18	13		<2	<2	74	9	0.13	0.007	<0.2	0.022	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone; part clayey		171870_22.66-23.2m	9.6	329	2140	2070	72	<1	4	17		<2	<2	71	7	0.09	0.008	<0.2	0.004	<0.002	<0.002	<0.002
Gp5	Fresh	Siltstone; minor sandst.		171870_30.87-33.92m	9.5	301	3510	3440	72	<1	2	10		<2	<2	68	6	0.18	<0.002	<0.2	0.009	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone, fine		171870_41.99-42.65m	9.4	273	4300	4230	72	<1	8	8		<2	<2	52	5	0.16	0.007	<0.2	0.01	<0.002	<0.002	<0.002
Gp5	Fresh	Siltstone; minor sandst.		171870_45.35-48.23m	9.3	249	738	666	72	<1	6	10		<2	<2	50	6	0.23	0.077	<0.2	0.007	<0.002	<0.002	<0.002
Gp5	Fresh	Siltstone; minor sandst.		171870_57.26-58.92m	9.4	287	2270	2160	108	<1	3	9		<2	<2	57	7	0.14	0.016	<0.2	0.022	<0.002	<0.002	<0.002
Gp5	Fresh	Siltst.; sandst.; calcite		171870_67.32-69.13m	9.2	283	4770	4680	90	<1	10	12		<2	<2	54	8	0.12	0.094	<0.2	0.021	<0.002	<0.002	<0.002
Gp5	Fresh	Claystone		171870_76.2-76.31m	5.4	345	119	119	<1	417	80	11		4	2	61	11	0.12	<0.002	0.2	0.159	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone; with siltst.		171870_79.08-81.08m	8.2	295	810	774	36	<1	30	13		<2	<2	59	5	0.12	0.321	<0.2	0.002	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone, with siltst.		171870_85.51-86.36m	9.7	345	2000	1890	108	<1	17	10		<2	<2	74	7	0.31	0.935	<0.2	0.028	<0.002	<0.002	<0.002
Gp5	Fresh	Mudstone		171870_91.77-92.35m	9.5	394	1170	1100	72	<1	49	9		<2	<2	84	7	0.15	0.432	<0.2	0.045	<0.002	<0.002	<0.002
Gp5	Fresh	Siltstone		171870_94.3-94.67m	9.3	338	666	648	18	<1	43	7		<2	<2	71	3	0.24	0.34	<0.2	0.013	<0.002	<0.002	<0.002
Gp5	Fresh	Claystone		171870_96.06-96.2m	9.6	493	8100	7990	108	<1	23	9		<2	<2	106	4	0.23	0.006	<0.2	0.035	<0.002	<0.002	<0.002
Gp5	Weath.	Sandstone, med.-coarse		171876_23.42-23.69m	9.2	230	36400	36200	170	<1.0	4	14		3	<2	43	7	0.11	0.002	<0.2	<0.002	<0.002	<0.002	<0.002
Gp5	Weath.	Sandstone, medium		171876_24.3-24.5m	9.2	221	15600	15500	170	<1.0	4	20		3	<2	40	4	0.08	<0.002	<0.2	<0.002	<0.002	<0.002	<0.002
Gp5	Weath.	Claystone		171876_26.9-27.08m	9.2	271	684	630	54	<1.0	20	41		<2	<2	75	12	0.06	<0.002	<0.2	0.008	<0.002	<0.002	<0.002
Gp5	Weath.	Claystone		171876_27.12-27.35m	9.0	396	1170	1100	72	<1.0	25	30		<2	<2	75	19	0.08	0.002	<0.2	0.022	<0.002	<0.002	<0.002
Gp5	Fresh	Siltstone; minor sandst.		171876_34-34.2m	9.1	164	540	504	36	<1.0	2	16		<2	<2	34	5	0.33	<0.002	<0.2	<0.002	<0.002	<0.002	<0.002
Gp5	Fresh	Siltst.; minor sandst.		171876_39.4-40m	9.3	127	3910	3740	170	<1.0	<2	11		<2	<2	25	4	0.41	0.003	<0.2	<0.002	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone; minor siltst.		171876_45.3-45.5m	9.4	266	250	2380	170	<1.0	<2	11		<2	<2	56	8	0.23	<0.002	<0.2	0.004	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone; minor siltst.		171876_52-52.2m	9.4	234	10200	10000	170	<1.0	7	8		<2	<2	43	10	0.3	0.257	<0.2	0.005	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone; some siltst.		171876_58.4-58.6m	9.2	163	996	900	36	<1.0	5	13		<2	<2	34	3	0.32	0.012	<0.2	0.002	<0.002	<0.002	<0.002
Gp5	Fresh	Siltstone; with sandst.		171876_64-64.2m	9.5	255	2660	2560	108	<1.0	8	7		<2	<2	50	11	0.26	0.107	<0.2	0.007	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone; with siltst.		171876_69.2-69.4m	9.3	236	10000	9960	170	<1.0	5	5		<2	<2	45	9	0.27	0.01	<0.2	0.016	<0.002	<0.002	<0.002
Gp5	Fresh	Mudstone		171876_76.8-77m	8.8	241	576	540	36	<1.0	9	14		<2	<2	66	3	0.04	0.022	<0.2	0.024	<0.002	<0.002	<0.002
Gp5	Fresh	Mudstone		171876_81.81-82.04m	8.9	97	693	657	36	<1.0	9	12		<2	<2	21	2	0.51	0.038	<0.2	0.003	<0.002	<0.002	<0.002
Gp5	Fresh	Sandstone, med.-coarse		171876_86-86.2m	9.6	328	630	594	36	<1.0	17	10		<2	<2	79	9	0.29	0.345	<0.2	0.024	<0.002	<0.002	<0.002
Gp5	Fresh	Sandst.; minor siltst.		171876_90-90.2m	9.5	323	24600	24500	170	<1.0	11	5		<2	<2	70	14	0.14	0.048	<0.2	0.034	<0.002	<0.002	<0.002
Gp5	Fresh	Siltstone; minor sandst.		171876_94-94.2m	9.6	274	972	900	72	<1.0	12	6		<2	<2	59	7	0.28	0.267	<0.2	0.011	<0.002	<0.002	<0.002
Gp5	Fresh	Mudstone		171876_100.09-100.35m	9.6	390	576	522	54	<1.0	18	10		<2	<2	71	6	0.17	0.019	<0.2	0.011	<0.002	<0.002	<0.002
Gp5	Fresh	Tuff		171876_101.47-101.61m	9.8	462	1850	1640	216	<1.0	3	8		<2	<2	108	8	0.22	0.004	<0.2	0.028	<0.002	<0.002	<0.002
Gp5	Fresh	Carb. Mudstone; coaly		171773_83.91-84.19m	9.7	230	207	189	18	<1.0	28	9		<2	<2	48	<2	0.13	0.234	<0.2	0.035	<0.002	<0.002	<0.002
Gp5	Fresh	Carb. Mudstone		171773_103.5-103.8m	9.3	229	450	432	18	<1.0	34	10		<2	<2	47	4	0.21	0.151	<0.2	0.005	<0.002	<0.002	<0.002
Gp5	Fresh	Carb. Mudstone; coaly		171870_77.04-77.82m	5.1	304	70	70	<1	517	61	8		2	<2	49	8	0.1	0.006	<0.2	0.145	<0.002	<0.002	<0.002
Gp5	Fresh	Carb. Siltstone		171876_99.28-99.57m	9.4	228	684	630	54	<1.0	54	8		<2	<2	55	4	0.21	0.397	<0.2	0.007	<0.002	<0.002	<0.002

All results mg/L except EC ($\mu\text{S}/\text{cm}$) and pH. Alkalinity and acidity as CaCO₃.

Table A3 (cont.): Soluble major ions, pH, electrical conductivity and metal/metalloid concentrations in water extracts

Group	Weath.	Description	Seam	Sample ID	Sol. Co	Sol. Cr	Sol. Cu	Sol. Fe	Sol. Hg	Sol. Mn	Sol. Mo	Sol. Ni	Sol. P	Sol. Pb	Sol. Sb	Sol. Se	Sol. Sn	Sol. Sr	Sol. Th	Sol. Ti	Sol. U	Sol. V	Sol. Zn	Sol. Zr
Gp3	Fresh	Coal	L	171773_80.49-81.37m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.011	0.014	<0.002	<2	<0.002	<0.002	<0.02	<0.02	0.6	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp3	Fresh	Carb. Mudstone; coaly	L	171773_82.84-83.03m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.002	0.124	<0.002	<2	<0.002	0.003	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp3	Fresh	Coal & carb. mudstone	V3	171773_109.02-109.16m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.002	0.009	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp3	Fresh	Coal	L3	171870_75.3-76.2m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.036	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	0.3	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp3	Fresh	Coal	L4	171870_76.31-77.04m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.008	<0.002	<0.002	<2	<0.002	0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp3	Fresh	Coal; minor carb. clayst.	V1	171870_33.16-34.3m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.002	0.008	<0.002	<2	<0.002	<0.002	<0.02	<0.02	0.4	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp3	Fresh	Coal	V2	171870_34.67-35.05m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.002	0.017	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.02	<0.010	<0.01
Gp3	Fresh	Coal; minor carb. clayst.	V3	171870_35.55-36.06m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.002	0.023	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp3	Fresh	Coal	L12	171876_78-78.4m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.002	0.015	<0.002	<2	<0.002	<0.002	0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp3	Fresh	Coal	V1	171876_97.44-97.62m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.002	0.044	<0.002	<2	<0.002	0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.08	<0.010	<0.01
Gp3	Fresh	Coal	V1	171876_98.78-99.28m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.002	0.004	<0.002	<2	<0.002	<0.002	<0.02	<0.02	0.3	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp3	Fresh	Coal	V3	171876_100.62-101.08m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.002	0.011	<0.002	<2	<0.002	<0.002	<0.02	<0.02	0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp4	Fresh	Coaly and carb.	RMI_WC01_ROM1		<0.001	<0.001	<0.001	<0.05	<0.0001	0.012	0.045	<0.001	<1	<0.001	0.004	<0.02	<0.001	1.96	0.001	<0.01	<0.001	<0.01	0.008	<0.001
Gp4	Fresh	Coaly and carb.	RMI_WC02_ROM2		<0.001	<0.001	0.001	<0.005	<0.0001	0.062	0.078	<0.001	<1	<0.001	0.002	0.01	<0.001	2.16	0.001	<0.01	<0.001	0.01	0.01	<0.001
Gp4	Fresh	Coaly and carb.	RMI_WC03_ROM3		<0.001	0.002	0.002	<0.05	<0.0001	0.006	0.066	<0.001	<1	<0.001	0.002	0.01	<0.001	1.91	0.001	<0.01	<0.001	<0.01	0.009	<0.001
Gp4	Fresh	Coaly and carb.	RMI_WC04_ROM4		0.01	<0.001	0.003	0.29	<0.0001	2.24	<0.001	0.005	<1	<0.001	<0.001	<0.01	<0.001	3.29	0.001	<0.01	<0.001	<0.01	0.087	<0.001
Gp4	Fresh	Coaly and carb.	RMI_WC05_ROM5		<0.001	<0.001	<0.001	<0.05	<0.0001	0.004	0.027	<0.001	<1	<0.001	0.002	0.01	<0.001	0.838	0.001	<0.01	<0.001	<0.01	<0.005	<0.001
Gp4	Fresh	Coaly & carb., clay, silt	RMI_WC06_PWD1		<0.001	0.001	0.017	<0.05	<0.0001	0.01	0.124	0.002	<1	<0.001	0.003	0.04	<0.001	2.113	0.001	<0.01	0.002	<0.01	0.011	<0.001
Gp4	Fresh	Coaly & carb., clay, silt	RMI_WC07_PWD2		<0.001	0.001	0.001	<0.05	<0.0001	0.132	0.006	<0.001	<1	<0.001	0.001	<0.01	<0.001	1.12	0.001	<0.01	<0.001	<0.01	<0.005	<0.001
Gp4	Fresh	Coaly and carb.	RMI_WC08_PCSctock1		<0.001	0.002	0.002	<0.05	<0.0001	0.045	0.013	<0.001	<1	<0.001	<0.001	<0.01	<0.001	0.297	0.001	<0.01	<0.001	<0.01	<0.005	<0.001
Gp4	Fresh	Coaly and carb.	RMI_WC09_PCSctock2		<0.001	0.001	0.002	<0.05	<0.0001	0.224	0.004	0.001	<1	<0.001	<0.001	<0.01	<0.001	2.7	0.001	<0.01	<0.001	<0.01	0.006	<0.001
Gp4	Fresh	Coaly & carb., clay, silt	RMI_WC10_ED1		<0.001	0.004	0.008	<0.05	<0.0001	0.041	0.024	0.001	<1	<0.001	0.002	<0.01	<0.001	0.899	0.001	<0.01	0.002	<0.01	0.006	<0.001
Gp4	Fresh	Coaly & carb., clay, silt	RMI_WC11_ED2		<0.001	0.002	0.011	<0.005	<0.0001	0.039	0.033	0.002	<1	<0.001	0.003	<0.01	<0.001	1.1	<0.001	<0.01	0.003	<0.01	0.009	<0.001
Gp5	Fresh	Siltstone; minor sand.	171773_21-21.2m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Claystone	171773_23.6-23.8m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Sandstone; minor siltst.	171773_28.2-28.4m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.007	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Siltstone	171773_33.5-33.7m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Siltstone; minor sandst.	171773_39.5-39.7m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Siltstone	171773_51.5-51.2m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Sandstone, medium	171773_71.75-74.91m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Sandst. & siltst., calcitic	171773_85.65-82m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.008	<0.002	<2	<0.002	0.011	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Fresh	Sandst. & siltst., calcitic	171773_76.28-76.48m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.034	<0.002	<2	<0.002	0.004	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Fresh	Siltstone; with mudst.	171773_78.29-78.36m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.04	<0.002	<2	<0.002	0.003	0.05	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Sandstone, fine-med.	171773_87.5-87.7m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.012	<0.002	<2	<0.002	0.004	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Fresh	Sandstone; some siltst.	171773_101.1-101.93m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.022	<0.002	<2	<0.002	0.005	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Tuff, partly carb.	171773_103.98-104.18m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.035	<0.002	<2	<0.002	0.003	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.05	<0.010	<0.01
Gp5	Fresh	Mudstone; clayev bands	171773_105.8-106m		<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.953	<0.002	<2	<0.002	0.053	0.06	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01

Table A3 (cont.): Soluble major ions, pH, electrical conductivity and metal/metalloid concentrations in water extracts

Group	Weath.	Description	Seam	Sample ID	Sol. Co	Sol. Cr	Sol. Cu	Sol. Fe	Sol. Hg	Sol. Mn	Sol. Mo	Sol. Ni	Sol. P	Sol. Pb	Sol. Sb	Sol. Se	Sol. Sn	Sol. Sr	Sol. Th	Sol. Ti	Sol. U	Sol. V	Sol. Zn	Sol. Zr
Gp5	Fresh	Mudstone; part carb.		171773_108.5-108.7m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.038	<0.002	<2	<0.002	0.003	0.03	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Fresh	Mudstone		171773_109.35-109.43m	<0.002	0.004	<0.002	<0.2	<0.00010	<0.002	0.012	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.09	<0.010	<0.01
Gp5	Fresh	Sandstone & Siltstone		171870_17.29-18.1m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.02	<0.010	<0.01
Gp5	Fresh	Sandstone; part clayey		171870_22.66-23.2m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Siltstone; minor sandst.		171870_30.87-33.92m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Sandstone, fine		171870_41.99-42.65m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Siltstone; minor sandst.		171870_45.35-48.23m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.01	<0.002	<2	<0.002	0.003	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.02	<0.010	<0.01
Gp5	Fresh	Siltstone; minor sandst.		171870_57.26-58.92m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Siltst.; sandst.; calcite		171870_67.32-69.13m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.004	<0.002	<2	<0.002	0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.02	<0.010	<0.01
Gp5	Fresh	Claystone		171870_76.2-76.31m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.025	<0.002	<0.002	<2	<0.002	0.003	<0.02	0.03	0.5	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Fresh	Sandstone; with siltst.		171870_79.08-81.08m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.112	<0.002	<2	<0.002	0.014	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.02	<0.010	<0.01
Gp5	Fresh	Sandstone; with siltst.		171870_85.51-86.36m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.029	<0.002	<2	<0.002	0.009	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.08	<0.010	<0.01
Gp5	Fresh	Mudstone		171870_91.77-92.35m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.328	<0.002	<2	<0.002	0.042	0.04	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Siltstone		171870_94.3-94.67m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.876	<0.002	<2	<0.002	0.061	0.06	<0.02	<0.2	<0.002	<0.02	<0.002	0.05	<0.010	<0.01
Gp5	Fresh	Claystone		171870_96.06-96.2m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.12	<0.002	<2	<0.002	0.004	0.03	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Weath.	Sandstone, med.-coarse		171876_23.42-23.69m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.004	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Weath.	Sandstone, medium		171876_24.3-24.5m	<0.002	<0.002	<0.002	<0.2	<0.00010	0.003	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Weath.	Claystone		171876_26.9-27.08m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Weath.	Claystone		171876_27.12-27.35m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Fresh	Siltstone; minor sandst.		171876_34.24-34.2m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Siltst.; minor sandst.		171876_39.8-40m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.06	<0.010	<0.01
Gp5	Fresh	Sandstone; minor siltst.		171876_45.3-45.5m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Sandstone; minor siltst.		171876_52.52-52.2m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.006	<0.002	<2	<0.002	0.006	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Sandstone; some siltst.		171876_58.4-58.6m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	<0.002	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Siltstone; with sandst.		171876_64.4-64.2m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.002	<0.002	<2	<0.002	0.003	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Sandstone; with siltst.		171876_69.2-69.4m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.004	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Fresh	Mudstone		171876_76.8-77m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.067	<0.002	<2	<0.002	0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.02	<0.010	<0.01
Gp5	Fresh	Mudstone		171876_81.81-82.04m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.01	<0.002	<2	<0.002	0.003	<0.02	<0.02	<0.2	<0.002	0.03	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Sandstone, med.-coarse		171876_86-86.2m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.016	<0.002	<2	<0.002	0.004	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.07	<0.010	<0.01
Gp5	Fresh	Sandst.; minor siltst.		171876_90-90.2m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.014	<0.002	<2	<0.002	0.004	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Fresh	Siltstone; minor sandst.		171876_94-94.2m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.028	<0.002	<2	<0.002	0.004	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.04	<0.010	<0.01
Gp5	Fresh	Mudstone		171876_100.09-100.35m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.022	0.003	<2	<0.002	0.003	0.04	<0.02	<0.2	<0.002	<0.02	<0.002	0.06	<0.010	<0.01
Gp5	Fresh	Tuff		171876_101.47-101.61m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.069	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	0.006	<0.02	<0.010	<0.01
Gp5	Fresh	Carb. Mudstone; coaly		171773_83.91-84.19m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.042	<0.002	<2	<0.002	<0.002	<0.02	<0.02	<0.2	<0.002	<0.02	<0.002	0.03	<0.010	<0.01
Gp5	Fresh	Carb. Mudstone		171773_103.5-103.8m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	0.541	<0.002	<2	<0.002	0.024	0.03	<0.02	<0.2	<0.002	<0.02	<0.002	0.05	<0.010	<0.01
Gp5	Fresh	Carb. Mudstone; coaly		171870_77.04-77.82m	0.002	<0.002	<0.002	<0.2	<0.00010	0.027	<0.002	<0.002	<2	<0.002	0.002	<0.02	<0.02	0.3	<0.002	<0.02	<0.002	<0.02	<0.010	<0.01
Gp5	Fresh	Carb. Siltstone		171876_99.28-99.57m	<0.002	<0.002	<0.002	<0.2	<0.00010	<0.002	1.13	<0.002	<2	<0.002	0.047	0.06	<0.02	<0.2	<0.002	<0.02	<0.002	0.06	<0.010	<0.01

All results mg/L except EC ($\mu\text{S}/\text{cm}$) and pH. Alkalinity and acidity as CaCO_3 .

Table A4: Exchangeable cations and Emerson Aggregate Class test results in potential landform cover material

Group	Weath.	Description	Sample ID	pH	EC	Exch. Acidity	Exch. Al	Exch. Ca	Exch. Mg	Exch. K	Exch. Na	CEC	ESP	Sodicity Rating	Emerson Class No. & Description
				pH	uS/cm			meq/100g					%		
Gp5	Weathered	Sandstone, med.-coarse	171876_23.42-23.69m	9.2	234			2.6	3.0	<0.2	1.7	7.5	23.2	strongly sodic	3 Dispersion
Gp5	Weathered	Sandstone, medium	171876_24.3-24.5m	9.2	223			2.0	1.8	<0.2	1.2	5.1	24.6	strongly sodic	3 Dispersion
Gp5	Weathered	Claystone	171876_26.9-27.08m	9.1	402			3.8	7.8	0.3	4.2	16.1	25.8	strongly sodic	2 Slaking. Some dispersion
Gp5	Weathered	Claystone	171876_27.12-27.35m	9.0	422			4.0	7.8	0.4	4.7	16.9	27.7	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Siltstone; minor sandst.	171773_21-21.2m	9.3	284			1.5	5.2	0.4	4.7	11.8	39.5	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Claystone	171773_23.6-23.8m	9.4	360			0.8	4.0	0.4	3.7	8.9	41.3	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Sandstone; minor siltst.	171773_28.2-28.4m	9.6	280			1.1	2.7	0.2	2.2	6.2	35.0	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Siltstone	171773_33.5-33.7m	9.8	238			2.0	2.8	0.3	3.2	8.3	38.3	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Siltstone; minor sandst.	171773_39.5-39.7m	9.7	265			4.0	4.3	0.5	4.1	12.8	31.6	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Siltstone	171773_51-51.2m	9.7	235			2.1	2.3	0.4	2.2	6.9	31.1	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Sandstone, medium	171773_54.71-54.91m	9.6	192			2.0	1.4	<0.2	1.0	4.6	22.4	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Sandst. & siltst.; calcitic	171773_65-65.2m	9.7	223			2.2	2.0	0.3	1.7	6.2	27.2	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Sandst. & siltst.; calcitic	171773_76.28-76.48m	9.5	217			1.9	1.6	0.2	1.4	5.0	27.0	strongly sodic	3 Dispersion
Gp5	Fresh	Siltstone; with mudst.	171773_78.29-78.36m	9.3	209			1.4	1.1	<0.2	1.4	3.9	35.7	strongly sodic	3 Dispersion
Gp5	Fresh	Sandstone, fine-med.	171773_87.5-87.7m	9.9	318			2.6	1.8	0.2	2.6	7.2	35.2	strongly sodic	3 Dispersion
Gp5	Fresh	Sandstone; some siltst.	171773_101.7-101.93m	9.5	364			3.2	1.6	0.3	3.9	9.0	43.2	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Mudstone; part carb.	171773_108.5-108.7m	9.9	156			3.7	1.3	0.5	6.8	12.3	55.2	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Mudstone	171773_109.35-109.43m	9.4	125			2.8	0.9	0.3	5.7	9.8	58.3	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Sandstone & Siltstone	171870_17.29-18.1m	9.0	384			1.3	2.7	0.2	2.1	6.4	33.4	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Sandstone; part clayey	171870_22.66-23.2m	9.2	369			1.8	2.9	0.3	2.4	7.4	32.1	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Siltstone; minor sandst.	171870_30.87-33.92m	9.1	333			2.0	1.8	0.2	2.0	6.1	32.7	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Sandstone, fine	171870_41.99-42.65m	9.2	280			1.9	1.3	<0.2	1.5	4.9	29.9	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Siltstone; minor sandst.	171870_45.35-48.23m	9.1	270			2.5	1.5	0.2	2.0	6.3	31.8	strongly sodic	2 Slaking. Some dispersion
Gp5	Fresh	Siltstone; minor sandst.	171870_57.26-58.92m	9.2	312			2.8	1.5	0.2	2.0	6.6	30.8	strongly sodic	2 Slaking. Some dispersion

Table A4 (cont.): Exchangeable cations and Emerson Aggregate Class test results in potential landform cover material

Group	Weath.	Description	Sample ID	pH	EC	Exch. Acidity	Exch. Al	Exch. Ca	Exch. Mg	Exch. K	Exch. Na	CEC	ESP	Sodicity Rating	Emerson Class No. & Description	
				pH	uS/cm			meq/100g					%			
Gp5	Fresh	Siltst.; sandst.; calcite	171870_67.32-69.13m	9.1	292			2.0	1.2	0.2	1.4	4.8	29.3	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Claystone	171870_76.2-76.31m	5.2	380	<0.1	<0.1	3.6	2.1	0.3	1.8	7.8	22.6	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Sandstone; with siltst.	171870_79.08-81.08m	8.5	311			2.4	1.2	0.2	2.0	5.8	35.4	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Sandstone, with siltst.	171870_85.51-86.36m	9.4	375			2.4	1.1	0.2	2.1	5.8	36.2	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Mudstone	171870_91.77-92.35m	9.2	431			3.2	1.4	0.3	3.1	7.9	38.8	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Siltstone	171870_94.3-94.67m	9.0	341			2.3	0.8	0.3	3.8	7.1	52.9	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Claystone	171870_96.06-96.2m	9.3	502			2.6	0.9	0.3	3.5	7.2	48.0	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Siltstone; minor sandst.	171876_34-34.2m	9.2	177			3.5	4.3	0.5	3.4	11.6	29.5	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Siltst.; minor sandst.	171876_39.8-40m	9.4	137			3.4	3.5	0.5	4.0	11.5	34.6	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Sandstone; minor siltst.	171876_45.3-45.5m	9.5	294			3.6	3.0	0.4	3.5	10.4	33.2	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Sandstone; minor siltst.	171876_52-52.2m	9.5	238			2.5	1.4	0.2	1.6	5.8	27.8	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Sandstone; some siltst.	171876_58.4-58.6m	9.2	178			5.0	2.9	0.4	4.3	12.6	34.1	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Siltstone; with sandst.	171876_64-64.2m	9.5	267			3.5	2.0	0.3	2.8	8.6	32.4	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Sandstone; with siltst.	171876_69.2-69.4m	9.4	243			3.5	1.8	0.3	2.4	8.0	30.5	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Mudstone	171876_76.8-77m	8.9	279			3.4	1.4	<0.2	3.0	8.0	38.1	strongly sodic	3	Dispersion
Gp5	Fresh	Mudstone	171876_81.81-82.04m	8.9	118			4.4	1.4	0.4	5.0	11.3	44.3	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Sandstone, med.-coarse	171876_86-86.2m	9.7	380			5.2	1.6	0.3	4.9	12.0	40.7	strongly sodic	3	Dispersion
Gp5	Fresh	Sandst.; minor siderite	171876_90-90.2m	9.5	331			3.6	1.6	0.3	2.7	8.2	33.3	strongly sodic	3	Dispersion
Gp5	Fresh	Siltstone; minor sandst.	171876_94-94.2m	9.6	305			4.7	1.4	0.4	5.1	11.7	44.1	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Mudstone	171876_100.09-100.35m	9.8	411			4.9	1.8	0.6	10.4	17.6	58.7	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Carb. Mudstone; coaly	171773_83.91-84.19m	9.7	223			1.0	1.2	0.2	1.9	4.3	44.6	strongly sodic	3	Dispersion
Gp5	Fresh	Carb. Mudstone	171773_103.5-103.8m	9.4	238			3.6	1.5	0.4	5.4	11.0	49.5	strongly sodic	2	Slaking. Some dispersion
Gp5	Fresh	Carb. Mudstone; coaly	171870_77.04-77.82m	5.0	297	<0.1	<0.1	2.8	1.5	0.2	2.1	6.8	31.3	strongly sodic	2	Slaking. Some dispersion

pH and EC on 1:5 water extracts; CEC = Cation exchange capacity; ESP = Exchangeable sodium percentage.

Appendix 9

CDM Smith (31 August 2021): Preliminary Site Investigation (PSI) Red Mountain Infrastructure Coal Handling and Preparation Plant, Poitrel Mine Road, Coppabella, QLD, 4741



BHP Billiton Mitsui Coal Pty Ltd (BMC)

**Preliminary Site Investigation (PSI) Red Mountain
Infrastructure Coal Handling and Preparation Plant,
Poitrel Mine Road, Coppabella, QLD, 4741**

31 August 2021

Cover images taken during site inspection

**CDM
Smith**

Executive Summary

CDM Smith has undertaken a Preliminary Site Investigation (PSI) of the Red Mountain Infrastructure (RMI) and the coal handling and preparation plant (CHPP) located on Lot 4 on plan SP190266 covering mining lease ML 70312. The PSI was undertaken in accordance with Schedule B2 of the National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM), the QLD Environmental Protection Act (EP Act 1994) and the Department of Environment and Science (DES) (2018) Queensland Auditor Handbook for Contaminated Land: Module 6.

CDM Smith has provided the information herein to support BHP in their development of the Transitional Progressive Rehabilitation and Closure (PRC) plan for RMI and to review whether current and historical site activities have had the potential to cause contamination, which will impact closure activities and rehabilitation plans for the site. The PSI provides a conservative approach to the assessment of potential contaminated land risks where data gaps were present. This conservative approach has also been applied to the development of the CSM and identification of potentially complete exposure pathways. The identified risks could be reduced or mitigated based on the collection of environmental data typically collected as part of Detailed Site Investigations (DSIs).

CDM Smith reviewed several environmental reports provided by BHP for RMI and the Poitrel, Millennium and Daunia mine sites, which identified sources of Contaminants of Potential Concern (CoPC) as outlined in Section 4.5, which will need to be considered in the PRC plan development. Potential sources of contamination identified onsite and offsite are associated with the following activities:

- Runoff from disturbed land (e.g., stockpiles) and (bulk) stored chemicals/fuels/coal;
- Saline, metalliferous and/or acidic leachate from overburden dumps located on surrounding mining leases;
- Leachate from on-site coal handling areas and seepage from on-site tailings drying cells, process water dam and environmental dam;
- Malfunction of sewerage storage/treatment facilities and discharge of contaminated water to the environment;
- Storage and use of hazardous materials within the CHPP and earthmoving plant; and
- Railway yards and transport corridors.

CDM Smith considers that there are current and future risks to consider during day-to-day mine operation as well as during mine closure and rehabilitation activities as a result of current and historical coal processing activities at the site and within the surrounding mining area.

It is understood that rehabilitation of the site after the closure of the CHPP will include the establishment of stable landforms that are intended to support future land uses including grazing and woodland habitats and will take into account the relevant planning overlays that apply to the Lot. As such, it is recommended that BHP progress their understanding of the actual contamination status at the site to inform the potential for exposure during decommissioning and rehabilitation activities, which includes gathering data about contamination at the site that could pose a risk to potential receptors. To that end, undertaking a Detailed Site Investigation of, at a minimum, soil and groundwater, is recommended allowing risk ratings to be confirmed and to better inform future closure efforts and long-term rehabilitation goals.

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Section 1 Introduction

1.1 Project Appreciation

BHP Billiton Mitsui Coal Pty Ltd (BMC) has engaged CDM Smith Australia Pty Ltd (CDM Smith) to undertake a Preliminary Site Investigation (PSI) of the Red Mountain Infrastructure (RMI) and the Coal Handling and Preparation Plant (CHPP) located on Lot 4 on SP190266 covering mining lease ML70312. In February 2018, the RMI CHPP changed ownership to BMC, an 80% owned subsidiary of BHP at the time of investigation.

The boundary of the PSI is the property boundary of Lot 4 on SP190266 (the investigation area; Figure 1). It is noted that the ML70312 mining lease boundary (as indicated by the green polygon on Figure 1) does not fully align with the property boundary.

The site is located approximately 140 km south west of Mackay in Central Queensland with the closest regional centre being Moranbah, which is approximately 22 km west of the site (Figure 1). The township of Coppabella is located approximately 30 km to the east of the site.

RMI has been a coal washing and preparation facility since 2006 and was originally designed to be utilised within a joint venture arrangement between Millennium Coal Pty Ltd and BMC to wash coal from the adjoining Peabody Millennium and BMC Poitrel mine projects (Figure 2). The coal is transported to the facility via haul roads to the Run of Mine (ROM) stockpile area situated in the coal handling area (see Figure 1 for the location of this facility), where it is then transferred to the CHPP to be washed, processed, loaded onto trains and transported to the Dalrymple Bay Coal Terminal. The facility has the capacity to wash up to 6Mt pa of coal, which is sent primarily to the export market.

1.2 Purpose and Objective

CDM Smith understands BHP is requiring this PSI to support the development of the Transitional Progressive Rehabilitation and Closure plan (PRC plan) for RMI as described in the Department of Environment and Science (DES; 2019) guideline and is accompanied by relevant declarations and supporting information (CVs) from the Suitably Qualified Person(s) involved in the project (see Appendix A). It is noted that a statutory contaminated land auditor will not be engaged as part of this project. The findings of the PSI presented herein will be used to develop a preliminary conceptual site model (CSM; Section 5) for the site and future users.

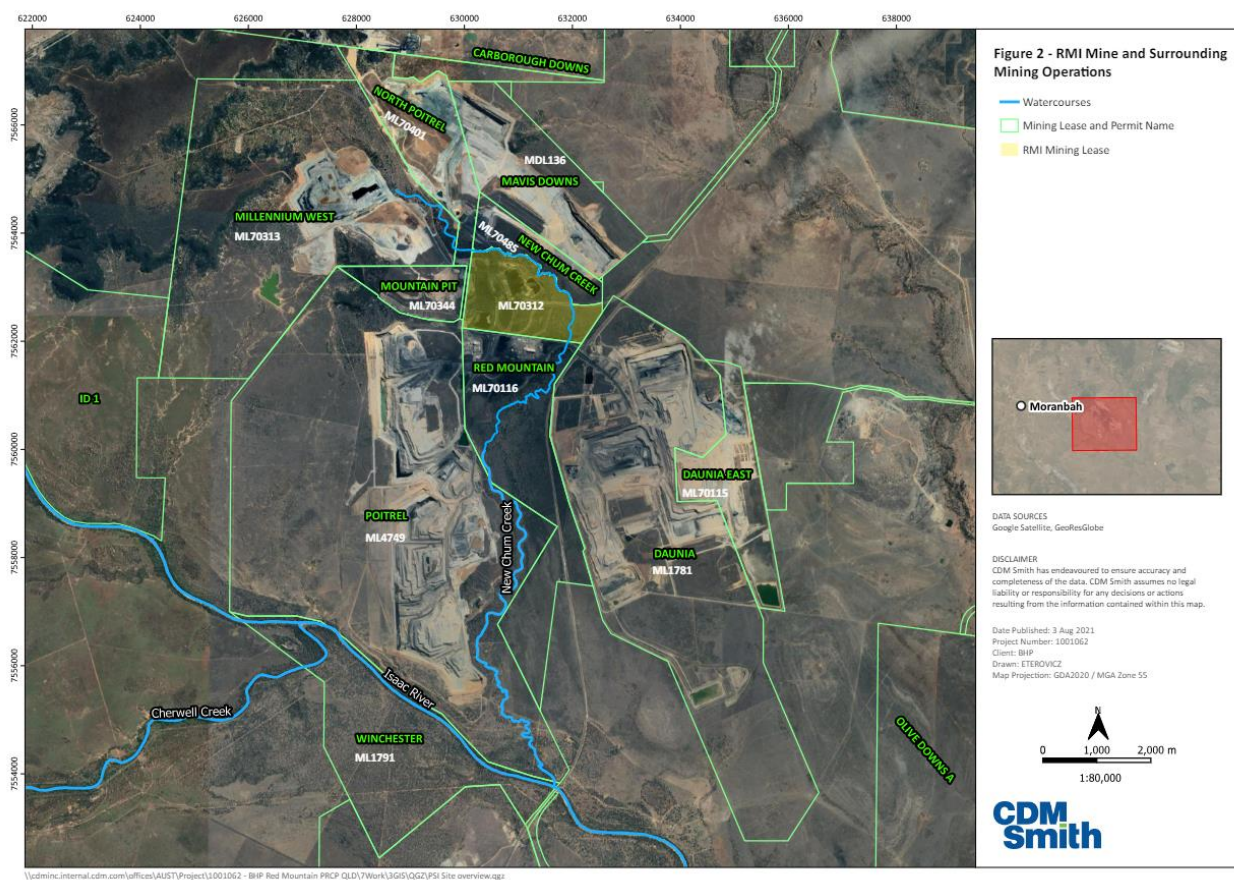
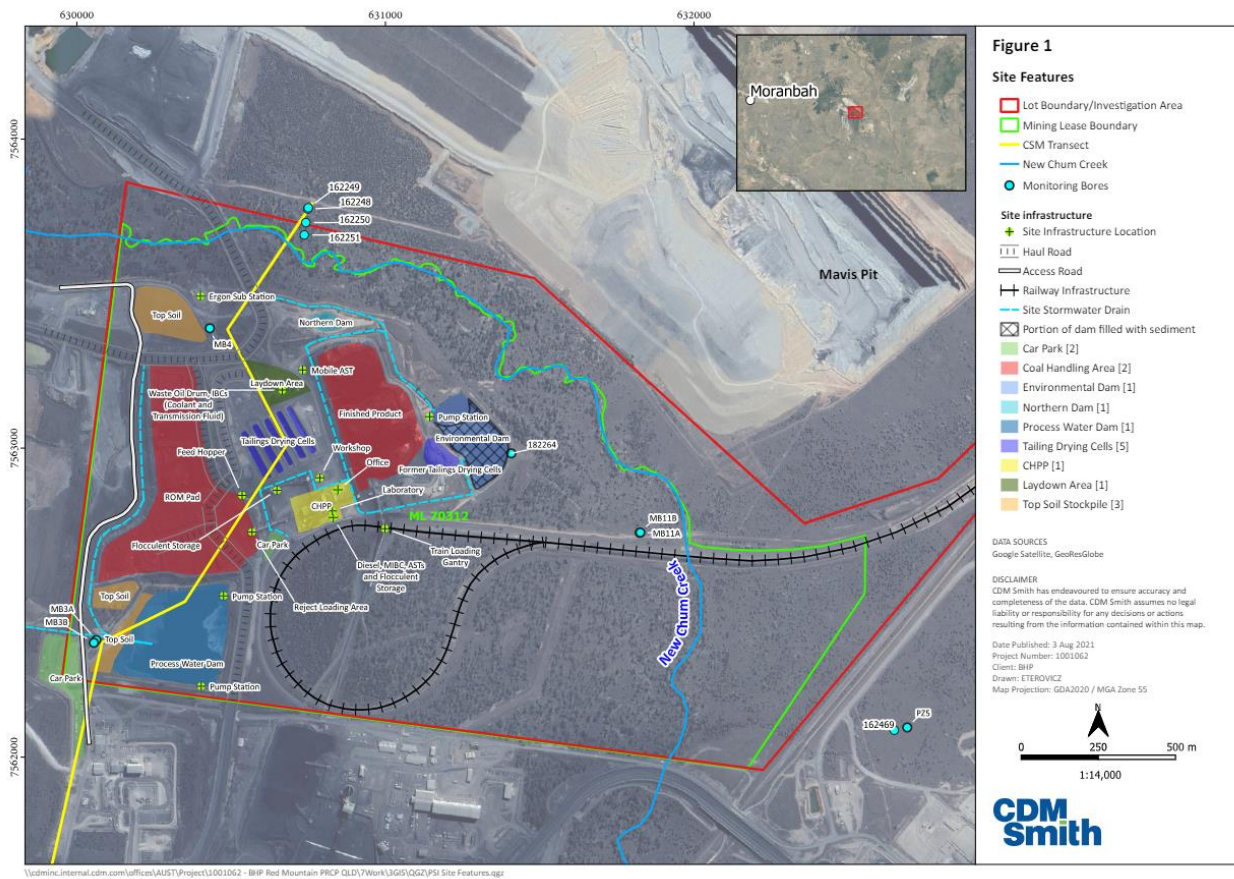
As such, the objectives of the PSI are to:

- Identify areas and (current and former) activities at the site (and surrounding areas) that have had the potential to have caused contamination to soil, groundwater and/or soil vapour;
- Assess potential for site contamination based on the potential sources of contamination identified during the PSI;
- Assess the potential for contamination to pose a risk to human health and the environment, relevant to the proposed future use of the site; and
- Identify potential contamination risks that have the potential to impact current future land uses and potentially require remediation or management as part of the rehabilitation of the site.

To inform the groundwater management components of the PRC plan, the PSI provides clear descriptions of:

- Contaminants that pose a risk to environmental values of the receiving environment;
- Source, pathway and fate of contaminants that have the potential to impact environmental values; and
- Infiltration and seepage intervention and collection control requirements at RMI.

The scope of works to meet these objectives is presented in Section 3.



Section 2 Regulatory Framework

2.1 Preliminary Site Investigations

The Department of Environment and Science (DES) is the environmental regulator for the State of Queensland and draws upon the legislation in the *Environmental Protection Act 1994*. DES also administers over 25 legislative Acts to manage health and prevent degradation of the environment. DES endorses the national framework of the ASC NEPM, which is made under the *National Environment Protection Council Act 1994* (Commonwealth) and is given effect by individual legislation and guidelines in each State and Territory¹. This PSI shall be undertaken and documented in accordance with the ASC NEPM, EP Act 1994 and the DES (2018) Queensland auditor handbook for contaminated land.

The goal of the ASC NEPM is to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community, which includes regulators; site assessors; environmental auditors; landowners; developers; and industry. Its desired outcome is to provide adequate protection of human health and the environment where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.

The NEPM references the Australian Standards AS 4482 *Guide to the investigation and sampling of sites with potentially contaminated soil*; Part 1 (2005): non-volatile and semi-volatile compounds, and Part 2 (1999): volatile substances) when discussing the process to undertake a PSI.

As stated in Schedule B2 Guideline on Site Characterisation (Section 2.1) of the NEPM, a PSI should be sufficient to:

- Identify potential sources of contamination and determine potential contaminants of concern;
- Identify areas of potential contamination;
- Identify potential human and ecological receptors;
- Identify potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air); and
- Develop a preliminary conceptual site model and identify data gaps for further investigation.

The NEPM is clear that characterisation of site contamination, such as that undertaken during a PSI, should only be conducted by professional environmental practitioners who are suitably qualified and experienced in the assessment of contaminated sites.

CDM Smith has compiled the PSI with an assessment that includes the desktop study to collect basic information and identify site characteristics, a site inspection, and where possible, interviews with current and past owners and occupiers of the site. The scope of works detailing this approach to meet the objectives is as discussed in Section 3.

The intent of the NEPM is that, if a thorough PSI is undertaken and shows a history of non-contaminating activities and there is no other evidence or suspicion of contamination, further investigation (such as a Detailed Site Investigation (DSI) or 'Phase 2 Environmental Site Assessment' (P2ESA) involving intrusive assessment of soil, groundwater, etc) is customarily not required.

However, if it is determined that a DSI is required, this would require a bespoke scope of works, which will be included as a recommendation of a PSI, if deemed appropriate.

¹ <http://www.nepc.gov.au/nepms/assessment-site-contamination>, site accessed 14/06/2021

2.2 Environmental Authority (EA)

The approved activities in the Environmental Authority (EA) EPML00819113 issued by the administering authority in accordance with the Environmental Protection Act (EP Act) for RMI include:

- ERA 31 - Mineral processing 2: Processing, in a year, the following quantities of mineral products, other than coke (b) more than 100,000 tonnes; and
- ERA 62 - Resource recovery and transfer facility operation 1: Operating a facility for receiving and sorting, dismantling, bailing or temporarily storing – (c) category 2 regulated waste.
- The RMI CHPP to date has primarily washed coal from both the Millennium and Poitrel projects. RMI does not include the extraction of coal or permanent storage of tailings or other wastes.

2.3 Water Quality Policy and Guidelines

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality form part of the National Water Quality Management Strategy (a joint national approach to improving water quality in Australian waterways) provide default guideline values for physical and chemical stressors. However, the DES has stated that local water quality information still applies as the first reference point. In Queensland, this includes:

- Environmental Protection (Water) Policy 2009 Isaac River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Isaac River Sub-basin (including Connors River) September 2011 (EPP (Water));
- Queensland's water quality guidelines (in the absence of scheduled values under the EPP Water and Wetland Biodiversity Policy);
- End of catchment anthropogenic pollutant reduction targets in Great Barrier Reef catchments contained in the Reef 2050 Water Quality Improvement Plan 2017–2022; and
- Water monitoring protocols provided in the 2018 Queensland Monitoring and Sampling Manual.

The purpose of Queensland's Environmental Protection (Water) Policy 2009 is to achieve the EP Act's objective in relation to waters and wetlands, which is to protect the State's water environment while allowing for development that is ecologically sustainable. The EVs and WQOs for Fitzroy Basin (Basin No. 130) waters are included the EPP (Water) Isaac River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Isaac River Sub-basin (including Connors River) (DEHP, 2011).

Section 3 Scope of Works

The scope of works undertaken to meet the objective, and in accordance with the NEPM and DES (2018) guidelines, included:

- Desktop review of site information including:
- Available historical and current aerial photographs and maps;
- Available certificates of title;
- Contaminated land search (Environmental and Contaminated Land Registers);
- Available historical and current regulatory licences and notices for the site and adjacent areas;
- Available historical business listings for the site and adjacent areas;
- Geological and hydrogeological electronic database and maps;
- Registered groundwater bore database for groundwater bores in the vicinity of the site, to assist in gaining an understanding of the local and regional hydrogeology; and
- Available services and utility infrastructure entering and surrounding the site.
- Review of relevant reports and data supplied by BHP;
- Site walkover and collection of anecdotal information (undertaken on 31 May 2021) including a review of the BMC incident register;
- Development of the preliminary CSM;
- Identification of contaminated land risks that have a potential to impact current and future land uses; and
- Preparation of this PSI report in accordance with the ASC NEPM and Module 6 of the Queensland Auditor Handbook for Contaminated Land.

Section 4 Environmental Site Setting & Summary of Desktop Review

4.1 Site Identification

A summary of the site information based on a review of publicly available information, previous environmental studies for the area, which were provided by BHP (Section 4.4), and information presented in the Lotsearch Report² (Appendix B) is presented below in Table 4-1.

Table 4-1 Site Details Summary

Item	Description
Site Address	Poitrel Mine Road, Coppabella, QLD, 4741
Lot/Plan	Lot 4 Plan SP190266, Mining Lease ML70312
Current Site Use	Coal handling and preparation plant
Certificate of Title Details/Registered Proprietor	BHP Billiton Mitsui Coal Pty Ltd (Appendix E)
Site Area	453.3 ha
Local Government Area	Isaac Regional Council
Planning Zone	Mining
Planning Overlay(s)	Refer to Section 4.3.3
Registers	A search of DES' Environmental Management Register (EMR) and Contaminated Land Register (CLR) shows that the property defined as Lot 4 Plan SP190266 is not included on either register. The search response is provided in Appendix F.
Land Use Description and General Site Description and Infrastructure	Refer to Section 4.5 for a summary of the site inspection notes. Details of the general site features/infrastructure and land use description are provided in Figure 1 and Appendix D.
Surrounding Land Uses	Mining and grazing, woodland vegetation is evident in all directions beyond the site boundary: - Peabody's Millennium mine is located to the immediate north of the site; - BMC's Poitrel and BHP Mitsubishi Alliance (BMA) Daunia mines are located to the immediate south of the site.
Proposed Land Use	Closure planning is underway to allow for the development of appropriate rehabilitation measures for the containment and management of contaminants once the CHPP ceases operation. The proposed land use will be grazing and woodland, however the outcome of this PSI and possible DSI works can define the future land use and land use options. The PRC plan requires BHP to plan for how and where activities will be carried out on the land in a way that maximises the progressive rehabilitation of the land to a stable condition.

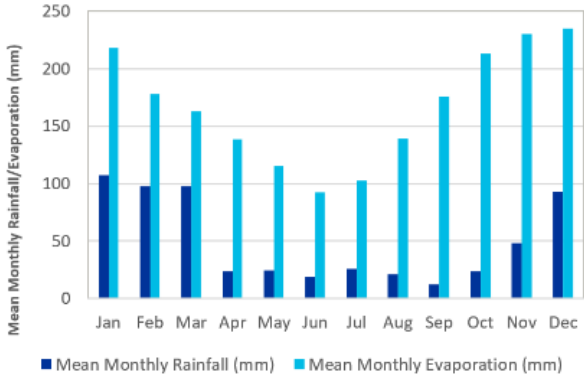
² Lotsearch (14 May 2021) for Poitrel Mine Road, Moranbah, QLD (report reference LS020216 EP)

4.2 Environmental Setting

The site environmental setting, such as topography, regional geology and hydrogeology, is outlined below in Table 4-2 based on information publicly available, previous environmental reports undertaken for the area and information provided in the Lotsearch report (Appendix B).

Table 4-2 Environmental Setting Summary

Setting	Details
Topography and Drainage	The average elevation of the investigation area is ~230 m Australian Height Datum (AHD). It should be noted that fill material is located under haul roads and approximately 13 m of fill material is located under the ROM pad which will impact onsite and offsite drainage. A number of offsite mining landforms including but not limited to waste dumps and open cut pits exist which will potentially impact drainage, flood regimes and groundwater flow. The topography of the mining lease is defined by gently undulating plains that drain via the New Chum Creek and continues in a south westerly direction towards the Isaac River, the regions dominant drainage feature. The receiving environment (including connected waterways) for the RMI is: ▪ New Chum Creek (on site boundary to north and east)– flowing in a south easterly direction across RMI to the Isaac River; ▪ Isaac River (6.1 km south west of RMI); and ▪ Conners River (Fitzroy) System (southern-most receiving water system).
Water Features	Based on data from the BHP Peabody Water Management Plan (2017), surface water generated at RMI is divided into five types: External Water: Has been sourced from outside of the operation and is supplied to RMI via the Poitrel Mine Braeside pipeline. There was no available water quality monitoring data for this external supply. Water is also supplied from the Millennium Coal Mine (MCM) operations via the Western Dam, which is supplied via the Sunwater pipeline and surface runoff. Groundwater: there are no direct groundwater inflows to the RMI area. Worked Water / (Mine Affected Water (MAW): Is water of lesser quality than other water types and is available for site utilisation. This water is returned to storage on completion of a task and can be reused: it is retained on site and managed in accordance with the site's EA. Worked water comprises: ▪ Groundwater inflow and rainfall runoff that has been collected on site and pumped to storage; ▪ The CHPP process water including recycled water from coal waste; ▪ Surface drainage water captured in regulated dams from catchment areas disturbed by site operations; and ▪ Any other water which site stores in the worked water system. Worked water surface runoff from ROM pad and from the eastern portion of the Millennium Mining lease drain into the Process water pond. Worked water surface runoff from the CHPP and product stockpiles drains to the Environmental Dam. Runoff from catchment within the MCM operations also drains into these dams. It was noted by BHP Peabody (2017) that water quality monitoring at these locations indicated that worked water surface runoff would exceed the Environmental Protection (Water) Policy 2009 water quality objectives (EPP WQOs) at the time of reporting. Surface Water: Is rainfall runoff and, when managed in accordance with the site's Erosion and Sediment Control Plan (ESCP), can be discharged from site. The surface water catchment within the RMI area is that associated with New Chum Creek. There are however water catchments from the adjacent MCM operations that drain to the RMI storages (Process Water Dam). Diverted Water: Is rainfall runoff that is diverted around the CHPP to ensure that the operations do not directly impact the water quality. It is noted that the alignment of New Chum Creek downstream of the RMI (offsite) has been diverted.

Setting	Details
Water Features (cont)	The RMI site is located within the Isaac River Catchment, which is part of the Fitzroy River Basin. The only water retaining structure in the catchment is the Burton George Dam located on the Isaac River, 45 km to the north of the site. RMI is located at the headwater of New Chum Creek which is slow flowing and seasonally variable with most flow occurring in the months of November to February. The RMI mining lease covers approximately 3.2 km² of the 3,560 km² Isaac River catchment area (BHP Peabody 2017). The New Chum Creek catchment area is 51 km² and RMI covers 6% of this catchment. New Chum Creek is characterised by coarse sandy bed channels within a wider floodplain. The main channel has a width of ~3m and a depth of ~2m (BHP Peabody 2017). Waterholes can be present within the weeks following rainfall however the stream is short lived so little aquatic vegetation exists. New Chum Creek downstream of RMI has been diverted as part of the neighbouring Poitrel Mine operation.
Local and Regional Geology	RMI is within the Bowen Basin and geologically is located on the western margins of the Taroom Trough. The geology within the site ranges from Late Permian arenite-mudrock (characterised as calcareous sandstone and shale, mudstone, coal and concretionary limestone), Late Permian sedimentary rock (characterised as lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff and tuffaceous (cherty) mudstone), Early Triassic-middle Triassic arenite-mudrock (characterised as lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate [at base]) and Later tertiary-quaternary alluvium (characterised as locally red-brown mottled, poorly consolidated sand, silt, clay, minor gravel and high-level alluvial deposits (generally related to present stream valleys but commonly dissected)). A fault is present within the south western corner of the lot boundary and several more can be found within 1 km of the site.
Soils	The soils within the investigation area are predominantly sodosols, which are characterised as soils that display a strong texture contrast between surface horizon and subsoil horizons. The soils in the area are generally of low-nutrient content and are vulnerable to erosion and dryland salinity when vegetation is removed. The soils within the south eastern corner of the lot boundary are vertosols, which are characterised as strong cracking clay soils when dry and shrink and swell considerably during wet and dry phases.
Acid Sulfate Soils	As reported by Lotsearch (Appendix B), there is a low (6-70%) probability of acid sulfate soils occurring across majority of the investigation area and an extremely low (1-5%) across a section of the south eastern corner of the lot boundary.
Rainfall and Evaporation	Climate data has been obtained for RMI from the SILO point data site (Lat, Long: -22.05, 148.25). Figure2-1 shows mean monthly rainfall and pan evaporation for the site for the period January 2010 to July 2021. The data demonstrates: ▪ Average annual evaporation (2033 mm) is well in excess of average annual rainfall (595 mm), with evaporation exceeding rainfall for every month of the year; and, ▪ A distinct wet season, with approximately 67% of average annual rainfall occurring during the four-month period from December to March  Figure 3 Distribution of Monthly Rainfall and Pan Evaporation (SILO)

Setting	Details
Local/Regional Hydrogeology	Two groundwater aquifer systems are identified within the project area: ▪ Alluvial aquifer – associated with New Chum Creek and comprised of relatively coarse (i.e. sandy) alluvium; and ▪ Fort Cooper Coal Measure Aquifer (FCCMA). Groundwater bores MB3A, MB3B, MB4 and MB11A and MB11B have been installed within the site, as shown in Figure 1. The bore depths range from 30 m below ground level (m bgl) to 80 m bgl: All wells are screened within the Fort Cooper Coal Measures (JBT Consulting 2015). Groundwater within the FCCMA is derived primarily from rainfall-recharge, which infiltrates across the site via unsaturated flow during the wet season. There are also a number of focussed recharge sources, namely creek infiltration during periods of flow from New Chum Creek, leakage from the Process Water Pond and Tailing Drying Cells via unsaturated flow. This water then travels vertically through the unsaturated zone until it meets the water table as recharge. The newly recharged water then mixes with the existing groundwater and travels from areas of high hydraulic head (i.e. water level) to areas of lower hydraulic head via saturated flow. Regionally, groundwater flow direction within the FCCMA is generally from the north-northeast towards the south-southwest, with some local deviation due to groundwater mounding below the process water pond at RMI. It is plausible for a transient perched aquifer system to exist within the alluvial sediments associated with New Chum Creek, however this is unconfirmed. If a perched groundwater system exists, infiltrating creek water is likely to then leak through the shale/mudstone geological units to join the deeper water table within the FCCMA. The FCCMA is a fractured rock aquifer due to its hard rock sandstone/siltstone geological units and so groundwater flow is dependent on the nature and interconnection of fracture networks. Groundwater flow through the coal seam sections of the aquifer may contain more primary porosity and facilitate groundwater flow through a porous media in addition to preferential pathways through fractures (secondary porosity). The dual porosity of the FCCMA means that groundwater flow paths are likely to be heterogeneous and may be challenging to accurately predict. An indication of these geological and hydrogeological features is presented on the CSM in Section 5. There are 297 registered bores listed on the Australian Bureau of Meteorology Australian Groundwater Explorer database³ within 20 km radius of RMI, of which 19 have been abandoned, 23 have been decommissioned, 10 are functional and used for commercial and industrial purposes and the remainder are functional however, their purpose is unknown. Lotsearch (Appendix B) reported that there are 14 existing bores used for mine monitoring, 3 abandoned and destroyed bores, 5 existing bores used for water supply and 2 existing bores with unknown water use purposes within 2 km of RMI. Groundwater use within and surrounding the site is minimal to non-existent with local landholders receiving water for domestic consumption from Moranbah Council or via rainfall. Stock water is predominantly supplied from surface water runoff into dams.

³ <http://www.bom.gov.au/water/groundwater/explorer/map.shtml>, site accessed 2 August 2021

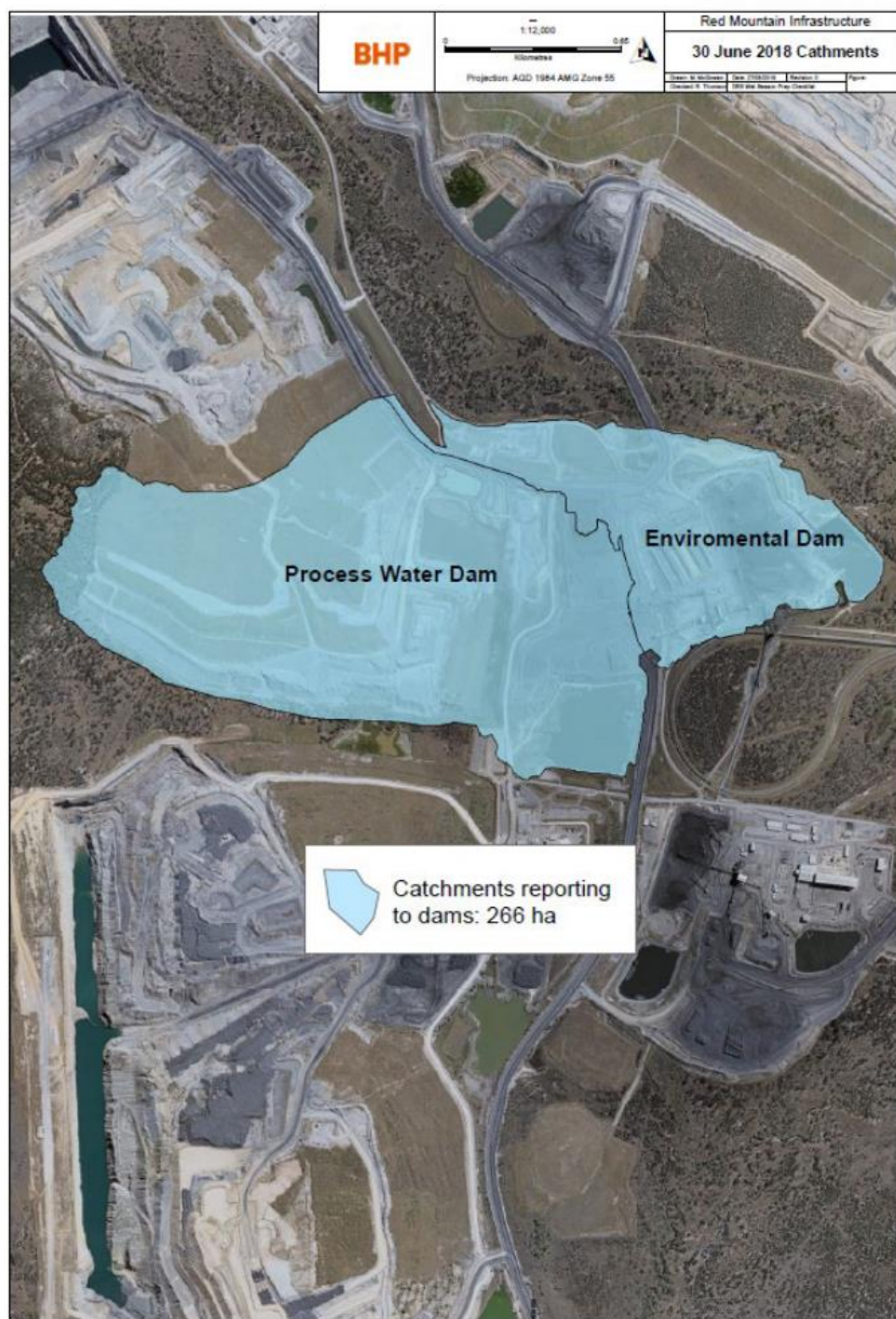


Figure 4 RMI MAW Catchment Area (Source: BHP, 2018)

A review of available laboratory analyses of groundwater samples collected suggest the following:

- Total Petroleum Hydrocarbons (TPH) were detected in MB3B at a concentration of 0.19mg/L in April 2021, which exceeds the Groundwater Contaminant Trigger Value of 0.1mg/L. There have not been any TPH detections greater than the laboratory limit of reporting to date;
- Metal concentrations (Mercury (inorganic), Aluminium, Antimony, Arsenic (As III), Molybdenum, Selenium and Silver) remain below or close to the limits of detection historically and in recent samples;
- Iron concentrations are typically elevated in MB4 and MB11B (up to 0.9mg/L and 0.4mg/L, respectively) compared to other bores (having concentrations near or below detection limits) and are variable over time at relatively low concentrations (i.e., < 1 mg/L) with no apparent trends over time. Iron concentrations in these wells also exceed the Groundwater Contaminant Trigger Value (0.3mg/L) listed in the EA (EPML00819113);
- Magnesium concentrations have consistently but only slightly exceeded the Groundwater Contaminant Trigger Value (0.19mg/L) in MB3A and MB11B, with a maximum concentration of 0.27mg/L detected in MB3A in June 2019. There is no apparent trend in concentrations over time;
- Sodium concentrations in MB11A/B have exceeded the Groundwater Contaminant Trigger (0.5mg/L) since February 2019, with a slightly increasing trend observed in MB11A;
- Chloride concentrations are typically elevated in all onsite monitoring wells, ranging between 0.5 – 1.9mg/L, compared to a Trigger Value of 0.04mg/L;
- Sulphate concentrations are typically elevated in MB3A and MB4 with concentrations up to 162mg/L, compared to a Trigger Value of 70mg/L; and
- Total Dissolved Solids (TDS) concentrations are shown in Figure 6 below and exceed the Trigger Value (2200mg/L) in MB11A/B.

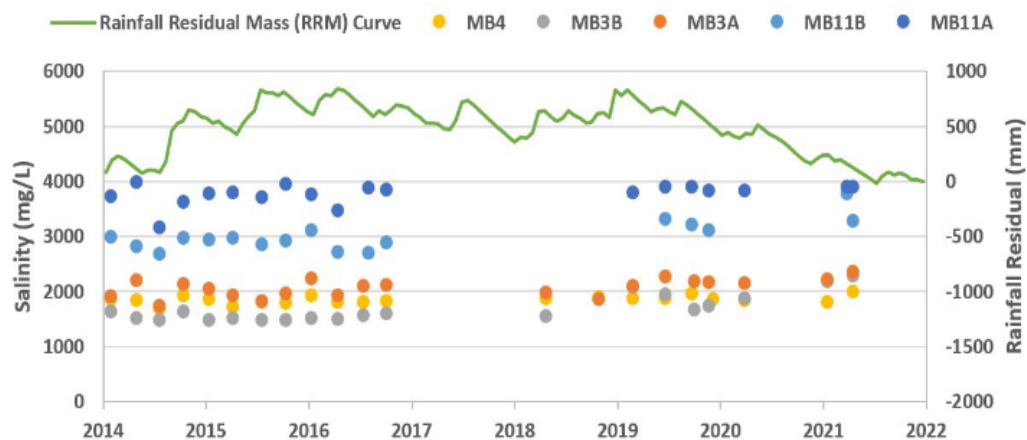


Figure 6 Groundwater Salinity (Total Dissolved Solids) Over Time vs RRM

4.3 Site History

Pastoralism has been undertaken in the area since the 1850s, predominantly for cattle grazing at varying intensities with extensive vegetation cleared for this purpose. This has resulted in significant disturbance of native species and introduction of non-endemic plant communities throughout the area.

Construction of the RMI began in 2005 and has been a coal washing and preparation facility since 2006. The first coal wash occurred in October 2006 with the plant formally commissioned in 2007 (BHP Peabody 2014). At that time, Millennium transferred a 50% interest in ML70312 to BMC, the EA that previously covered the Millennium Coal Project and relevant tenements (ML 70312 and ML 70313) were amended to cover the mine leases separately.

In February 2018, the RMI CHPP changed ownership to BMC, an 80% owned subsidiary of BHP.

It is noted that historical certificate of titles was not included in this report given the age of the mine and the historical use of the land, the current title search is provided in Appendix E.

4.3.1 Historical Aerials, Maps and Figures

A review of selected aerial photographs from 1957 to 2017 was undertaken, in addition to a review of a historical map from 1972. A summary of observations from these resources is provided below in Table 4-4 based on the information provided in the Lotsearch report (Appendix B). Historical aerials sourced from QLD Globe are also included in Appendix B.

Table 4-4 Historical aerial photography and maps

Year	Observations Onsite	Observations of Surrounding Area
1957 (Aerial Image)	The investigation area is undeveloped land. New Chum Creek is located within the lot boundary.	A road runs along the western boundary of the investigation area.
1960 (Aerial Image)	There are no significant changes within the investigation area when compared to the 1957 aerial image.	There are no significant changes surrounding the investigation area when compared to the 1957 aerial image
1964 (Aerial Image)		Further roads are now present surrounding the investigation area.
1972 (Historical Map)	There are no significant changes within the investigation area when compared to the 1957 aerial image.	A railway line exists on the eastern boundary of the lot. What appears to be a landing strip exists to the south east within 1 km. Waterways are present within 1 km of the investigation area. Red Mountain is located to the north.
1972 (Aerial Image)	The investigation area and surrounds now contain a number of evenly spaced and deliberate tracks, possibly seismic exploration tracks. The railway line on the eastern site boundary is now well developed.	
1978 (Aerial Image)	Vegetation clearing appears to have been done to the north of New Chum Creek within the northern portion of the lot.	Extensive vegetation clearing is evident in all directions from the investigation area. What appears to be a water body exists along the rail line in the south.
1985 (Aerial Image)	There are no significant changes when compared to the 1978 aerial image.	There are no significant changes surrounding the investigation area when compared to the 1978 aerial image.
2000 (Aerial Image)	Further vegetation clearing or low vegetation coverage (seasonal) is now evident within and beyond the investigation area.	
2004 (aerial image provided by BHP)	The investigation area and surrounding area appears to have been extensively cleared of vegetation.	

Year	Observations Onsite	Observations of Surrounding Area
2007 (Aerial Image)	Mining operations including the rail loop now appear within the investigation area. Large coal stockpiles are evident as well as large water bodies that approximate current day infrastructure and features. Excavation works are evident to the west of the current day environmental dam, this could indicate temporary tailings cells or general earthworks occurring (These are only visible in the 2007 and 2009 images)	Poitrel Mine now appears to the west and south west.
2008 (aerial image provided by BHP)	The investigation area is not visible in the image.	Mining operations are underway at the Poitrel mine. Vast excavation and stockpiling is evident across the site. A large waterbody appears to the east of the Poitrel mine and a smaller waterbody is evident outside of the mine operation area to the west.
2009 (aerial image sourced from QLD Globe)	The RMI is now established an operation within the investigation area. The Daunia loading facility now exists to the south of the rail loop.	A number of exploration tracks are evident to the north on the now MCM site.
2012 (aerial image sourced from QLD Globe)	The tailing drying cells now appear to the right of the ROM pad. The initial drying cells appear to have been removed near the environmental dam.	The MCM now appears to the north of the investigation area. Exploration tracks and roads now exist to the south east at the current day Daunia site.
2013 (Aerial Image)	Further development within the mining area is evident. A road to the MCM mine to the north now exists.	Extended mining infrastructure is now evident in the south (Poitrel) and to the south east (Daunia) of the investigation area. Large water bodies and stockpiles are evident in both of these areas.
2017 (Aerial Image)	There are no significant changes within the investigation area when compared to the 2013 aerial image.	Further developments of the mines to the north and south east are evident.

4.3.2 Planning Zones

Planning zone information has been sourced using publicly available information on Qld Globe⁴. The investigation area and the area within a 1 km radius have portions that are zoned as mining, other minimal use, railway infrastructure and or grazing native vegetation. No other planning zones apply within the area.

4.3.3 Planning Scheme Overlays, including Natural Hazards and Groundwater Dependent Ecosystems (GDEs)

A review of the planning overlays made publicly available by QLD Globe identified the planning overlays onsite that are relevant to current mine operation and future mine closure. The reasoning for each overlay is provided in Table 4-5 and it is noted that overlays relevant to offsite land parcels are consistent with those onsite.

It is understood that rehabilitation of the site after the closure of the CHPP will include the establishment of stable landforms that are intended to support future land uses including grazing and woodland habitats and will take into account the relevant planning overlays that apply to the Lot.

⁴ <https://qldglobe.information.qld.gov.au/> site accessed 15/06/2021

Table 4-5 Summary of Planning Overlay and their Significance to the Investigation Area

Planning Scheme Overlay	Relevant to day-to-day operations	Relevant to mine closure process	Reasoning
Onsite			
Mackay, Isaac and Whitsunday Regional Plan	-	X	Will apply to future planning decisions in the region and will be relevant to future mine closure.
Aquatic Conservation Assessments Riverine spatial units – conservation significance (medium) Buffered streams – conservation significance (medium)	X	X	Can be used to determine priorities for protection or rehabilitation of aquatic ecosystems, contribute to impact assessments, identify aquatic assets and provide help with social and economic evaluation and prioritisation. This is relevant to day-to-day operations and during the mine closure process.
Waterways Wetland areas - L_WB – Lacustrine wetland and O1-50_RE – Wetlands are subdominant (comprising 50 % or less of the area) Queensland waterways for waterway barrier works (moderate and high)	X	X	Local waterways and the environmental protection requirements need to be considered when undertaking mine closure activities.
State Biodiversity Significance Remnant contains at least 1 Vulnerable or Near Threatened species (A) and Nat. Threatened Ecol. Community (B1) Remnant contains at least 1 Endangered RE (B1) and Nat. Threatened Ecol. Community (B1) Regional Biodiversity Significance Remnant contains at least 1 Vulnerable or Near Threatened species (A)	-	X	Biodiversity assessments are incorporated into regional plans and will assist with the appropriate management and investment in environmental rehabilitation and restoration activities.
Regional Ecosystem Mapping Biodiversity status – preclear Endangered – dominant vegetation and sub-dominant Of concern – dominant Biodiversity status – remnant Endangered – sub-dominant	-	X	Regional ecosystems and land zones will need to be taken into account during mine closure. This will impact how the area is to be managed.
Landzone – preclear Cainozoic clay deposits, gentle undulating plains Cainozoic sand deposits, extensive flat or gently undulating plains Cainozoic alluvial plains and piedmont fans Landzone – remnant Cainozoic alluvial plains and piedmont fans Cainozoic clay deposits, gentle undulating plains Cainozoic sand deposits, extensive flat or gently undulating plains	-	X	Pre-clear and remnant land zones will need to be taken into account during mine closure. This will impact how land is managed based on the major geology and geomorphic processes at the site.
Vegetation Management Essential habitat RVM category B – remnant vegetation RVM category R Category A or B area containing endangered species and those of least concern	-	X	Specific vegetation and its requirements within the site area will need to be taken into account during mine closure. This will impact the revegetation objectives including seed mix, how vegetation is managed and may determine how successful rehabilitation works will be.

Planning Scheme Overlay	Relevant to day-to-day operations	Relevant to mine closure process	Reasoning
Onsite			
Matters of State Environmental Significance (MSES) MSES regulated vegetation (defined watercourse) MSES wildlife habitat (endangered or vulnerable) MSES regulated vegetation (category B and C – endangered or of concern) MSES regulated vegetation (100 m from wetland)	X	X	Those environmental values that are protected must be considered during day-to-day mining operations and mine closure and rehabilitation stages.
Koala District Koala District C	-	X	Koala conservation measures need to be considered during mine closure and rehabilitation. This may impact clearing restriction, prohibit clearing and implement priority areas.
Environmental authority locations Prescribed ERA Resource Activity	X	X	The environmentally relevant activities and resource activities at the site as well as the surrounding mine sites will need to be considered during mine rehabilitation and closure.
Cultural Heritage CLH000643 Poitrel Mine Project Cultural Heritage Management Plan CLH000771 Daunia Mine Moranbah Cultural Heritage Management Plan CLH011011 Millennium Mine and Expansion Project	X	X	Current cultural heritage management plans applicable to the site and surrounding area during day-to-day operations and future rehabilitation works will need to be taken into account.
Native Title Indigenous land use agreements (ILUA registered)	-	X	Native title land use agreements are applicable to the site and need to be considered during mine closure.
Economy Mineral permits MDL3046 and MDL 495 Petroleum ATP granted Potential petroleum PCA Area 152 and 143 Historical Exploration Permits Mineral (EPM) Historical EPM 1991 to 2000 Historical exploration permit coal (EPC) prior to 1971, 1971 to after 2010 Historical production permits Mining lease ML70364, MW70320 Production Permits ML70312	X	X	The current site operations must work within the mineral permits obtained. The current permits in place on site and on the surrounding mine sites will need to be considered during mine closure. Surrounding mine operations may impact rehabilitated efforts onsite.
Weed distribution Bellyache bush Harrisia cactus Lantana Parkinsonia Parthenium Prickly pear Rat's tail grass	-	X	Weeds and their significance in the area will need to be considered during mine closure and rehabilitation works.
Drought Declarations 90.3% of Isaac shire partly drought-declared	X	X	Impacts of drought on the site and the surrounding environment needs to be considered during mine closure and rehabilitation. This may influence the success rate of rehabilitation at the site.

4.3.4 Environmental Authorities Register and Resource Activities

4.3.4.1 Current and Former Prescribed ERA and Resource Activities

As reported by Lotsearch (Appendix B), there are several current and former prescribed environmentally relevant activities (ERAs) and resource activities within the investigation area and buffer zone. A summary of these is provided in Table 4-6. Not all records on the Environmental Authorities Register (EAR) have specific or current location details, and some premises with a permit reference number may not have been mapped and therefore may not appear in the report.

Table 4-6 Summary of Current Prescribed ERA and Resource Activities

Permit No	Primary Holder	Premises	Effective Date	Activity	Distance and Direction from Investigation Area
Current Prescribed ERA Activities					
EPPR00930713	Quarrico Products Pty Ltd	Isaac	20/01/2014	ERA 16 – Extraction and Screening, 1, 2 and 3	Onsite
Current Prescribed Resource Activities					
EA0001673	Galilee Pipelines Pty Ltd	PSL2037	22/05/2019	Non-scheduled, petroleum activity, petroleum survey licence – PSL	Onsite
EPML00561913	BHP Coal Pty Ltd	ML1781 ML70116	18/11/2019	Ancillary 08 – Chemical storage, 1 Ancillary 31 – Mineral processing, 2 Ancillary 56 – Regulated waste storage, receiving and storing regulated waste Ancillary 63 – Sewage treatment, 1 schedule 3, 13	Onsite
EPML00819113	BHP Billiton Mitsui Coal Pty Ltd	ML70312	15/11/2019	ERA31 – Mineral processing, 2 ERA 62 – Resource recovery and transfer facility operation 1	Onsite
EPML00819213	Millennium Coal Pty Ltd	ML70313 ML70344 ML70401 ML70457 ML70483 ML70485	26/03/2020	Ancillary 07 – Chemical manufacturing, 3 Ancillary 08 – Chemical storage, 3 Ancillary 60 – Waste disposal, 2 Ancillary 62 – Resource recovery and transfer facility operation, 1 Ancillary 63 – Sewage treatment, 1 schedule 3, 13	Onsite
EPML00963013	BHP Billiton Mitsui Coal Pty Ltd	ML4749 ML70116	28/10/2019	Ancillary 08 Chemical storage, 3 Ancillary 56 – Regulated waste storage, receiving and storing regulated waste Ancillary 60 – Waste disposal, 1 Ancillary 63 – Sewage treatment, 1 schedule 3, 13	Onsite
EPPG00699613	CH4 Pty Ltd	ATP1103	24/08/2017	Non-scheduled, petroleum activity, authority to prospect – ATP	Onsite
EPVX01126213	Peabody Moorvale West Pty Ltd	MDL495	03/07/2018	Non-scheduled, mining activity, mineral development licence – MDL	Onsite
Former Prescribed Resource Activities					
EA0001644	Blue Energy	PSL2037	-	Non-scheduled, petroleum activity, petroleum survey licence – PSL	Onsite
EPVX0027063	Peabody Moorvale West Pty Ltd	EPC680	27/01/2006 (Surrendered)	Exploration – coal	Onsite

4.3.5 Per- and Poly-Fluoroalkyl Substances (PFAS) Investigation or Management Program Investigation Sites

The report provided by Lotsearch (Appendix A) stated that RMI had not been managed and/or investigated by the Department of Defence (DoD), Airservices Australia (ASA) and Queensland Fires and Emergency Services (QFES) for PFAS in relation to use of PFAS within the RMI.

4.3.6 Waste Management, Liquid Fuel Facilities and Former Gasworks

4.3.6.1 National Waste Management Facilities

There are no known national waste management facilities within the investigation area or buffer zone. There are however waste management facilities available within the investigation area, as discussed in Section 4.4.

4.3.6.2 National Liquid Fuel Facilities

There are no known national liquid fuel facilities within the investigation area or buffer zone. There are however liquid fuel storage facilities available within the investigation area, which is discussed in Section 4.4.

4.3.7 Historical Business Directory

There are no historical business results available for review for the investigation area and surrounding buffer zone.

4.3.8 Services to the Site

A Dial Before You Dig database search was undertaken on 16 June 2021 to understand the service assets on the site. Search results are presented in Table 4-7 and a summary is provided below in Appendix C.

Table 4-7 Summary of services relevant to the site

Service Provider	Details
Aurizon Network Pty Ltd	This information was not received by the time the report was issued.
BM Alliance Coal Operations Pty Ltd	No information was received at the time this report was issued.
Ergon Energy Corporation Ltd	A connector point installation external location electricity – earth existing is located on the south western corner of the lot boundary. Multiple high voltage and multiple unknown voltage electricity pole exists near the northern western boundary of the site. Multiple TR/Comms poles exist in the north western portion of the lot. Multiple high voltage poles, connector point installation external location – earth existing and 19.1kV services exists at the south eastern boundary of the lot. A communications site exists relatively close to the centre of the site.
Isaac Regional Council	No results were received as the search area was too large.
Telstra	No Telstra services were identified within the lot boundary.

4.3.9 Incidents, Hazardous Materials and Storage of Dangerous Goods

Incidents relating to runoff from chemical or fuel/oil spills are recorded in BMC incident register (2019 to present) as presented in Appendix G.

A copy of the stock register, including dangerous goods and hazardous materials stored and used at the CHPP is provided in Appendix G.

BHP indicated that that “Currently, there is no testing of diesel storage tanks” (email correspondence date 15 September 2021)..

4.4 Previous Environmental Reports

Previous environmental management reports and assessments undertaken at the site and surrounding mine sites were provided by BHP to assist with the development of this PSI. A summary of each is provided below.

BHP Black Book Mineral System (Volume 1) – A geological summary of BHP coal assets

BHP prepared the Black Book Mineral System (Volume 1) to provide geological background information for BHP active coal mine assets, and provides geological information in regard to stratigraphy, structural geology, coal inventory and coal quality of the nine active coal mine sites in the Bowen Basin and Sydney Basin.

Daunia Coal Mine Project - Environmental Impact Statement (partial)

The partial Daunia EIS (Section 7) document includes groundwater information gathered from a 2004 investigation involving monitoring of water levels and sampling of groundwater levels to provide information for the Poitrel Mine Impact Statement which was completed in 2005. No hydrogeological investigations have been undertaken within the project site however a monitoring program including installation of groundwater bores was planned for 2009. The Daunia monitoring program compliments the monitoring program run at the adjacent Poitrel Mine which includes bores that lie within the Red Mountain lease. Section 7 of the report addresses the geology and hydrogeology, monitoring well network, groundwater quality, surrounding groundwater users, legislation relevant to groundwater, potential impacts, groundwater modelling methodology, impacts on regional groundwater levels and quality during mine operation, impacts of groundwater – post mining, groundwater quality – post mining, impacts on groundwater users – post mining, groundwater monitoring and post closure.

Groundwater was sampled from four of the six monitoring bores located on the Poitrel Mine during the 2004 monitoring program, the remaining two bores were dry. Each bore location was sampled for alkalinity, total dissolved solids (TDS), pH, sulphate, sulphide, chloride, calcium, magnesium, sodium, iron, antimony, arsenic, cadmium, chromium, cobalt, copper, lead, manganese, nickel, selenium, zinc and mercury. The samples were then compared against the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) and the Australian Drinking Water Guidelines (NHMRC, 2004). The levels of salinity, arsenic, chromium, copper, manganese and zinc levels were above the ANZECC guidelines for irrigation in the majority of the groundwater samples. Chloride, sodium, iron and manganese were above the ANZECC guidelines for irrigation in the majority of the samples. It was noted that elevated concentrations of iron and manganese are not uncommon in groundwater in the sample area as it likely to be naturally occurring. It is also mentioned that due to the salinity levels in the groundwater the use of this water for drinking water is not possible at the time of reporting and stock watering is limited without significant dilution with fresh water.

The mining and dewatering operations are not expected to have a detrimental impact on the groundwater quality in proximity to the Daunia site as that there is low risk of acid generation from the overburden, coal and interburden materials and no direct discharge of wastewater to groundwater during project construction or operation is planned.

It is noted surrounding properties within 10 km of the project site would experience up to 10 m drawdown, reducing to less than 2 m at a distance of between 4 and 10 km from the site depending on their location.

In addition, when high rainfall occurs within the Isaac River it is likely that the groundwater in the alluvial aquifer may rise and could potentially cause more inflow into the mine pit. The interaction between groundwater in the alluvial aquifer and surface water in the Isaac River is not well understood and the potential for increase flows to the pit would need to be assessed in more detail.

Once mining operations have ceased at Daunia, it is assumed that all mining activities within the immediate area will also cease, this is including Poitrel and Millennium. The site will be backfilled to an elevation of around 160 m AHD, and all groundwater extraction will cease, thus it is likely that groundwater inflows will form a small lake within the void. It is anticipated that surface water runoff from the spoil dumps will be directed to the rehabilitated final void, this may have a low pH and should be monitored to ensure the quality of this water is appropriate. It is noted that there could be issues associated with oxidation of the coal seams and potential changes to the groundwater chemistry however any impacts are likely to be localised in the vicinity of the rehabilitated final void. There is also likely to be

little or no potential for detrimental impacts to the riparian vegetation as a consequence of groundwater level drawdown in the alluvium aquifer.

BHP Billiton (2005) Poitrel Coal Mine Project Environmental Impact Statement

BMC prepared the environmental impact statement (EIS) to support the amendment of an existing environmental authority (at Poitrel) and to convert a transitional environmental authority (at Red Mountain) to an environmental authority which was agreed upon by the EPA (now the DES). The EIS provided information about the site, land resources, water resources, flora and fauna, air quality, noise and vibration, cultural heritage, scenic values, waste management, infrastructure and traffic, community consultation, social environment, economic impacts, health and safety and the draft environmental management plan (EMP).

A search on the Queensland Environmental Management Register (EMR) and the Contaminated Land Register (CLR) found that there were no sites on the properties relating to the project area included on either register. As the site has been used for sheep and cattle grazing, contamination may have occurred from agricultural chemicals such as dips, drenches and herbicides. Two sites; Poitrel Cattle Dip and Poitrel Station Tip were identified and targeted for assessment. A preliminary investigation of the cattle dip area indicated that the cattle dip area is contaminated with low levels of arsenic and organochlorine pesticide. These levels are relatively low although above threshold levels, it is recommended that the area be fenced off from stock access.

The Poitrel Homestead landfill site is located north of the homestead in a gully fill washout leading to the Isaac River. Waste observed appears to be generally household waste, wire, corrugated iron, asbestos cement sheeting, tin cans, bottles, old machinery, star pickets, concrete waste, rusted 44-gallon drums. The size of the site appears to be less than 200-500 m³. No contaminants of concern were detected at the old tip site upon investigation. Metals and arsenic were below trigger thresholds and no petroleum hydrocarbons were detected.

The main risk of land contamination is due to hydrocarbon spills and potential acid rock drainage. The workshop and fuel storage areas are the areas with the highest potential to cause spills. These areas are bunded and contaminants from these areas will be directed to a sump or drain where they can be treated or disposed of.

Sampling occurred at 19 locations over a representative grid of the overburden and interburden to be mined. Samples were analysed for paste pH and electrical conductivity (EC), cation exchange capacity (CEC), trace metals arsenic, chromium, copper, manganese, nickel, selenium, zinc and total sulphur. Where elevated total sulphur concentrations were detected the chromium reducible sulphur (CRS) and acid neutralising capacity (ANC), acid production (AP) and Net Acid Production Potential (NAPP) were performed.

Surface water and groundwater monitoring at the site and within the New Chum Creek and Isaac River is a requirement by the EA, this report makes reference to the future monitoring programs at the time of reporting. The report states that analytical results indicate that there is likely to be little or no potential for detrimental impacts to the riparian vegetation as a consequence of groundwater level drawdown in the alluvium unit.

Air quality modelling was undertaken at the mine to predict dust levels at sensitive locations – nearest residences. The natural air quality in the region is in generally good condition due to the limited number of anthropogenic air pollutants in region. Air pollutants such as SO₂ and NO_x are not considered significant due to their low levels of emission and localised impact. The predicted particulate matter concentrations of PM₁₀ in production year 20 are well below EPA guideline values. The maximum predicted increase in annual concentrations of TSP is well within the EPP (Air) guideline. Other potential impacts include sulphur dioxide, nitrogen dioxide and carbon dioxide which are emitted from internal combustion engines in mine equipment and from the spontaneous combustion of coal. These gases have the potential to dissolve in water and increase acidity leading to elevated corrosion rates. It is noted however, that this is not an issue of any significance in relation to coal mines in Queensland and no other contamination of drinking water is expected as a result of the sites dust emissions.

GHD (2010) Draft Peabody Red Mountain Coal Handling Preparation Plant (CHPP) - Receiving Environment Monitoring Program

GHD prepared a draft Receiving Environment Monitoring Program (REMP) for Red Mountain Infrastructure Joint Venture (RMJV) CHPP in accordance with the EA. The purpose of the REMP is to monitor and record the effects of contaminants on the receiving environment with the aim of identifying the extent of any adverse impacts on the local

environment and provide guidance on best practice water management for the site. This is measured by monitoring water quality at release points and within the receiving waterways. A number of potential sources of contamination were outlined in this report and have been considered in Section 4.5.

WRM Water and Environmental (WRM) (2014) Millennium Coal Mine Water Balance Model Review and Update – 2013/2014

WRM was engaged by Peabody Energy to prepare a water balance model for the MCM, complying with sections C33 and C34 of the MCM EA and relates to the development of a water management plan (WMP). The report assessment included:

- Update and review of project data by MCM;
- Update and review of the OPSIM water balance model;
- Assessment of the current status of the MCM/Red Mountain Joint Venture (RMJV) Water Management System (WMS) using the baseline model; and
- Preparation of a report summarising the outcomes of the assessment.
- The following conclusions and recommendations were made from the assessment:
- The model results indicate that the design runoff parameters, the MCM and RMJV WMSs comply with the EA requirements to their capacity to contain the design wet season;
- The MCM WMS worked water storages (dirty water dam and southern void) have adequate capacity to ensure that no unauthorised discharges of worked water for events up to an AEP 0.01 wet season; and
- The RMJV WMS worked water storages (process water dam, environment dam and tailings cells) do not have adequate capacity to ensure that there will be no unauthorised discharges of worked water for events up to an AEP⁵ 0.1 (10%) wet season.

WRM (2014) Millennium Mine and RMJV Integrated Water Management System and Water Balance Review 2014

WRM was engaged to review the MCM/RMJV mine WMS as a requirement of the EA. This review included:

- Review and interpretation of project data provided by MCM;
- Update of baseline OSPIM water balance model to reflect current mine catchments, storage levels and water demands;
- Assessment of current status of WMS using the water balance model; and
- Preparation of a report summarising the outcome.

After the assessment, WRM concluded that the water management system complies with the MCM and RMJV EA condition relating to wet season containment and when operated in accordance with the standard operating procedures for the site. It was noted that the mine water storages Mavis ROM Dam, Southern Void, RMJV WMS and the sediment dams can be operated to ensure that there will be no unauthorised discharge of worked water for events up to AEP 0.01 (1%) wet season.

BHP Billiton and Peabody Energy (2014) Red Mountain Joint Venture CHPP Environmental Management Plan

The purpose of the BHP and Peabody EMP for the RMJV CHPP facility is to provide documentation for managing environmental impacts resulting from mining activities. Specific details of how the EMP is implemented is contained in the plan of operations. The operating plans and structure may change periodically in response to a number of factors. These changes however are managed within the framework of the EMP and comply with the EA.

⁵ AEP refers to the annual exceedance probability of a flood event occurring in any year expressed as a percentage.

Peabody Energy (2014) Annual Groundwater Monitoring Review – Red Mountain Joint Venture (RMJV)

Peabody Energy undertook an annual groundwater monitoring review to the groundwater monitoring program. This involved assessing the current monitoring locations, annual rainfall, groundwater use, groundwater model, historical data against assessment criteria, review of groundwater monitoring and provided recommendation based on the information obtained. It was recommended that containment trigger values and condition W50 of the EA be removed as the data obtained in 2014 after installation of additional monitoring bores correlates with the background data obtained in 2010 and 2013. The use of groundwater for stock and/or agricultural purposes is negligible and cannot be used consistently by surrounding landholders and/or users that rely on surface dams or raw water pipelines. It was recommended to maintain the current monitoring frequency for a further 12 months and complete a yearly groundwater data review as required by the EA until an amended EA is issued based on the historical groundwater data obtained.

Peabody Energy (2015) Annual Groundwater Monitoring Review – Red Mountain Joint Venture (RMJV)

This annual report is a continuation of the annual groundwater monitoring review undertaken by Peabody Energy in 2014. The recommendations in the 2014 report are consistent with the comments made in the 2015 annual report.

WRM (2016) Risk of Discharge of mine affected water from Millennium Mine and RMJV

WRM was engaged to review the water management system and water/salt balance model for the Millennium Mine and RMJV operations. The main purpose of the review was to confirm that the risk of wet season mine water discharge is less than 1 in 100 AEP for the Millennium Mine and 1 in 10 ARI⁶ for the RMJV.

As a result of this review, WRM made updates to the rainfall/runoff model to better reflect the current infrastructure. The key changes to the site water balance were:

- Upgrades to the pumping infrastructure between the RMJV and Southern Void; and
- An increase in the modelled runoff inflows to the site dams.

WRM concluded that if the site water management system is operated in accordance with the rules set out in the System Operating Plan, the operations are compliant with the conditions of the EA. It was noted however that the RMJV site has insufficient local storage capacity to meet wet season or storm surge requirements. The reliable operation of the pump system from the RMJV to the Southern Void is the key to achieving containment during these events.

Peabody Energy (2016) Annual Groundwater Monitoring Review – Red Mountain Joint Venture (RMJV)

This annual report is a continuation of the annual groundwater monitoring review undertaken by Peabody Energy in 2014 and 2015. The recommendations in the 2016 report are consistent with the comments made in both the 2014 and 2015 annual reports.

JBT Consulting (2015) Red Mountain Joint Venture (RMJV) Review and Assessment of the RMJV Groundwater Monitoring Network and Data

JBT Consulting was commissioned by RMJV to review water level and water quality data from existing groundwater monitoring bores, review the effectiveness of the existing monitoring program and make recommendations for improvements or modifications to the program. Review of the current monitoring program is as a result of current groundwater trigger levels being exceeded each quarter and if these trigger levels are appropriate given the background water quality.

In summary, it was concluded by JBT Consulting (2015) that the EA trigger levels for electrical conductivity (EC) and total dissolved solids (TDS), major ions and metals/metalloids are set at a concentration that is too low given the background water quality observed in regional site groundwater bores for the majority of parameters. This results in the majority of EA trigger levels being exceeded at the majority of monitoring sites. It was recommended that the EA trigger values either be amended or removed based on the assessment undertaken.

⁶ ARI is the average recurrence interval between exceedances of a given rainfall total accumulated over a given duration

BHP Peabody (2017) Red Mountain Joint Venture Water Management Plan

The RMJV WMP is a compliance document that was prepared to satisfy the conditions of the RMJV EA and is to be reviewed annually by an appropriately qualified person in accordance with the RMJV EA. The surface water monitoring plan, MCM and RMJV Integrated WMS and standard operating procedures and plans will be updated to incorporate any of the changes identified.

BHP (2017) Poitrel Mine Water Management Plan

BHP established the BHP Coal Mine Water Management Standards to ensure practices prevent impact to mine production by excess or insufficient mine water inventory, conduct annual water risk assessments for each site and to support BHP Billiton's overall goal of becoming a global leader in water management. The Mine Water Management Plan (MWMP) was developed as part of these standards and is to be read in conjunction with the Environment Water Management Plan. These are used to ensure compliance with the licence in which the facility operates.

The MWMP outlines the management of the water balance and water inventory by running annual modelling of the Poitrel Mine (PTM) management system and long-term water inventory forecasting. The PTM water inventory Trigger Action Response Plan (TARP) is also outlined in the MWMP to provide water inventory operating levels to assist with water management on site.

BHP (2018) Technical Guidance Note – Regional and Local Structural Interpretation Poitrel Mine

BHP prepared the Technical Guidance Note for the Poitrel Mine as a result of the stage 1 3D seismic survey completed in August 2018. Changes in the number, intensity and geometry of structures were noted when compared to previous models as well as changes in bedding dips around faults. As a result of the survey, a number of recommendations were made to better understand these changes and to further investigate any structural issues in strips and pits.

Advisian (2018) Poitrel Mine Operational Improvement Program – Hydrogeological Impact Assessment

Advisian undertook a hydrogeological assessment of PTM's current planned life of asset operations by researching a number of key aspects associated with the site including:

- Hydrogeological data (geological units, hydrostratigraphy, regional bore data and locations, site hydrogeology and hydrogeology conceptualisation);
- Undertaking analytical modelling of potential inflows;
- Assessment of potential drawdown impacts based on analytical modelling;
- Preparation of drawdown maps based on the results of the analytical modelling; and
- Provide recommendations for mitigation measures and improvements to monitoring groundwater if any are identified.
- The following is a summary of the conclusions that were made:
- It is expected that dewatering of sump pits and transfer of water will continue as mining progresses;
- The active pits and final pit voids will receive rainfall and surface runoff and become groundwater sinks until an equilibrium is reached;
- Impacts on local and regional groundwater is expected to be minimal due to the low hydraulic conductivity and low flows associated with the pits;
- Groundwater level monitoring and hydrogeochemical investigation should be continued to better understand the water quality downgradient;
- Monitoring of piezometric levels, pit water levels, flow rates and hydraulic response to better predict overall water site balance;
- Map areas of potential ecological impacts in the vicinity of the river and creeks;
- Ensure appropriate measures are in place to limit erosion;

- Monitor groundwater levels on a monthly basis to assess groundwater fluctuations;
- Continue undertaking groundwater testing for pH and TDS and sampling for analytes specified in the EA;
- Undertake annual groundwater sampling based upon ANZECC (2000) guidelines;
- Continue to undertake annual review of the monitoring program to assess historical trend analysis, assessment and effectiveness of monitoring locations, recommendations for additional locations and monitoring depths, modifications to the monitoring program, impact assessment and additional monitoring in case of significant environmental incident occurring;
- Undertake climate measurements to include precipitation and evaporation;
- Measure daily dewatering volumes, inflows and outflows from pits, mixing and storage, maintain measurements and accurate water balance; and
- Records water usage and water quality (pH, EC, TDS) when using mixed groundwater/surface water for mining operations.

SLR Consulting (2020) Annual Groundwater Monitoring Review

SLR Consulting conducted an annual review of the BMC Poitrel Mine (PTM) groundwater monitoring network, consistent with condition F58 of the PTM Environmental Authority (EA) EPML00963013, for the period September 2019 to August 2020. Its investigation comprised:

- Review of previous groundwater monitoring data and bore logs provided by PTM, collected by various environmental consultancies;
- Source climate data from the Bureau of Meteorology;
- Monitoring of five monitoring bores for groundwater levels, pH, electrical conductivity (EC) and suspended solids (SS); and
- Groundwater trigger levels were compared against previously defined values as part of the EA.

Following is a summary of the results:

- SLR recommended that OBS10 bore be supplemented by the OB9 bore to offer coverage of the aquifer;
- Groundwater levels in the interburden of the Fort Cooper Coal Measures were reported to have stable water levels;
- Bore OB5 showed signs of a trend in decline groundwater over the reporting period which was reported to be possibly related to average rainfall in the periods leading up to the monitoring event. pH or SS were observed. There were no trends in pH, SS or EC for this location;
- OB2 showed exceedances of pH and should be monitored and investigated further;
- OB1 has an increased trend in EC;
- No EC or SS trends were noted for OB4 however an upwards trend in pH is evident; and
- SLR considered that SS is not an appropriate parameter from which to assess groundwater quality and suggests that metal concentrations may be a more useful parameter to assess mine impacts on groundwater quality at the site.

BHP Environmental Sampling – April 2021

BHP conducted a Groundwater Monitoring Event on 21 April 2021 whereby MB3A, MB3B, MB4, MB114A and MB11B were sampled, and groundwater samples were submitted to a NATA-accredited laboratory (ALS) for testing. The results showed that for a sample collected from MB3B (in the south west corner of the site, see Figure 1), TRH fractions C16-C34 concentration (0.190mg/L) exceeded the adopted trigger level of 0.1 mg/L.

4.4.1 Summary of Previous Reports

- Groundwater quality has been found to exceed the ANZECC Irrigation Water Quality guidelines for chloride, sodium, iron and manganese at the Daunia site, however it is noted that the concentrations of both iron and manganese are considered to be naturally occurring (i.e. background concentrations) and may also impact the RMI;
- Water balance modelling undertaken for the Daunia site for their Environmental Impact Statement concludes that any groundwater impacts caused due to mining operations are anticipated to be localised to the vicinity of the rehabilitated final void and may have some applicability to the environmental condition at RMI;
- Little to no potential for detrimental impacts to the riparian vegetation as a consequence of groundwater level drawdown in the alluvium aquifer was reported in the Daunia Environmental Impact Statement and may have some applicability for RMI;
- It is recommended that the Poitrel cattle dip and Poitrel Station Tip are fenced off to prevent stock access;
- Poitrel Homestead Landfill is considered to be a potential source of hydrocarbon impact (i.e. spills associated with the workshop and the fuel storage areas) and potential acid rock drainage that may have a contamination potentials for RMI.
- The use of groundwater for stock and/or agricultural purposes in the local region is considered negligible as it cannot be used consistently by surrounding landholders; and
- Trigger values appear in appropriate when compared to regional water quality in the reports reviewed

4.5 Potential Sources of Contamination and Likely CoPC

The following activities on and off the investigation have the potential to be a source of contamination, relevant at the site:

- Onsite:
 - Fill material;
 - Rail facilities;
 - Tailing drying cells;
 - Chemicals stored onsite;
 - Land clearing and levelling;
 - Runoff from disturbed land (e.g., stockpiles, ROM pad);
 - Saline, metalliferous and/or acidic leachate from stockpiles (observed to the west of the process water dam, and to the north of the finished product stockpile as location marked northern pond on Figure 1);
 - Coal/product spills;
 - Discharge of Mine Affected Water (e.g., overflow and/or seepage from the process water dam and / or the environmental dam);
 - Bulk fuel/chemical storage;
 - Runoff from chemical or fuel/oil spills;
 - Stormwater and process water channels diversion;
 - Sewage generation and storage;
 - Waste storage (general, recyclable, oil filters, septic (raw sewage), waste oil, oily rags, scrap steel, scrap tyres, pallets, batteries, hydraulic hoses and coal waste); and Regulated waste (such as waste oil) storage within the CHPP area and Laydown Area; and
 - Water use.

- Offsite:
 - Coal mining / handling / processing activities;
 - Bulk chemical and fuel storage at surrounding mine sites;
 - Livestock grazing (e.g., could include chemical storage and runoff, sediment laden runoff and increased nutrients loads, cattle dips); and
 - Railway yards and transport corridors.

4.6 Site Inspection

A site visit was undertaken on the 31 May 2021 by CDM Smith Environmental Engineer, Lionel Meynadier. A summary of site observations is provided in Table 4-8, and the site inspection log and photographs are provided in Appendix D.

Table 4-8 Summary of Site Observations

Site Observations	Description	Photo Reference
Current Use	The site is currently used as a coal washing, storage and loading facility.	-
Most Recent Historical Use	The mining facility has been in operation on Lot 4 Plan SP190266 mining lease ML70312 which began construction in 2005.	-
Surrounding Land Use	The RMI is surrounded by multiple mining operations. Daunia, Poitrel and Red Mountain Lease (ML70116) is located immediately to the south and of the South. Mountain Pit Lease (ML70344), Millennium West Lease (ML70313) and North Poitrel Lease (ML70401) are located immediately to the North. West of the site Poitrel Lease (ML4749) is located to the south west of the site. Daunia Lease (ML1781) and Daunia East Lease (ML70115) are located to the south east of the site. Coal from Daunia and Daunia East lease is processed in the Red Mountain Lease (ML70116). Red Mountain facility utilises the site coal load out facility but do not share the CHPP at RMI.	Figure 2
General Site Features	The site features the coal handling and preparation plant, environment dam, process water dam, Tailing Drying Cells, ROM pad. Inside a concrete bund were: - one 22.7 kL diesel above ground storage tank (AST) - one 22.7 kL Methyl Isobutyl Carbinol (MIBC) AST and - 2 x AFFF fire extinguishers potentially containing PFAS. Flocculant product provided by BASF in powdered form was evident near the CHPP area. Diesel mobile ASTs were located near the laydown area for machinery refuelling. Five clay lined tailing drying cells were evident. Dangerous goods storage was evident within the workshop cabinets. The finished coal product was stockpiled in the coal handling area before being loading onto a train via conveyor belt. Drums and Intermediate Bulk Containers (IBCs) containing lubricant, oil, coolant and transmission fluid were observed within the laydown area. These Drums and IBCs were stored on a layer of old rubber conveyor belt placed on the ground. Waste oils were observed to be stored in poorly banded drums and open IBCs. No ground covering was noted (Photo 22)	1-32

Site Observations	Description	Photo Reference
Building and Grounds Condition	Bunded concrete pads in the stationary AST area were in relatively good condition with some evidence of diesel staining (Photo 7). Evidence of subsidence in the concrete delivery pad was evident, allowing potential spills to runoff onto the ground (Photo 8). The integrity of the tailing drying cells clay liner is monitored and maintained regularly. Coal fines were evident in the CHPP stormwater drains channels that are included in the stormwater catchment that discharge into the environmental dam. Stockpiles containing waste coal were noted in several locations across the site.	
Water Supply	The process water dam is used to store processed water. Additional water used at site is pumped from a bore 50 km from site. The process water dam and the environmental dam are connected to the Western Dam located within Millennium West Lease and Dams located within Poitrel Lease are interconnected by a network of pumps and pipeline that allow transfer of water between dams.	-

Section 5 Preliminary Conceptual Site Model

Based on a review of data as presented and an assessment of the COPC at the site, a preliminary CSM has been developed (Figure 7) with consideration of the consequence of the risk and potential control mechanisms and mitigation measures that can be applied both during mining operations and the subsequent transition to closure and related closure activities.

The development of the preliminary CSM (source-pathway-receptor model) included assessment of the following:

- Sources of contamination and likely CoPC;
- Pathways by which contaminants can or may move in the environment; and
- Receptors, including humans, animals, waterways and ecosystems that may be impacted the identified contamination onsite and offsite.

The identified onsite and offsite features and activities with the potential to be a source of contamination are summarised in Table 5-1 together with the likely pathways between the sources and receptors. A risk rating (low, moderate, high) has been applied to the source-pathway-receptor linkage based on available and collated data presented herein. CDM Smith has been conservative in its risk rating application based on the absence of data (soil, groundwater, etc) and recognises that the risk rating could be reduced when contamination data is collected and reviewed, such as via the undertaking of a DSI.

Table 5-1 Preliminary Conceptual Site Model

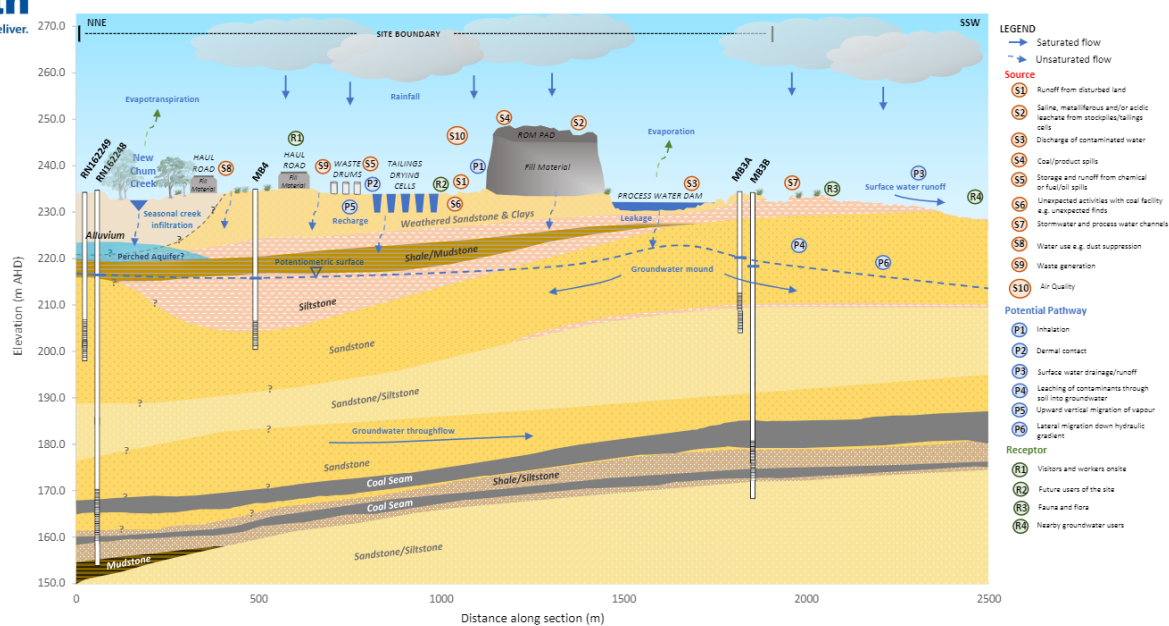
Potential Source of Contamination	Potential Transport Mechanisms and Pathways	Potential Receptors	Potential to Cause Site Contamination	Consequence	Potential Control Mitigation Measures
Onsite	Runoff from disturbed land (e.g. stockpiles, ROM pad, roads)	Visitors and workers onsite Fauna and flora Future users of the site Nearby groundwater users	Low – Runoff is captured in the surrounding storage dams.	Impacts to surface water and groundwater.	Already captured via surrounding storage dams. Continue to dam water levels to ensure levels do not exceed dam capacity during high rainfall events.
	Water use e.g. dust suppression		Low – All dirty water onsite is stored in the Process Water Dam and is not released into the receiving waterways.	Minor, negligible.	Ensure all water used for dust suppression is of suitable quality to minimise potential impacts to human health via inhalation risks.
	Unexpected activities associated with coal facility e.g. unexpected finds		Low – Depends on the type and size of the find, but risk is considered to be low given knowledge of the site and current and historical activities.	Localised impacts to land and potentially groundwater.	Ongoing groundwater monitoring program and site operations undertaken in accordance with EMP.
	Fill material – uncontrolled and source unknown	Visitors and workers on site Future users of the site Fauna and flora Nearby groundwater users	Low to Moderate – depending on the components of the fill material used. Surface water and groundwater likely impacted already from this source.	Impacts to surface water and groundwater.	Control onsite surface water runoff through appropriate stormwater management devices.
	Land clearing and levelling		Low – May be impacted by unexpected/unknown CoPC that are buried.	Impacts to surface water and groundwater.	Control onsite surface water runoff through appropriate stormwater management devices.
	Tailings drying cells		Moderate – Various potential risks that may lead to contamination as a result (see Table 5-5).	Impacts to surface water and groundwater.	Control onsite surface water runoff through appropriate stormwater management devices. Additional bunding and runoff collection controls around tailing drying cells.

Potential Source of Contamination	Potential Transport Mechanisms and Pathways	Potential Receptors	Potential to Cause Site Contamination	Consequence	Potential Control Mitigation Measures
Onsite	Saline, metalliferous and/or acidic leachate from stockpiles of uncharacterised material including coal waste	Visitors and workers on site Fauna and flora Nearby groundwater users	Moderate – In the absence of environmental data of soil/sediment and groundwater, a moderate rating has been applied. Saline drainage is likely not an issue as all runoff from the ROM and/or product stockpiles is captured within the Process Water Dam and/or Environment Dam (BHP Peabody 2017). Acid mine drainage is likely not an issue as tailings and reject material is not disposed of on the RMJV infrastructure area. All waste material is disposed of within in-pit overburden waste dumps external to the site. Seepage from the tailings drying cells is a risk if the foundations and walls are damaged.	Impacts to surface water and groundwater.	Control onsite surface water runoff through appropriate stormwater management devices. Additional bunding and runoff collection controls around tailing drying cells. Ensure tailings drying cells are regularly inspected as required.
	Coal/product spills, air pollution	Visitors and workers onsite Fauna and flora Nearby residents	Low – Depending on the severity of the spills and the location. Air pollution (mostly confined to rising dust) is considered to be low due to the types of activities on the site and absence of significant sensitive receptors surrounding the site. Spontaneous combustion of stockpiled coal is considered unlikely due to low levels of sulfur and low moisture (BHP Peabody 2014).	Localised impacts to surface soils and air, with some potential for localised groundwater impacts (coal spills).	Mitigation in place to ensure appropriate bunding and storage of all chemical used onsite (coal spills) and monitor dust generation (air pollution).
	Discharge of contaminated water to the environment	Future users of the site Fauna and flora Nearby groundwater users	Moderate – The RMJV WMS has insufficient local storage capacity to meet wet season or storm surge requirements, which relies on the correct operation of the pump system from the RMJV to the southern void during storm events. Dams must be operated at the target operating levels to ensure the design pump capacities at dams can be achieved during rainfall events (WRM 2016). Since BHP operation (2018) there have been no discharges or requirement for discharges from the dams.	Overland flow from onsite dams, causing localised erosion and sedimentation issues and water quality impacts to downstream receptors, potentially including Isaac River.	Ensure at all times that dams are operated at target operating levels. Consider additional pump redundancy to ensure higher pumping capacities during heavy rainfall events. Continue water monitoring program to ensure water used onsite is of adequate condition for use.

Potential Source of Contamination	Potential Transport Mechanisms and Pathways	Potential Receptors	Potential to Cause Site Contamination	Consequence	Potential Control Mitigation Measures
Releases/seepage of MAW infrastructure including dams, pipes and other plant	Surface water drainage/runoff Leaching of contaminants through the soil profile into groundwater Lateral migration down hydraulic gradient	Visitors and workers onsite Fauna and flora Future users of the site Nearby groundwater users	Low to Moderate – May contribute to erosion and change of energy flow, causing downstream damage. Diversions have been made to ensure that water channels do not come into contact with the mine operations and MAW. All dams are inspected annually by a suitably qualified and experienced person (BHP Peabody 2017).	Potential to impacts groundwater onsite as well as down gradient.	All dams and associated infrastructure inspected and maintained as required.
Sewage generation, storage, malfunction	Inhalation Surface water drainage/runoff Leaching of contaminants through the soil profile into groundwater Lateral migration down hydraulic gradient Upward migration of vapour	Visitors and workers onsite Fauna and flora Future users of the site Nearby groundwater users	Low – Sewage generated is collected and stored in tanks that are periodically pumped out by regulated waste contractors and taken offsite. No treatment occurs on site.	Localised impacts to land and potentially groundwater.	Ensure sufficient control are in place to prevent overfilling of storage tanks. Storage tanks are to be inspected as required.
Regulated waste generation/storage	Surface water drainage/runoff Leaching of contaminants through the soil profile into groundwater Lateral migration down hydraulic gradient	Visitors and workers onsite Fauna and flora	Low – Minimal waste disposal occurs on site. Most waste is taken off the site for disposal by licenced contractors.	Localised impacts to land.	Ensure all appropriate waste management procedures are followed in accordance with site EMP.
Bulk storage and runoff from chemical or fuel/oil spills	Inhalation Surface water drainage/runoff Leaching of contaminants through the soil profile into groundwater Lateral migration down hydraulic gradient Upward migration of vapour	Visitors and workers onsite Fauna and flora Future users of the site Nearby groundwater users	Low – Fuel storage facilities are located in designated areas and are contained to the maximum extent possible. Fuel delivery pad has a gap in concrete bund which was identified during the site inspection which may be a potential pathway.	Localised impacts to surface soils, with some potential for localised groundwater impacts.	Ensure maintenance and inspections of bunding and storage facilities is undertaken regularly for all fuel/chemicals onsite.

Potential Source of Contamination	Potential Transport Mechanisms and Pathways	Potential Receptors	Potential to Cause Site Contamination	Consequence	Potential Control Mitigation Measures
Livestock dips/grazing (chemical runoff, sediment laden runoff and increased nitrogen phosphorus loads)	Leaching of contaminants through the soil profile into groundwater Lateral migration down hydraulic gradient	Future users of the site Fauna and flora Nearby groundwater users	Low – Grazing land does not occur within 1 km of the site.	Potential localised impacts to land, surface water and localised groundwater on surrounding mine sites.	Continue monitoring groundwater program to assist in identifying offsite contamination.
Railway yards and transport corridors	Inhalation Surface water drainage/runoff Leaching of contaminants through the soil profile into groundwater	Future users of the site Fauna and flora Nearby groundwater users	Low – The rail network and loading facility is cross gradient/downgradient of the site.	Negligible	No mitigation measures recommended.
Coal mining/handling activities	Inhalation Surface water drainage/runoff Leaching of contaminants through the soil profile into groundwater Lateral migration down hydraulic gradient	Visitors and workers onsite Future users of the site Fauna and flora Nearby groundwater users	Moderate – Surrounding mine operations may impact future rehabilitation and closure plans due to the type of activities undertaken and their impact on the RMI site.	Potential contamination from offsite sources in	Ensure continual monitoring around the site to identifier potential contamination issues.
Bulk chemical and fuel storage associated with surrounding mine sites and located upgradient from site	Surface water drainage/runoff Leaching of contaminants through the soil profile into groundwater Lateral migration down hydraulic gradient Upward vertical migration of vapour	Future users of the site Fauna and flora Nearby groundwater users	Low – Will depend on volume and storage facilities. The risk to the RMI site could increase if spills have occurred up gradient.	Localised impacts to groundwater.	Maintain appropriate tank testing program and check for product loss. Continue groundwater monitoring program to assist in identifying offsite contamination.

Figure 7. Conceptual Site Model



5.1 Qualitative Risk Assessment

5.1.1 CoPC

Based on the summary of the identified historical and current activities both on the site and in surrounding areas, that have the potential to cause contamination on the site, as gleaned from the information review and presented above, we identified associated contaminants of potential concern (CoPC) as presented in Table 5-5. Their potential to cause contamination to the site has been determined based upon (i) type of activity; (ii) depth to groundwater and distance to sensitive receptors; (iii) mobility of CoPC; and (iv) proximity of contaminating activity to site based on hydraulic gradient and a risk rating has been applied.

5.1.2 Risk Rating

Consistent with the NEPM (2013) which states that “Contaminated sites may contain multiple contaminants in soil and groundwater and the risk posed is affected by site characteristics such as soil properties and the depth to the contamination” (Section 3.2), a qualitative risk rating (i.e. potential to cause contamination) was applied to each identified source in preliminary conceptual site model (Table 5-1) and in the absence of empirical data confirming or otherwise that contamination is, or the CoPC are, present.

A low, moderate, high risk rating was applied relevant to the CoPC’s potential to cause contamination taking into account source-pathway-receptor linkages, whether the exposure pathways are plausible and whether any exposure will cause harm, and based on:

- the location of the contamination in relation to any on-site and off-site sensitive receptors;
- the existing or proposed land use(s);
- the presentation of contaminants including lateral extent, depth below finished ground level, the presence of barriers or containment that prevents or minimises the migration of contamination or exposure pathways;
- the in situ leaching characteristics of contaminants of concern and the potential for leachate to adversely affect any accessible sensitive on-site and off-site receptors; and
- the potential for contaminants to be transported from the site at levels of concern by erosive forces.

The likelihood ratings and the severity ratings are defined in Table 5-2 and Table 5-3, respectively. The risk rating is calculated by multiplying the likelihood and severity rating factors and are defined in Table 5-4. We have based the likelihood definitions, severity ratings and risk rating calculation on BMC’s standard.

Table 5-2 Likelihood Rating Definitions

Likelihood Level	Description
Highly Likely -Factor 3	Likely to occur within a 1-year period
Likely - Factor 1	Likely to occur within a 1-to-5-year period
Possible - Factor 0.3	Likely to occur within a 5-to-20-year period
Unlikely - Factor 0.1	Likely to occur within a 20-to-50-year period
Highly Unlikely - Factor 0.03	Not likely to occur within a 50-year period

Table 5-3 Severity Rating Definitions

Severity Level	Description
Very high Factor 1000	6 or more fatalities or 6 or more chronic life-threatening illnesses; or Severe impact to the environment and where recovery of ecosystem function takes 10 years or more; or Severe impact on community lasting more than 12 months or a substantiated human rights violation impacting 6 or more people; or Severe impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a global level; or US\$2 billion or more.
High Factor 300	1-5 fatalities or 1-5 or more chronic life-threatening illnesses; or Serious impact to the environment, where recovery of ecosystem function takes between 3 and up to 10 years; or Serious impact on community lasting 6-12 months or a substantiated human rights violation impacting 1-5 persons; or Serious impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a national level; or Between US\$250 million and up to US\$2 billion.
Moderate Factor 100	Life altering or long term/permanent disabling injury or illness to one or more persons; or Substantial impact to the environment, where recovery of ecosystem function takes between 1 and up to 3 years; or Substantial impact on community lasting 2-6 months; or Substantial impact on company reputation, legal rights or compliance, social value proposition, or ability to access opportunities at a sub national level (state, territory, province); or Between US\$50 million and up to US\$250 million.
Low Factor 30	Non-life altering or short-term disabling injury or illness to one or more persons; or Measurable but limited impact to the environment, where recovery of ecosystem function takes less than 1 year; or Measurable but limited community impact lasting less than one month; or Measurable but limited impact on company reputation, legal rights or compliance, or social value proposition at a local level (region, city, town); or Between US\$2 million and up to US\$50 million.
Very Low Factor 10	Low level impact resulting in first aid only; or Minor, temporary impact to the environment, where the ecosystem recovers with little intervention; or Minor, temporary community impact that recovers with little intervention; or Minor, temporary impact on company reputation, legal rights or compliance, or social value proposition; or Less than US\$2 million.

Table 5-4 Risk Rating Definitions

Risk Level	Description
High >300	Indicates that the activity results in serious or significant or substantial impact to sensitive receptors where recovery requires intervention such as remediation to mitigate or reduce the risk to as low as reasonably practicable.
Moderate 30 to 300	Indicates that the activity has a measurable but manageable level to cause harm or impact to sensitive receptors from the identified contamination sources based on type, pathway and hydraulic gradient. Recovery of the impact is likely achievable in the short term and the risk level could likely be reduced/mitigated with additional data collection or additional controls/monitoring and/or management.
Low <30	Indicates that the activity has a low to tolerable level of risk to cause impact to groundwater based on the identified sources, and pathways being absent or incomplete. The risk level could likely be reduced with collection of data (monitoring/management) or controls put in place (such as remove the source)

A summary of all potential sources of contamination, associated with current activities, identified during the PSI and their associated risk ratings, are as presented in Table 5-5, below.

Table 5-5 Risk Rating of current activities on and offsite with the potential to cause contamination

Potential Source	Potential for site impacts based on hydraulic gradient	CoPC	Risk of Contamination to:		
			Land	Groundwater	Soil Vapour
Fill material – uncontrolled and source unknown	Onsite/Offsite	Range of CoPC	Moderate	Moderate	Low
Land clearing and levelling	Onsite/Offsite	Salinity, sediment, buried (unknown/unexpected) CoPC	Moderate	Moderate	Low
Runoff from disturbed land (e.g. stockpiles, ROM and product pads, roads)	Onsite/Offsite	Lubricants, detergents, hydrocarbons, heavy metals, ammonium nitrate, dissolved salts and particulate matter	Low	Low	Low
Saline, metalliferous and/or acidic leachate from stockpiles of uncharacterised material including coal waste	Onsite/Offsite	Acids/alkali, salinity, sediment, metals, hydrocarbons, oil and grease	Moderate	Moderate	Moderate
Coal/product spills	Onsite/Offsite	Lubricants, detergents, hydrocarbons, heavy metals, ammonium nitrate, dissolved salts and particulate matter	Moderate	Moderate	Moderate
Tailings drying cells: ▪ Clay Drying Cells clay liner failure ▪ Rupture of slurry delivery pipeline or decant water pipeline ▪ Rainfall induced erosion ▪ Geotechnical failure or deformation of containment wall ▪ Overfilling ▪ Seepage through wall and/or foundation ▪ Dust or gaseous emissions ▪ Exposure of wildlife or livestock to contaminated water or entrapment	Onsite/Offsite	Heavy metals, sulfates particulate matter (dust), chemical dust suppressants, gases, acids/alkali, salinity, sediment, metals,	Moderate	Moderate	Low
Discharge of contaminated water to the environment such as overflow and/or seepage from the process water dam, the environmental dam, the tailings drying cells and/or water transfer pipelines failure	Onsite/Offsite	Acids, alkalis, TDS ⁷ , organic flocculants, metals, hydrocarbons, oil and grease, radioactive materials, solvents and caustic	Moderate	Moderate	Moderate

⁷ TDS refers to total dissolved solids

Potential Source	Potential for site impacts based on hydraulic gradient	CoPC	Risk of Contamination to:		
			Land	Groundwater	Soil Vapour
Bulk fuel/chemical storage	Onsite/Offsite	Petroleum hydrocarbons, MAHs ⁸ , PAHs ⁹ , MIBC, metals and oil and greases	Moderate to High	Moderate to High	Moderate to High
Runoff from chemical or fuel/oil spills	Onsite/Offsite	Petroleum hydrocarbons, PAHs, metals and oil and greases, lubricants and solvents	Moderate to High	Moderate to High	Moderate to High
Accidental spills and releases from CHPP	Onsite/Offsite	Range of CoPCs	Moderate	Moderate	Moderate
Releases/seepage of MAW infrastructure including dams, pipes and other plant	Onsite/Offsite	Acids, alkalis, TDS, organic flocculants, metals, hydrocarbons, oil and grease, solvents and caustic	Moderate	Moderate	Low
Water use e.g., dust suppression	Onsite/Offsite	Acids, alkalis, organic flocculants, metals, hydrocarbons, oil and grease, solvents and caustic	Low	Low	Low
Sewage generation, storage or malfunction	Onsite/Offsite	Nutrients, metals, phenols and pathogens	Moderate	Moderate	Moderate
Regulated waste storage	Onsite/Offsite	Heavy metals, hydrocarbons, grease/oil	Moderate	Moderate	Moderate
Spills/ leaks of hazardous material from storage and handling	Onsite/Offsite	Heavy metals, hydrocarbons, grease/oil	High	High	High
Coal mining/handling activities	Onsite/Offsite	Acids, alkalis, TDS, organic flocculants, metals, hydrocarbons, materials, solvents, caustic, sediment and particulates.	Moderate	Moderate	Moderate
Livestock dips/grazing	Offsite	Herbicides, pesticides, insecticides, fertilisers, aldrin and dieldrin, salinity, metals (e.g. arsenic), nutrients and sediment laden run off due to grazing.	Low	Low	Low
Railway yards and transport corridors offsite	Onsite/Offsite	Hydrocarbons, phenolics, metals, nutrients, carbamates, pesticides, herbicides, asbestos and any additional contaminants according to what has been transported by rail	Low	Low	Low

⁸ MAH refers to monocyclic aromatic hydrocarbons

⁹ PAH refers to polycyclic aromatic hydrocarbons

The likelihood of impacts on groundwater resources or receptors is considered low given the current understanding of potential risk pathways identified, namely:

- A relatively deep watertable precluding the possibility of groundwater discharge to New Chum Creek, with current groundwater predicted to discharge downgradient into neighbouring mining operations where those operations are actively mining coal seams of the FCCMA;
- Current onsite stormwater management prevents uncontrolled direct discharge to the surface water environments, with future surface water flows planned to occur across fully rehabilitated land surfaces presenting a low likelihood of future impact to receptors;
- A thick unsaturated zone provides a viable source of soil moisture for use by vegetation during dry periods, rather than potential use of water sourced from the capillary fringe above the watertable (i.e. riparian vegetation communities are less likely to be GDEs);
- Groundwater flowing through the site may ultimately discharge into the open pits of adjacent mining leases to be managed there, and is not considered to present an unacceptable risk;
- Groundwater users have not been identified on or in the immediate vicinity of the site, with the nearest groundwater users reported that there are five existing bores used for water supply and two existing bores with unknown water use purposes within 2 km of RMI; and
- Given the depth to groundwater, the dilution that would occur should any seepage occur and the water quality results noted to date it is unlikely the current water supply users would be impacted.

Considering the above the consequence of potential impact to groundwater receptors is considered to be low given the lack of identified adverse groundwater conditions within the context of its potential uses (non-drinking water quality uses). From a closure perspective and considering the rehabilitation plan for the site (decommissioning and removal of all water storage facilities, site stockpiles and contamination sources where possible) it is expected that post-closure potential impact to groundwater receptors will also be low.

Section 6 Conclusions

CDM Smith has undertaken a Preliminary Site Investigation (PSI) of the Red Mountain Infrastructure (RMI) and the coal handling and preparation plant (CHPP) located on Lot 4 Plan SP190266 covering mining lease ML70312. The PSI was undertaken in accordance with Schedule B2 of the ASC NEPM, the QLD Environmental Protection Act (EP Act 1994) and the DES (2018) Queensland Auditor Handbook for Contaminated Land: Module 6.

CDM Smith has provided the information herein to support BHP in their development of the Transitional PRC plan for RMI and to review whether current and historical site activities have had the potential to cause contamination, which will impact closure activities and rehabilitation plans for the site. Based on the available information and that provided by BHP, we have been conservative in our risk rating applied during the development of the CSM. It is likely that these risk ratings could be reduced or mitigated based on the collection of environmental data such as would be collected during a DSI.

CDM Smith reviewed several environmental reports provided by BHP for RMI and the Poitrel, Millennium and Daunia mine sites which identified sources of CoPC as outlined in Section 4.5, which will need to be considered in the PRC plan development. Potential moderate to high risk sources of contamination identified onsite and offsite are associated with the following activities:

- Fill material – uncontrolled and source unknown;
- Land clearing and levelling;
- Saline, metalliferous and/or acidic leachate from stockpiles of uncharacterised material including coal waste;
- Coal/product spills;
- Tailings drying cells;
- Discharge of contaminated water to the environment such as overflow and/or seepage from the process water dam, the environmental dam, the tailings drying cells and/or water transfer pipelines failure;
- Bulk fuel/chemical storage;
- Runoff from chemical or fuel/oil spills;
- Accidental spills and releases from the CHPP;
- Releases/seepage of MAW infrastructure including dams, pipes and other plant;
- Sewage generation, storage or malfunction;
- Regulated waste storage;
- Spills/ leaks of hazardous material from storage and handling; and
- Coal mining/handling activities.

CDM Smith considers that there are current and future risks to consider during day-to-day mine operation as well as during mine closure and rehabilitation activities as a result of current and historical mining activities at the site and within the surrounding area.

It is understood significant landform manipulation will be undertaken upon closure to support future land uses including grazing and woodland habitats and will take into account the relevant planning overlays that apply to the Lot. As such, it is recommended that BHP progress their understanding the actual contamination status at the site to inform the potential for exposure during decommissioning and rehabilitation activities which includes gathering data about contaminants that may have been contained or buried at the site that could pose a risk to sensitive receptors via pathways that have not yet been identified. To that end, undertaking a DSI of, at a minimum, soil and groundwater, is recommended allowing risk ratings to be confirmed and to better inform future closure efforts and long-term rehabilitation goals.

Section 7 References

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- AGE (2013) *Poitrel Mine Bore Assessment – BHP Billiton Mitsui Coal Pty Ltd*
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- BHP Billiton (2005) *Poitrel Coal Mine Project – Environmental Impact Statement*
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- BHP (2018) *Technical Guidance Note – Regional and Local Structural Interpretation Poitrel Mine*
- BMA (date unknown) *Daunia Coal Mine Project – Environmental Impact Statement (partial)*
- CDM Smith 2021 BHP Proposal for Hydrogeological, Groundwater Quality and Preliminary Site Investigation Scope of Work – Red Mountain – Progressive Rehabilitation and Closure Plan
- Department of Environment and Science (2018) *Queensland auditor handbook for contaminated land: Module 6: Content requirements for contaminated land investigation documents, certifications and audit reports*, Brisbane: Department of Environment and Science, Queensland Government
- Department of Environment and Science (2019) *Progressive rehabilitation and closure plans (PRC plans)*, Brisbane: Department of Environment and Science, Queensland Government
- GHD (2010) *Peabody Red Mountain Coal Handling Preparation Plant (CHPP) – Receiving Environment Monitoring Program* (Report reference: 42/16164/24652)
- JBT (2015) *Red Mountain Joint Venture (RMJV) – Review and Assessment of the RMJV Groundwater Monitoring Network and Data* (Report reference: JBT01-062-003)
- Peabody (2014) *Annual Groundwater Monitoring Review – Red Mountain Joint Venture (RMJV)*
- Peabody (2015) *Annual Groundwater Monitoring Review – Red Mountain Joint Venture (RMJV)*
- Peabody (2016) *Annual Groundwater Monitoring Review – Red Mountain Joint Venture (RMJV)*
- SLR (2020) *Poitrel Coal Mine 2020 Annual Groundwater Monitoring Review*, (Report reference: SLR Ref 620.11372.00500-Lo01-v1.0.docx)
- WRM (2013/2014) *Millennium Coal Mine Water Balance Model Review and Update* (Report reference: 0570-12-G1)
- WRM (2014) *Millennium Mine and RMJV Integrated Water Management System and Water Balance Review*, (Report reference: 0570-16-B2)
- WRM (2016) *Risk of discharge of mine affected water from Millennium Mine and RMJV*

Section 8 Disclaimer and Limitations

This report has been prepared by CDM Smith Australia Pty Ltd (CDM Smith) at the request of BHP Billiton Mitsui Coal Pty Ltd (BMC) for the purpose of conducting a Preliminary Site Investigation (PSI) to support the development of the Transitional Progressive Rehabilitation and Closure Plan (PRC plan) for the Red Mountain Infrastructure (RMI).

This report can be used and relied upon but neither CDM Smith, nor any officer or employee of CDM Smith, accepts responsibility or liability in any way whatsoever for the use of or reliance on this report for any purpose other than that for which it has been prepared.

Except with CDM Smith's prior written consent, this report may be:

- released to any other party, whether in whole or in part (other than to officers, employees and advisers of BHP Billiton Mitsui Coal Pty Ltd (BMC));
- used or relied upon by any other party; or
- filed with any Governmental agency or other person or quoted or referred to in any public document.

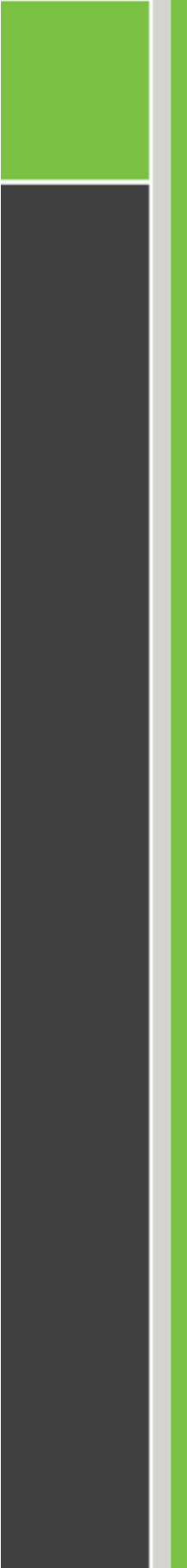
Neither CDM Smith, nor any officer or employee of CDM Smith, accepts responsibility or liability for or in respect of any use or reliance upon this report by any third party.

The information on which this report is based has been provided by BHP Billiton Mitsui Coal Pty Ltd (BMC) and third parties. CDM Smith (including its officers and employees):

- has relied upon and presumed the accuracy of this information;
- has not verified the accuracy or reliability of this information (other than as expressly stated in this report);
- has not made any independent investigations or enquiries in respect of those matters of which it has no actual knowledge at the time of giving this report to BHP Billiton Mitsui Coal Pty Ltd (BMC); and
- makes no warranty or guarantee, expressed or implied, as to the accuracy or reliability of this information.

In recognition of the limited use to be made by BHP Billiton Mitsui Coal Pty Ltd (BMC) of this report, BHP Billiton Mitsui Coal Pty Ltd (BMC) agrees that, to the maximum extent permitted by law, CDM Smith (including its officers and employees) shall not be liable for any losses, claims, costs, expenses, damages (whether in statute, in contract or tort for negligence or otherwise) suffered or incurred by BHP Billiton Mitsui Coal Pty Ltd (BMC) or any third party as a result of or in connection with the information, findings, opinions, estimates, recommendations and conclusions provided in the course of this report.

If further information becomes available, or additional assumptions need to be made, CDM Smith reserves its right to amend this report.



Appendix A SQP Declarations and CVs

Suitably qualified person declaration

In accordance with section 566 of the Environmental Protection Act 1994 (EP Act), a suitably qualified person (SQP) must provide the administering authority with a declaration to accompany a document prepared by the SQP in relation to a regulatory function. Section 564 states that a regulatory function to be performed by an SQP means:

- conducting a site investigation to prepare a site investigation report
- preparing a validation report
- preparing a draft SMP or a draft amended SMP.

A contaminated land investigation document, which needs to be prepared in accordance with section 389, can comprise any of the above documents or a combination of these.

This template is for use by a SQP to make a declaration under section 566 of the EP Act, which must accompany a contaminated land investigation document submitted to the administering authority.

1. Suitably qualified person (SQP) details

FULL NAME Kylie Jane Bradley	
COMPANY CDM Smith	
REGISTERED ADDRESS 4/51 Alfred Street, Fortitude Valley	POSTCODE 4006
TELEPHONE 0405 382 958	
EMAIL bradleykj2@cdmsmith.com	
POSTAL ADDRESS (WRITE 'AS ABOVE' IF THE SAME AS REGISTERED ADDRESS) PO Box 359 Fortitude Valley	POSTCODE 4006
PRESCRIBED ORGANISATION (IN ACCORDANCE WITH SCHEDULE 14 OF ENVIRONMENTAL PROTECTION REGULATION 2019) OF WHICH I AM A MEMBER: ACLCA	

2. SQP's role in preparing the contaminated land investigation document

- ☐ I am the suitably qualified person who prepared the contaminated land investigation document OR
- ☒ I am a suitably qualified person who prepared specific components of the contaminated land investigation document. (Provide details below)

The contaminated land investigation document is comprised of:

- ☒ Site investigation report
- ☐ Validation Report
- ☐ Draft SMP
- ☐ Draft amended SMP

Suitably qualified person declaration

DETAILS OF THE CONTAMINATED LAND INVESTIGATION DOCUMENT (OR PART(S) THEREOF) THAT I PREPARED:

As technical lead on the project, designed the PSI, guided the preparation and development of the PSI and undertook the review of the document.

e.g. Title, date, version and where appropriate chapter, section

3. Declaration

I do solemnly and sincerely declare that:

- I have the following qualification(s) relevant to work I have completed for the contaminated land investigation document:

Identified knowledge area required	Name of degree or post graduate qualifications (and major discipline of study if relevant)	Institution conferring the degree	Year of completion
Soil Science and contaminated land management	Bachelor of Science (Hons)	UNSW	1992
	PhD Land and Food (Soil Science)	UQ	1998
	CPSS-CSAM	Soil Science Australia	2020

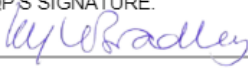
- I have the following experience relevant to the work I have completed for the contaminated land investigation document

Identified knowledge area required	DETAILS OF PAST PROJECTS DEMONSTRATING EXPERIENCE IN THE IDENTIFIED KNOWLEDGE AREA					
	Nature of hazardous contaminant / notifiable activity	Site details		Role in project	Date finalised	Regulatory function under Ch. 7, Pt 8 of the EP Act (if applicable)
		Lot and Plan reference	State			
Contaminated land management	Petroleum product or oil storage	Lot11 SP139023 Lot10 RP202791	QLD	Groundwater assessment and management	current	Site investigation
Contaminated land management	NA	Lot2 DP1063293	NSW	Preliminary site investigation	2021	Site investigation
Contaminated land management	Volatile organic compounds including chlorinated hydrocarbons	Lot40 DP1002367	NSW	Preliminary site investigation and soil gas assessment	2021	Site investigation
Contaminated land management	Petroleum product or oil storage, PAHs, dioxins, mining activities	Lot411 SP285383 and Lot 14 CP846391	QLD	Soil sampling and analysis Conceptual site model	2020	Site investigation

Suitably qualified person declaration

Identified knowledge area required	DETAILS OF PAST PROJECTS DEMONSTRATING EXPERIENCE IN THE IDENTIFIED KNOWLEDGE AREA					
	Nature of hazardous contaminant / notifiable activity	Site details		Role in project	Date finalised	Regulatory function under Ch. 7, Pt 8 of the EP Act (if applicable)
		Lot and Plan reference	State			
				Integration of site investigation report		
Contaminated land management	Petroleum product or oil storage	Lot11 SP139023	QLD	Soil and groundwater assessment	2018	EMR removal - exploratory
Contaminated land management	Petroleum product or oil storage	Lot 19 SP284805	QLD	Soil sampling and analysis Groundwater sampling and analysis Conceptual site model Remediation and validation	2016	CLID EMR removal

- I have not knowingly included false, misleading or incomplete information in the document.
- I have not knowingly failed to reveal any relevant information or document to the administering authority.
- The contaminated land investigation document (or part thereof which I have prepared) addresses the relevant matters for the function and is factually correct.
- The opinions expressed within the contaminated land investigation document (or part thereof which I have prepared) are honestly and reasonably held.

SQP'S NAME: Kylie Jane Bradley
COMPANY: CDM Smith
SQP'S SIGNATURE: 
DATE: 2/08/2021

Dr Kylie Bradley, BSc (Hons), PhD, CPSS-CSAM

Principal Environmental Scientist



Summary

Kylie is a Principal Environmental Scientist providing technical direction, expertise and oversight and leadership in the Environment, Water & Technology team, in addition to providing technical support to the broader CDM Smith Australian business. As Operations Manager of the Environment, Water & Technology team, Kylie coordinates and manages a growing team of 26 members, comprising soil and environmental scientists, engineers, risk assessors & toxicologists, and data analysts. In this role Kylie provides management and leadership in operations, technical delivery and culture.

Experience Highlights

- Soil and groundwater (bio) remediation
- Characterisation and chemical assessment of soil and groundwater
- Conceptual Site Models
- Remediation and validation of soil and groundwater assessment
- Program/Project management and coordination
- Organisational experience with multi-disciplinary/multi-institutional groups
- Diagnosis and problem-solving skills in research and government environments
- Implementation and validation of corporate workplace health and safety requirements

Kylie holds a position on the CDM Smith Australian Leadership Team reporting to and working with the Managing Director and Managing Principals to deliver the Australian strategic plan to ensure our objectives are met, provide vision and an environment with a strong and supportive culture.

Kylie has developed and stewards the implementation of CDM Smith Australia's Graduate Development Framework and the Project Management Framework. Through the implementation of the Graduate Program Kylie fosters and maintains strong connections with national educational institutions, and managing the engagement with those in

Queensland with a reputation for environmental and earth science disciplines, including the University of Queensland and The Queensland University of Technology.

Technical Career Summary

Kylie is a Principal Environmental Scientist with almost 20 years' experience in the soil science and contaminated land industry both as a consultant and as an industry client. Kylie is a Certified Professional Soil Scientist (CPSS, since 2017) with the specialist competency in Contaminated Site Assessment and Management (CSAM, certified April 2020). With a combination of experience, qualification and skills she has a reputation for providing and delivering high quality programs and fostering strong, effective, and respectful relationships with her clients.

Kylie has predominantly worked on projects related to the assessment and investigation of soils and groundwater with the objective of rehabilitation and management specifically related to contaminated land, including acid sulfate soils. More recently, Kylie has been integral in stewarding CDM Smith's understanding of the changes to Queensland Legislation governing the contaminated land industry, actively participating in industry forums for emerging issues, including PFAS, and leading larger environmental programs for CDM Smith's clients.

Kylie acts as a Suitably Qualified Person under Queensland Environmental Protection Act 1994 to assist clients in meeting their regulatory needs with respect to contaminated land management in Queensland.



Education

PhD Land and Food, The University of Queensland, Brisbane, 1998 (Scholarship)

Bachelor of Science, Physical Geography (Honours), The University of New South Wales, Sydney, 1992

Women and Leadership, Executive Ready, July 2019 – April 2020

Cert IV Project Management Practice - current

Boards

Soil Science Australia CPSS

Memberships

Soil Science Australia

ACLCA

ALGA

EIANZ

Certifications

Certified Professional Soil Scientist (CPSS) since 2017

Contaminated Site Assessment and Management (CSAM) since 2020

Professional Highlights

Program and Project Manager, Technical Design and Delivery, Confidential Mining Client

CDM Smith was engaged under legal privilege to assist our client in managing the human health and environmental aspects resulting from an unexpected fire incident at their mine site, that had the potential to cause significant harm to the environment and human health. Kylie as Program and Project Manager, and SQP, coordinated the significant contaminated land (soil, sediment, surface water and groundwater) assessment at the site, advising erosion and sediment control matters, management of waste, and onsite remediation treatment options. An extensive groundwater and surface water assessment assisted the client in engaging a water treatment subcontractor to manage contaminated water at the site, for a range of contaminants including PFAS.

Kylie has coordinated the expertise and efforts to CDM Smith's data analytics team in developing robust and accessible tools to manage a data set that covers a range of contaminants of concern, several media and almost 12 months' worth of sample collection (in excess of 2000 data points), cross referenced to location data provided by drone surveys.

The assessment has included a toxicological assessment and the development of site-specific human health exposure criteria and onsite/offsite reuse criteria for a range of contaminants. Additionally, the works involved the development of a health surveillance program and risk assessments to ensure ongoing operations at the site did not pose an unacceptable exposure risk to workers and visitors.

The work has been critical in providing lines of evidence and supporting document to share with the regulatory authorities to assist in working on management options and solutions to appropriate and effective outcomes for ongoing future site use. As the nominated Suitably Qualified Person under the QLD EP Act 1994 Kylie has assisted the client in the notification of environmental harm to the Department of Environment and Science, and coordinated the responses to the third party reviewer (voluntary contaminated land audit) of the detailed site investigation and toxicology reports for submission to DES as supporting lines of evidence demonstrating appropriate assessment and effective management of contaminated land issues at the site.

Project value ~\$1.5M, Project Duration October 2018 - current

Client Manager (Environment) and Technical Lead, RACQ

Since 2013 Kylie has managed RACQ as a client for CDM Smith, coordinating and delivering environmental projects across all RACQ assets, with projects including asbestos assessment and management, Phase 1 site assessments (internal compliance), detailed site assessments for due diligence, planning and approvals for development projects, etc. Kylie is not only CDM Smith's RACQ Contracts Manager (Master Services Agreement) but manages and coordinates the technical delivery of all projects. She is integral in developing and/or assisting in the technical design of all environmental assessments for the RACQ portfolio.

Project value >\$1M, Project Duration 2013 - current

Program Manager, Confidential PFAS Environmental Services, Victoria

Kylie is the Program Manager delivering a series of assessments (environmental (soil, surface water, groundwater, risk) concerned with the presence of PFAS in various media and the potential impact to identified sensitive receptors. Kylie ensures that the multiple phases of works are delivered on time, and within budget, and at a high quality. Kylie coordinates the requirement for additional services, including community and stakeholder engagement, and facilitates client meetings and workshops to discuss approaches or deliver results.

Project value: >\$3M, Project Duration March 2016 to current



Project Director and Technical Lead, Soil and Groundwater Assessment, Hamilton Northshore Urban Development Precinct, Economic Development, QLD

Kylie managed the Stage 1 of the desktop review and detailed intrusive contamination investigations (soil and groundwater, including acid sulfate soils) of two former Hamilton cold storage sites to facilitate potential subdivision and redevelopment and possible removal from the Department of Environment and Science's Environmental Management Register.

Project value ~\$150K, Project Duration July 2018 – 2020

Project Director, Environmental Services for the Dryandra Road Taxiway Underpass, Brisbane Airport

The project is the construction of a road underpass structure under the new third parallel runway taxiway. CDM Smith was engaged to assist the client to deliver the environmental site services which includes training and auditing of water quality sampling and reporting, advice and support for PFAS contamination, and acid sulfate soil training, auditing and reporting. The project includes monthly compliance reporting to Brisbane Airport, auditing and compliance monitoring against Brisbane Airport control plans, best practice, and technical advice on any environmental aspect of the project. Kylie is the client liaison manager, auditor, and coordinates monthly compliance deliverables.

Project value ~\$200K, Project Duration April 2017 to September 2018

Project Director and SQP, Removal of Site from EMR for inner-city Urban Development

Required by client to facilitate the removal of an inner-city commercial property from the EMR to facilitate development for a mixed commercial/residential development on the Brisbane River. Works required assessment, remediation of former service station activities, and working with Department of Environment and Science to remove property from the EMR and deem suitable for future residential development. Challenges of the project included a constrained time frame based on sale contract requirements, small, inner-city site with limited room for remediation works, and bedrock close to surface.

Project value ~\$280K, Project Duration February to August 2016

Lead Soil Scientist, Bandanna Energy Springsure Coal Mine EIS

As Project Director and lead Field Technician Kylie managed and undertook that assessment and investigation works to determine presence of actual or potential acid sulfate soils for a linear alignment for utility infrastructure.

Project Value ~\$100K Project Duration 2012 to 2013

Program Director and Lead Soil Scientist, Linear Soil Survey, APLNG/QGC Pipeline Project, Bowen/Surat Basins to Gladstone, QLD

Kylie was the Project Director and Soil Science Lead to contractor McConnell Dowell Joint Venture (MCJV) for the baseline soil survey of the 360 km pipeline alignment from Dalby/Chinchilla to Gladstone. Works spanned 18 months, comprised survey design and sampling and analysis of soil samples from in excess of 600 sampling locations, undertaking a soil assessment at 50 - 500 m intervals in test pits up to 2 m in depth. The assessment, analytical and reporting program was designed to meet the requirements of the regulator relevant to linear infrastructure alignments, to ensure compliance to appropriate rehabilitation plans and good quality agricultural land and strategic cropping land requirements.

Project Value ~\$2M Project Duration 2011 to 2013

Suitably qualified person declaration

In accordance with section 566 of the Environmental Protection Act 1994 (EP Act), a suitably qualified person (SQP) must provide the administering authority with a declaration to accompany a document prepared by the SQP in relation to a regulatory function. Section 564 states that a regulatory function to be performed by an SQP means:

- conducting a site investigation to prepare a site investigation report
- preparing a validation report
- preparing a draft SMP or a draft amended SMP.

A contaminated land investigation document, which needs to be prepared in accordance with section 389, can comprise any of the above documents or a combination of these.

This template is for use by a SQP to make a declaration under section 566 of the EP Act, which must accompany a contaminated land investigation document submitted to the administering authority.

1. Suitably qualified person (SQP) details

FULL NAME Lionel Meynadier	
COMPANY CDM Smith Pty Ltd	
REGISTERED ADDRESS 4/51 Alfred Street, Fortitude Valley	POSTCODE 4006
TELEPHONE 0438 294 046	
EMAIL meynadierf@cdmsmith.com	
POSTAL ADDRESS (WRITE 'AS ABOVE' IF THE SAME AS REGISTERED ADDRESS) PO Box 359 Fortitude Valley	POSTCODE 4006
PRESCRIBED ORGANISATION (IN ACCORDANCE WITH SCHEDULE 14 OF ENVIRONMENTAL PROTECTION REGULATION 2019) OF WHICH I AM A MEMBER: ACLCA	

2. SQP's role in preparing the contaminated land investigation document

- ☐ I am the suitably qualified person who prepared the contaminated land investigation document OR
- ☒ I am a suitably qualified person who prepared specific components of the contaminated land investigation document. (Provide details below)

The contaminated land investigation document is comprised of:

- ☒ Site investigation report
- ☐ Validation Report
- ☐ Draft SMP
- ☐ Draft amended SMP

Suitably qualified person declaration

DETAILS OF THE CONTAMINATED LAND INVESTIGATION DOCUMENT (OR PART(S) THEREOF) THAT I PREPARED:

I completed the Site Inspection on 2 June 2021 and co-authored the PSI report

e.g. Title, date, version and where appropriate chapter, section

3. Declaration

I do solemnly and sincerely declare that:

- I have the following qualification(s) relevant to work I have completed for the contaminated land investigation document:

Identified knowledge area required	Name of degree or post graduate qualifications (and major discipline of study if relevant)	Institution conferring the degree	Year of completion
Soil Science and contaminated land management	Master of engineering - Environmental Management	Ecole des Mines d'Ales - France	2007

- I have the following experience relevant to the work I have completed for the contaminated land investigation document

Identified knowledge area required	DETAILS OF PAST PROJECTS DEMONSTRATING EXPERIENCE IN THE IDENTIFIED KNOWLEDGE AREA					
	Nature of hazardous contaminant / notifiable activity	Site details		Role in project	Date finalised	Regulatory function under Ch. 7, Pt 8 of the EP Act (if applicable)
		Lot and Plan reference	State			
Contaminated land management	Non-halogenated Solvent contamination of groundwater	Lot 677 and 684 SL7140	QLD	Groundwater plume delineation and monitoring Remediation	2020	Site investigation
Contaminated land management	Former Mineral Sand Mining and processing facility	Lot 6 SP314789	QLD	Validation sampling and CLID preparation	2017	Validation report

- I have not knowingly included false, misleading or incomplete information in the document.
- I have not knowingly failed to reveal any relevant information or document to the administering authority.
- The contaminated land investigation document (or part thereof which I have prepared) addresses the relevant matters for the function and is factually correct.
- The opinions expressed within the contaminated land investigation document (or part thereof which I have prepared) are honestly and reasonably held.

SQP'S NAME:
Lionel Meynadier

Suitably qualified person declaration

COMPANY: CDM Smith Pty Ltd
SQP'S SIGNATURE: 
DATE: 04/08/2021

Lionel Meynadier

Senior Environmental Engineer

Summary

Lionel Meynadier has over 10 years' experience in the field of environmental engineering, focusing on the assessment and remediation of contaminated sites.

The technical breadth of Lionel's experience in contaminated land assessment includes site assessments for fire training areas, former landfills, fuel farms, industrial sites, former gasworks sites, petroleum retail sites, bulk petroleum storage sites, airports, industrial sites and numerous commercial / industrial developments.

Experience Highlights

- Project & Change Management
- Groundwater Monitoring
- Remediation works
- Soil Waste Characterisation
- High resolution vertical profiling (HRVP)
- Environmental data analysis
- Stakeholder Engagement

Lionel has also managed several soil and groundwater remediation projects including multi-phase extraction (MPE) of hydrocarbon impacted groundwater, groundwater pump and treat remediation, supervision of contaminated material

removal and subsequent validation of remedial activities.

Fieldwork for these projects has incorporated drilling, test-pitting and monitoring well installation as well as sampling of groundwater, soil, soil vapour and ambient air. Results have been incorporated into risk assessment tools, ongoing environmental management plan and remediation plans.

Lionel has been involved in different stages of investigations from the desktop site study stage to remediation and removal of remediated sites from the EMR. Lionel is a project manager able to successfully manage a project from the proposal stage to delivery.

Selected Professional Experience

Former Mineral Sand Mining and Processing Site - Rainbow Beach – Several projects 2013-2020.

Characterisation of portion of the site historically dredged for ore extraction

Lionel completed the soil sampling and reporting for the characterisation of a 4ha area previously dredged for ore extraction.

Validation and EMR removal of the former dry processing plant site 2017-2018

This project included the validation of the area historically used for dry separation of mineral sand after the remediation work was completed by a remediation contractor engaged by DNRME.

The scope consisted in validating the site of the former dry processing plant (~2ha) to demonstrate that residual mineral sands had been removed and the impacted fill material was clean.

After validation, Lionel prepared a CLID which was reviewed by the CLA and DES and the site of the former dry processing plant was subsequently removed from the EMR.

Extended Site Characterisation and Remediation - 2019-2020

This project included working with QH radiation specialists to map lateral and vertical repartition of residual mineral sands across a 12ha site.

The scope of work included:

Education

Master of Engineering -
Industrial Risks and
Environmental
Management -

Engineering School of
Ales - France (2007)

- Managing an intensive sampling program consisting of the collection of over 3000 soil samples over three mobilisations with 70% of the sampling locations being inaccessible to a drill rig (dense protected vegetation) and were accessed by foot and advanced by hand auger
- Unexpected asbestos impact was found in limited cleared areas of the site.
- Additional characterisation was performed to inform asbestos remediation scope
- Validation sampling was performed after completion of asbestos remediation scope
- Preparation of mineral sands remediation scope to maximise surface area remediated with a limited budget

CSG Ponds Characterisation and CleanUp

Lionel was involved in assessment and validation of CSG ponds including:

- Installation of seepage monitoring wells around CSG pond to allow for pond integrity monitoring
- Characterisation of residual material at the base of ponds after pond decommissioning
- Supervision of impacted material removal
- Validation of remedial activities

Manufacturing site – Wacol – Confidential client - Light TRH fractions and BTEXN impact to soil and groundwater

Compliance with EA conditions (2014-2020)

Lionel managed the annual groundwater monitoring project allowing Bandag to meet the requirement of the groundwater monitoring EA conditions.

Further assessment (2018)

DES requested the site owner to commission further environmental site assessment in 2018 to establish the origin of LNAPL reported downgradient from the former UST pit (historical source of impact).

In response to DES request, Lionel completed sub-slab vapour monitoring of buildings above and in the vicinity of the plume to assess potential hazard from vapour intrusion to building occupiers. Lionel also installed additional groundwater monitoring wells to delineate the potential plume of hydrocarbon associated with the LNAPL. Lionel also undertook a detailed review of the site history.

The result of this assessment was that the LNAPL reported up-gradient from the source was not linked to a secondary source but to the known source. The LNAPL had migrated via a trench acting as a preferential pathway built shortly before the first instance of LNAPL was reported at that location.

Further delineation works and groundwater remediation – Enhanced biodegradation of dissolved hydrocarbons – 2020

The findings of the annual groundwater monitoring event completed in 2019 suggested that the plume of contamination would extend beyond the site boundaries unless some remedial action was implemented. This prompted the installation of additional groundwater wells to refine the delineation of the lateral extent of the plume and assess volume of impacted groundwater and installation of injection wells in the centre of the plume. This allowed to obtain a more accurate delineation of the plume of dissolved hydrocarbon allowing to estimate the volume of impacted groundwater beneath the site.

The monitoring of natural attenuation parameters (including terminal electrons acceptors [TEA] and biodegradation by-products) suggested that low TEA concentrations within the plume were slowing the natural attenuation processes and allowed to design a remediation plan consisting of injection of a sulphate rich solution in the plume increasing TEA concentration in the plume and to enhance the natural attenuation process.

Retail petroleum Sites – Various clients

Lionel is experienced in working on petroleum service station owned by including VEA, Caltex, BP, 7-eleven etc.

Lionel completed a large number of environmental site assessments (including soil and groundwater sampling and assessments) on active service stations allowing clients to understand the contamination status of their sites.

At site where a vapour intrusion risk was identified, Lionel performed soil vapour and sub-slab vapour sampling to assess risk to site workers and users.

Pump and Treat - near Lismore

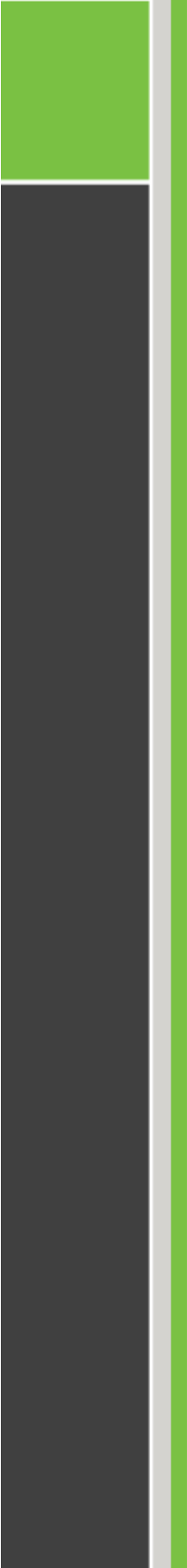
Lionel played a key role in commissioning and O&M of groundwater pump and treat system (OWS and three in-line GAC vessels) at an operational service station near Lismore, ensuring the remediation system was operating in compliance with the trade waste disposal permit.

Tank pull and UPSS removal - various sites

Lionel was involved in several project where he supervised the removal of impacted material after UST removal. Lionel's tasks also included validation sampling of the excavations to ensure remaining material was not impacted.

Monitoring PFAS impact to groundwater – ASA – Gold Coast and Brisbane Airport

Lionel conducted groundwater monitoring programs at within portions of Brisbane and Gold Coast Airports that were known to have been previously impacted with AFFF containing.



Appendix B Lotsearch Report and Additional Aerials

Lotsearch Report dated 14 May 2021 for Poitrel Mine Road, Moranbah, QLD,
4744

QLD Globe Aerials for 2009 and 2012



LOTSEARCH
LOTSEARCH ENVIRO PROFESSIONAL

Address: Poitrel Mine Road, Moranbah, QLD 4744

Date: 14 May 2021 13:46:33

Reference: LS020216 EP

Disclaimer:

The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features. You should obtain independent advice before you make any decision based on the information within the report. The detailed terms applicable to use of this report are set out at the end of this report.

Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features in Buffer
Cadastral Boundaries	State of Queensland (Department of Natural Resources, Mines and Energy) and Mines) 2017	27/04/2021	27/04/2021	Quarterly	-	-	-	-
Environmental Authorities Register Current Prescribed Environmentally Relevant Activities	Queensland Department of Environment and Science	10/05/2021	10/05/2020	Monthly	2000	1	1	1
Environmental Authorities Register Current Resource Activities	Queensland Department of Environment and Science	10/05/2021	10/05/2020	Monthly	2000	7	7	7
Environmental Authorities Register Former Prescribed Environmentally Relevant Activities	Queensland Department of Environment and Science	10/05/2021	10/05/2020	Monthly	2000	0	0	0
Environmental Authorities Register Former Resource Activities	Queensland Department of Environment and Science	10/05/2021	10/05/2020	Monthly	2000	2	2	2
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	29/04/2021	29/04/2021	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	29/04/2021	29/04/2021	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	26/04/2021	26/04/2021	Monthly	2000	0	0	0
Queensland Fire and Emergency Services PFAS Investigation Sites	Queensland Fire and Emergency Services	15/04/2021	15/04/2021	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	11/05/2021	11/05/2021	Monthly	2000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	12/05/2021	07/03/2017	Quarterly	1000	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	13/07/2012	Annually	1000	0	0	0
UBD Business Directories (Premise & Intersection Matches)	Hardie Grant			Not required	150	0	0	0
UBD Business Directories (Road & Area Matches)	Hardie Grant			Not required	150	-	0	0
UBD Business Directory Dry Cleaners & Motor Garages/Service Stations (Premise & Intersection Matches)	Hardie Grant			Not required	500	0	0	0
UBD Business Directory Dry Cleaners & Motor Garages/Service Stations (Road & Area Matches)	Hardie Grant			Not required	500	-	0	0
Groundwater Boreholes	State of Queensland (Department of Natural Resources, Mines and Energy)	16/02/2021	16/02/2021	Quarterly	2000	6	8	24
Detailed Surface Geological Units	State of Queensland (Department of Natural Resources, Mines and Energy)	13/11/2017	28/03/2017	As required	1000	4	-	4
Detailed Surface Geological Structures	State of Queensland (Department of Natural Resources, Mines and Energy)	13/11/2017	28/03/2017	As required	1000	1	-	2
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	2	2	2
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	2	2	2

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features in Buffer
Commonwealth Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
National Heritage List	Australian Government Department of Agriculture, Water and the Environment	23/02/2021	20/11/2019	Quarterly	1000	0	0	0
Heritage Register Boundaries	State of Queensland (Environment and Heritage Protection)	30/03/2021	30/03/2021	Quarterly	1000	0	0	0
Statewide Bushfire Prone Areas	State of Queensland (Department of Natural Resources, Mines and Energy)	04/03/2021	30/09/2014	Annually	1000	2	2	2
Queensland Floodplain Assessment Overlay	State of Queensland (Department of Natural Resources, Mines and Energy)	26/03/2021	17/10/2013	Annually	1000	0	0	0
Wetland Protection Area	State of Queensland (Environment and Heritage Protection)	09/04/2018	14/09/2017	Unknown	1000	0	0	0
Groundwater Dependent Ecosystems Atlas	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000	1	1	1
Inflow Dependent Ecosystems Likelihood	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000	4	4	4

Aerial Imagery 2018

Poitrel Mine Road, Moranbah, QLD 4744

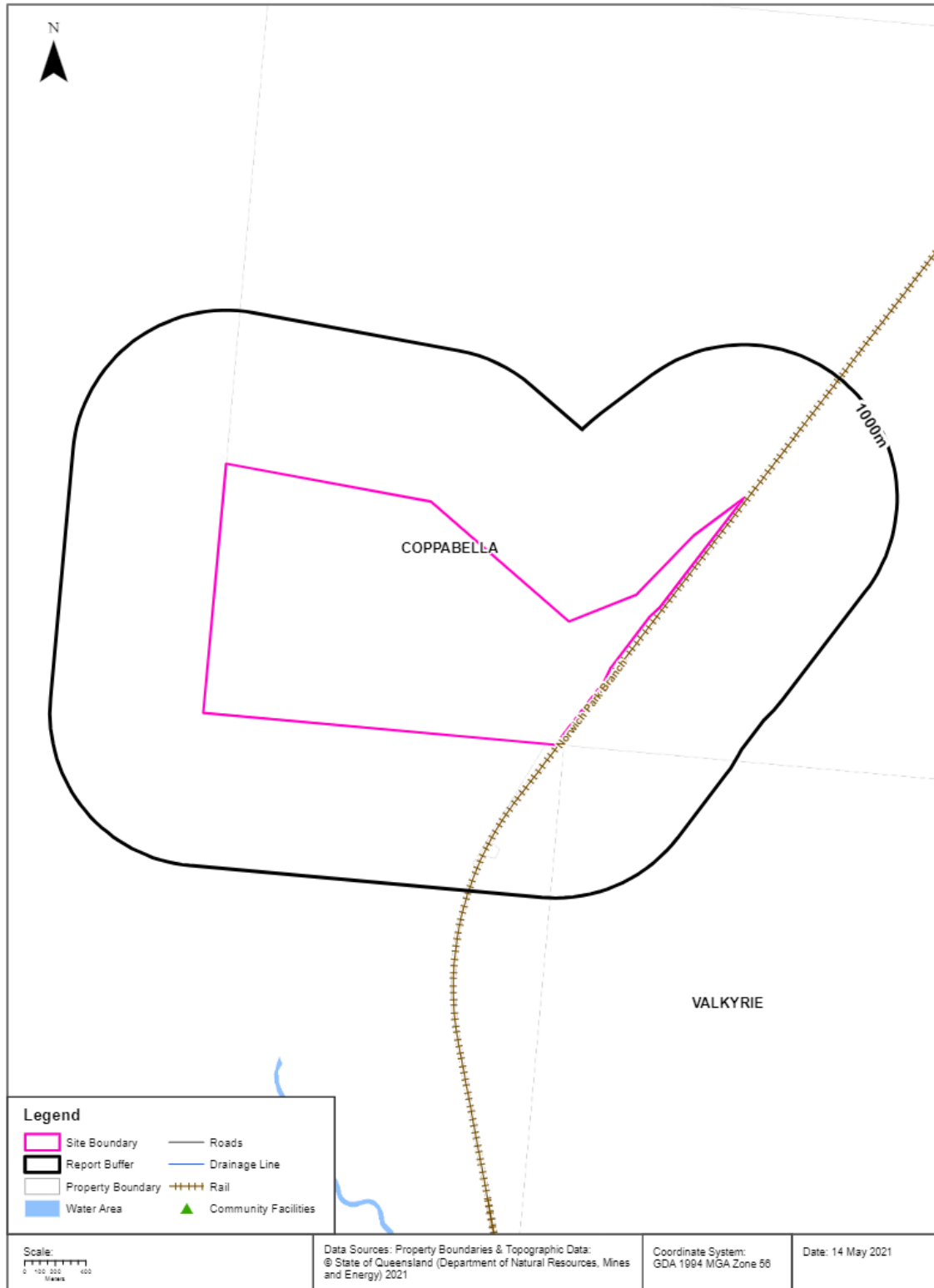


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Topographic Features

Poitrel Mine Road, Moranbah, QLD 4744

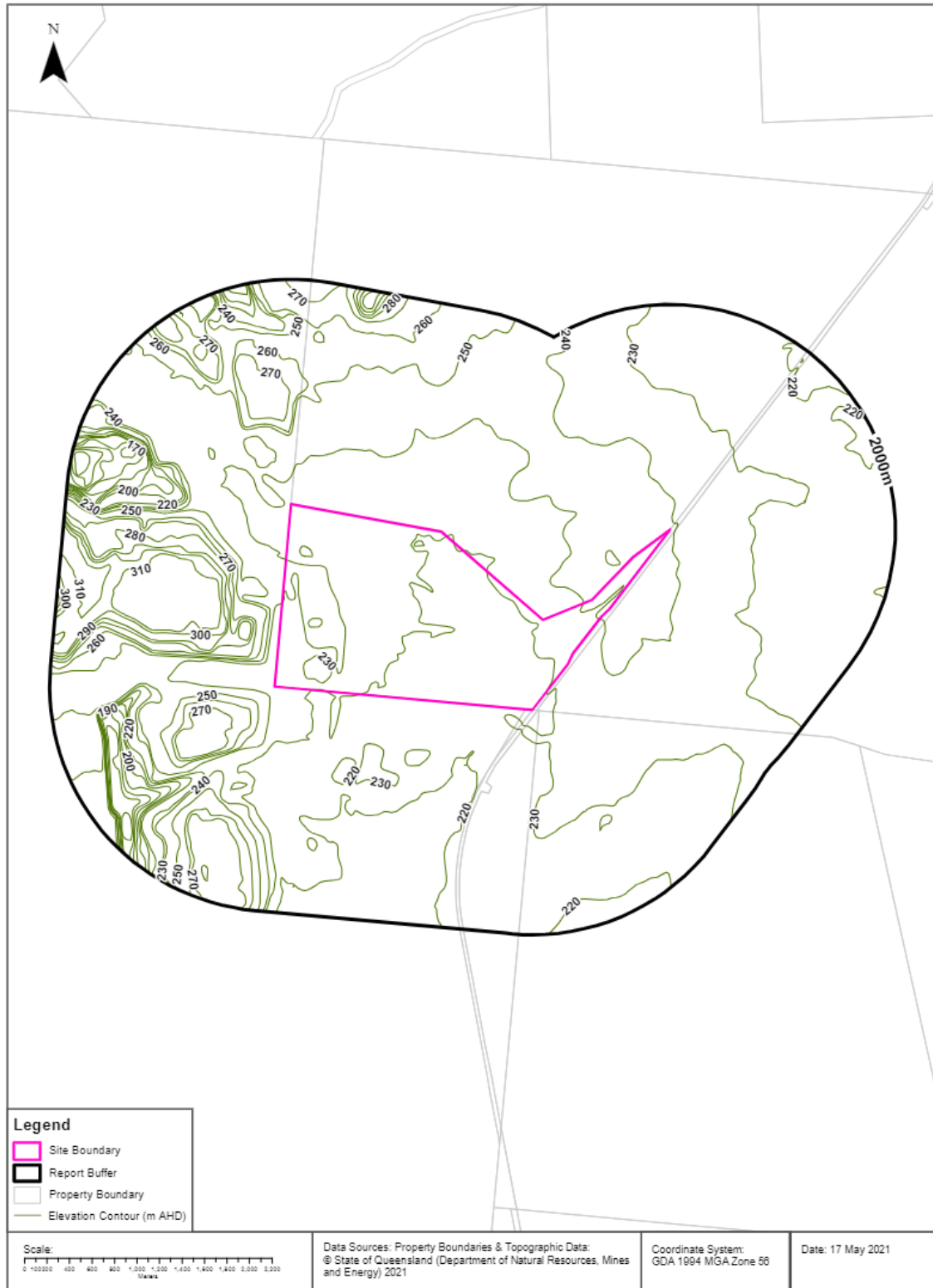


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Elevation Contours (10m)

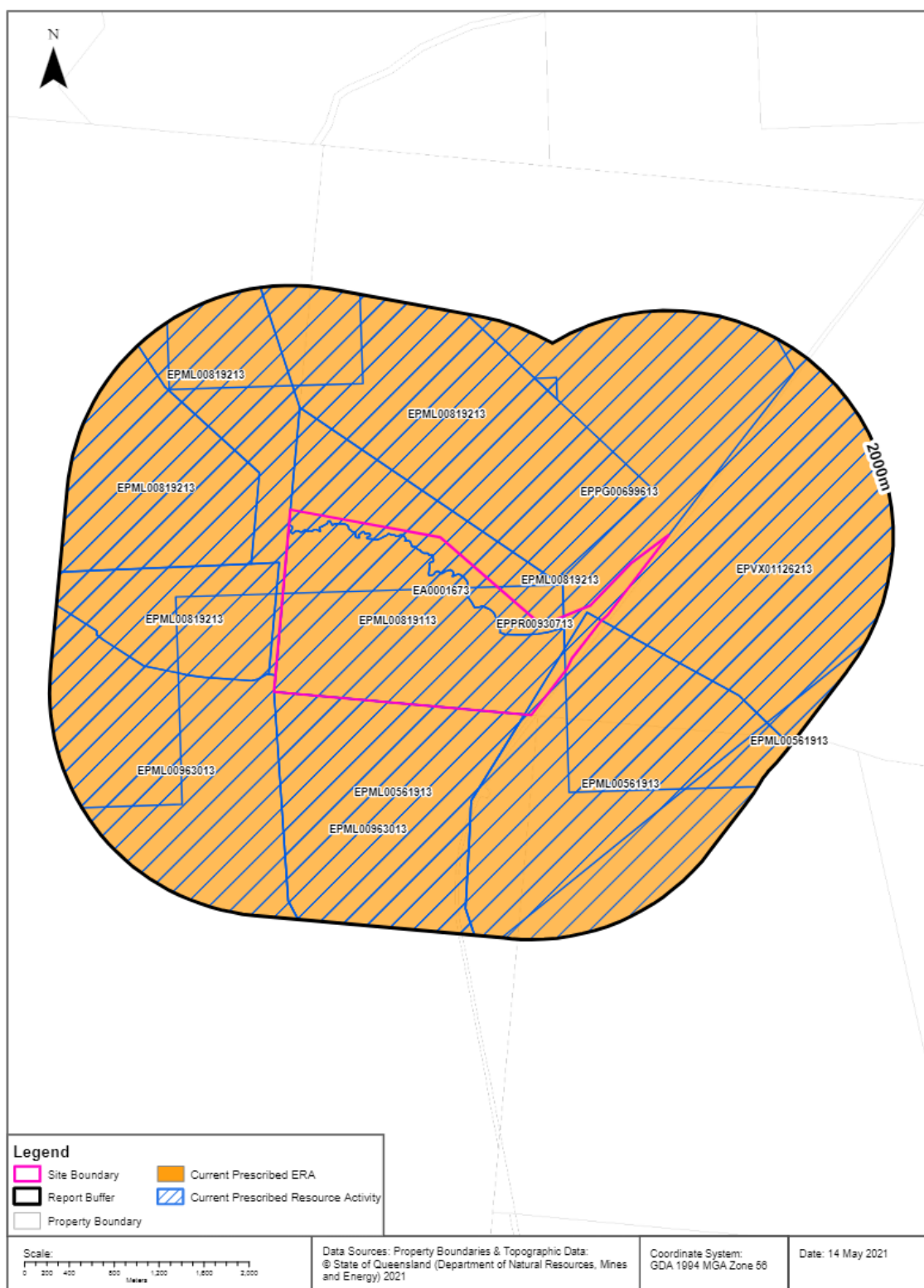
Poitrel Mine Road, Moranbah, QLD 4744



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Poitrel Mine Road, Moranbah, QLD 4744



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Environmental Authorities Register

Poitrel Mine Road, Moranbah, QLD 4744

Current Prescribed ERA Activities

Current prescribed environmentally relevant activities within the dataset buffer.

Note: Due to the fact that not all records on the EAR have specific or current location details, some premises associated with a permit reference number may not have been mapped, and therefore will not appear in this report. For further details refer to: <https://environment.ehp.qld.gov.au/env-authorities>

Permit No	Permit Status	Effective Date	Primary Holder	Premise	Activity	Loc Conf	Dist'	Dir'n
EPPR00930713	Granted	2014-01-20	QUARRICO PRODUCTS PTY LTD	Isaac	ERA 16 - Extraction and Screening, 1 ERA 16 - Extraction and Screening, 2 ERA 16 - Extraction and Screening, 3	As Supplied	0m	Onsite

Current Prescribed ERA Activities Data Source: QLD Department of Environment and Science
Creative Commons Attribution 4.0 <https://creativecommons.org/licenses/by/4.0/>

Current Prescribed Resource Activities

Current prescribed resource activities within the dataset buffer.

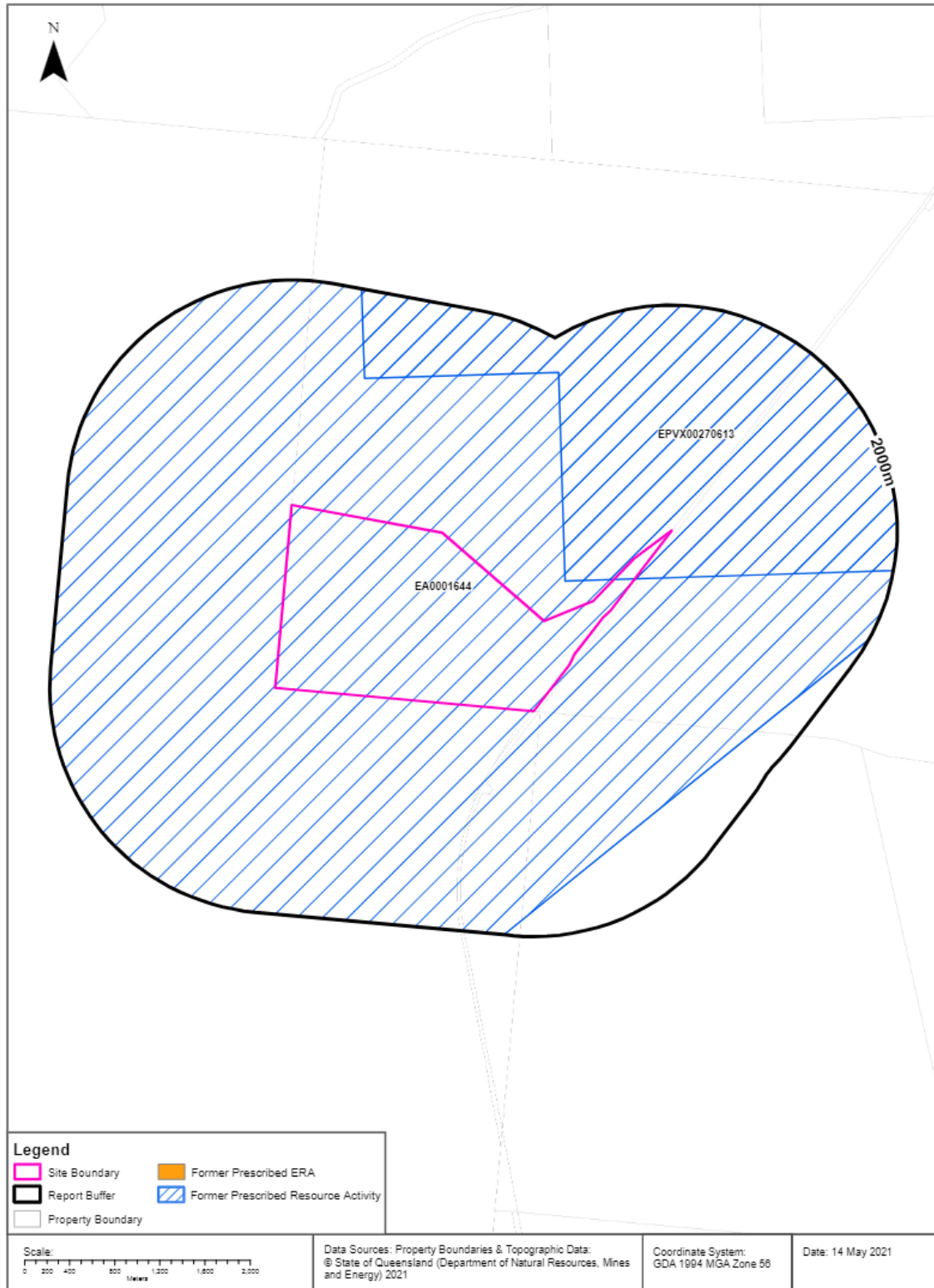
Note: Due to the fact that not all records on the EAR have specific or current location details, some premises associated with a permit reference number may not have been mapped, and therefore will not appear in this report. For further details refer to: <https://environment.ehp.qld.gov.au/env-authorities>

Permit No	Permit Status	Effective Date	Primary Holder	Premise	Activity	Loc Conf	Dist'	Dir'n
EA0001673	Granted	2019-05-22	Galilee Pipelines Pty Ltd	PSL2037	Non-Scheduled, Petroleum Activity, Petroleum Survey Licence - PSL	General area	0m	Onsite
EPML00561913	Granted	2019-11-18	BHP Coal Pty Ltd	ML1781 ML70116	Ancillary 08 - Chemical Storage, 1 Ancillary 31 - Mineral processing, 2 Ancillary 56 - Regulated Waste Storage, Receiving and storing regulated waste Ancillary 63 - Sewage Treatment, 1 Schedule 3, 13	General area	0m	Onsite
EPML00819113	Granted	2019-11-15	BHP BILLITON MITSUI COAL PTY LTD	ML70312	ERA 31 - Mineral processing, 2 ERA 62 - Resource recovery and transfer facility operation, 1	General area	0m	Onsite
EPML00819213	Granted	2020-03-26	Millennium Coal Pty Ltd	ML70313 ML70344 ML70401 ML70457 ML70483 ML70485	Ancillary 07 - Chemical Manufacturing, 3 Ancillary 08 - Chemical Storage, 3 Ancillary 60 - Waste disposal, 2 Ancillary 62 - Resource recovery and transfer facility operation, 1 Ancillary 63 - Sewage Treatment, 1 Schedule 3, 09 Schedule 3, 13	General area	0m	Onsite
EPML00963013	Granted	2019-10-28	BHP BILLITON MITSUI COAL PTY LTD	ML4749 ML70116	Ancillary 08 - Chemical Storage, 3 Ancillary 56 - Regulated Waste Storage, Receiving and storing regulated waste Ancillary 60 - Waste disposal, 1 Ancillary 63 - Sewage Treatment, 1 Schedule 3, 13	General area	0m	Onsite
EPPG00699613	Granted	2017-08-24	CH4 PTY LTD	ATP1103	Non-Scheduled, Petroleum Activity, Authority to Prospect - ATP	General area	0m	Onsite
EPVX01126213	Granted	2018-07-03	Peabody Moorvale West Pty Ltd	MDL495	Non-Scheduled, Mining Activity, Mineral Development Licence - MDL	General area	0m	Onsite

Current Prescribed Resource Activities Data Source: QLD Department of Environment and Science
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Former Prescribed ERA and Resource Activities

Poitrel Mine Road, Moranbah, QLD 4744



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Environmental Authorities Register

Poitrel Mine Road, Moranbah, QLD 4744

Former Prescribed ERA Activities

Former prescribed environmentally relevant activities within the dataset buffer.

Note: Due to the fact that not all records on the EAR have specific or current location details, some premises associated with a permit reference number may not have been mapped, and therefore will not appear in this report. For further details refer to: <https://environment.ehp.qld.gov.au/env-authorities>

Permit No	Permit Status	Effective Date	Primary Holder	Premise	Activity	Loc Conf	Dist'	Dir'n
N/A	No records in buffer							

Former Prescribed ERA Activities Data Source: QLD Department of Environment and Science
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Former Prescribed Resource Activities

Former prescribed resource activities within the dataset buffer.

Note: Due to the fact that not all records on the EAR have specific or current location details, some premises associated with a permit reference number may not have been mapped, and therefore will not appear in this report. For further details refer to: <https://environment.ehp.qld.gov.au/env-authorities>

Permit No	Permit Status	Effective Date	Primary Holder	Premise	Activity	Loc Conf	Dist'	Dir'n
EA0001644	Cancelled		Blue Energy Ltd	PSL2037	Non-Scheduled, Petroleum Activity, Petroleum Survey Licence - PSL	General area	0m	Onsite
EPVX00270613	Surrendered	2006-01-27	Peabody Moorvale West Pty Ltd	EPC680	Exploration - Coal	General area	0m	Onsite

Former Prescribed Resource Activities Data Source: QLD Department of Environment and Science
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PFAS Investigation Sites

Poitrel Mine Road, Moranbah, QLD 4744

Defence PFAS Investigation and Management Program Investigation Sites

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Investigation and Management Program Management Sites

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Dist	Dir
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Queensland Fire and Emergency Services PFAS Investigation Sites

Sites being investigated by Queensland Fire and Emergency Services for PFAS contamination within the dataset buffer:

Map ID	Fire Station Name	PFOA (µg/L)	PFOS (Σ(PFOS + PFHxS) (µg/L)	Location Confidence	Dist	Dir
N/A	No records in buffer					

Queensland Fire and Emergency Services PFAS investigation Sites Data Source: Queensland Fire and Emergency Services, Queensland Government

Defence Sites

Poitrel Mine Road, Moranbah, QLD 4744

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

Waste Management and Liquid Fuel Facilities

Poitrel Mine Road, Moranbah, QLD 4744

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site Id	Owner	Name	Address	Suburb	Class	Landfill	Reprocess	Transfer	Comments	Loc Conf	Dist'	Direction
N/A	No records in buffer											

Waste Management Facilities Data Source: Australian Government Geoscience Australia
Creative Commons 3.0 © Commonwealth of Australia <http://creativecommons.org/licenses/by/3.0/au/deed.en>

National Liquid Fuel Facilities

National Liquid Fuel Facilities within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist (m)	Dir
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia
Creative Commons 3.0 © Commonwealth of Australia <http://creativecommons.org/licenses/by/3.0/au/deed.en>

Historical Business Directories

Poitrel Mine Road, Moranbah, QLD 4744

Business Directory Records 1941-1941 Premise or Road Intersection Matches

Universal Business Directory records, from years 1941, mapped to a premise or road intersection within the dataset buffer:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
	No records in buffer						

Business Directory Content Derived from Universal Business Directories (UBD) - Licensed from Hardie Grant

Business Directory Records 1941-1941 Road or Area Matches

Universal Business Directory records, from years 1941, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
	No records in buffer					

Business Directory Content Derived from Universal Business Directories (UBD) - Licensed from Hardie Grant

Historical Business Directories

Poitrel Mine Road, Moranbah, QLD 4744

Dry Cleaners, Motor Garages & Service Stations 1941-1941 Premise or Road Intersection Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, from years 1941, mapped to a premise or road intersection, within the dataset buffer.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
	No records in buffer						

Business Directory Content Derived from Universal Business Directories (UBD) - Licensed from Hardie Grant

Dry Cleaners, Motor Garages & Service Stations 1941-1941 Road or Area Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, from years 1941, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
	No records in buffer					

Business Directory Content Derived from Universal Business Directories (UBD) - Licensed from Hardie Grant

Aerial Imagery 2017

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Aerial Imagery 2013

Poitrel Mine Road, Moranbah, QLD 4744



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Aerial Imagery 2007

Poitrel Mine Road, Moranbah, QLD 4744

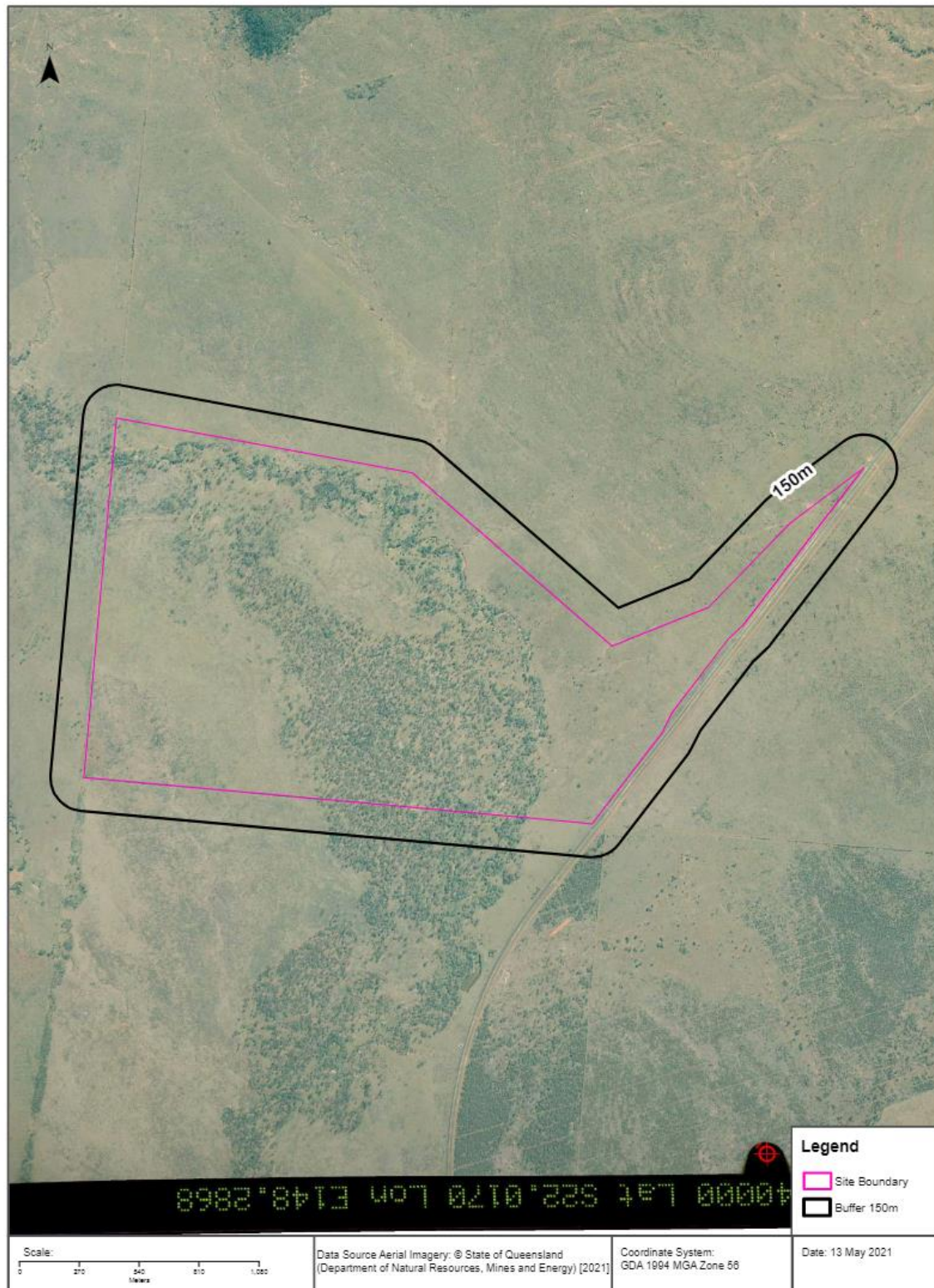


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Aerial Imagery 2000

Poitrel Mine Road, Moranbah, QLD 4744



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Aerial Imagery 1985

Poitrel Mine Road, Moranbah, QLD 4744

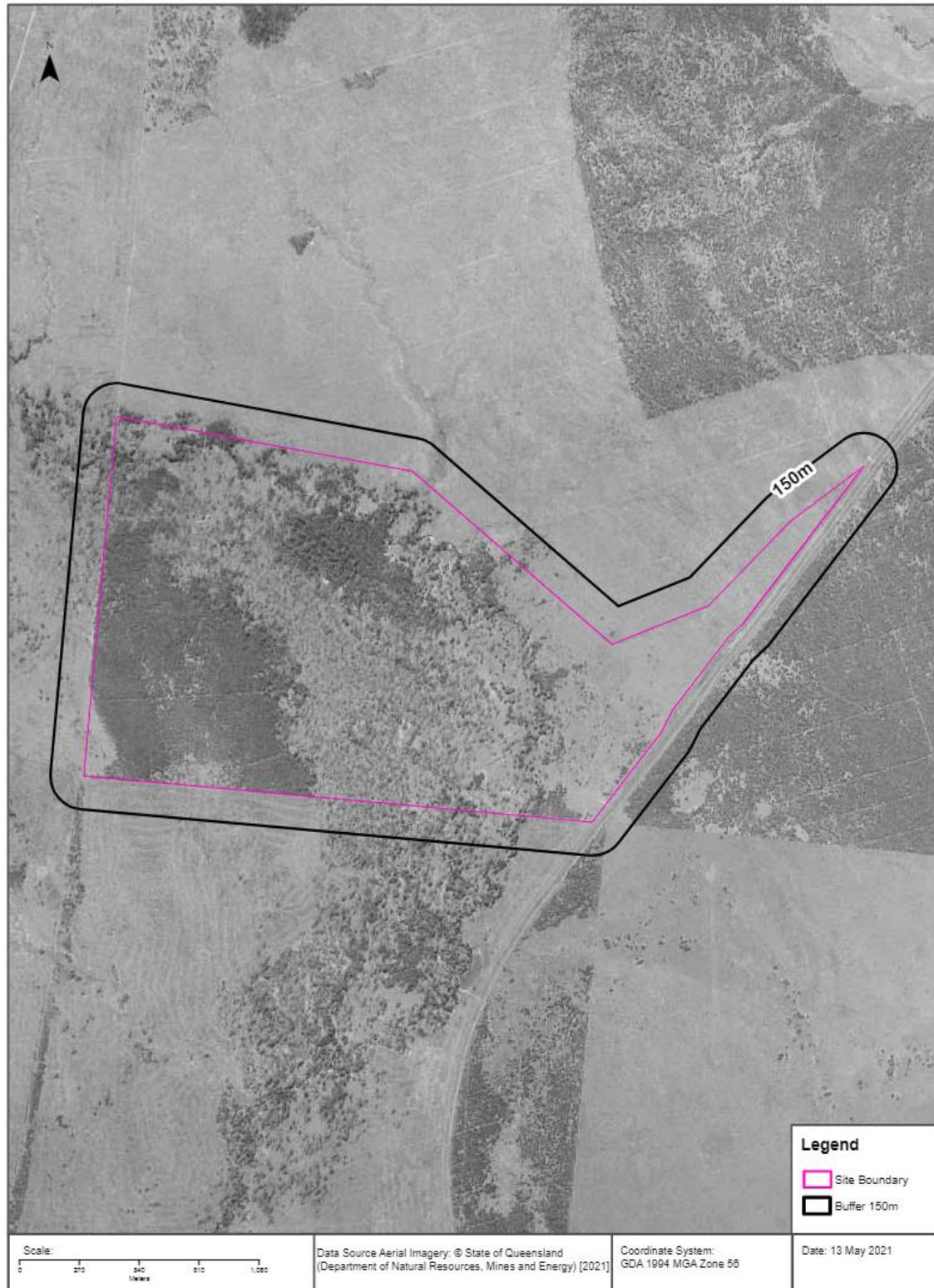


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Aerial Imagery 1978

Poitrel Mine Road, Moranbah, QLD 4744



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Aerial Imagery 1972

Poitrel Mine Road, Moranbah, QLD 4744

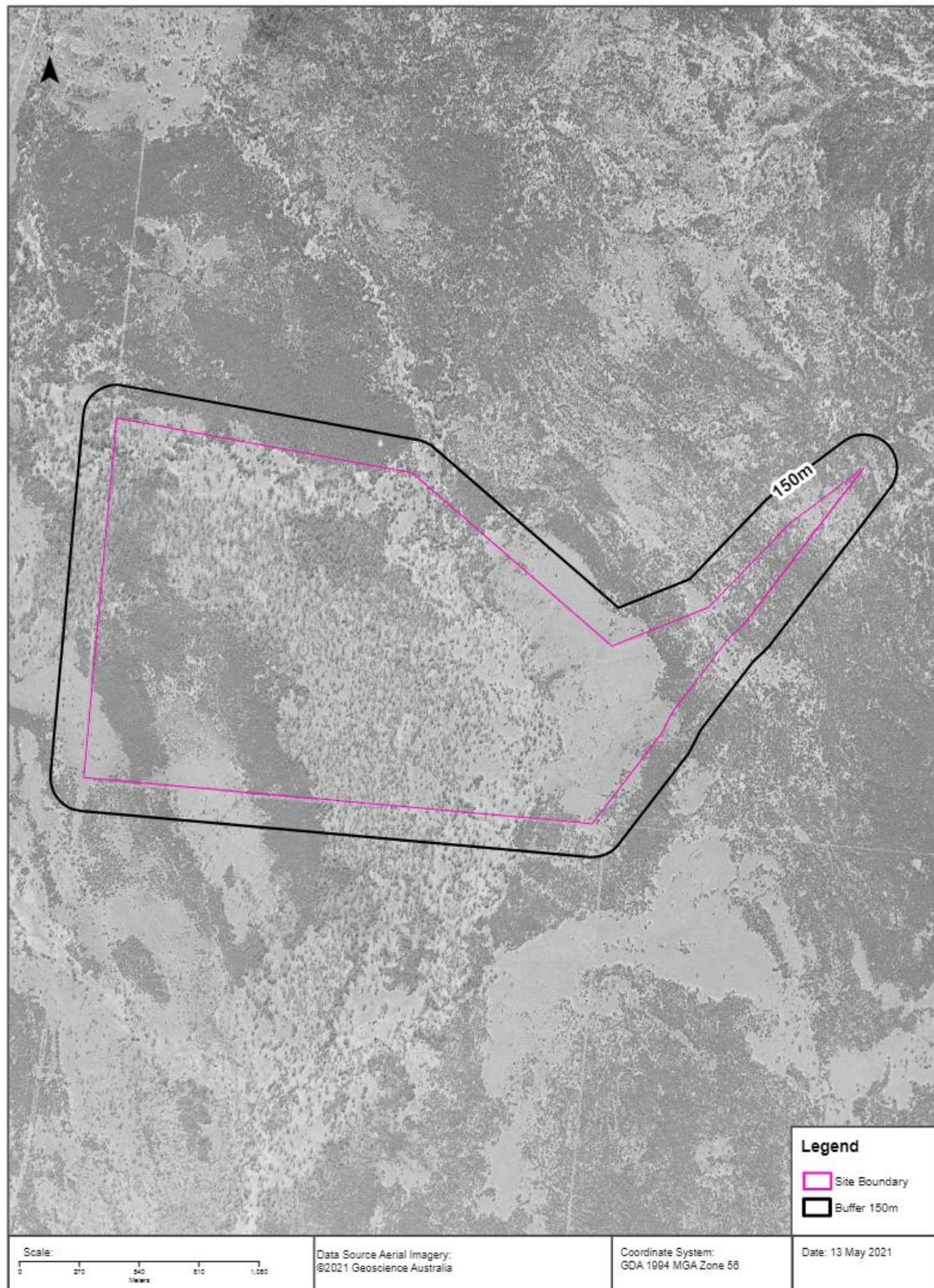


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Aerial Imagery 1964

Poitrel Mine Road, Moranbah, QLD 4744



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Aerial Imagery 1960

Poitrel Mine Road, Moranbah, QLD 4744

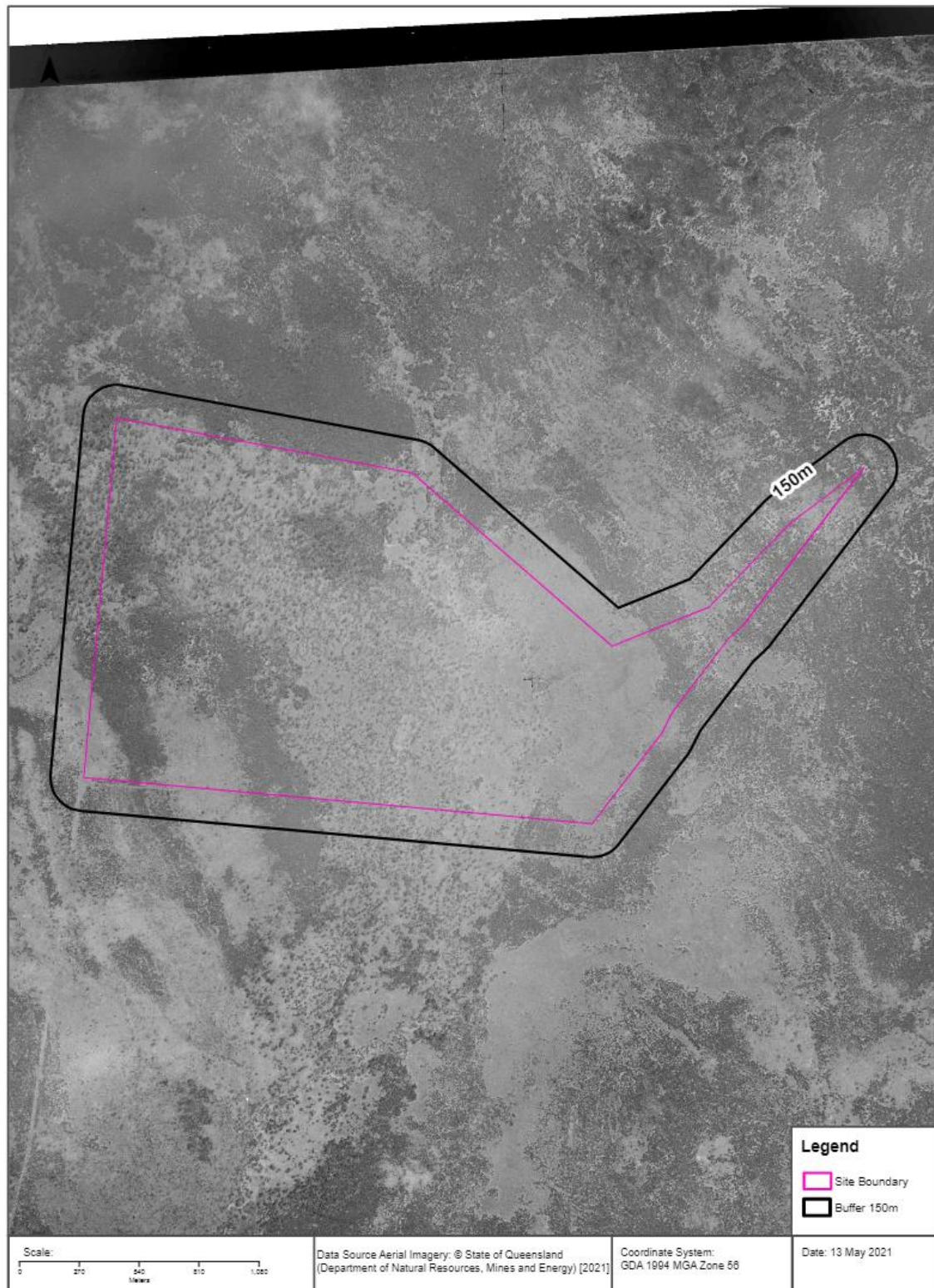


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Aerial Imagery 1957

Poitrel Mine Road, Moranbah, QLD 4744

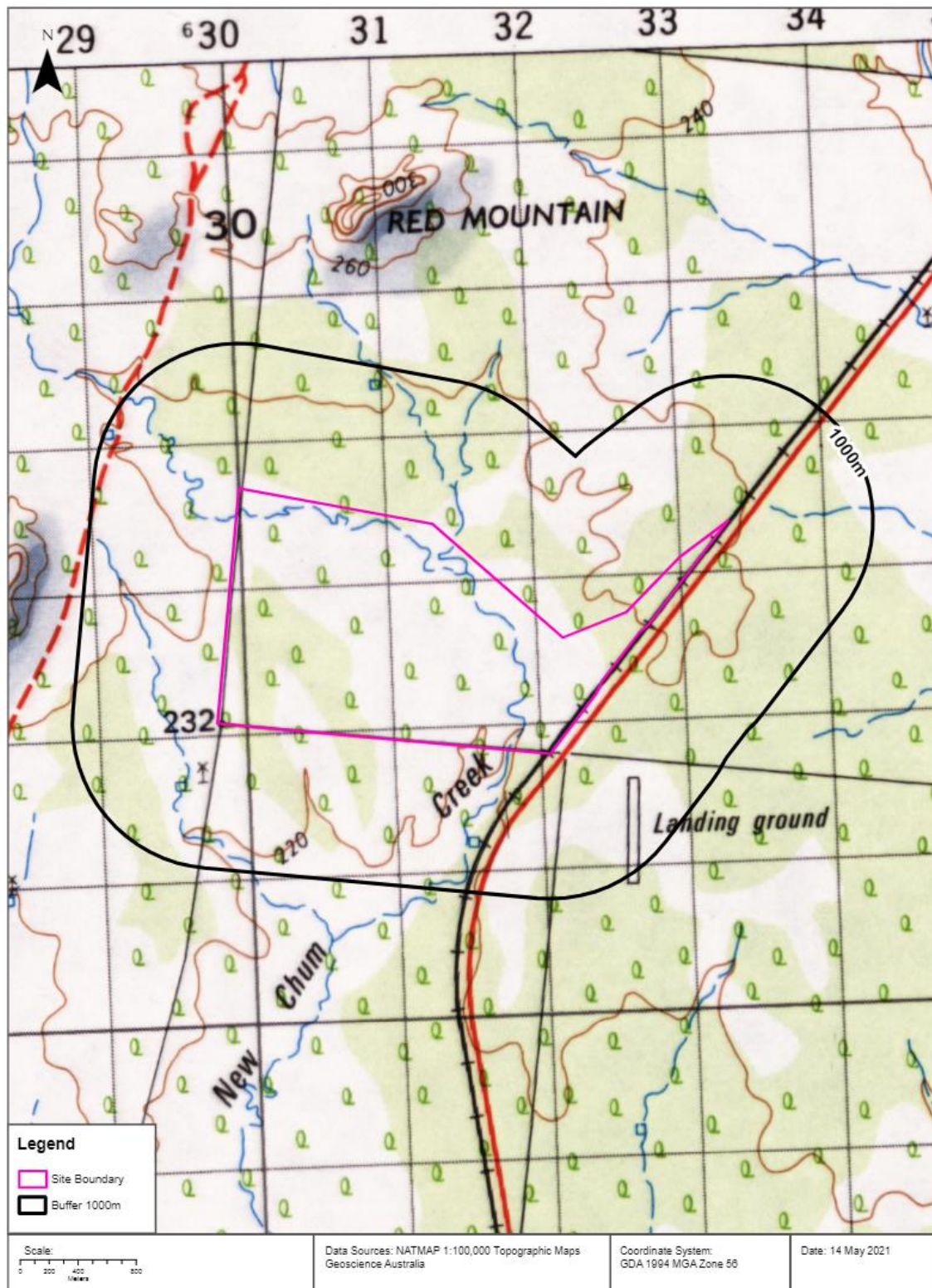


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Historical Map 1972

Poitrel Mine Road, Moranbah, QLD 4744



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Groundwater Boreholes

Poitrel Mine Road, Moranbah, QLD 4744



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Groundwater Boreholes

Poitrel Mine Road, Moranbah, QLD 4744

Groundwater Boreholes

Boreholes within the dataset buffer:

Bore No	Facility Type	Facility Role	Status	Drillers Log	Aquifer	Drill Date	Dist	Direct*
162249	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-0.50m SOIL 0.50m-3.00m CLAY 3.00m-8.00m CLAY, SANDY 8.00m-8.50m CLAY, DRY 8.50m-9.00m COAL, WEATHERED 9.00m-14.00m CLAY 14.00m-17.00m MUDSTONE 17.00m-20.00m SANDSTONE 20.00m-20.20m COAL 20.20m-21.00m MUDSTONE 21.00m-26.00m SANDSTONE 26.00m-35.00m SANDSTONE, COARSE		2013-12-10	0m	Onsite
162251	Sub-artesian Facility	Mine Monitoring	Existing			2013-12-13	0m	Onsite
141750	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-11.00m SANDSTONE, BROWN 11.00m-15.00m SILTSTONE, GREY-BROWN 15.00m-18.00m "SHALE/COAL, BLACK" 18.00m-19.00m SILTSTONE, GREY 19.00m-21.00m "SILTSTONE/COAL - GREY BLACK" 21.00m-30.00m SILTSTONE, GREY 30.00m-35.00m SANDSTONE, GREY		2010-08-28	0m	Onsite
162248	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-0.50m SOIL 0.50m-3.00m CLAY 3.00m-8.00m CLAY, SANDY 8.00m-8.50m CLAY, DRY 8.50m-9.00m COAL, WEATHERED 9.00m-14.00m CLAY 14.00m-17.00m MUDSTONE 17.00m-20.00m SANDSTONE 20.00m-20.20m COAL 20.20m-21.00m MUDSTONE 21.00m-26.00m SANDSTONE 26.00m-78.00m SANDSTONE, COARSE 78.00m-80.00m MUDSTONE	Aquifer Top-Bottom: 20.00m-20.20m. Consolidated Condition. Formation does not contribute water to the bore. Formation does not flow. Quality: "BRACKISH" Yield: 12.00 SVL: -18.50 Aquifer Top-Bottom: 66.00m-78.00m. Consolidated Condition. Formation does not contribute water to the bore. Formation does not flow. Quality: "BRACKISH" Yield: 0.10	2013-12-10	0m	Onsite
162250	Sub-artesian Facility	Mine Monitoring	Existing			2013-12-13	0m	Onsite
182264	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-0.50m BLUE BASALT BOULDERS AND COBBLES 0.50m-8.50m LIGHT BROWN, FRM, SILTY CLAY 8.50m-10.60m LIGHT BRWON CLAYEY SAND		2019-04-14	0m	Onsite
141748	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-2.00m CLAY, SANDY 2.00m-6.00m SILTSTONE, GREY- BROWN 6.00m-23.00m SANDSTONE, GREY-BROWN 23.00m-24.00m SILTSTONE, GREY "MOIST" 24.00m-30.00m "SANDSTONE/SILTSTONE GREY-DARK GREY"		2010-08-27	51m	South West

Bore No	Facility Type	Facility Role	Status	Drillers Log	Aquifer	Drill Date	Dist	Direct
141749	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-2.00m CLAY, SANDY, BROWN 2.00m-6.00m SILTSTONE, GREY-BROWN 6.00m-23.00m SANDSTONE, BROWN-GREY 23.00m-24.00m SILTSTONE, GREY 24.00m-39.00m "SANDSTONE-SILTSTONE" 39.00m-48.00m SANDSTONE, GREY 48.00m-49.00m "SANDSTONE/SILTSTONE GREY" 49.00m-56.00m "COAL SHALE/SANDSTONE BROWN-BLACK" 56.00m-59.00m "SHALE/SILTSTONE GREY-BLACK" 59.00m-61.00m "SHALE COAL SILTSTONE BROWN-BLACK" 61.00m-62.00m "COAL/SILTSTONE BLACK-GREY" 62.00m-63.00m SILTSTONE, GREY 63.00m-66.00m "SILTSTONE-SANDSTONE GREY"	Aquifer Top-Bottom: 59.00m-61.00m. Consolidated Condition. Formation is contributing water to the bore. Formation does not flow. Quality: "BRACKISH" Yield: 0.10 SWL: -17.05	2010-08-27	62m	South West
162469	Sub-artesian Facility	Mine Monitoring	Abandoned and Destroyed	0.00m-2.00m TOPSOIL (SILTY CLAY): BR, MINOR GRAVEL, TRACE SAND, ORGANIC MATTER PRESENT, GRAVEL FINE TO MEDIUM, SAND COARSE TO FINE 2.00m-3.00m CLAYEY SILT: BROWN MINOR GRAVEL, TRACE SAND, ORGANIC MATTER PRESENT, GRAVEL FINE TO MEDIUM, SAND COARSE TO FINE 3.00m-5.00m SANDY SILT: BROWN, MINOR CLAY, SAND FINE TO MEDIUM 5.00m-10.00m SANDY SILT: GREY-BROWN, MINOR CLAY, TRACE GRAVEL, SAND FINE TO MEDIUM 10.00m-17.00m MUDSTONE: GREY, INTERBEDDED WITH SILTSTONE AND SANDSTONE, MODERATELY SOFT, IRON STAINING PRESENT, LIGNEOUS IN SECTIONS 17.00m-19.00m BLACK COAL: GREY-BLACK, MODERATELY SOFT, MICRO PLATY TEXTURE 19.00m-22.00m COAL/MUDSTONE: GREY, INTERBEDDED, MODERATELY SOFT 22.00m-31.00m MUDSTONE: GREY, CARBONACEOUS IN SECTIONS, MODERATELY SOFT 31.00m-67.00m SILTSTONE: GREY, CLAYEY/SILTY IN SECTIONS, SOME IRON STAINING PRESENT, BECOMING CARBOACEOUS WITH DEPTH 67.00m-70.00m MUDSTONE: GREY, CARBONACEOUS IN SECTIONS, TUFF LAYER PRESENT MOSTLY WEATHERED TO BROWN CLAY, MODERATELY HARD 70.00m-75.00m COAL: GREY-BLACK, TRACE FINE SAND AND SILT, TUFF LAYER STILL PRESENT MOSTLY WEATHERED BROWN CLAY	Aquifer Top-Bottom: 66.00m-72.00m. Weathered Zone. Formation is contributing water to the bore. Formation does not flow.	2009-03-18	261m	South East

Bore No	Facility Type	Facility Role	Status	Drillers Log	Aquifer	Drill Date	Dist	Direct
162527	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-1.00m RED CLAY 1.00m-4.00m HIGHLY WEATHERED SANDSTONE: MEDIUM GRAIN, RUSTY BROWN 4.00m-9.00m WEATHERED SANDSTONE: MEDIUM GRAIN, FIRM, TAN BROWN 9.00m-10.00m CARBY CLAY 10.00m-14.00m CARB SILTSTONES: SOFT 14.00m-14.50m COAL: WEATHERED 14.50m-20.00m SILTSTONE: DARK GREY, FIRM, SLIGHTLY WEATHERED 20.00m-22.00m BASE OF WEATHERING, SANDSTONE, LIGHT GREY, FIRM MEDIUM GRAIN 22.00m-29.00m GRAY FRESH SANDSTONE: FINE GRAIN 29.00m-31.00m SANDSTONE: LIGHT GRAY, MEDIUM GRAIN 31.00m-36.00m SANDSTONE: DARK GRAY, MEDIUM GRAIN 36.00m-47.00m SANDSTONE: LIGHT GRAY, FINE GRAIN 47.00m-49.00m SILTSTONE: DARK GRAY	Aquifer Top-Bottom: 30.20m-48.20m. Consolidated Condition. Formation is contributing water to the bore. Formation does not flow. Quality: 4320 US	2016-03-13	287m	South East
105500	Sub-artesian Facility	Water Supply	Existing	0.00m-4.00m CLAY 4.00m-60.80m SANDSTONE 60.80m-63.00m CARBONACEOUS SHALE AND SILTSTONE 63.00m-72.00m CARBONACEOUS SHALE		2002-02-20	492m	West
105487	Sub-artesian Facility	Water Supply	Existing	0.00m-53.90m SANDSTONE 53.90m-55.90m SILTSTONE 55.90m-59.30m COAL 59.30m-60.90m CARBONACEOUS SHALE 60.90m-81.00m SILTSTONE 81.00m-82.00m COAL 82.00m-83.90m CARBONACEOUS SHALE 83.90m-87.00m SILTSTONE		2002-02-20	734m	West
162528	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-2.00m SANDY LOAM 2.00m-3.00m WEATHERED SILTSTONE (TAN) SOFT 3.00m-7.00m WEATHERED SANDSTONE: FINE GRAIN (BROWN) 7.00m-12.00m WEATHERED SANDSTONE: FINE GRAIN, FIRM, LIGHT BROWN 12.00m-20.00m COAL: WEATHERED 20.00m-30.00m SILTSTONE: DARK GREY, FIRM 30.00m-36.50m SANDSTONE: LIGHT GREY, MEDIUM GRAIN 36.50m-38.40m COAL 38.40m-40.00m CARBY SILTSTONE 40.00m-48.10m GREY SANDSTONE: FINE GRAIN 48.10m-48.50m COAL 48.50m-51.00m SILTSTONE: GRAY 51.00m-52.60m COAL 52.60m-56.43m CARB SILTSTONE		2016-03-14	790m	South
162839	Sub-artesian Facility		Abandoned and Destroyed				986m	North
141688	Sub-artesian Facility		Existing	0.00m-51.00m SILTY CLAY, PALE GREY & SILTS, BROWN & LOAM SANDS		2007-10-10	1285m	West
141687	Sub-artesian Facility		Existing	0.00m-36.00m SILTY CLAY, BROWN		2007-10-17	1287m	West

Bore No	Facility Type	Facility Role	Status	Drillers Log	Aquifer	Drill Date	Dist	Direct
105493	Sub-artesian Facility	Water Supply	Existing	0.00m-0.90m SOIL 0.90m-10.00m SILTSTONE AND SANDSTONE 10.00m-21.90m SANDSTONE 21.90m-25.00m SILTSTONE 25.00m-31.00m SANDSTONE 31.00m-43.90m SANDSTONE AND SILTSTONE 43.90m-49.30m SILTSTONE 49.30m-54.00m COAL 54.00m-57.90m SANDSTONE 57.90m-64.10m COAL 64.10m-67.00m SILTSTONE 67.00m-70.00m SANDSTONE AND SILTSTONE 70.00m-82.80m SANDSTONE 82.80m-83.40m COAL 83.40m-87.00m SILTSTONE 87.00m-92.00m SANDSTONE 92.00m-95.00m SILTSTONE 95.00m-98.00m SANDSTONE 98.00m-104.10m SILTSTONE 104.10m-105.80m COAL 105.80m-108.90m SILTSTONE 108.90m-111.00m SANDSTONE		2003-02-13	1343m	North West
162233	Sub-artesian Facility	Mine Monitoring	Existing		Aquifer Top-Bottom: 45.00m-48.00m. Consolidated Condition. Formation does not contribute water to the bore. Formation does not flow.	2004-01-01	1354m	West
162232	Sub-artesian Facility	Mine Monitoring	Existing		Aquifer Top-Bottom: 23.30m-28.00m. Consolidated Condition. Formation does not contribute water to the bore. Formation does not flow.	2004-01-01	1356m	West
141746	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-1.00m CLAY, SANDY, BROWN 1.00m-4.00m SANDSTONE, LIGHT BROWN 4.00m-15.00m SILTSTONE, BROWN-GREY 15.00m-19.00m COAL, BLACK 19.00m-23.00m SILTSTONE, GREY 23.00m-33.00m SANDSTONE, LIGHT GREY- GREY 33.00m-37.00m SILTSTONE, GREY-DARK GREY 37.00m-38.00m SHALE, CARBONACEOUS, BLACK 38.00m-40.00m SANDSTONE, LIGHT GREY 40.00m-48.00m SILTSTONE, GREY 48.00m-49.00m SHALE, CARBONACEOUS, DARK GREY 49.00m-54.00m SILTSTONE, DARK GREY 54.00m-61.00m "INTERBEDDED SILTSTONE/CARBONACEOUS SHALE DARK GREY TO BLACK" 61.00m-64.00m SHALE, CARBONACEOUS, DARK GREY TO BLACK 64.00m-66.00m SILTSTONE, DARK GREY 66.00m-67.00m COAL, BLACK "MOIST" 67.00m-68.00m CLAY, BROWN TO WHITE 68.00m-71.00m COAL, BLACK "MOIST" 71.00m-75.00m "INTERBEDDED SILTSTONE/SANDSTONE GREY TO DARK GREY" 75.00m-78.00m SILTSTONE, GREY	Aquifer Top-Bottom: 66.00m-75.00m. Consolidated Condition. Formation is contributing water to the bore. Formation does not flow. Quality: "BRACKISH" Yield: 0.10 SWL: -37.34	2010-08-28	1401m	North West

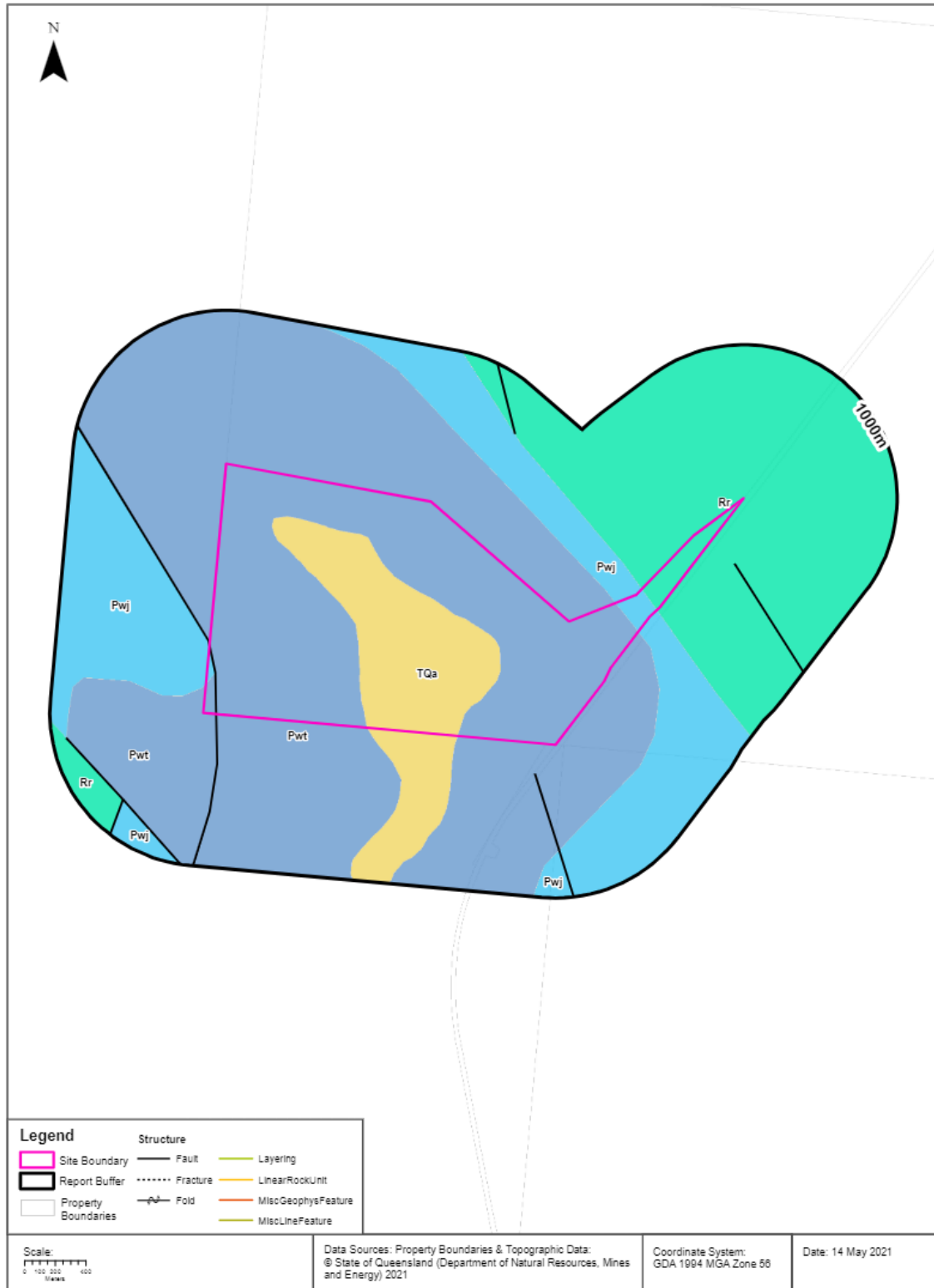
Bore No	Facility Type	Facility Role	Status	Drillers Log	Aquifer	Drill Date	Dist	Direct
182546	Sub-artesian Facility	Mine Monitoring	Existing	0.00m-11.00m SPOIL 11.00m-12.00m BROWN CLAY 12.00m-24.00m GREEN WEATHERED SANDSTONE 24.00m-27.00m GREEN MUDSTONE 27.00m-29.00m COAL, WITH SOME MUDSTONE LAYERING: WEATHERED	Aquifer Top-Bottom: 12.00m-24.00m. Weathered Zone. Formation is contributing water to the bore. Formation does not flow. Quality: SALTY Yield: 0.30	2020-06-23	1464m	South West
141980	Sub-artesian Facility	Mine Monitoring	Abandoned and Destroyed	0.00m-3.00m TOP SOIL, BROWN 3.00m-4.00m SILTSTONE, BROWN 4.00m-5.00m CLAY, BROWN 5.00m-11.00m SILTSTONE, LIGHT GREY 11.00m-27.00m SANDSTONE, GREY 27.00m-29.00m SILTSTONE, GREY 29.00m-36.00m SANDSTONE, LIGHT GREY 36.00m-39.00m SANDSTONE, MEDIUM GREY 39.00m-55.00m SANDSTONE, LIGHT GREY 55.00m-57.00m SILTSTONE, DARK GREY 57.00m-64.00m COAL, DARK 64.00m-72.00m SILTSTONE, DARK GREY 72.00m-77.00m SANDSTONE, LIGHT GREY 77.00m-80.00m SILTSTONE, DARK GREY 80.00m-85.00m SILTSTONE, DARK GREY 85.00m-88.00m COAL, BLACK 88.00m-93.00m SILTSTONE, DARK GREY 93.00m-96.00m COAL, BLACK 96.00m-104.00m SILTSTONE, DARK GREY - NO WATER ENCOUNTERED		2012-05-22	1709m	South East
105484	Sub-artesian Facility	Water Supply	Existing	0.00m-2.90m CLAY 2.90m-43.90m SILTSTONE 43.90m-49.00m SANDSTONE 49.00m-60.00m SILTSTONE 60.00m-66.90m SANDSTONE 66.90m-75.00m SILTSTONE 75.00m-76.00m CARBONACEOUS SHALE 76.00m-88.10m SILTSTONE 88.10m-94.00m CARBONACEOUS SHALE		2001-08-22	1723m	North West
105490	Sub-artesian Facility	Water Supply	Existing	0.00m-5.00m SOIL 5.00m-12.90m SANDSTONE 12.90m-18.00m SILTSTONE 18.00m-22.00m SANDSTONE AND SILTSTONE 22.00m-27.90m SANDSTONE 27.90m-28.90m CARBONACEOUS SHALE 28.90m-43.90m SILTSTONE 43.90m-53.90m CARBONACEOUS SHALE AND SILTSTONE 53.90m-116.90m SANDSTONE 116.90m-120.00m SANDSTONE AND SILTSTONE 120.00m-120.40m CARBONACEOUS SHALE 120.40m-128.10m SANDSTONE 128.10m-140.00m SANDSTONE AND SILTSTONE 140.00m-142.90m SILTSTONE 142.90m-150.90m SANDSTONE 150.90m-152.50m COAL 152.50m-156.00m SILTSTONE 156.00m-168.00m SANDSTONE 168.00m-170.00m SILTSTONE 170.00m-170.90m CARBONACEOUS SHALE 170.90m-174.00m SILTSTONE		2003-02-19	1915m	North West

Groundwater Borehole Data: © State of Queensland (Department of Natural Resources and Mines) [2016]
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Groundwater Borehole Metadata: https://www.dnrm.qld.gov.au/__data/assets/pdf_file/0015/31317/bore-baseline-assessment-dictionary.pdf

Detailed Surface Geology
Poitrel Mine Road, Moranbah, QLD 4744



Lotsearch Pty Ltd ABN 89 600 168 018

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Geology

Poitrel Mine Road, Moranbah, QLD 4744

Detailed Surface Geological Units

What are the Geological Units onsite?

Symbol	Lithology Summary	Unit Name	Dominant Rock	Rock Type	Age
Pvj	Calcareous sandstone, calcareous shale, mudstone, coal, concretionary limestone	Rangal Coal Measures	ARENITE-MUDROCK	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)	LATE PERMIAN
Pvt	Lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff, tuffaceous (cherty) mudstone	Fort Cooper Coal Measures	SEDIMENTARY ROCK	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)	LATE PERMIAN
Rr	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base)	Rewan Group	ARENITE-MUDROCK	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)	EARLY TRIASSIC - MIDDLE TRIASSIC
TQa	Locally red-brown mottled, poorly consolidated sand, silt, clay, minor gravel; high-level alluvial deposits (generally related to present stream valleys but commonly dissected)	TQa-QLD	ALLUVIUM	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)	LATE TERTIARY - QUATERNARY

What are the Geological Units within the dataset buffer?

Symbol	Lithology Summary	Unit Name	Dominant Rock	Rock Type	Age
Pvj	Calcareous sandstone, calcareous shale, mudstone, coal, concretionary limestone	Rangal Coal Measures	ARENITE-MUDROCK	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)	LATE PERMIAN
Pvt	Lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff, tuffaceous (cherty) mudstone	Fort Cooper Coal Measures	SEDIMENTARY ROCK	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)	LATE PERMIAN
Rr	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base)	Rewan Group	ARENITE-MUDROCK	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)	EARLY TRIASSIC - MIDDLE TRIASSIC

Symbol	Lithology Summary	Unit Name	Dominant Rock	Rock Type	Age
TQa	Locally red-brown mottled, poorly consolidated sand, silt, clay, minor gravel; high-level alluvial deposits (generally related to present stream valleys but commonly dissected)	TQa-QLD	ALLUVIUM	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)	LATE TERTIARY - QUATERNARY

Detailed Geological Structures

What are the Geological Structures onsite?

Feature	Name	Description	Source	Scale
Fault		Fault Approximate	Map Sheet 8553 (GROSVENOR DOWNS) - 1985 Pre-Cainozoic geology compiled PE Balfe, JJ Draper, SG Scott & RL Belcher from reports related to company and Department of Mines exploration for coal and petroleum, supplemented by 250000-scale geological maps pro	85000

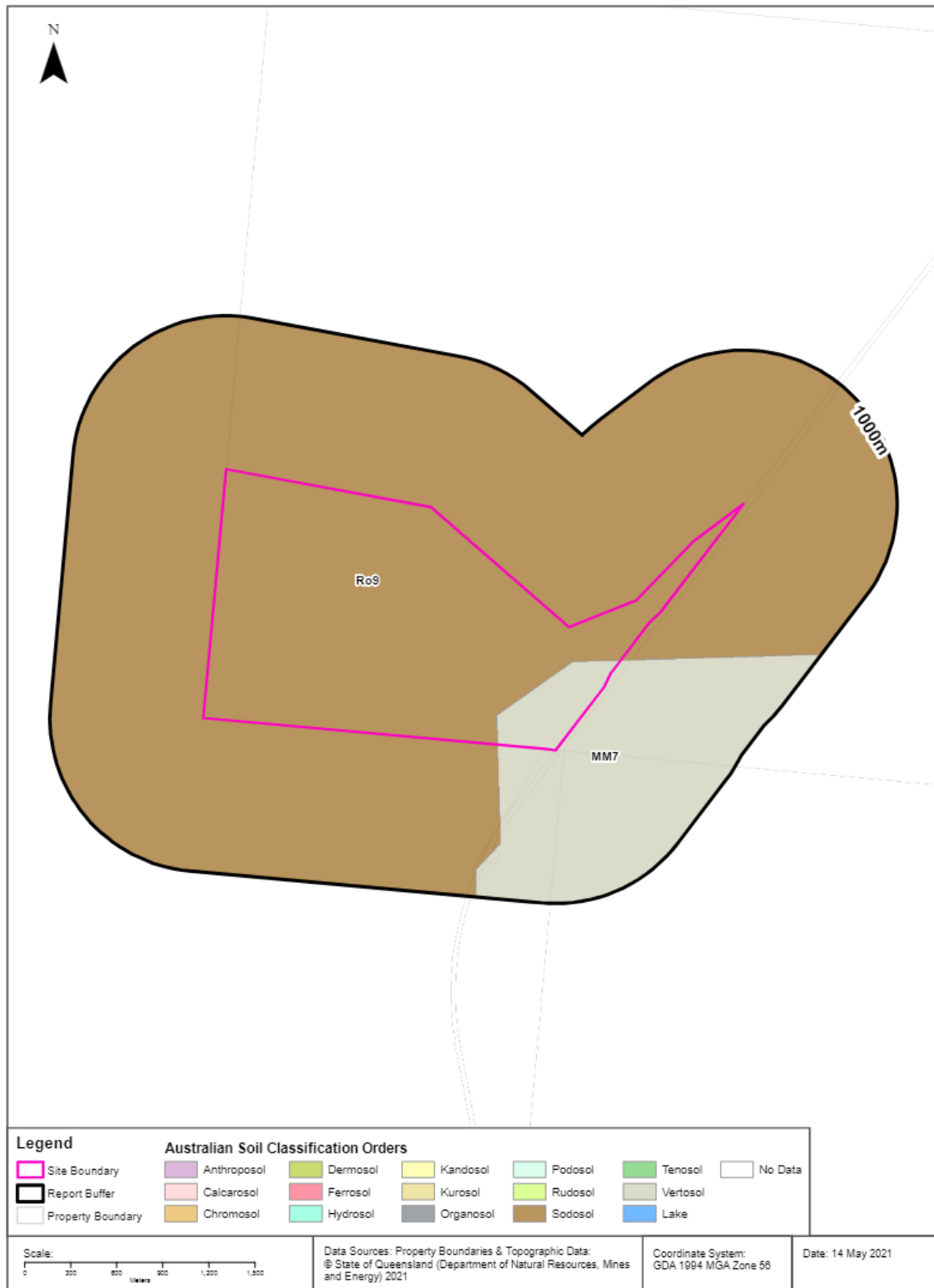
What are the Geological Structures within the dataset buffer?

Feature	Name	Description	Source	Scale
Fault		Fault Approximate	Map Sheet 8553 (GROSVENOR DOWNS) - 1985 Pre-Cainozoic geology compiled PE Balfe, JJ Draper, SG Scott & RL Belcher from reports related to company and Department of Mines exploration for coal and petroleum, supplemented by 250000-scale geological maps pro	85000
Fault		Fault Inferred	Map Sheet 8553 (GROSVENOR DOWNS) - 1985 Pre-Cainozoic geology compiled PE Balfe, JJ Draper, SG Scott & RL Belcher from reports related to company and Department of Mines exploration for coal and petroleum, supplemented by 250000-scale geological maps pro	85000

Geological Data Source : Detailed Surface Geology & Detailed Geological Structures
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Atlas of Australian Soils

Poitrel Mine Road, Moranbah, QLD 4744



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Soils

Poitrel Mine Road, Moranbah, QLD 4744

Atlas of Australian Soils

Australian soil types within the dataset buffer:

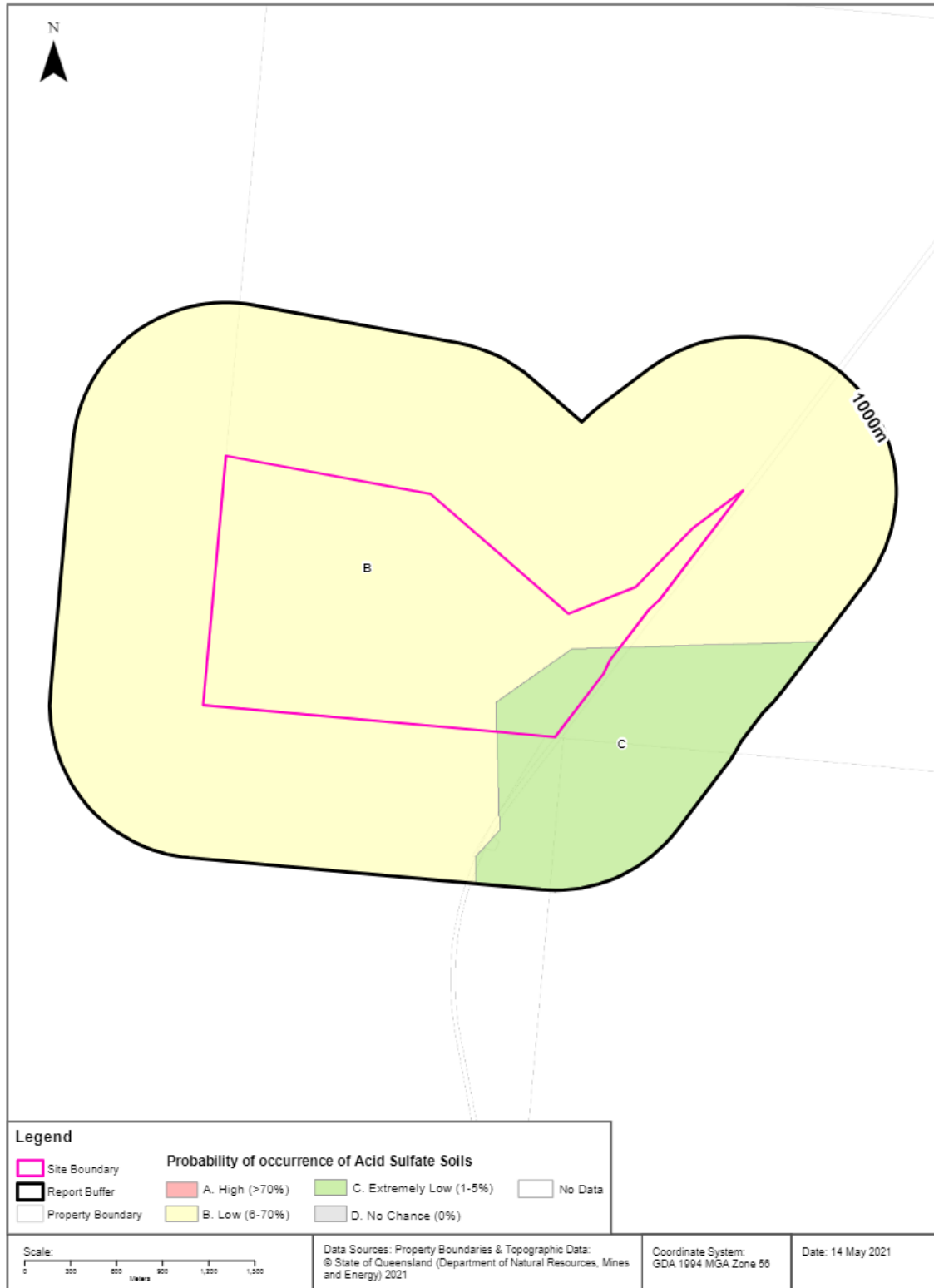
Symbol	Soil Order	Map Unit Description	Distance
MM7	Vertosol	Moderate to gently undulating lowlands and plains: dominant soils are moderately deep to deep clays, which in some areas have a moderate gilgai microrelief (1-2 ft). In some areas the soil surface may be strewn with silcrete (billy) gravel to 4 in. diameter. Brown clays (Ug5.34, Ug5.38, Ug5.32, and Ug5.37) are dominant but grey forms (Ug5.25, Ug5.24, and Ug5.22) are also common; dark clays (Ug5.13, Ug5.15, and Ug5.16) also occur. Closely associated are thin-surfaced loamy duplex soils, chiefly (Dr2.13 and Dr2.33), (Db1.13 and Db1.33), and (Dy2.33 and Dy2.43), which occur particularly on flood-plains of small streams. Small areas of friable earths (Gn3.13 and Gn3.12) also occur, particularly where the unit borders the high mountains of unit Bz1	0m
Ro9	Sodosol	Undulating lands with some high flat-topped or steep stony ridges: dominant on the flatter areas are brown loamy duplex soils (Db1.33), (Db1.13), and (Db1.43) with commonly associated similar (Dy2) soils. Small areas of cracking clays (Ug5.22), (Ug5.24), and (Ug5.34) also occur in lower sites and occasionally are slightly gilgaied (1-2 ft). On some sloping sites red loamy duplex soils (Dr2.12) and (Dr2.33) may occur. The higher flat-topped ridges mostly have loamy nodular yellow earths (Gn2.22) and occasionally red earths (Gn2.12). These are remnants of unit My3. More-dissected steeper ridges have shallow stony loams (Um4.1) and (Um1.43); these are inclusions of unit LK16.	0m

Atlas of Australian Soils: CSIRO

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Atlas of Australian Acid Sulfate Soils

Poitrel Mine Road, Moranbah, QLD 4744



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Acid Sulfate Soils

Poitrel Mine Road, Moranbah, QLD 4744

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

PROBCLASS	Description	Distance
B	Low Probability of occurrence. 6-70% chance of occurrence.	0m
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Heritage

Poitrel Mine Road, Moranbah, QLD 4744

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?

Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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Heritage Register Boundaries

Heritage Register Boundaries within the dataset buffer:

Place ID	Name	Entry Date	Distance	Direction
N/A	No records within buffer			

Heritage Register Boundaries Data: © State of Queensland (Department of Environment and Heritage Protection)
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Natural Hazards - Bushfire Prone Areas

Poitrel Mine Road, Moranbah, QLD 4744



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Natural Hazards

Poitrel Mine Road, Moranbah, QLD 4744

Statewide Bushfire Prone Areas

Bushfire Prone Areas within the dataset buffer:

Bushfire Prone Area Class	Version	Region	Distance	Direction
Medium Potential Bushfire Intensity	July 2014	MacKay, Isaac, Whitsunday	0m	Onsite
Potential Impact Buffer	July 2014	MacKay, Isaac, Whitsunday	0m	Onsite

Bushfire Prone Areas Data: © State of Queensland (Department of Natural Resources and Mines)
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Natural Hazards

Poitrel Mine Road, Moranbah, QLD 4744

Queensland Floodplain Assessment Overlay

QFAO within the dataset buffer:

Number	Name	Distance	Direction
N/A	No records within buffer		

Queensland Floodplain Assessment Overlay Data: © State of Queensland (Department of Natural Resources and Mines)
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Ecological Constraints

Poitrel Mine Road, Moranbah, QLD 4744

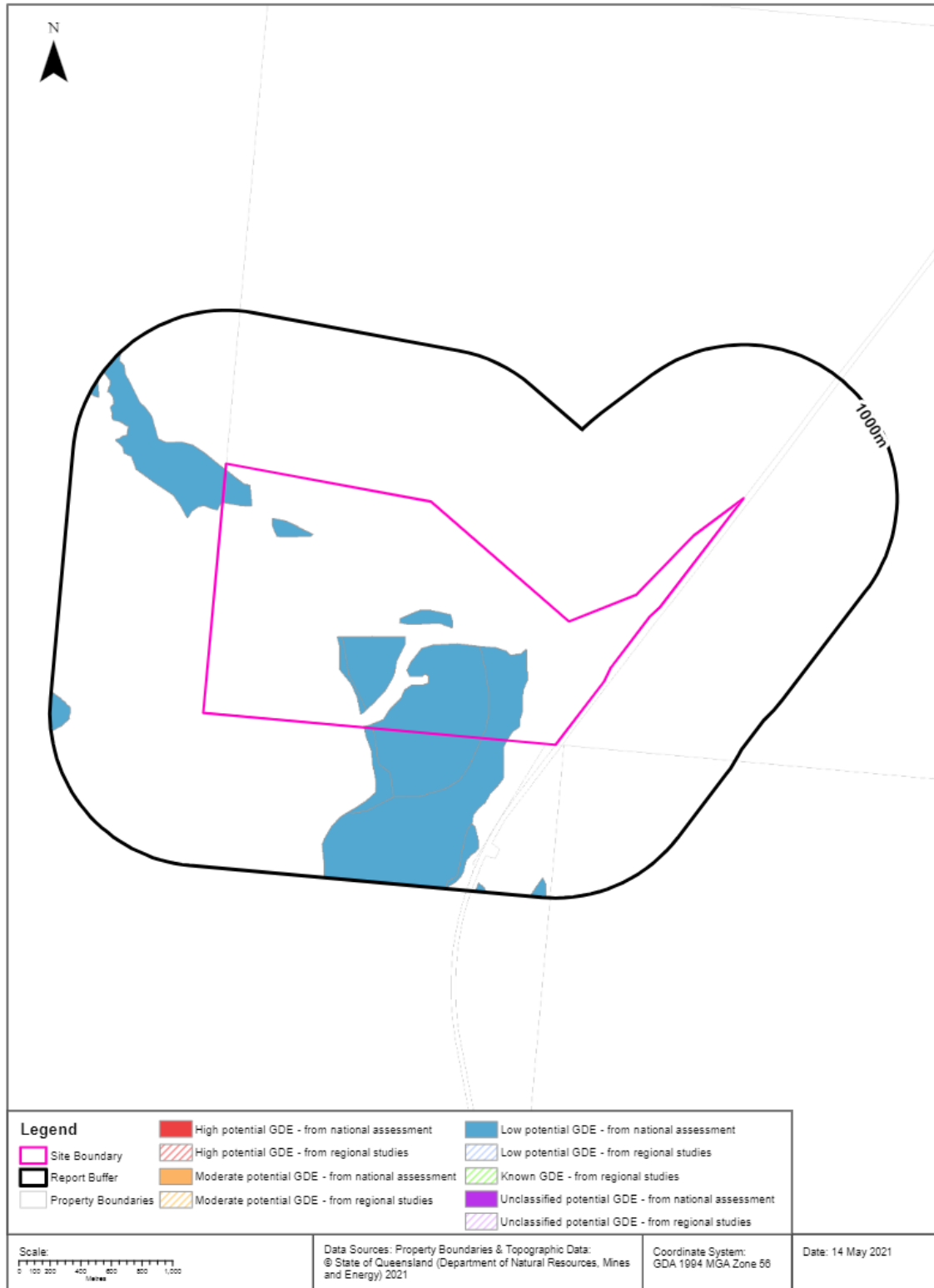
Wetland Protection Area

Wetland Protection Areas within the dataset buffer:

SPUNIT ID	Study Area	Wetland ID	Aqua Score	Sub-catchment Name	Sub-catchment ID	Distance	Direction
N/A	No records within buffer						

Wetland Protection Area Data Source: State of Queensland (Environment and Heritage Protection)

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Ecological Constraints

Poitrel Mine Road, Moranbah, QLD 4744

Groundwater Dependent Ecosystems Atlas

GDEs within the dataset buffer:

Type	GDE Potential	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	Low potential GDE - from national assessment	Floodplains, clay plains and sandy bedrock lowlands.	Vegetation		0m

Groundwater Dependent Ecosystems Atlas Data Source: The Bureau of Meteorology
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Ecological Constraints - Inflow Dependent Ecosystems Likelihood

Poitrel Mine Road, Moranbah, QLD 4744



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Ecological Constraints

Poitrel Mine Road, Moranbah, QLD 4744

Inflow Dependent Ecosystems Likelihood

IDEs within the dataset buffer:

Type	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	4	Floodplains, clay plains and sandy bedrock lowlands.	Vegetation		0m
Terrestrial	6	Floodplains, clay plains and sandy bedrock lowlands.	Vegetation		0m
Terrestrial	7	Floodplains, clay plains and sandy bedrock lowlands.	Vegetation		0m
Terrestrial	8	Floodplains, clay plains and sandy bedrock lowlands.	Vegetation		0m

Inflow Dependent Ecosystems Likelihood Data Source: The Bureau of Meteorology
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Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading "LC" or "LocConf". These codes lookup to the following location confidences:

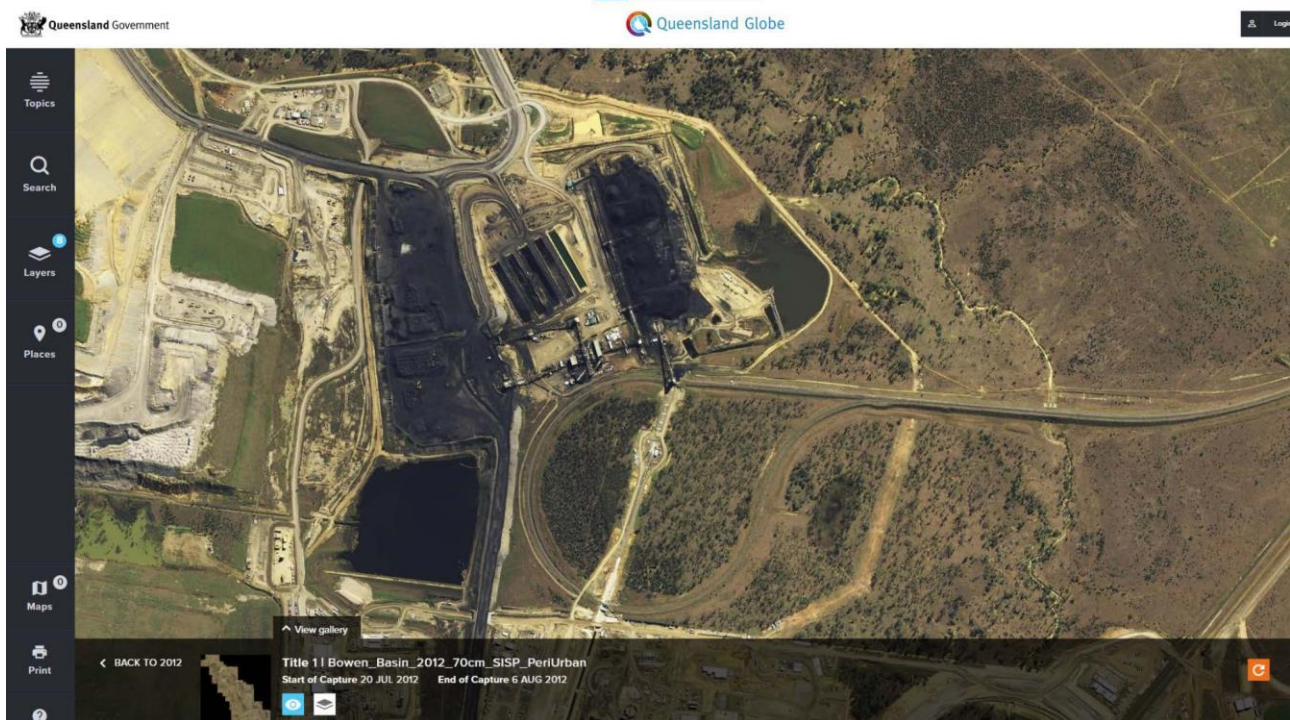
LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

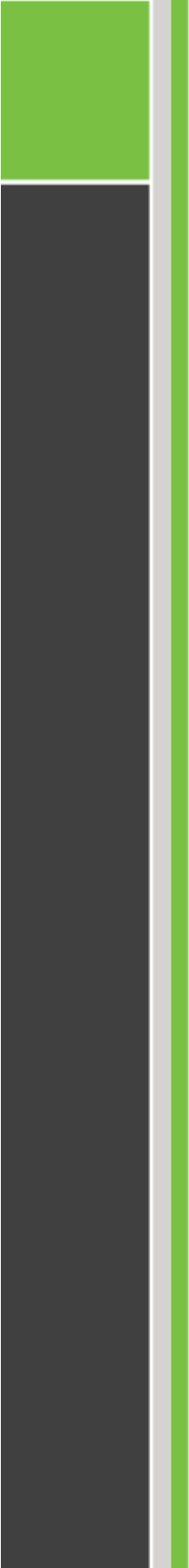
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Appendix C Dial Before You Dig Results



Job No 21816834

Phone: 1100
www.1100.com.au

Caller Details

Contact: Miss Tegan Jarvis
Company: CDM Smith
Address: 51 Alfred St
Fortitude Valley QLD 4006

Caller Id: 2293967
Mobile: 0423286892
Email: jarviste@cdmsmith.com
Phone: 0423286892
Fax: Not Supplied

Dig Site and Enquiry Details

WARNING: The map below only displays the location of the proposed dig site and does not display any asset owners' pipe or cables. The area highlighted has been used only to identify the participating asset owners, who will send information to you directly.



User Reference: 1001062
Working on Behalf of: Private
Enquiry Date: 16/06/2021
Start Date: 20/06/2021
End Date: 25/06/2021
Address: Poitrel Mine Road
Coppabella QLD 4741
Job Purpose: Excavation
Location of Workplace: Both
Onsite Activity: Vertical Boring
Location in Road: CarriageWay, Footpath, Nature Strip

- Check the location of the dig site is correct. If not submit a new enquiry.
- If the scope of works change, or plan validity dates expire, resubmit your enquiry.
- Do NOT dig without plans. Safe excavation is your responsibility. If you do not understand the plans or how to proceed safely, please contact the relevant asset owners.

Notes/Description of Works:

Your Responsibilities and Duty of Care

- The lodgement of an enquiry does not authorise the project to commence. You must obtain all necessary information from any and all likely impacted asset owners prior to excavation.
- If plans are not received within 2 working days, contact the asset owners directly & quote their Sequence No.
- ALWAYS perform an onsite inspection for the presence of assets. Should you require an onsite location, contact the asset owners directly. Please remember, plans do not detail the exact location of assets.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- Ensure you adhere to any State legislative requirements regarding Duty of Care and safe digging requirements.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using this service, you agree to Privacy Policy and the terms and disclaimers set out at www.1100.com.au
- For more information on safe excavation practices, visit www.1100.com.au

Asset Owner Details

The assets owners listed below have been requested to contact you with information about their asset locations within 2 working days. Additional time should be allowed for information issued by post. It is **your responsibility** to identify the presence of any underground assets in and around your proposed dig site. Please be aware, that not all asset owners are registered with the Dial Before You Dig service, so it is **your responsibility** to identify and contact any asset owners not listed here directly.

** Asset owners highlighted by asterisks ** require that you visit their offices to collect plans.

Asset owners highlighted with a hash require that you call them to discuss your enquiry or to obtain plans.

Seq. No.	Authority Name	Phone	Status
110856585	Aurizon Network Pty Ltd	0730197969	NOTIFIED
110856584	BM Alliance Coal Operations Pty Ltd	1800772061	NOTIFIED
110856582	Ergon Energy Corporation Ltd	137466	NOTIFIED
110856581	Isaac Regional Council	1300857870	NOTIFIED
110856583	Telstra QLD, Regional	1800653935	NOTIFIED

END OF UTILITIES LIST

NEW iPhone & Android Apps
Download on July 1

**NEXT GEN
DBYD Coming
July 1**

NEW Referral Service Platform
[Click here for more details](#)

Underground Electrical Equipment Location Details - Assets Found



To:	Miss Tegan Jarvis	DBYD Inquiry/Referral No:	110856582
Company:	CDM Smith	Date:	16/06/2021 10:46:00 AM
Address:	51 Alfred St Fortitude Valley QLD 4006	From:	Ergon Energy
Fax No:	Not Supplied	Region:	Ergon MK
Telephone: 13 10 46 or 13 2296 (Fault Calls)			
THIS RESPONSE IS APPLICABLE ONLY FOR ERGON ENERGY ELECTRICITY			
Our search has revealed there is existing Ergon Energy underground electrical equipment within the defined search area. Please see attached plan.			
It is Important that you note:			
1. That in addition to underground cables marked on attached plan there maybe underground Substation earth conductors, M.E.N. Conductors, S.W.E.R. Substation Earth Conductors, ABS Earth Mats, or Consumers Mains in the vicinity.			
2. This advice does not identify the presence of private underground cables that may run from Ergon Energy mains to consumer's premises			
Further Comments:			

In response to your application, Ergon Energy provides the attached copy of existing records showing the approximate location of known Ergon Energy underground electrical equipment within the vicinity of:

Location address: Poitrel Mine Road
Private/Road/Both: B
Activity Code: 31

Suburb/Town: Coppabella QLD 4741
UBD Map/Ref: Q415_65,Q415_75
Start Date: 20/06/2021 12:00:00 AM

Terms and Conditions

Responsibilities When Working in the Vicinity of Ergon Energy Underground Electrical Equipment

Extreme care must be taken during non-mechanical or mechanical excavation as damage to Ergon Energy underground electrical equipment can lead to injury or death of workers or members of the public.

Everyone has a legal "Duty of Care" to ensure safety which must be observed, particularly when working in the vicinity of underground electrical equipment. Underground electrical equipment includes underground cables, conduits and other associated underground equipment. When discharging this "Duty of Care" in relation to Ergon Energy underground electrical equipment, the following points must be considered:

1. It is the responsibility of the architect, consulting engineer, developer, and principal contractor in the project planning stages to design for minimal impact and protection of Ergon Energy underground electrical equipment.

Check this is the latest Process Zone version before use.

Page 1 of 3

Form BS001405F114 Ver 2

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Underground Electrical Equipment Location

Details - Assets Found



Ergon Energy will provide free plans showing the presence of the underground electrical equipment to assist at this design stage.

2. It is the constructor's responsibility to:
 - a. Obtain DBYD plans of Ergon Energy underground electrical equipment for a particular location at a reasonable time before civil work begins.
 - b. Visually locate Ergon Energy underground electrical equipment by non-mechanical excavation (potholing) when civil work activities may damage or interfere with Ergon Energy underground electrical equipment.
 - c. If Ergon Energy underground electrical equipment is wholly or partly affected by planned civil work activities, contact Ergon Energy on 13 10 46 and request Safety Advice.

A constructor may include but not limited to designer, project manager, installer, contractor, civil contractor.

3. The alignments and boundaries contained within Ergon Energy plans and maps will sometimes differ from present alignments and boundaries "on the ground". Accordingly, in every case where it appears that alignments and boundaries have shifted, or new road ways have been added, the constructor should obtain confirmation of the actual position of Ergon Energy cables and pipelines. In no case should the constructor rely on statements of third parties in relation to the position of Ergon Energy cables and pipelines.

Conditions of Supply of Information

- Plans and details provided by Ergon Energy are current for 4 weeks from the date of dispatch and should be disposed of by shredding or any other secure disposal methods after use.
- Ergon Energy agrees to provide free plans if an Ergon Energy underground electrical equipment location request is made to Freecall "1100" (Dial Before You Dig - DBYD) only on the basis that at least 2 business days' notice is given and the DBYD applicant agrees to the terms of this agreement. Ergon Energy does not provide information on private underground installations.
- Ergon Energy retains copyright of all plans and details provided in connection to your request.
- Ergon Energy plans or other details are provided for the use of the DBYD applicant, its servants, or agents, for the sole purpose of the applicant's responsibilities in relation to Ergon Energy underground electrical equipment and shall not be used for any other purpose.
- Ergon Energy plans are circuit diagrams only and indicate the presence of underground electrical equipment in the general vicinity of the geographical area shown. It is important to note that exact ground cover and alignments cannot be given with any certainty as such levels can change over time. The plans do not pinpoint the exact location of cables.
- On receipt of DBYD plans and before commencing excavation work or similar activities near Ergon Energy's underground electrical equipment, check to see that it relates to the area you have requested and carefully locate this underground electrical equipment first to avoid damage. If you are unclear about any information contained on the plan, please contact Ergon Energy on 13 10 46 for further advice.
- Ergon Energy, its servants or agents shall not be liable for any loss or damage caused or occasioned by the use of plans and of details so supplied to the DBYD applicant, its servants or agents, and the DBYD applicant agrees to indemnify Ergon Energy against any claim or demand for any such loss or damage to the DBYD applicant, its servants, or agents or to any third party.
- The constructor is responsible for all underground electrical equipment damaged when works commence prior to obtaining Ergon Energy plans, or at any time after that for failure to follow agreed instructions contained in this document or any other advice provided by Ergon Energy.
- By undertaking any work, you acknowledge that Ergon Energy reserves all rights to recover compensation for loss or damage to Ergon Energy caused by interference or damage, including consequential loss and damage to its cable network, or other property.
- Be aware that some underground conduits may contain asbestos. Refer to "Code of Practice for the Management and Control of Asbestos in Workplace [NOHSC;2018 (2005)]" for guidance.

When working in the vicinity of Ergon Energy underground electrical equipment, you must observe the following conditions:

Records

The first step before any excavation commences is to obtain records of Ergon Energy underground electrical equipment in the vicinity of the work (from DBYD). For new work, records should be obtained during the planning and design stage. The records provided by Ergon Energy must be made available to all relevant work groups on site. Where Ergon Energy underground electrical equipment information is transferred to plans for the proposed work, care must be exercised that important detail is not lost in the process.

Location of Cables

Examining the records is not sufficient, as reference points may change from the time of installation. Records must also be physically proven when working in close proximity to them. The exact location of underground electrical equipment likely to be affected shall be confirmed by use of an electronic cable locator followed by careful non mechanical excavation to the level of concrete slabs or conduits. Non mechanical excavation (potholing) must be used in advance of excavators. In any case, where doubt exists with respect to interpretation of cable records, contact Ergon Energy on 13 10 46 for further advice.

Check this is the latest Process Zone version before use.

Page 2 of 3

Form BS001405F114 Ver 2

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

Underground Electrical Equipment Location Details - Assets Found



- If during excavation, cables or conduits are damaged:
 - Call Ergon Energy Fault Call on 13 22 96 to report damaged cables or conduits.
 - Treat cables as if alive, post a person to keep all others clear of the excavation until Ergon Energy crew attend to make safe.
- If **unknown** cables or conduits (i.e. not shown on issued DBYD plans) are located during excavation:
 - Call Ergon Energy Fault Call on 13 22 96 to report
 - Treat cables as if alive, post a person to keep all others clear of the excavation until Ergon Energy crew attend to make safe.
- If the constructor is unable to locate Ergon Energy underground assets within 2.5 metres of nominal plan locations, they should contact the Ergon Energy on 13 10 46 for further advice.

THIS RESPONSE IS APPLICABLE ONLY FOR ERGON ENERGY ELECTRICITY

IMPORTANT NOTICE

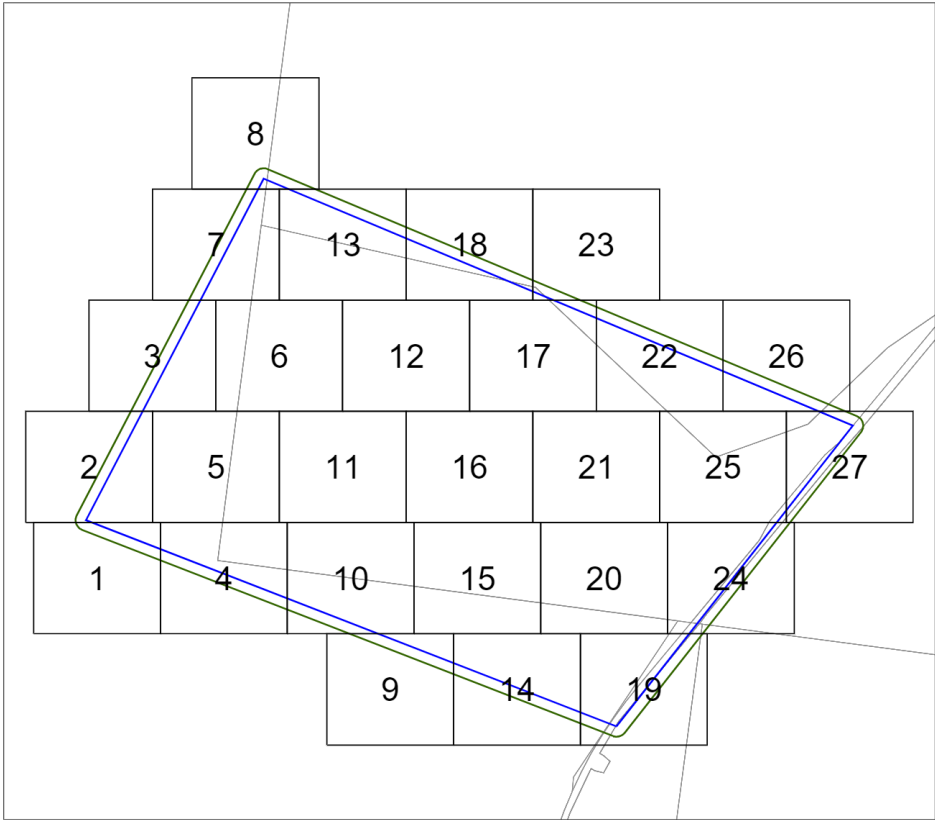


Please be advised that Ergon Energy GIS system has had an upgrade, which resulted in some assets requiring name changes.

The following table outlines the names of all assets that may appear in your upgraded plans.

Old Name	New EO Name
Communications Cable	Communications Cable
Communications Joint	Communications Joint
Communications Pit	Communications Pit
Communications Site	Communications Site
Duct	Accurate Route
Earth	Connector Point Installation
Earth Cable	Cable Segment
Earth Cable Joint	Connector Point Installation
HV Cable	Cable Segment
HV Cable Joint	Connector Point Installation
LV Cable	Cable Segment
LV Cable Joint	Connector Point Installation
Pillar	Pedestal
Pit	Pit
Pole	Pole
Substation	Substation
TR Cable	Cable Segment
TR Cable Joint	Connector Point Installation
Zone Substation Site	Substation

We apologise for any inconvenience and thank you for your patience and co-operation.





110856582-21816834

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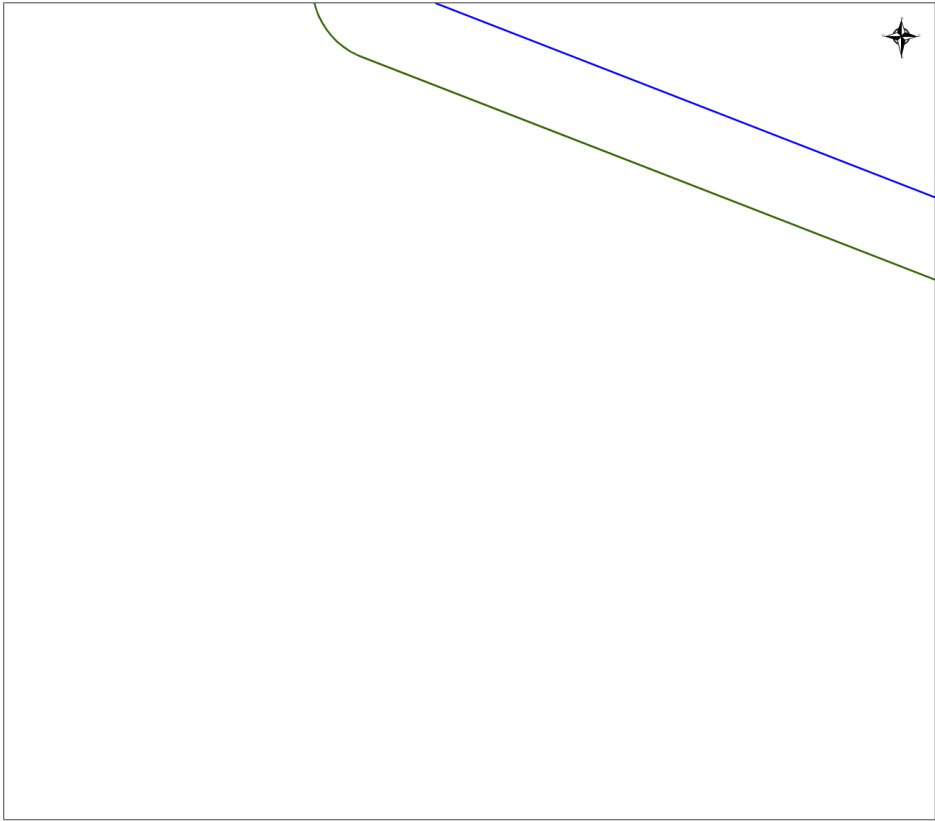
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DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Land Parcel Medium Area Geom





110856582-21816834

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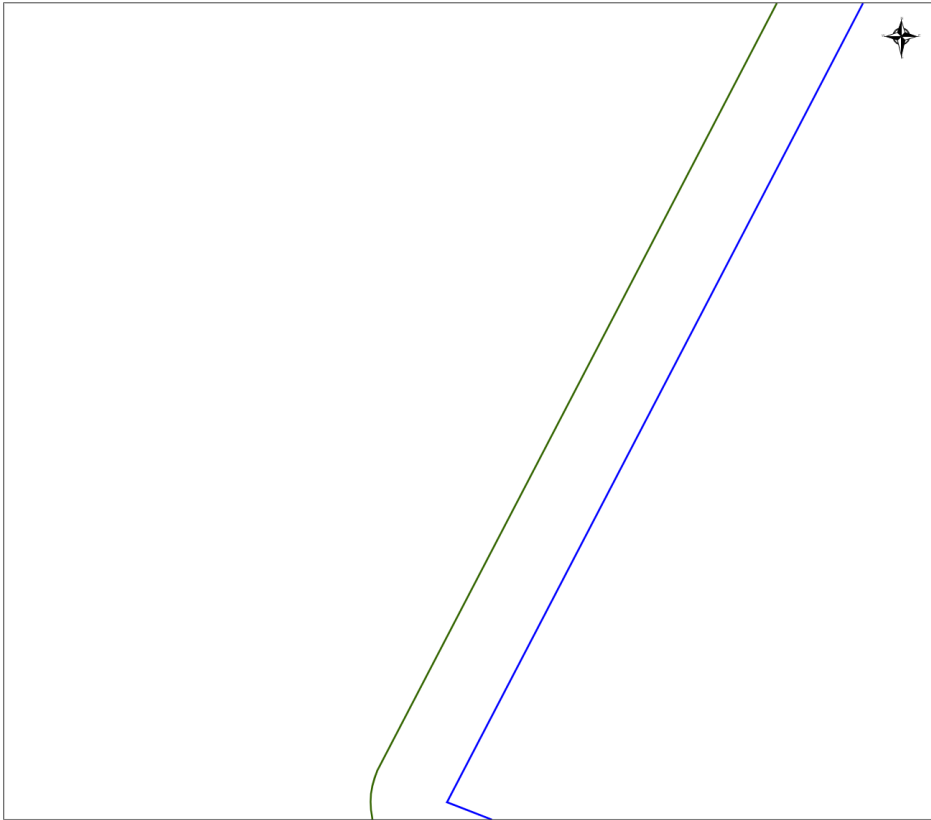
LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom





110856582-21816834

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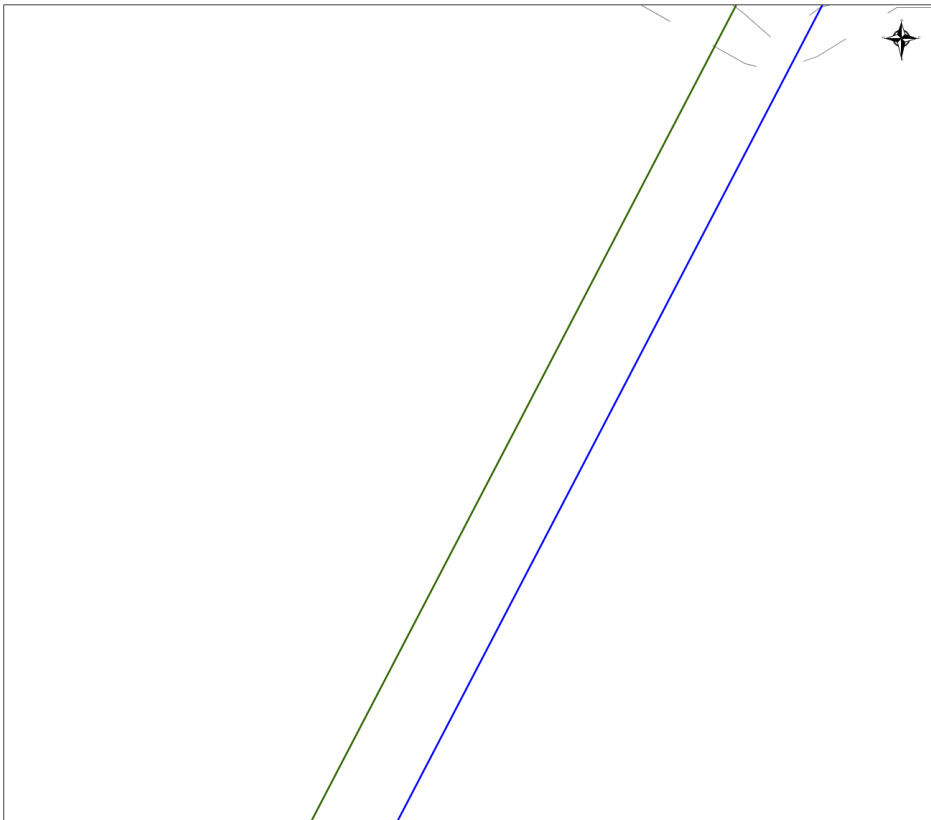
LEGEND

DBYD [Misc_oracle]

-  DBYD Request Ergon Search Area
-  DBYD Request Area

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom





110856582-21816834

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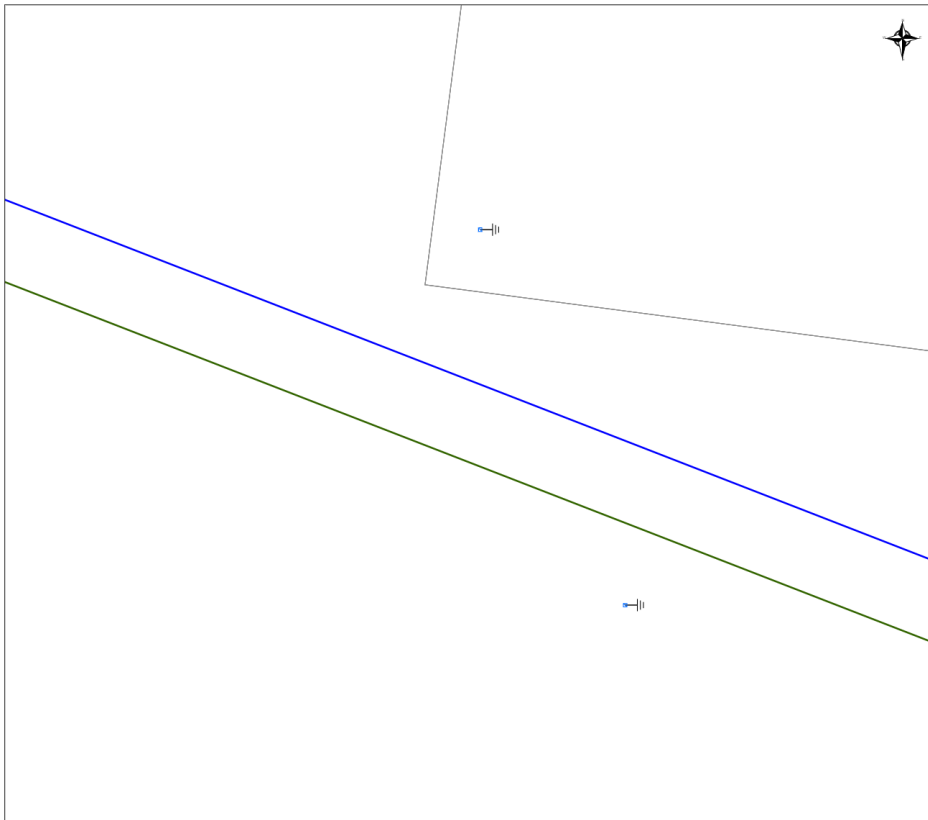
LEGEND

DBYD [Misc_oracle]

-  DBYD Request Ergon Search Area
-  DBYD Request Area

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom
-  Easement Area Geom



110856582-21816834

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Scale: 1:2000

LEGEND

Segments [Electric]
 - Communications Pole Inspection External Location - Earth Binding
 Communications [Electric]
 - Communications Pole Location - Existing
 DBVD [Misc_oracle]
 - DBVD Request Ergon Search Area
 - DBVD Request Area
 DCDB [Operational_cadastre]
 - Land Parcel Area Geom
 - Land Parcel Large Area Geom



110856582-21816834

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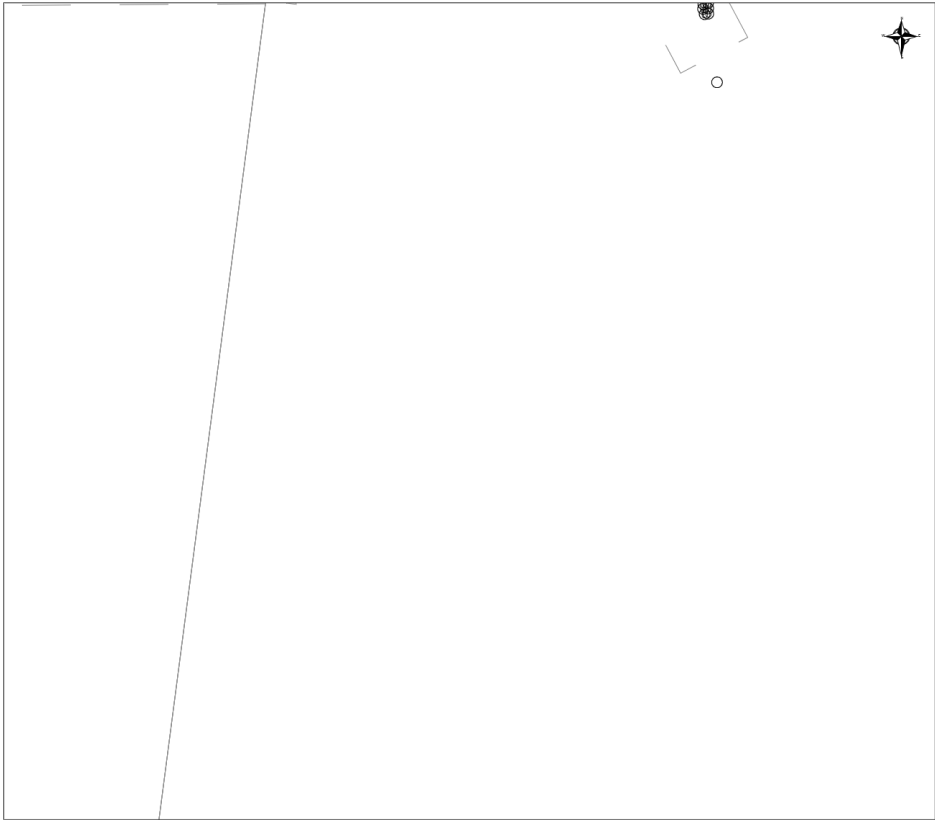
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Created Date 16/06/2021 10:52:19

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LEGEND

DBVD [Misc_oracle]
 - DBVD Request Ergon Search Area
 - DBVD Request Area
 DCDB [Operational_cadastre]
 - Land Parcel Area Geom
 - Land Parcel Large Area Geom





110856582-21816834

Sheet: 6 Layer: All Layers

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LEGEND

Distribution Structures [Electric]

- Pole Existing Location - Unknown
- Pole Existing Location - HV

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Easement Area Geom





110856582-21816834

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Created Date 16/06/2021 10:52:21

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LEGEND

Distribution Structures [Electric]

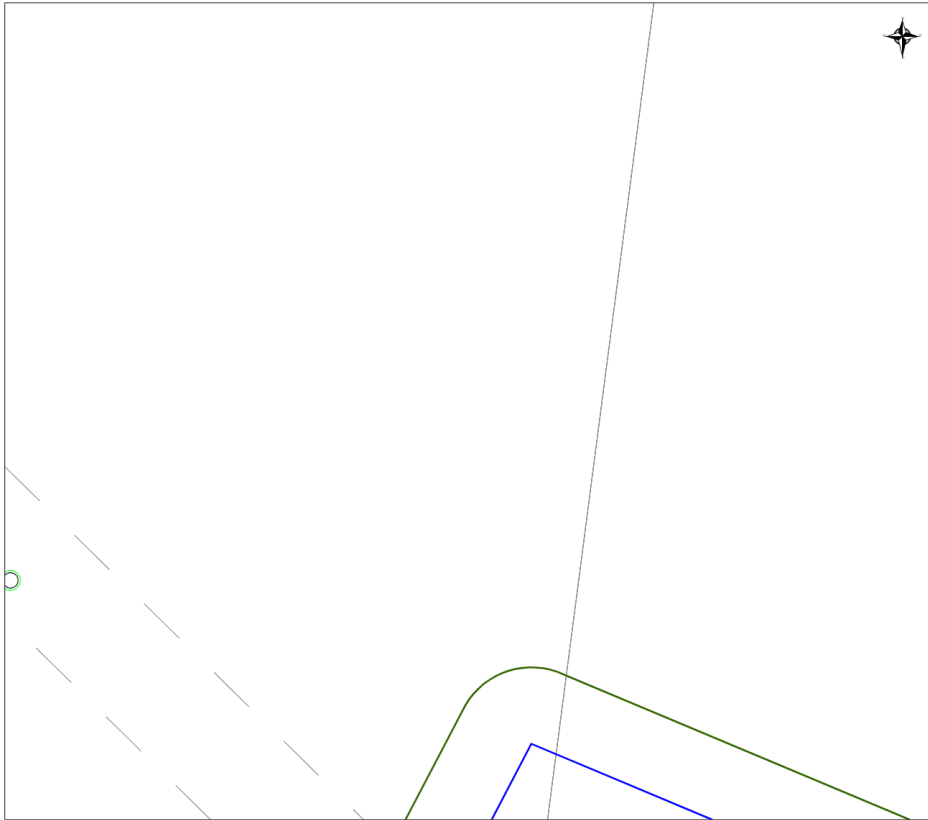
- Pole Existing Location - TR/Comms

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Easement Area Geom





110856582-21816834

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Created Date 16/06/2021 10:52:21

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LEGEND

Distribution Structures (Electric)

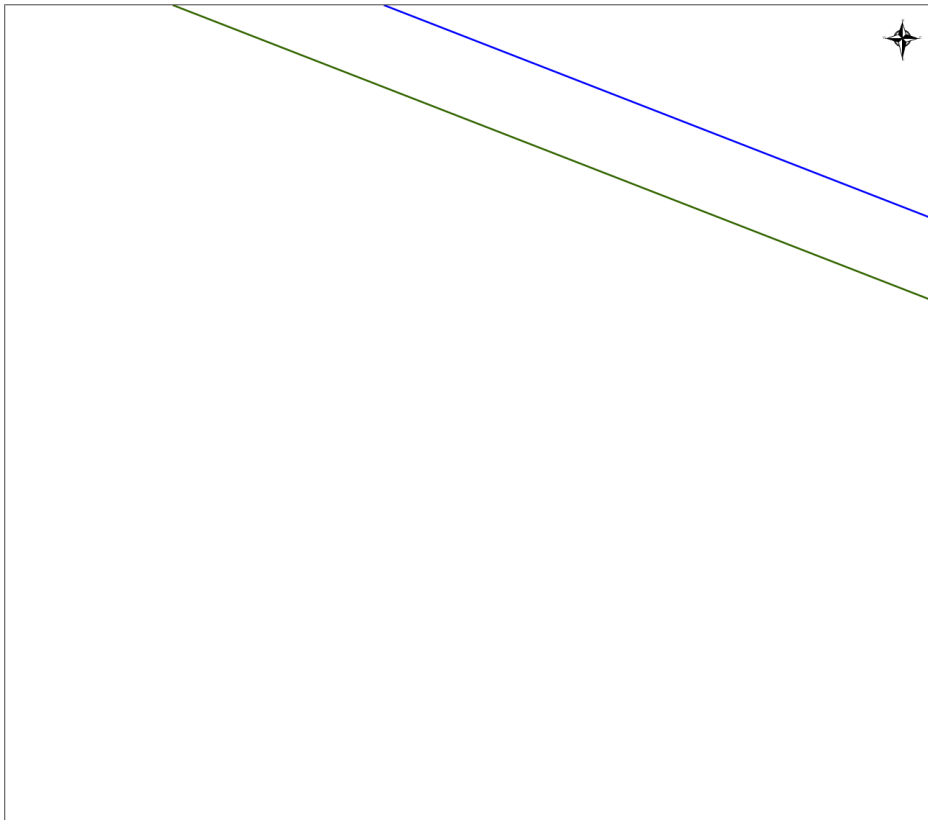
- Pole Existing Location - TR/Comms

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Easement Area Geom





110856582-21816834

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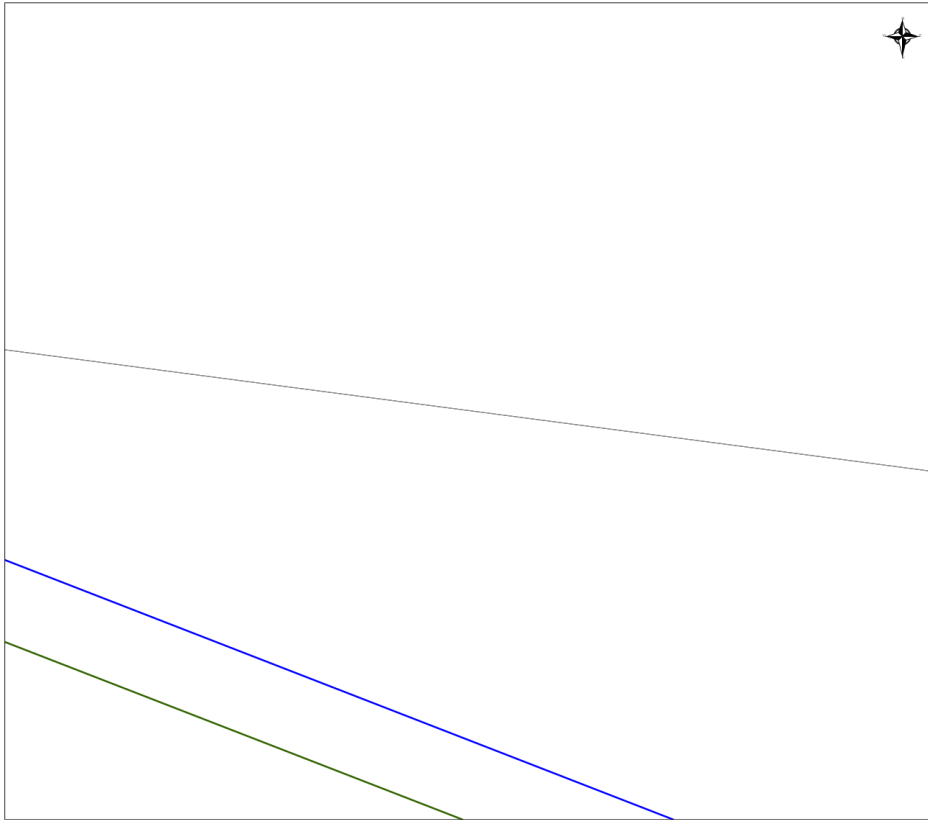
LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom





110856582-21816834

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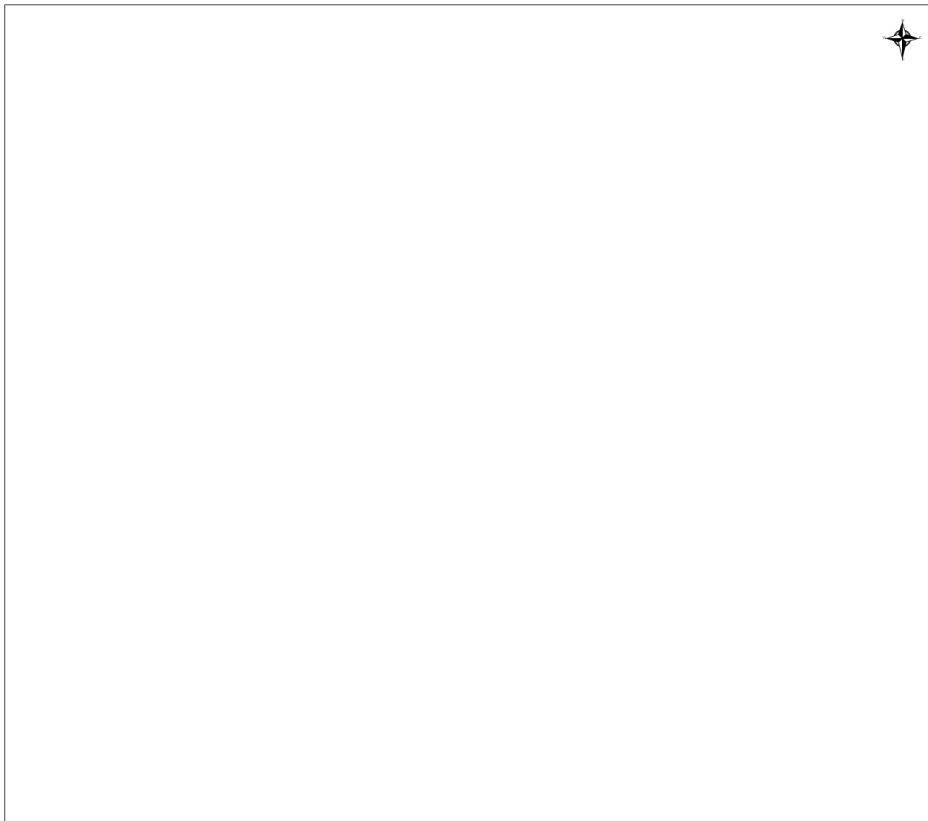
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LEGEND

DBYD [Misc_oracle]
 DBYD Request Ergon Search Area
 DBYD Request Area

DCDB [Operational_cadastre]
 Land Parcel Area Geom
 Land Parcel Large Area Geom





110856582-21816834

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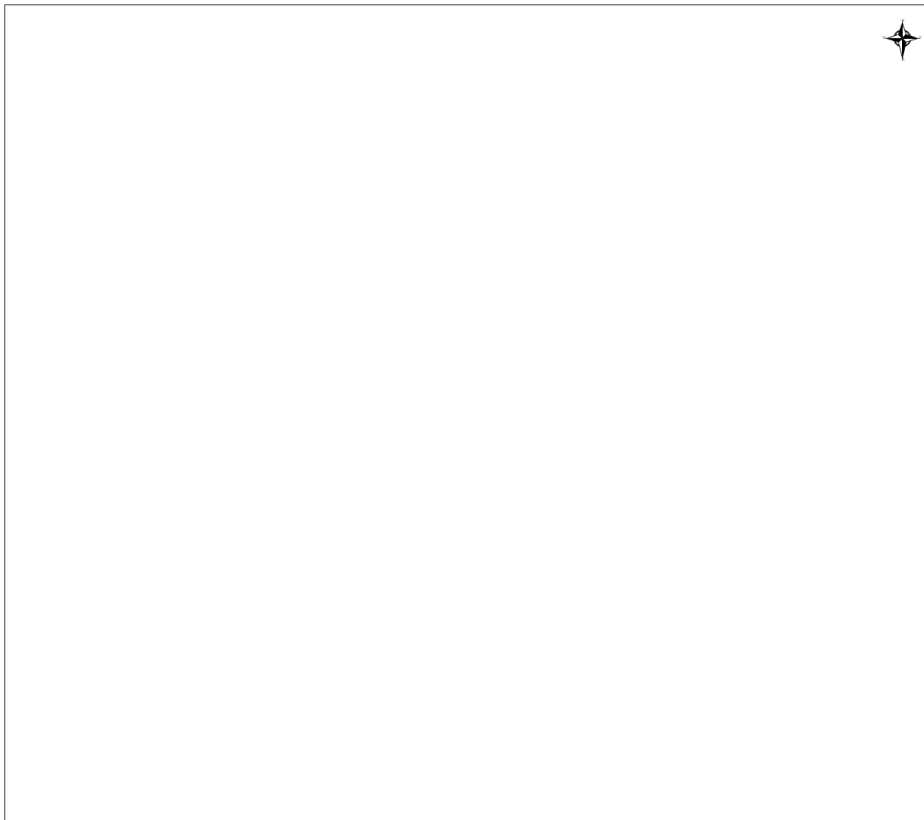
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LEGEND

DBYD [Misc_oracle]
 DBYD Request Ergon Search Area
 DBYD Request Area

DCDB [Operational_cadastre]
 Land Parcel Area Geom
 Land Parcel Large Area Geom





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Sheet: 12 Layer: All Layers

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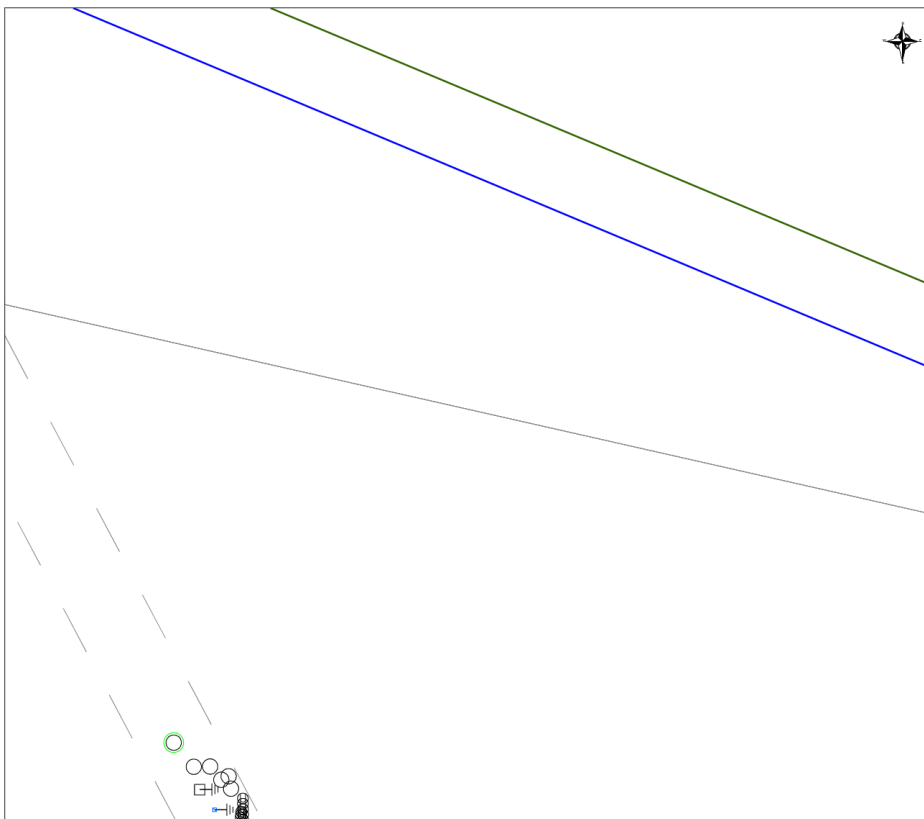
LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom





110856582-21816834

Sheet: 13 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:25

Scale: 1:2000

LEGEND

Supernode [District]

- Converter Point Installation External Location - Earth Existing

Distribution Structure [District]

- Pole Existing Location - Unknown
- Pole Existing Location - TR
- Pole Existing Location - TR/Gamma

Substation Site [District]

- Substation Existing Location - Zone Substation

Communications [District]

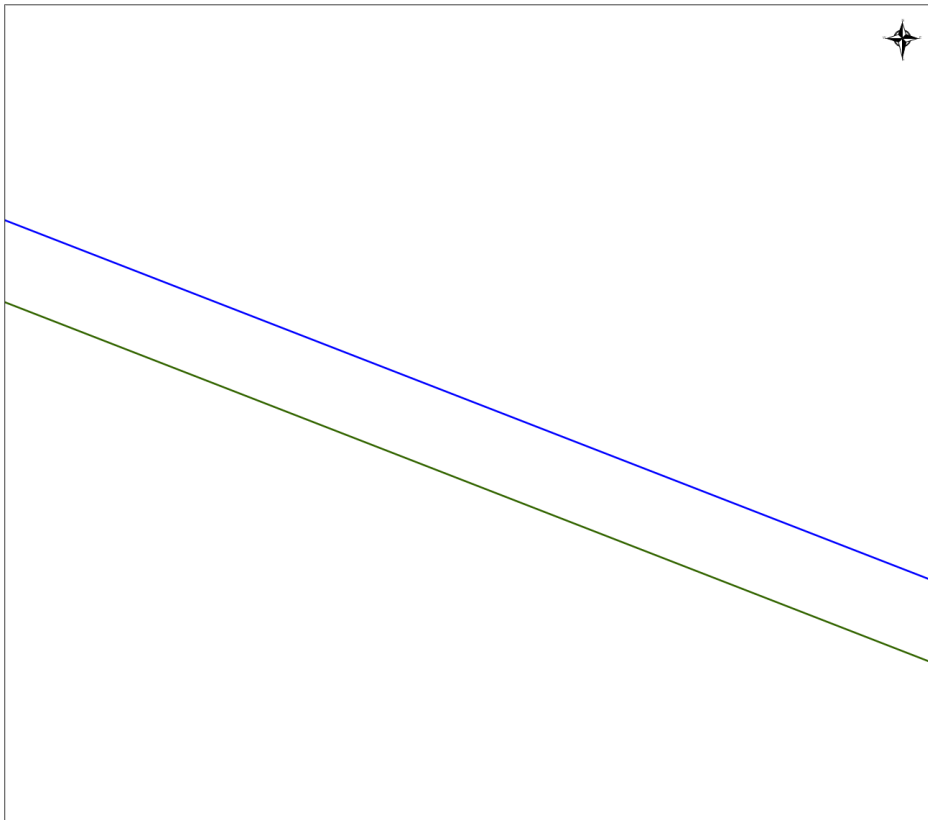
- Communications Site Location - Existing

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Easement Area Geom





110856582-21816834

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Created Date 16/06/2021 10:52:26

Scale: 1:2000

LEGEND

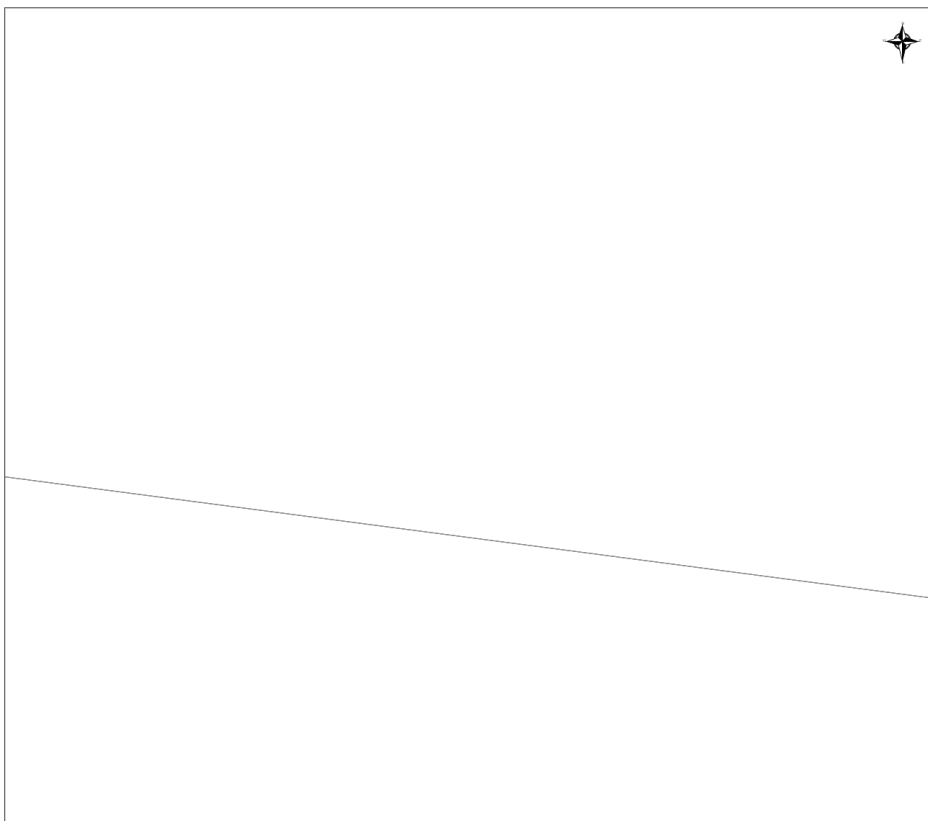
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

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110856582-21816834

Sheet: 15 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:27

Scale: 1:2000

LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

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110856582-21816834

Sheet: 16 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:28

Scale: 1:2000

LEGEND

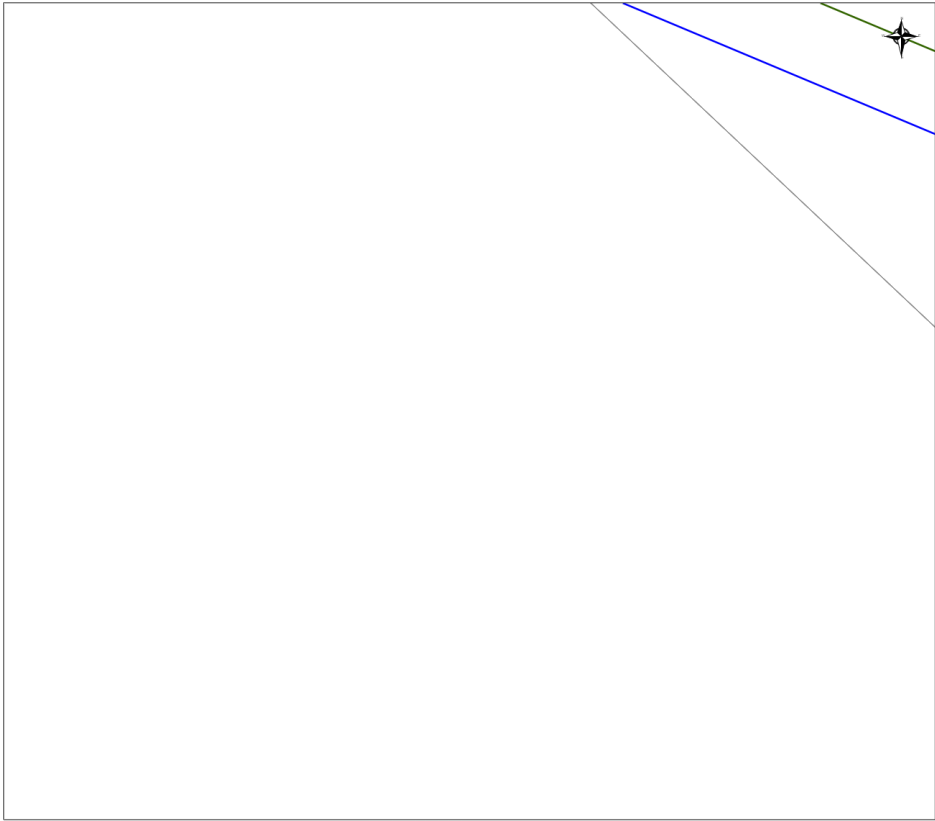
DBYD [Misc_oracle]

-  DBYD Request Ergon Search Area
-  DBYD Request Area

Abc Def Qvas Label Geom

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom





110856582-21816834

Sheet: 17 Layer: All Layers

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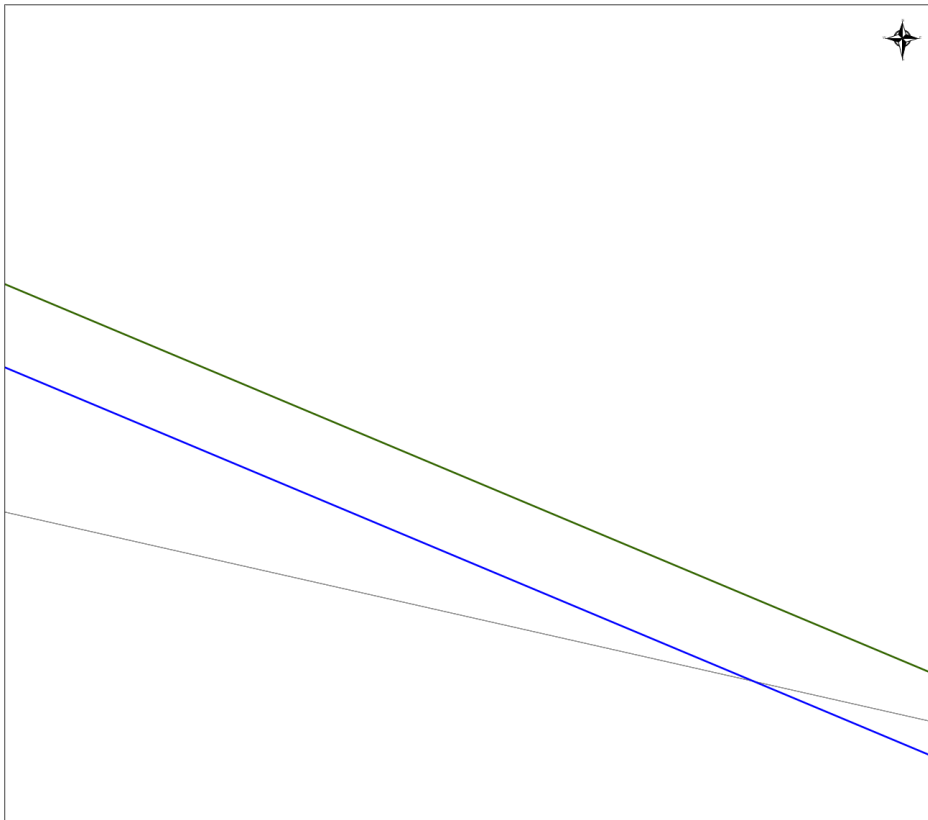
LEGEND

DBYD [Misc_oracle]

-  DBYD Request Ergon Search Area
-  DBYD Request Area

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom





110856582-21816834

Sheet: 18 Layer: All Layers

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Created Date 16/06/2021 10:52:29

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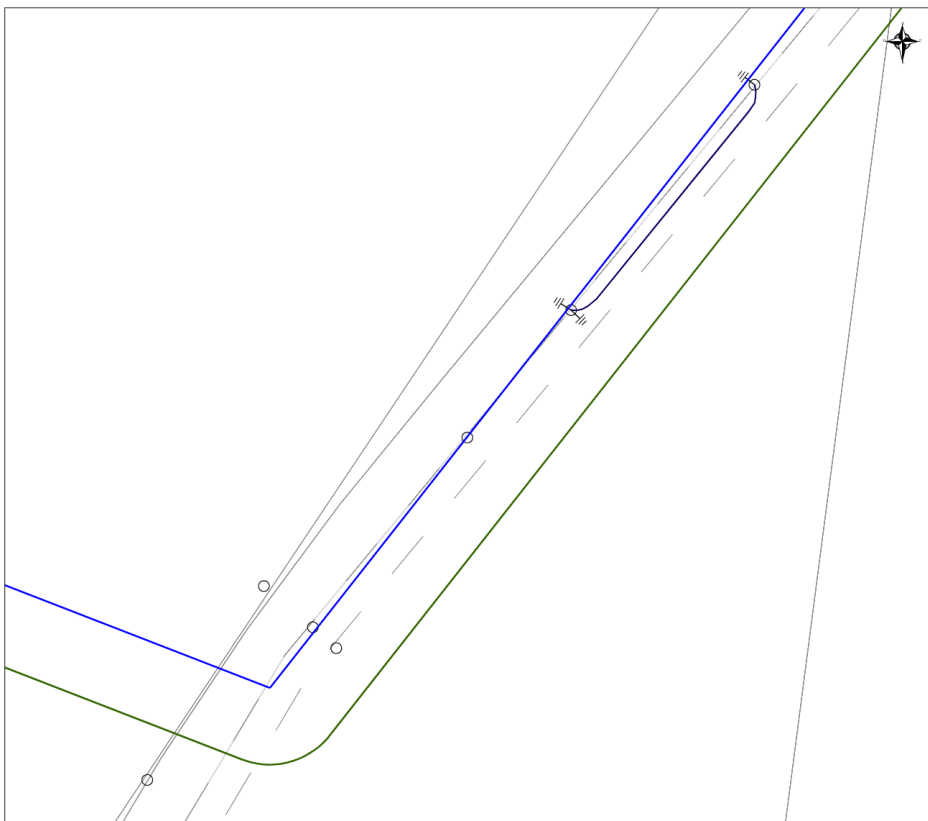
LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom





110856582-21816834

Sheet: 19 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:30

Scale: 1:2000

LEGEND

Segments [Electric]

- Cable Segment - HV Route - 18/10/1
- Connector Point Installation - Skirmal Location - Earth Raising

Distribution Structures [Electric]

- Accessory Route Route
- Pole String Location - HV

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Land Parcel Medium Area Geom
- Estimation Area Geom





110856582-21816834

Sheet: 20 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:31

Scale: 1:2000

LEGEND

DBYD [Misc_oracle]

-  DBYD Request Ergon Search Area
-  DBYD Request Area

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom





110856582-21816834

Sheet: 21 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:32

Scale: 1:2000

LEGEND

Communications [Electric]

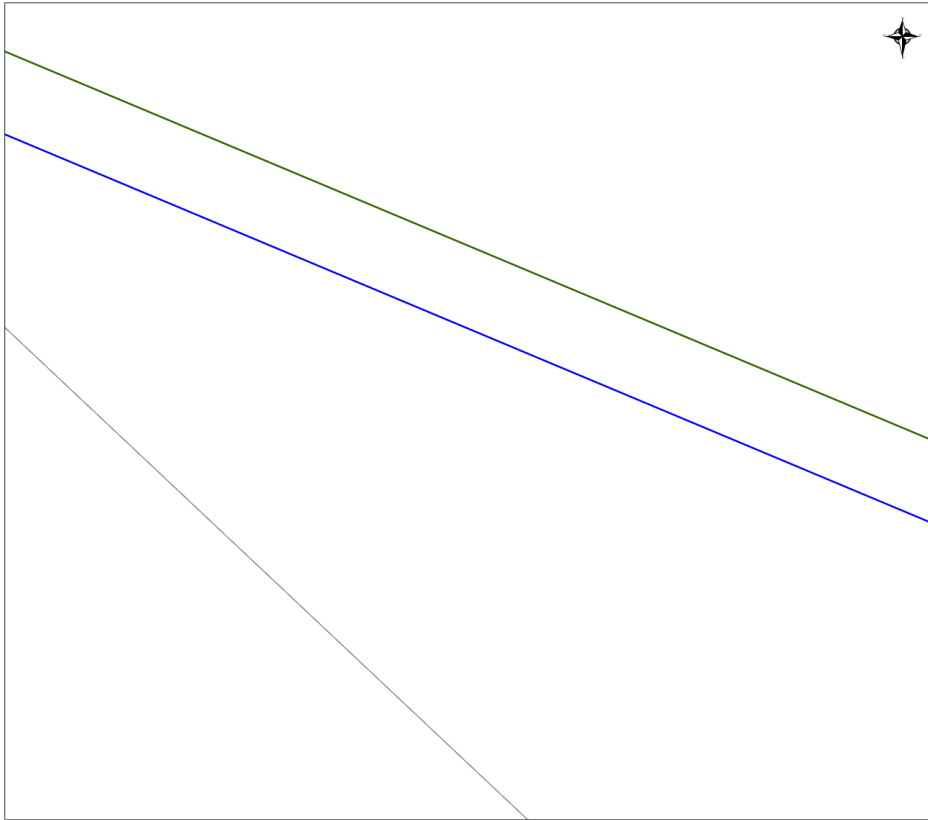
-  Communications Site Location - Existing

DBYD [Misc_oracle]

-  DBYD Request Ergon Search Area
-  DBYD Request Area

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom



110856582-21816834

Sheet: 22 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:32

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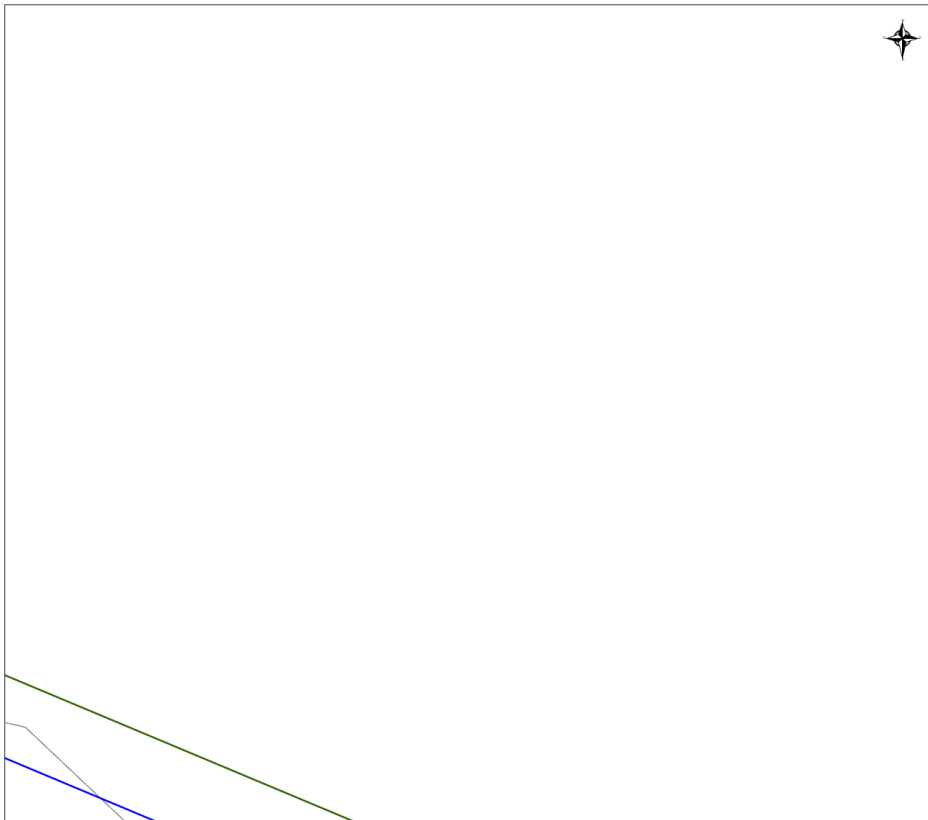
LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom



110856582-21816834

Sheet: 23 Layer: All Layers

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Created Date 16/06/2021 10:52:33

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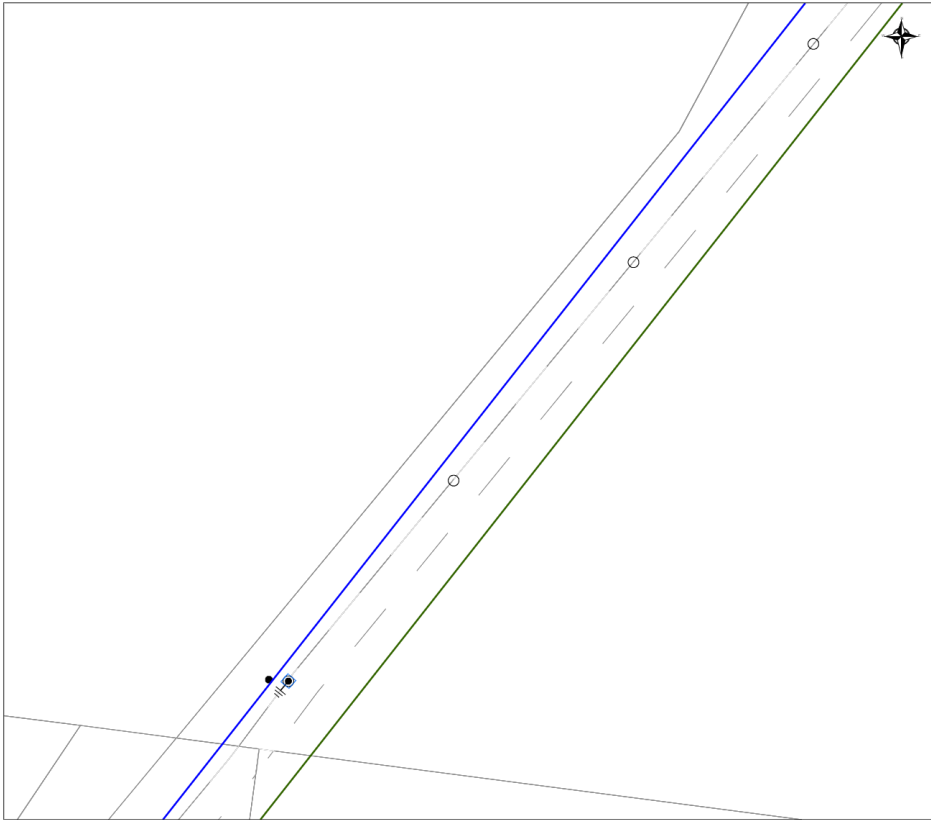
LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom





110856582-21816834

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Created Date 16/06/2021 10:52:34

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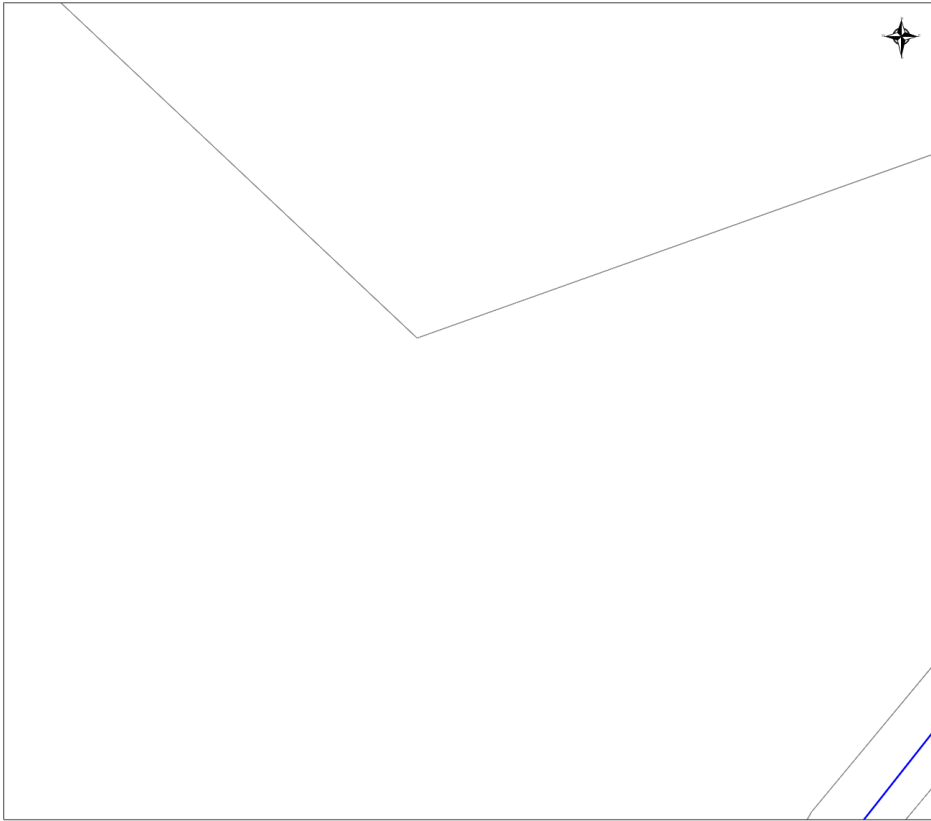
LEGEND

Segments [Electric]

- H— Converter Point Insulation External Location - Earth Existing
- H— Distribution Structures (existing)
- Pole Existing Location - HV
- Pole Existing Location - HV/LV
- Pole Existing Location - LV
- H— Substation Site (existing)
- H— Substation Existing Location - Pole Mounted Distribution

DBVD [Misc_oracle]

- DBVD Request Ergon Search Area
- DBVD Request Area
- DCDB [Operational_cadastre]
- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Land Parcel Medium Area Geom
- Easement Area Geom





110856582-21816834

Sheet: 25 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

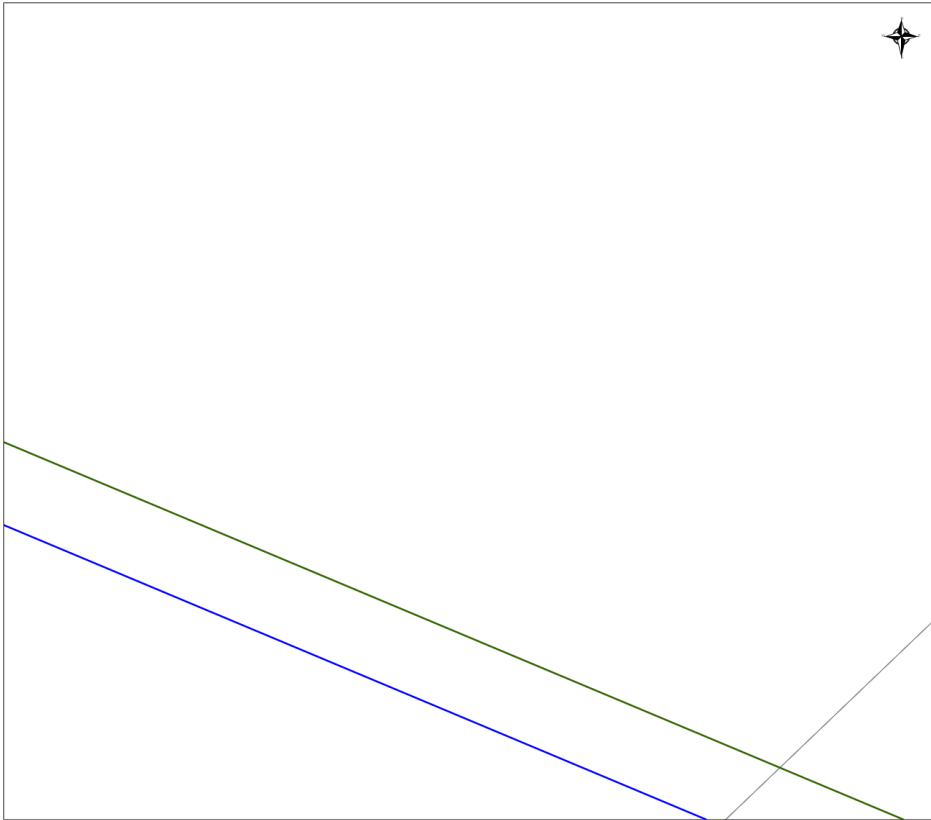
Created Date 16/06/2021 10:52:35

Scale: 1:2000

LEGEND

DBVD [Misc_oracle]

- DBVD Request Ergon Search Area
- DBVD Request Area
- DCDB [Operational_cadastre]
- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Land Parcel Medium Area Geom
- Easement Area Geom





110856582-21816834

Sheet: 26 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:36

Scale: 1:2000

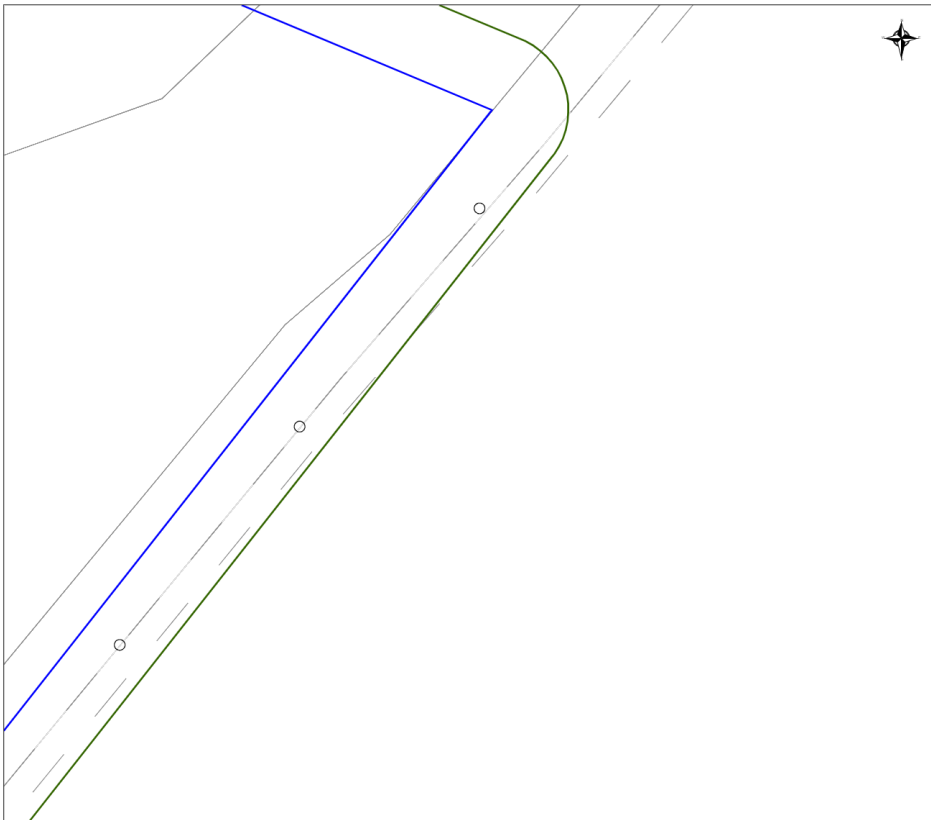
LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom





110856582-21816834

Sheet: 27 Layer: All Layers

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:36

Scale: 1:2000

LEGEND

Distribution Structures [Electric]

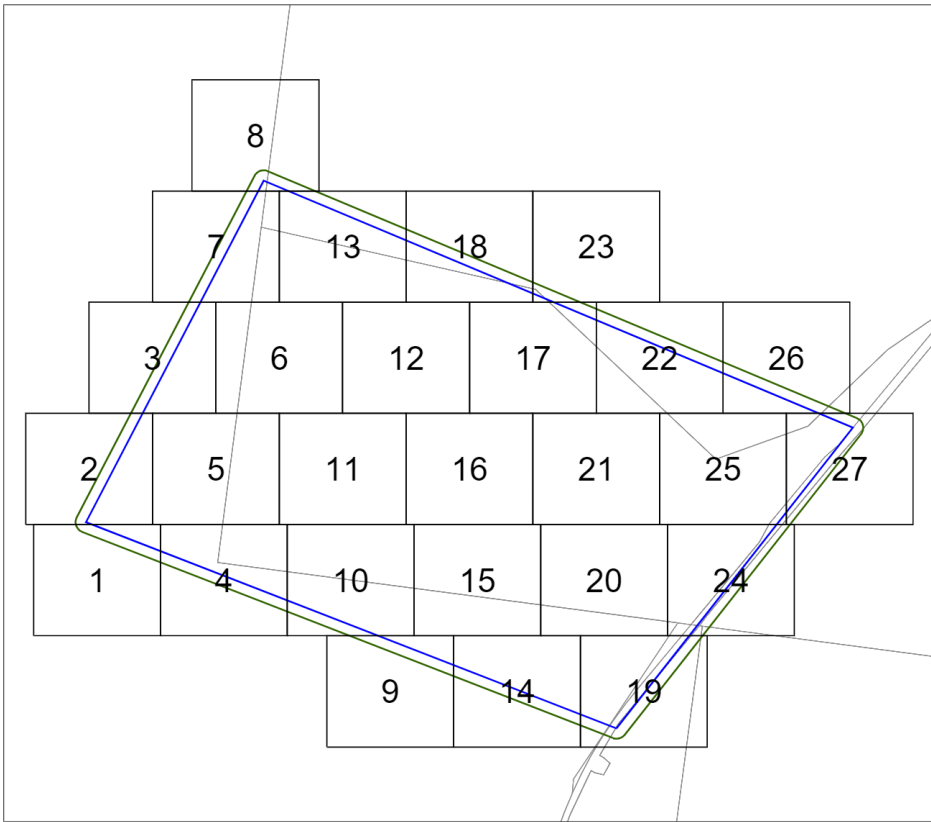
- Pole Existing Location - HV

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Land Parcel Medium Area Geom
- Easement Area Geom





110856582-21816834

Sheet: Index Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:14

Scale: 1:14700

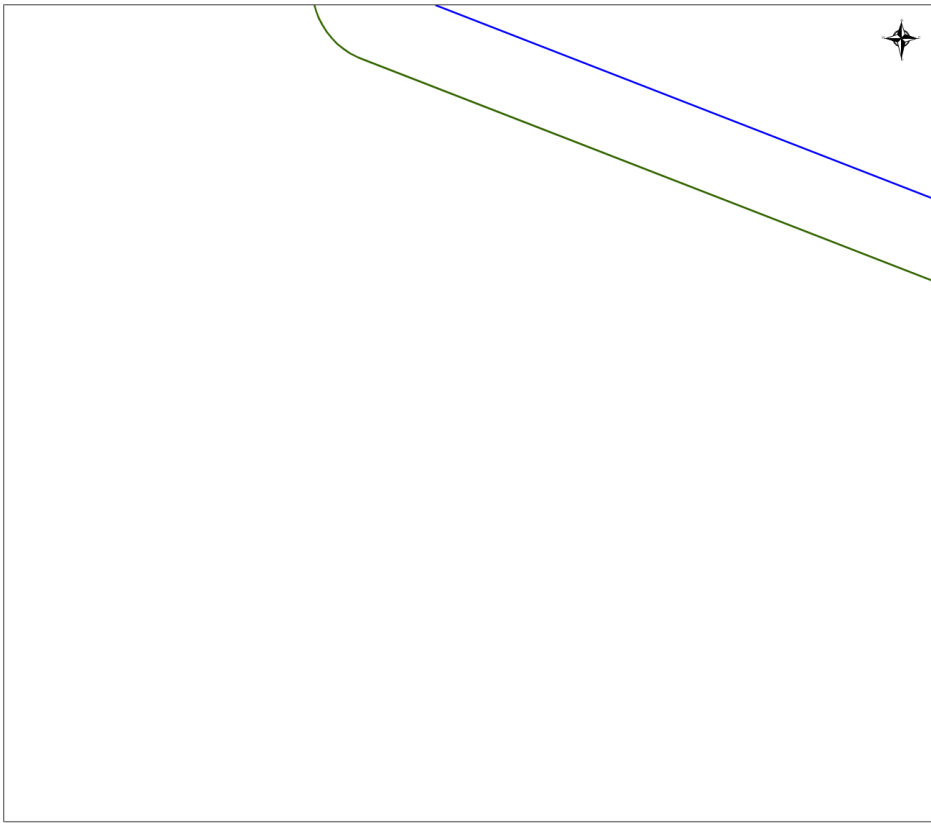
LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Land Parcel Medium Area Geom





110856582-21816834

Sheet: 1 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:18

Scale: 1:2000

LEGEND

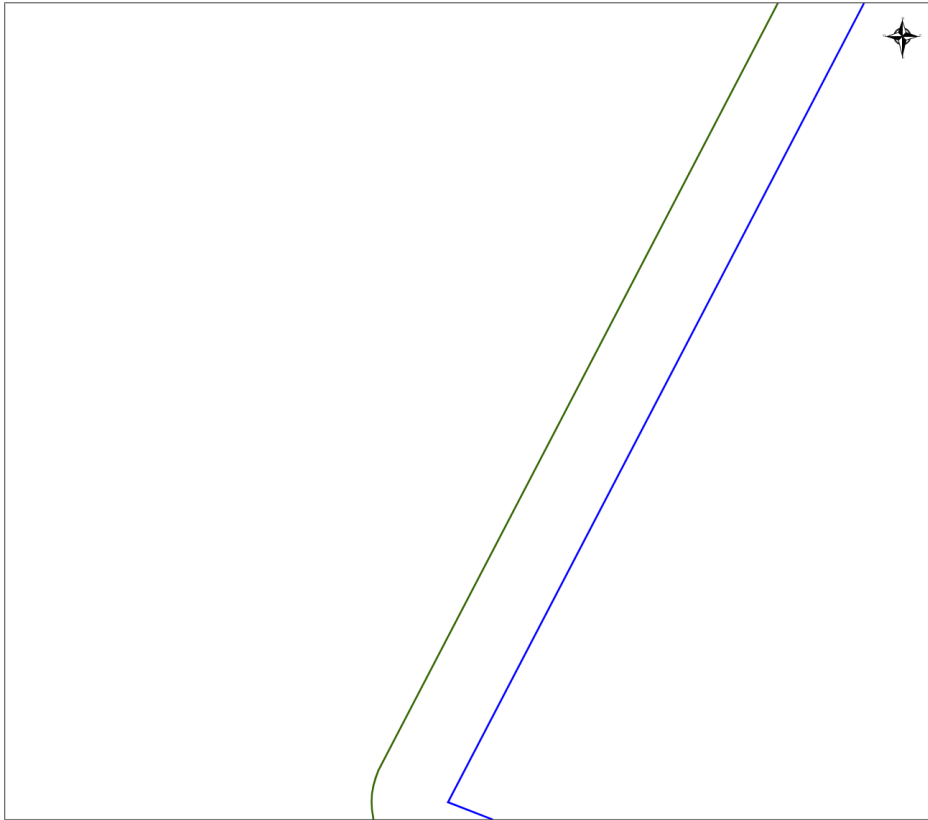
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 2 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:19

Scale: 1:2000

LEGEND

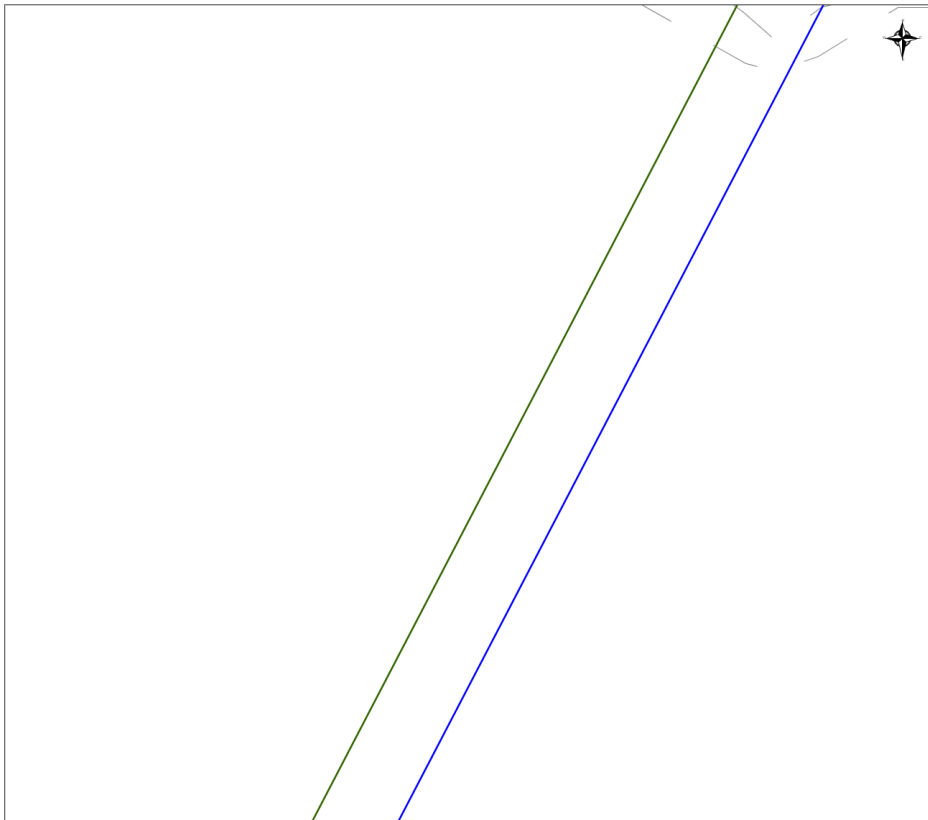
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 3 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:20

Scale: 1:2000

LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Easement Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 5 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:21

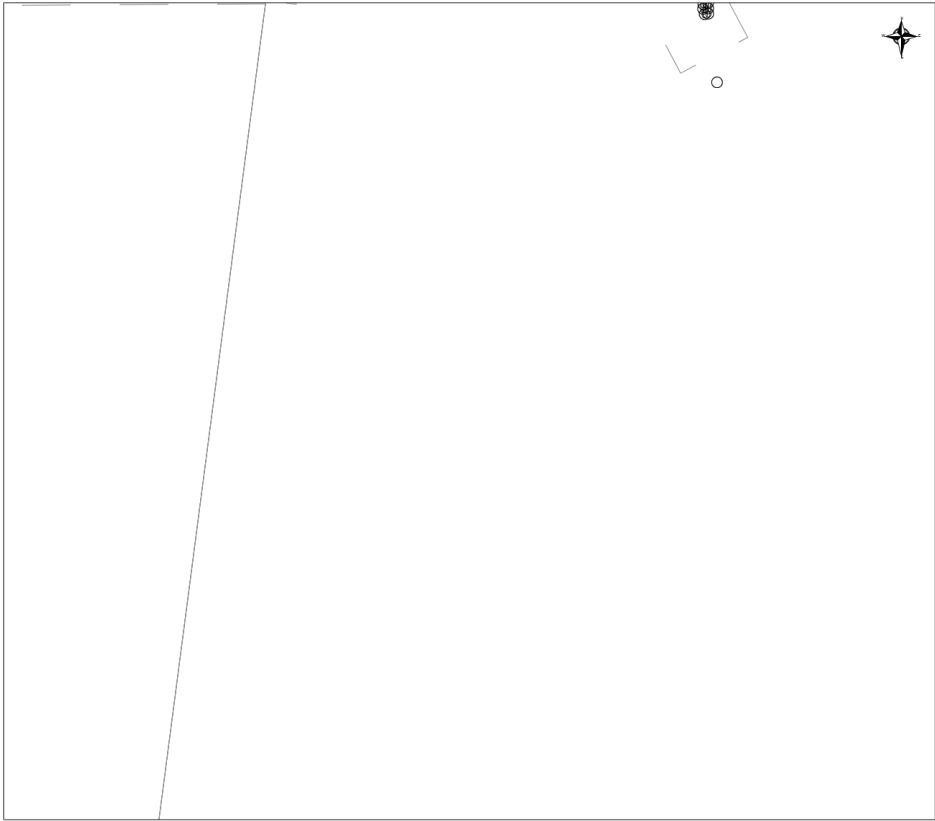
Scale: 1:2000

LEGEND

DBYD [Misc_oracle]
 DBYD Request Ergon Search Area
 DBYD Request Area

DCDB [Operational_cadastre]
 Land Parcel Area Geom
 Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 6 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:22

Scale: 1:2000

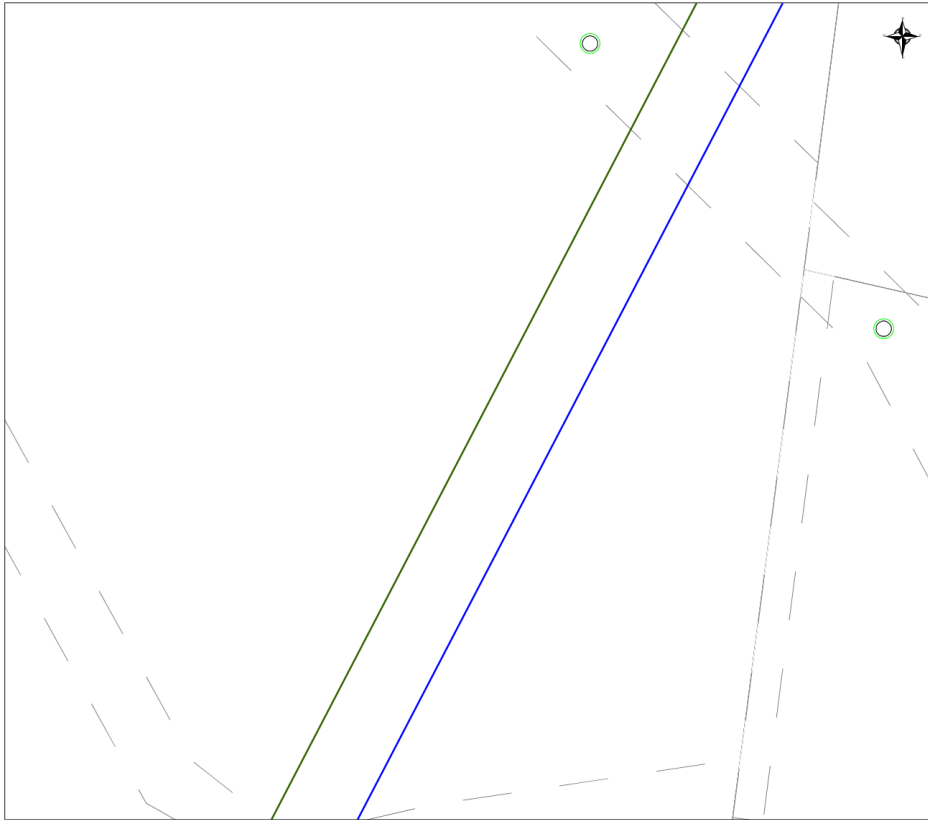
LEGEND

Distribution Structures [Electric]
 Pole Existing Location - Unknown
 Pole Existing Location - HV

DBYD [Misc_oracle]
 DBYD Request Ergon Search Area
 DBYD Request Area

DCDB [Operational_cadastre]
 Land Parcel Area Geom
 Land Parcel Large Area Geom
 Easement Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot



110856582-21816834

Sheet: 7 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:23

Scale: 1:2000

LEGEND

Distribution Structures (Electric)

- Pole Existing Location - TR/Comms

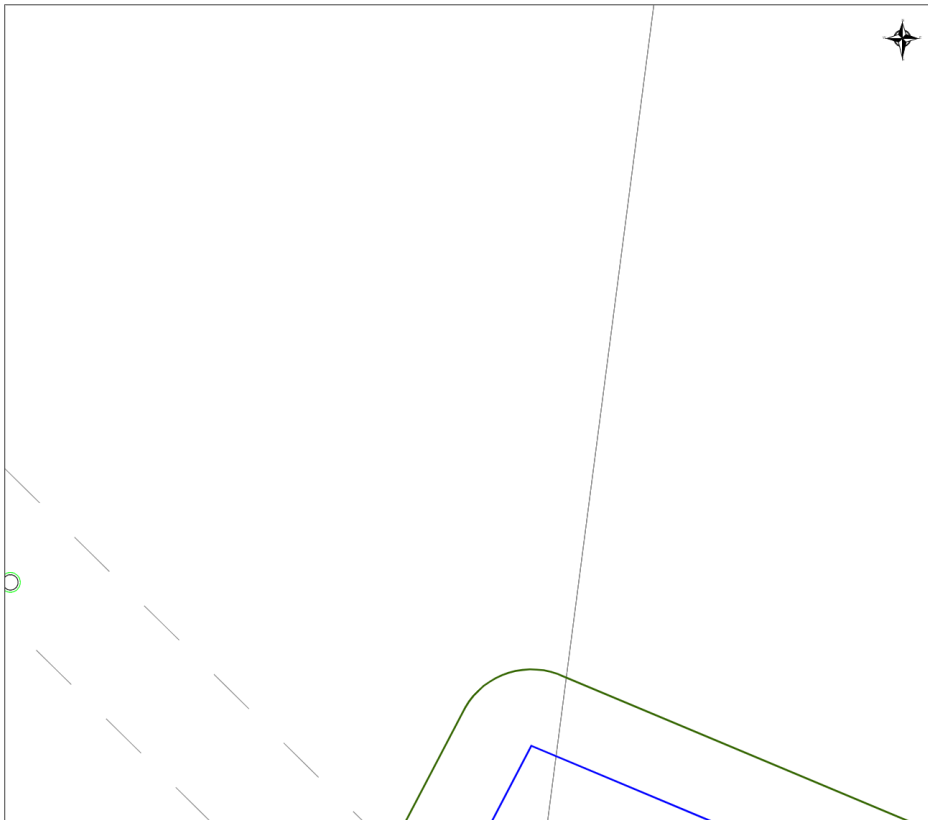
DBYD (Misc_oracle)

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB (Operational_cadastre)

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Easement Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot



110856582-21816834

Sheet: 8 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:23

Scale: 1:2000

LEGEND

Distribution Structures (Electric)

- Pole Existing Location - TR/Comms

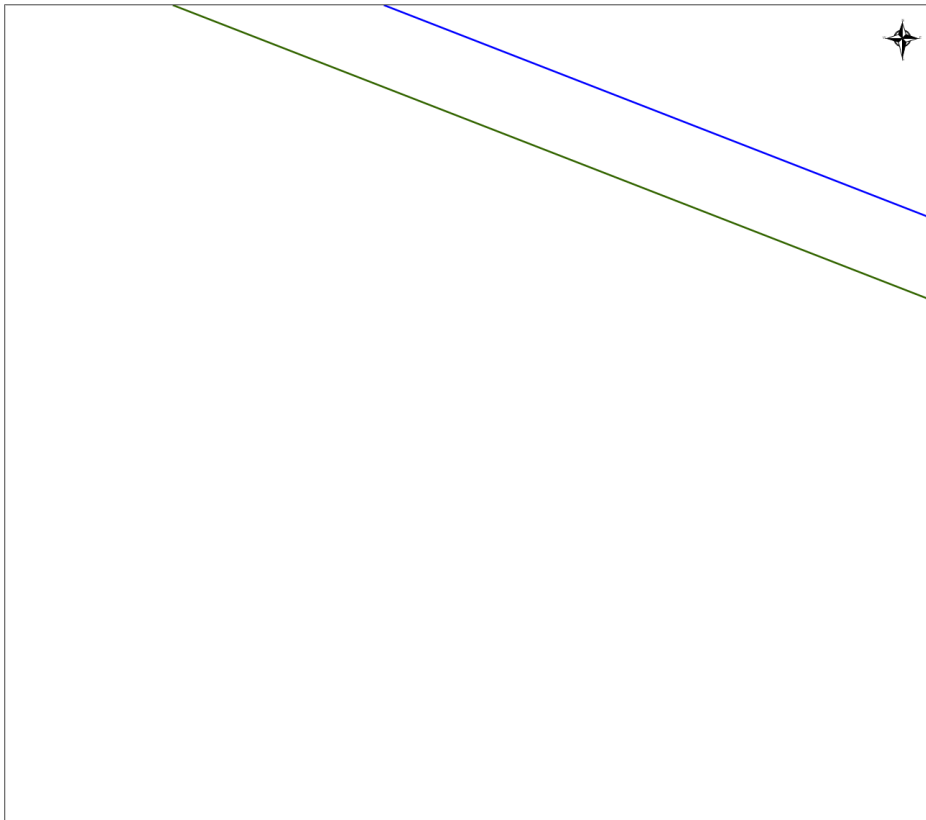
DBYD (Misc_oracle)

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB (Operational_cadastre)

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Easement Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot



ERGON ENERGY

110856582-21816834

Sheet: 9 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:24

Scale: 1:2000

LEGEND

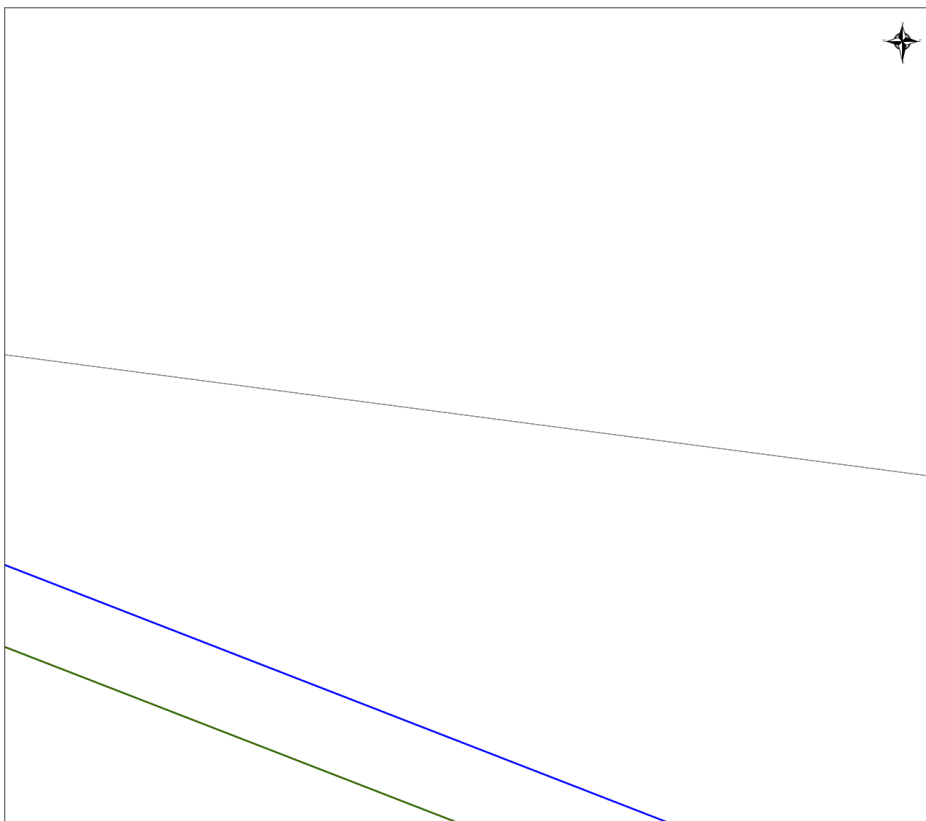
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot



ERGON ENERGY

110856582-21816834

Sheet: 10 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:25

Scale: 1:2000

LEGEND

DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot



110856582-21816834

Sheet: 11 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:26

Scale: 1:2000

LEGEND

DBYD [Misc_oracle]

-  DBYD Request Ergon Search Area
-  DBYD Request Area

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot

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110856582-21816834

Sheet: 12 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:26

Scale: 1:2000

LEGEND

DBYD [Misc_oracle]

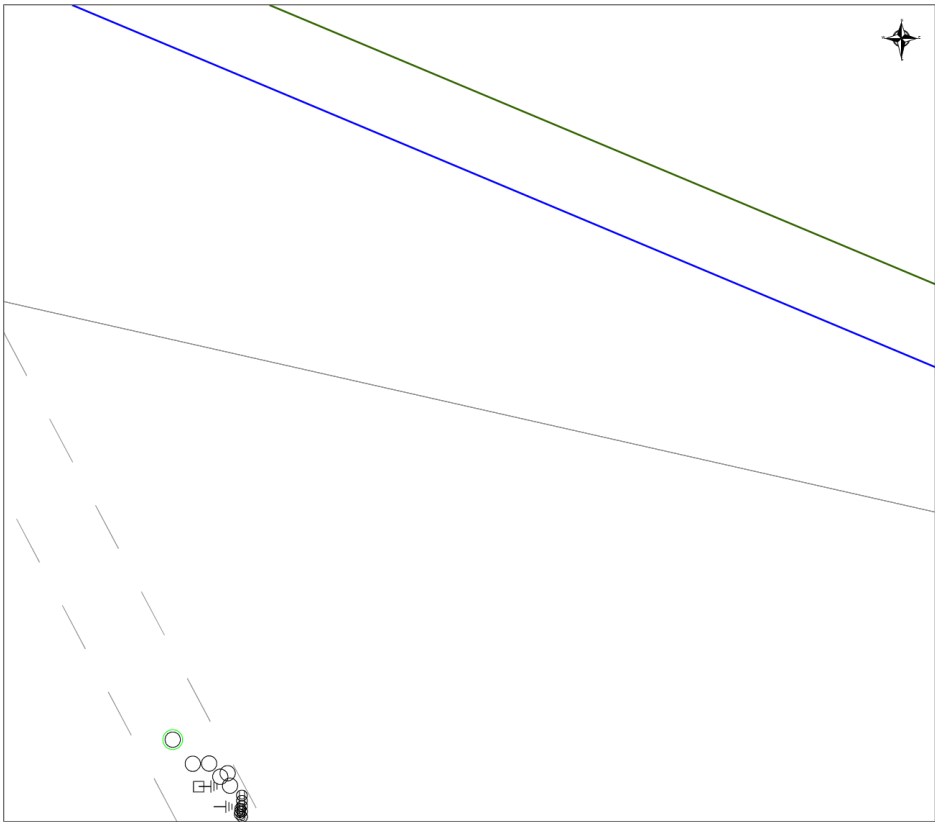
-  DBYD Request Ergon Search Area
-  DBYD Request Area

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot

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110856582-21816834

Sheet: 13 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:27

Scale: 1:2000

LEGEND

Erponents (Electro)

-  Conductor Pole Insulation External Location - Earth Existing
-  Distribution Structures (Electro)
-  Pole Existing Location - Unknown
-  Pole Existing Location - TS
-  Pole Existing Location - TR/Comms
-  Substation Site (Electro)
-  Substation Existing Location - Zone Substation

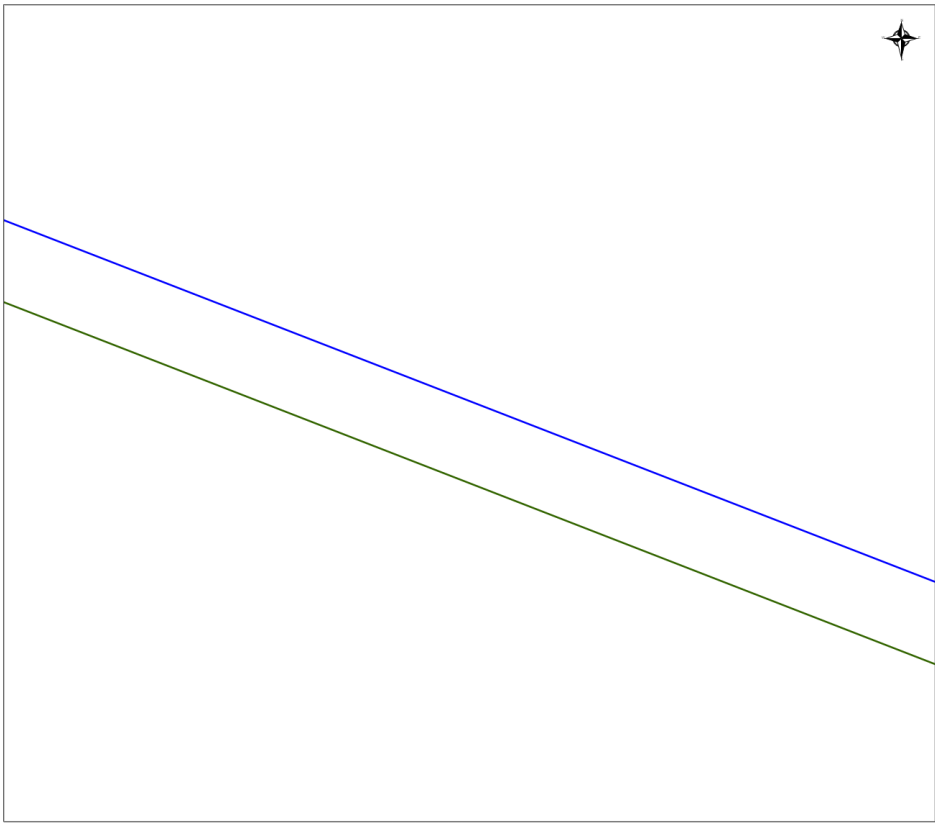
DBVD (Misc_oracle)

-  DBVD Request Ergon Search Area
-  DBVD Request Area

DCDB (Operational_cadastre)

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom
-  Exemption Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 14 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:28

Scale: 1:2000

LEGEND

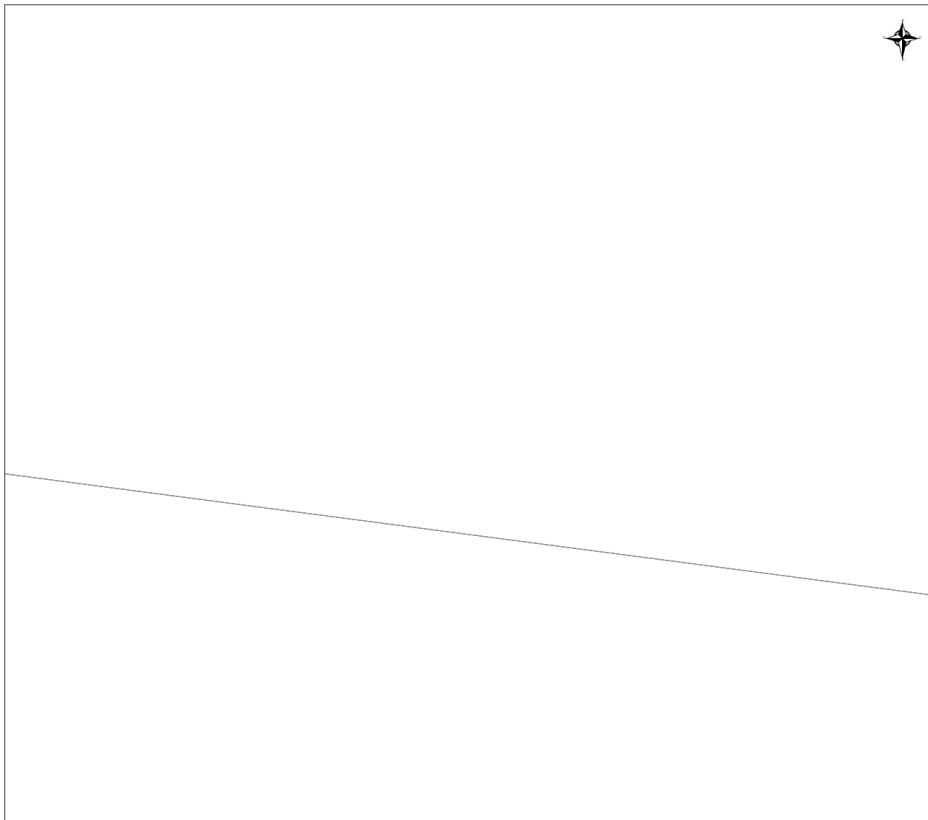
DBVD [Misc_oracle]

-  DBVD Request Ergon Search Area
-  DBVD Request Area

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 15 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:29

Scale: 1:2000

LEGEND

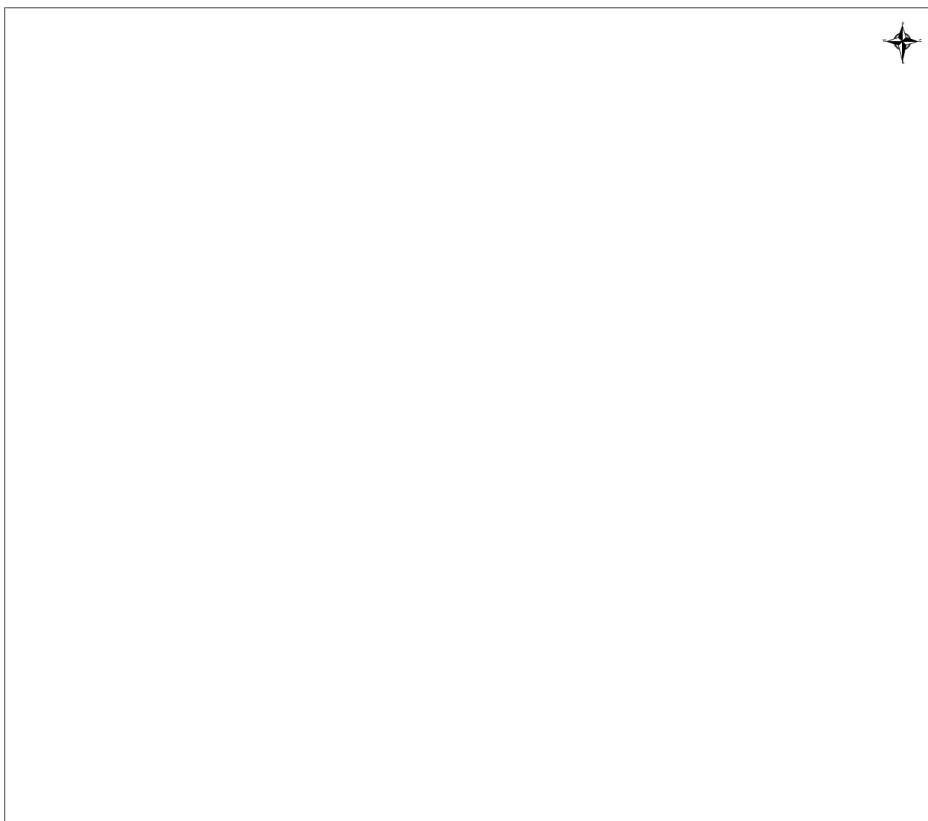
DBYD [Misc_oracle]

-  DBYD Request Ergon Search Area
-  DBYD Request Area

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 16 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:29

Scale: 1:2000

LEGEND

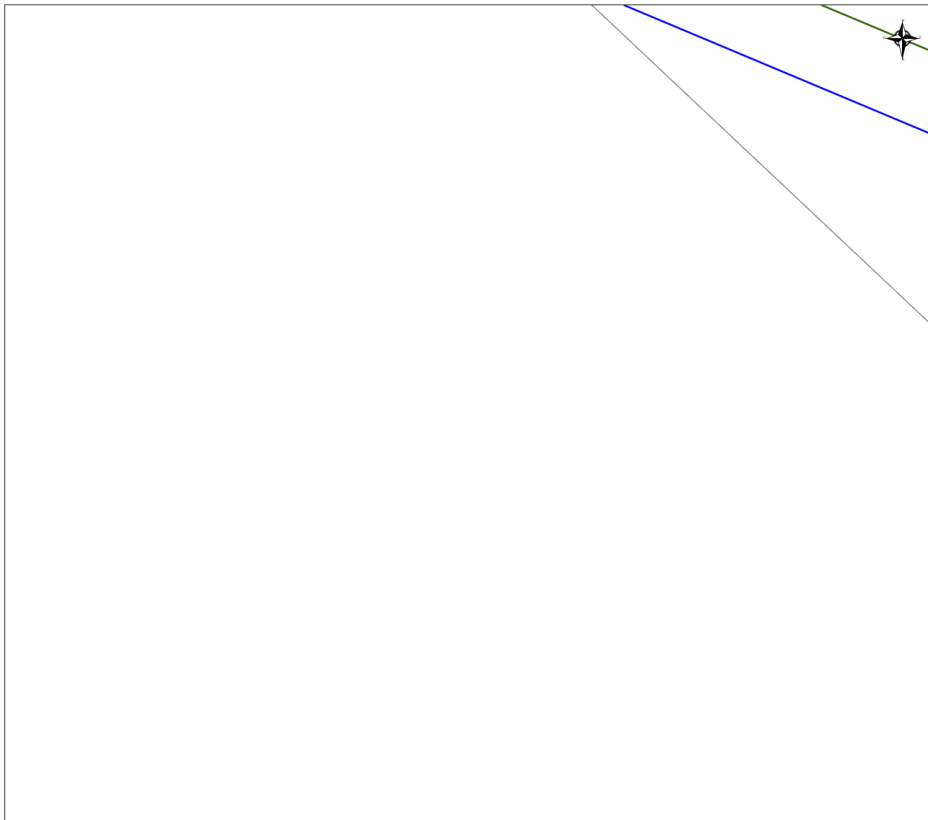
DBYD [Misc_oracle]

-  DBYD Request Ergon Search Area
-  DBYD Request Area
-  Qvas Label Geom

DCDB [Operational_cadastre]

-  Land Parcel Area Geom
-  Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 17 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:30

Scale: 1:2000

LEGEND

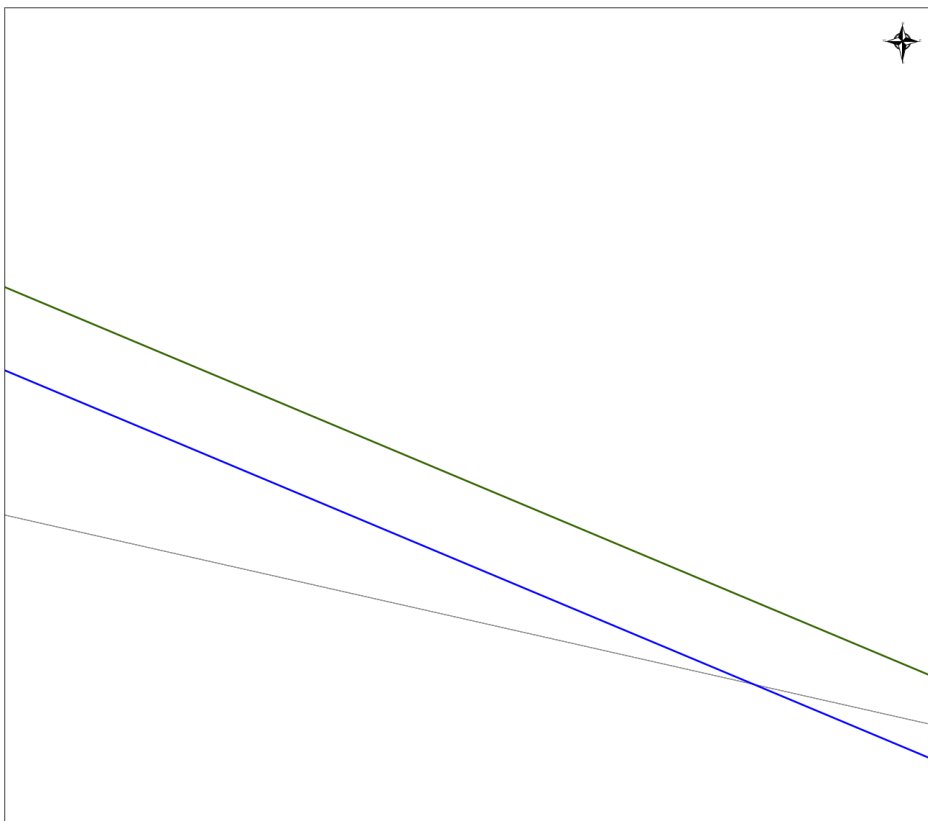
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 18 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:31

Scale: 1:2000

LEGEND

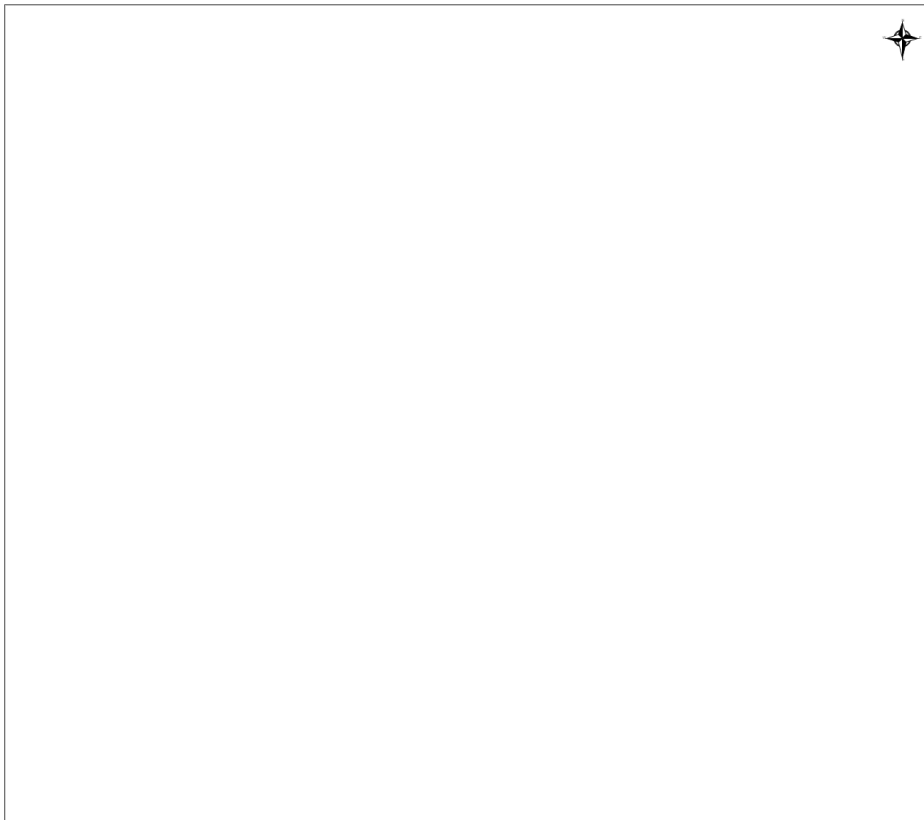
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 21 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:33

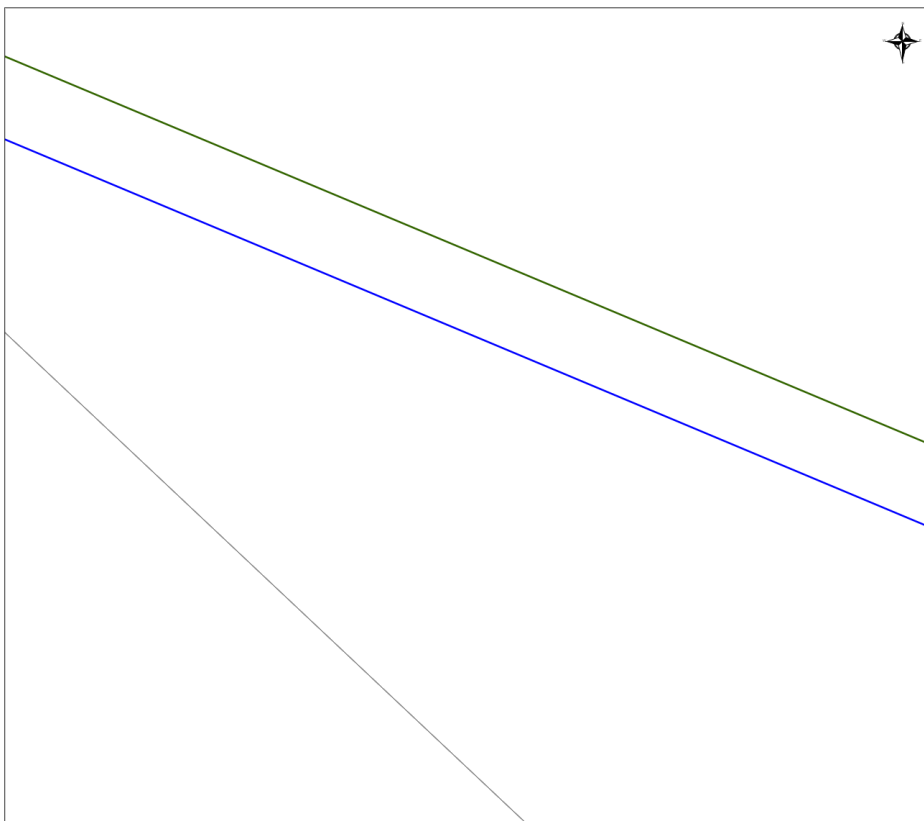
Scale: 1:2000

LEGEND

DBYD [Misc_oracle]
 DBYD Request Ergon Search Area
 DBYD Request Area

DCDB [Operational_cadastre]
 Land Parcel Area Geom
 Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 22 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:34

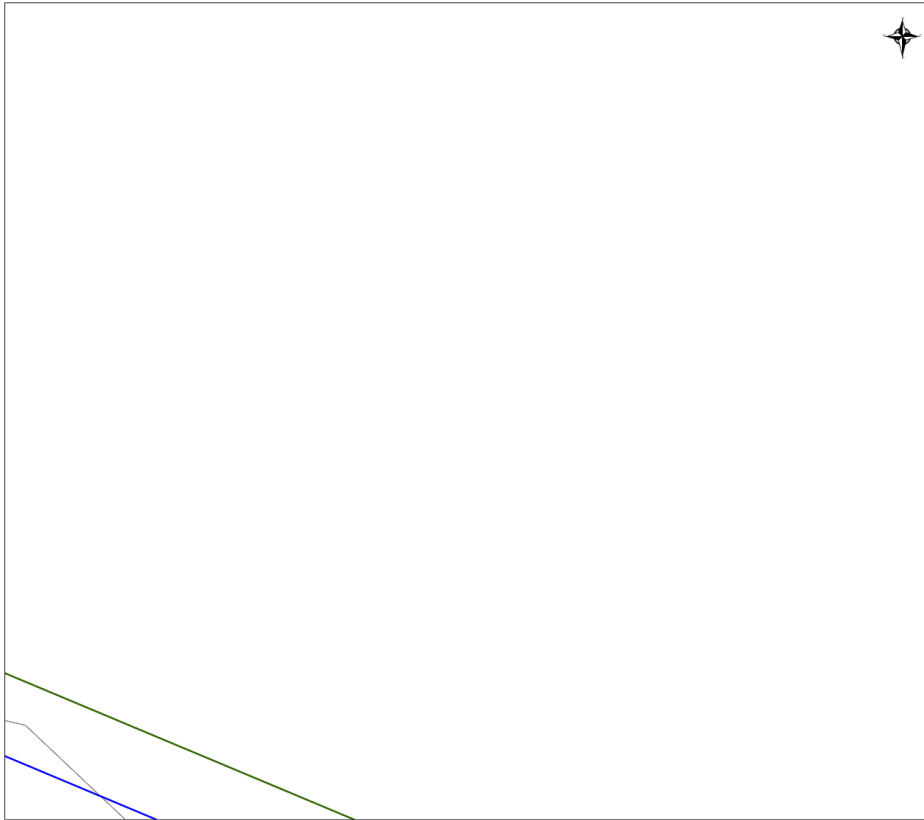
Scale: 1:2000

LEGEND

DBYD [Misc_oracle]
 DBYD Request Ergon Search Area
 DBYD Request Area

DCDB [Operational_cadastre]
 Land Parcel Area Geom
 Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 23 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:35

Scale: 1:2000

LEGEND

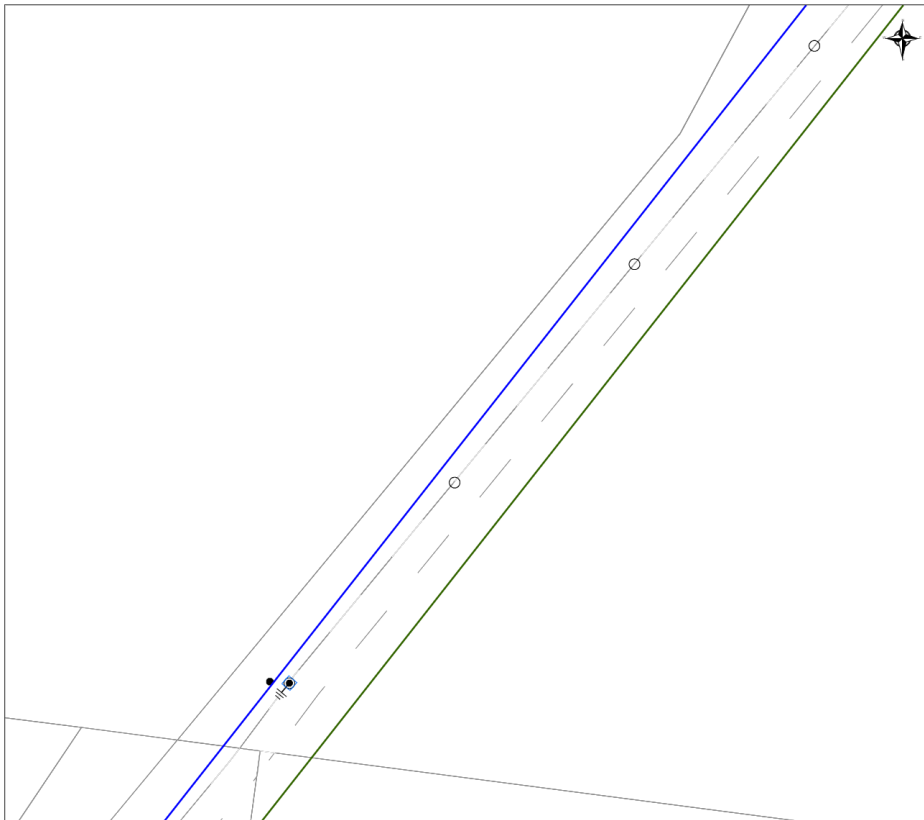
DBYD (Misc_oracle)

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB (Operational_cadastre)

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 24 Layer: Conduits

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:35

Scale: 1:2000

LEGEND

Segments (Electric)

- Connection Point Installation External Location - Earth Existing

Distribution Structures (Electric)

- Pole Existing Location - HV
- Pole Existing Location - HV/LV
- Pole Existing Location - LV

Substation Site (Electric)

- Substation Existing Location - Pole Mounted Distribution

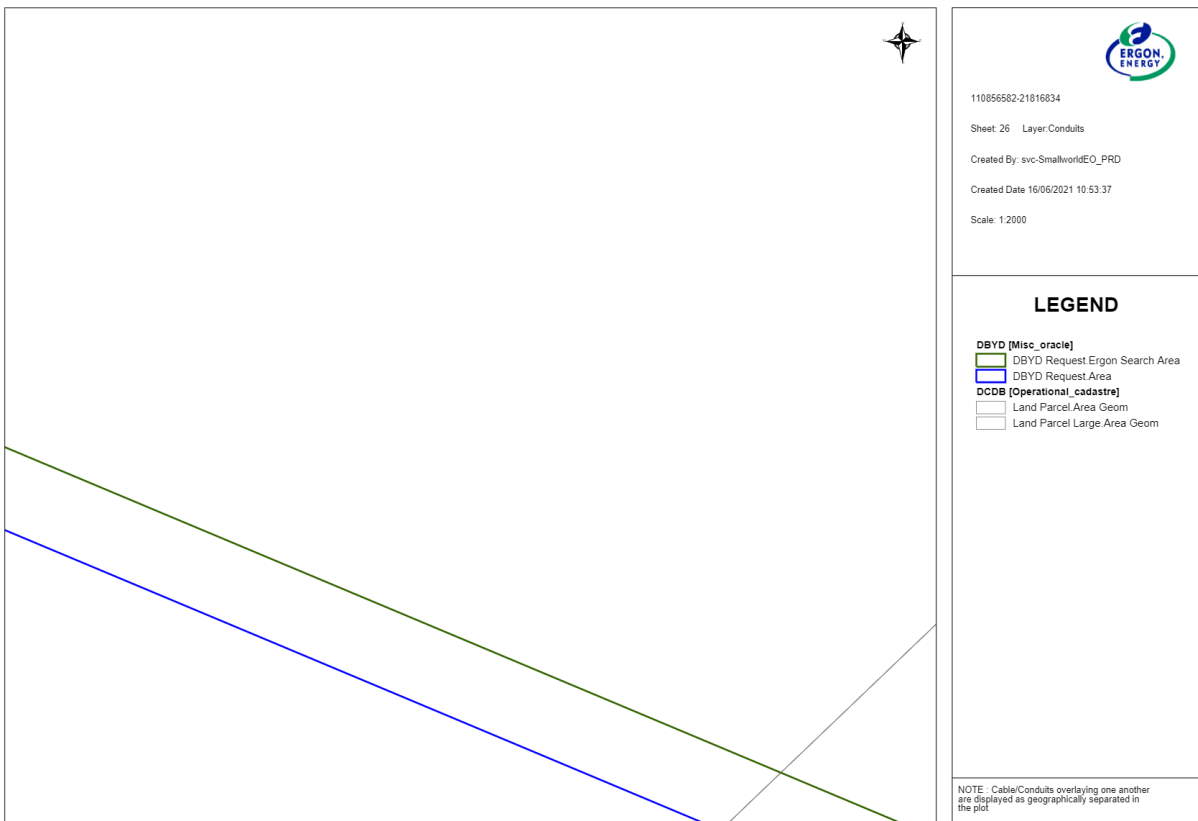
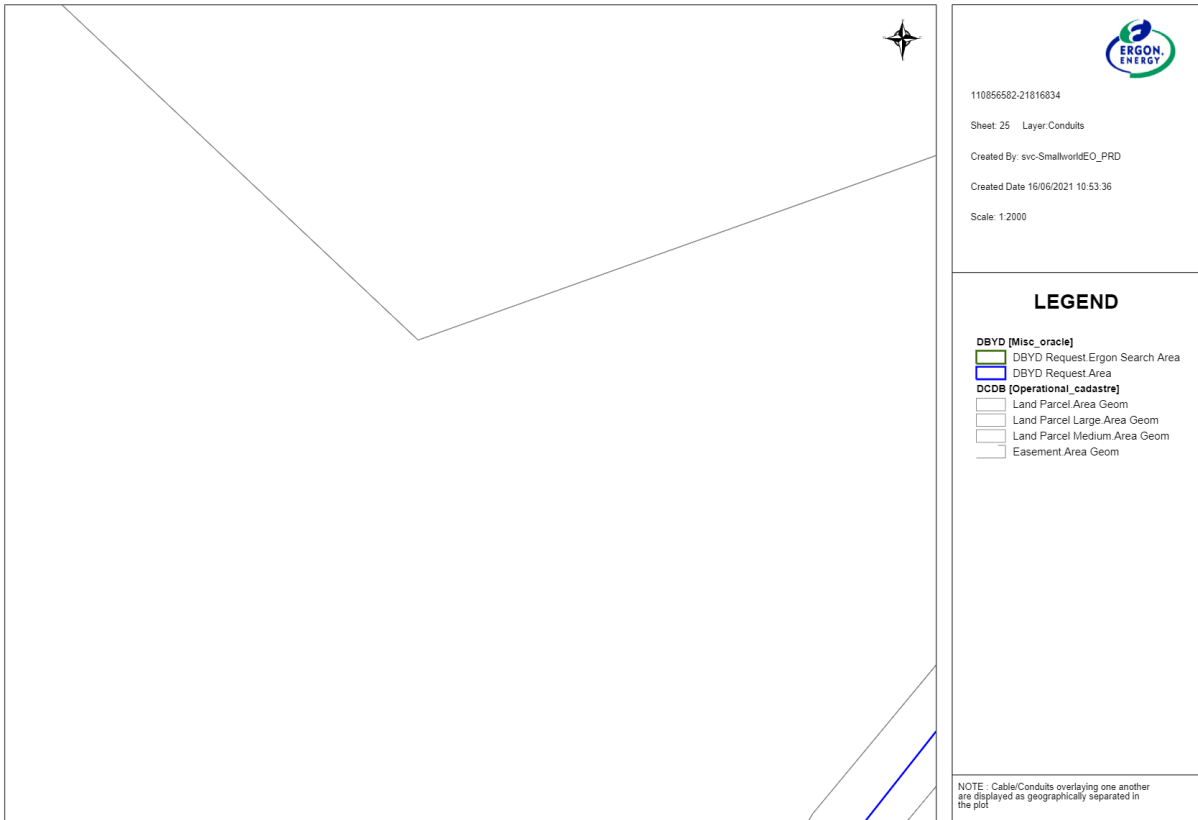
DBYD (Misc_oracle)

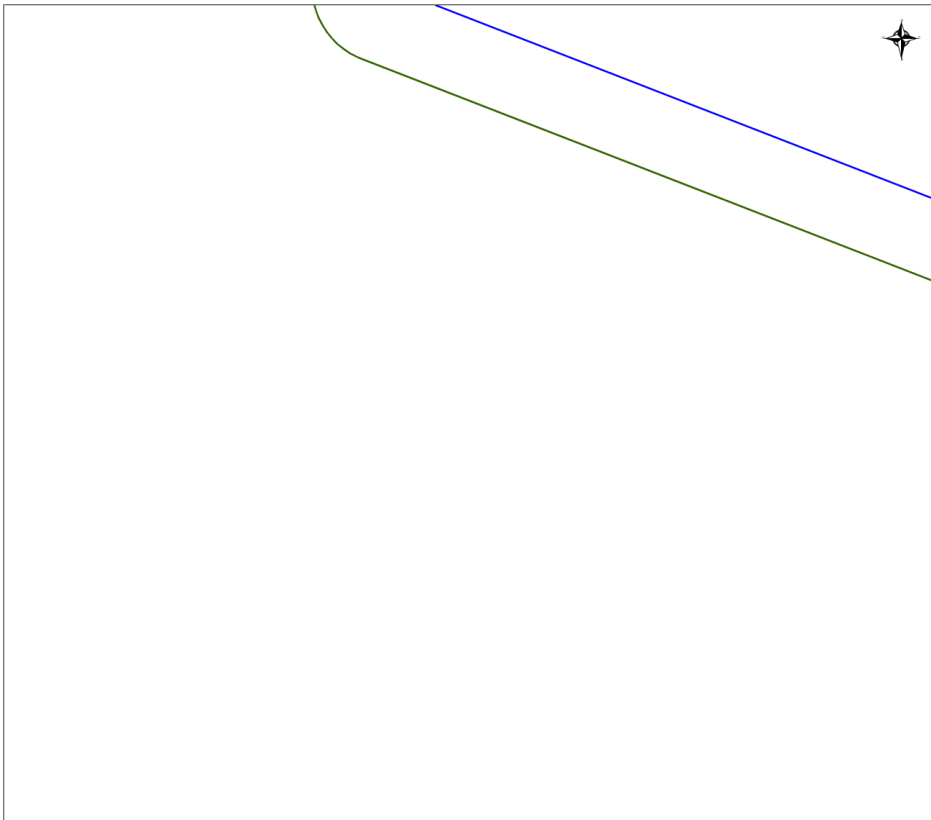
- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB (Operational_cadastre)

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Land Parcel Medium Area Geom
- Basement Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot







110856582-21816834

Sheet: 1 Layer: Hv Cables

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:47

Scale: 1:2000

LEGEND

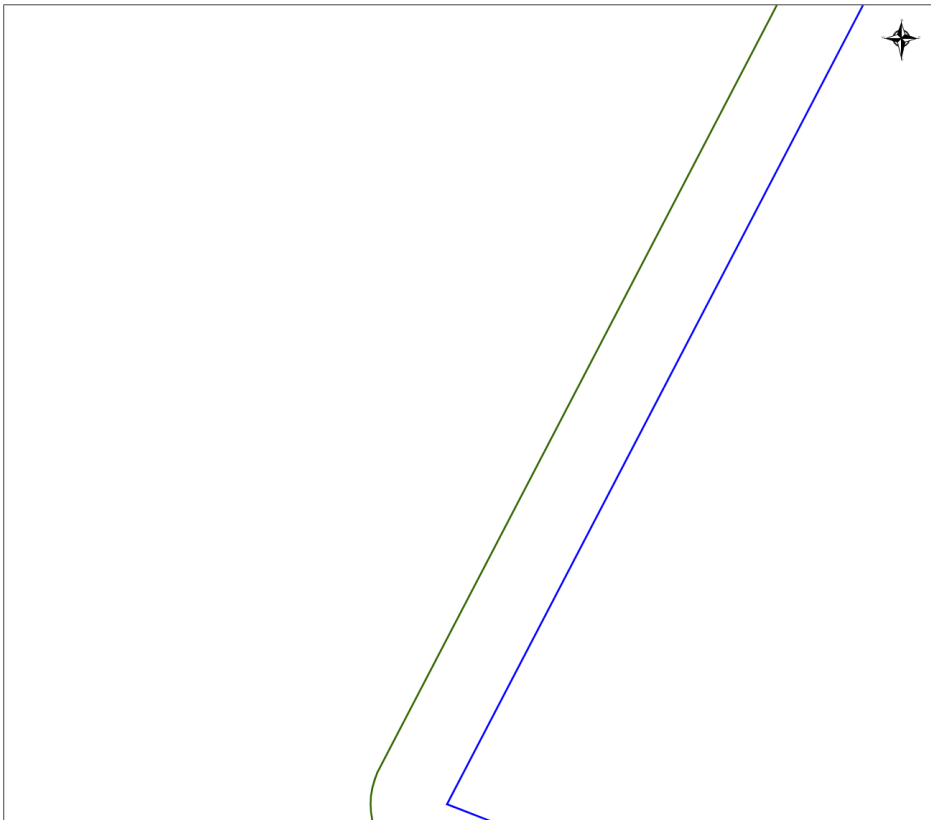
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 2 Layer: Hv Cables

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:49

Scale: 1:2000

LEGEND

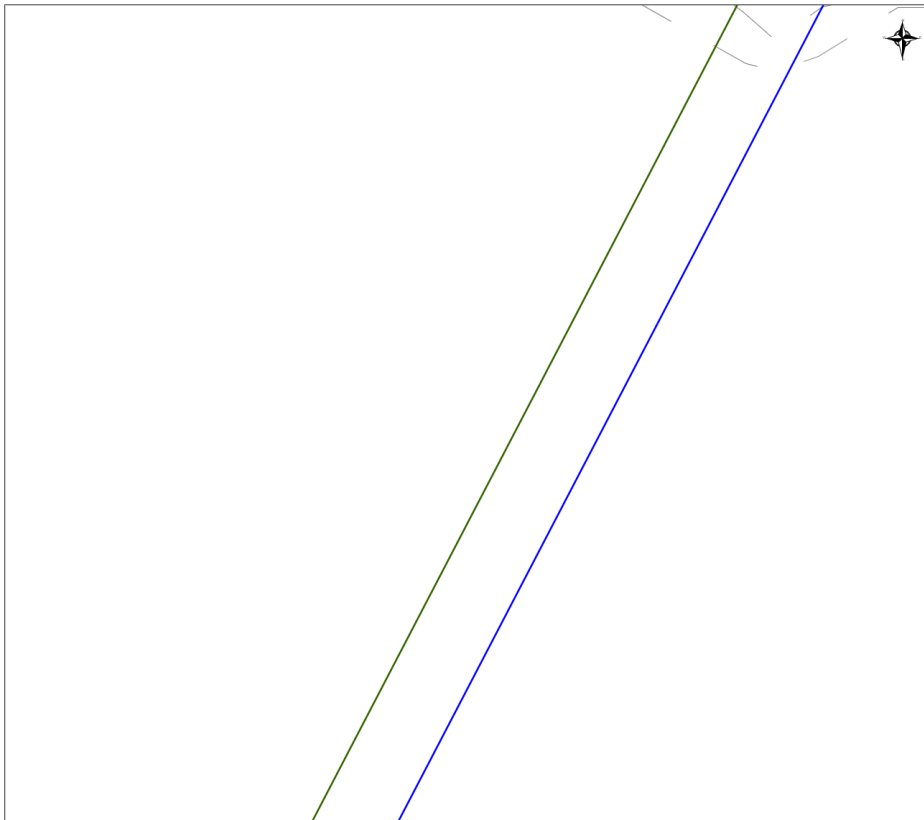
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 3 Layer: Hv Cables

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:49

Scale: 1:2000

LEGEND

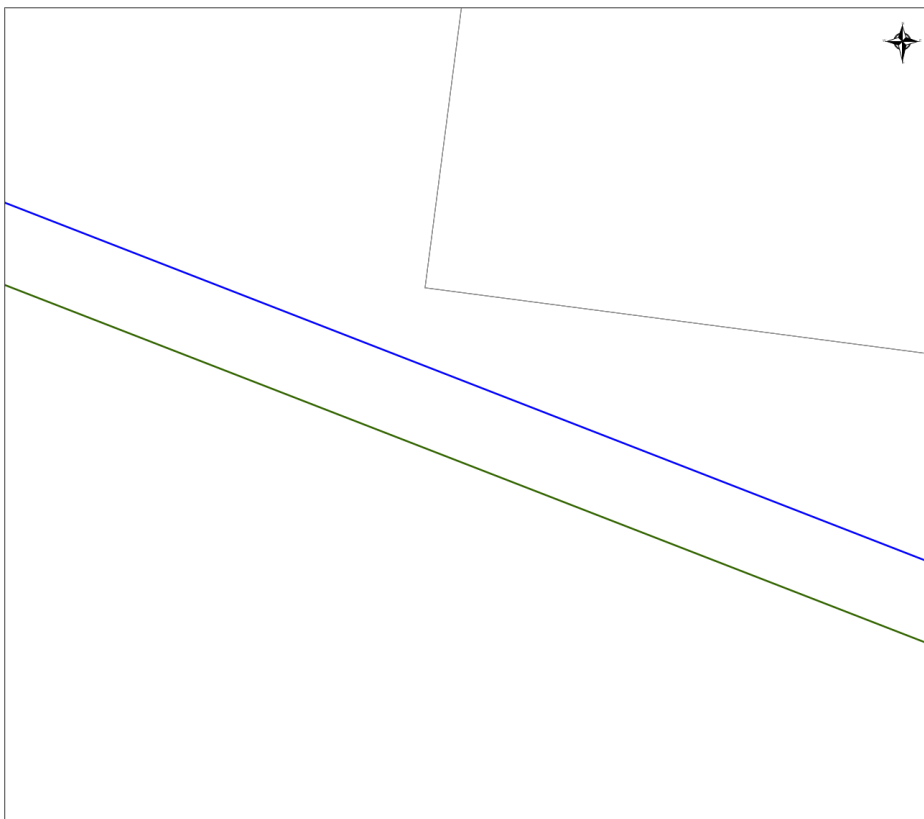
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Easement Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 4 Layer: Hv Cables

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:50

Scale: 1:2000

LEGEND

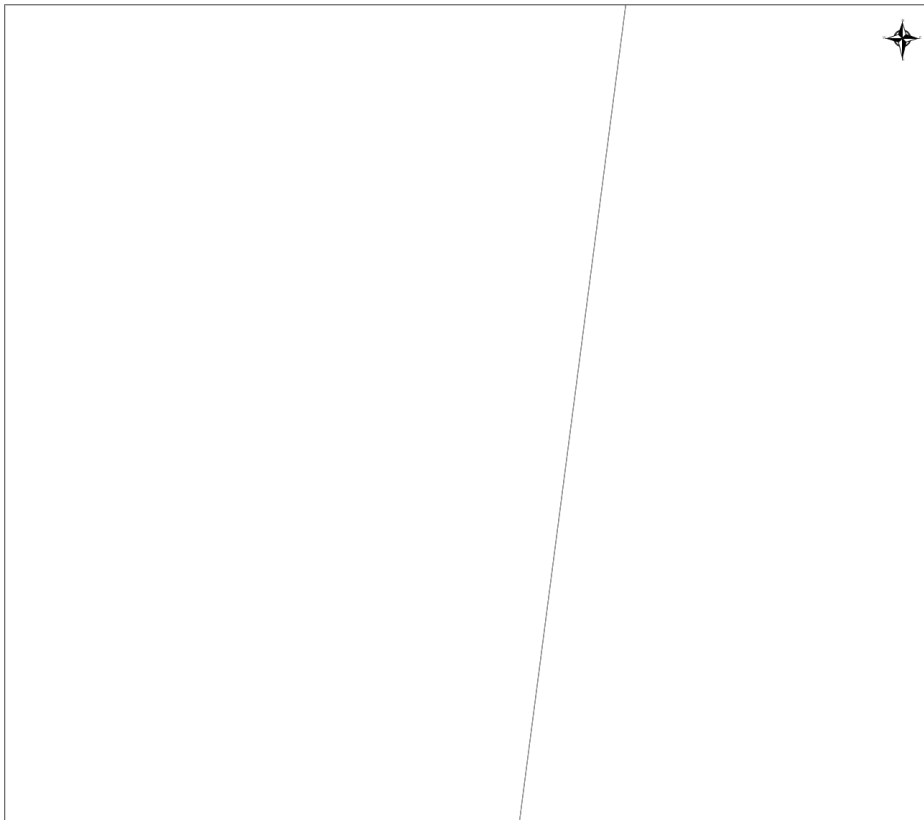
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot



ERGON ENERGY

110856582-21816834

Sheet: 5 Layer: Hv Cables

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:52:51

Scale: 1:2000

LEGEND

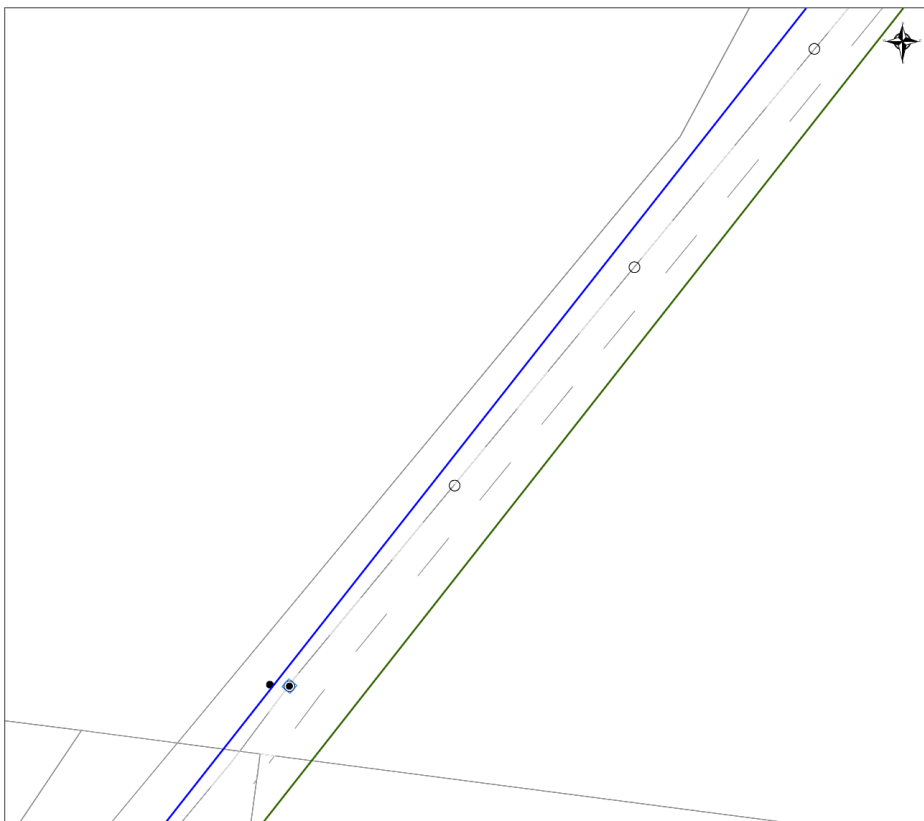
DBYD [Misc_oracle]

- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot



ERGON ENERGY

110856582-21816834

Sheet: 24 Layer: Hv Cables

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:05

Scale: 1:2000

LEGEND

Distribution Structures [Electric]

- Pole Existing Location - HV
- Pole Existing Location - HV/LV
- Pole Existing Location - LV
- Substation Site [Electric]
- Substation Existing Location - Pole Mounted Distribution

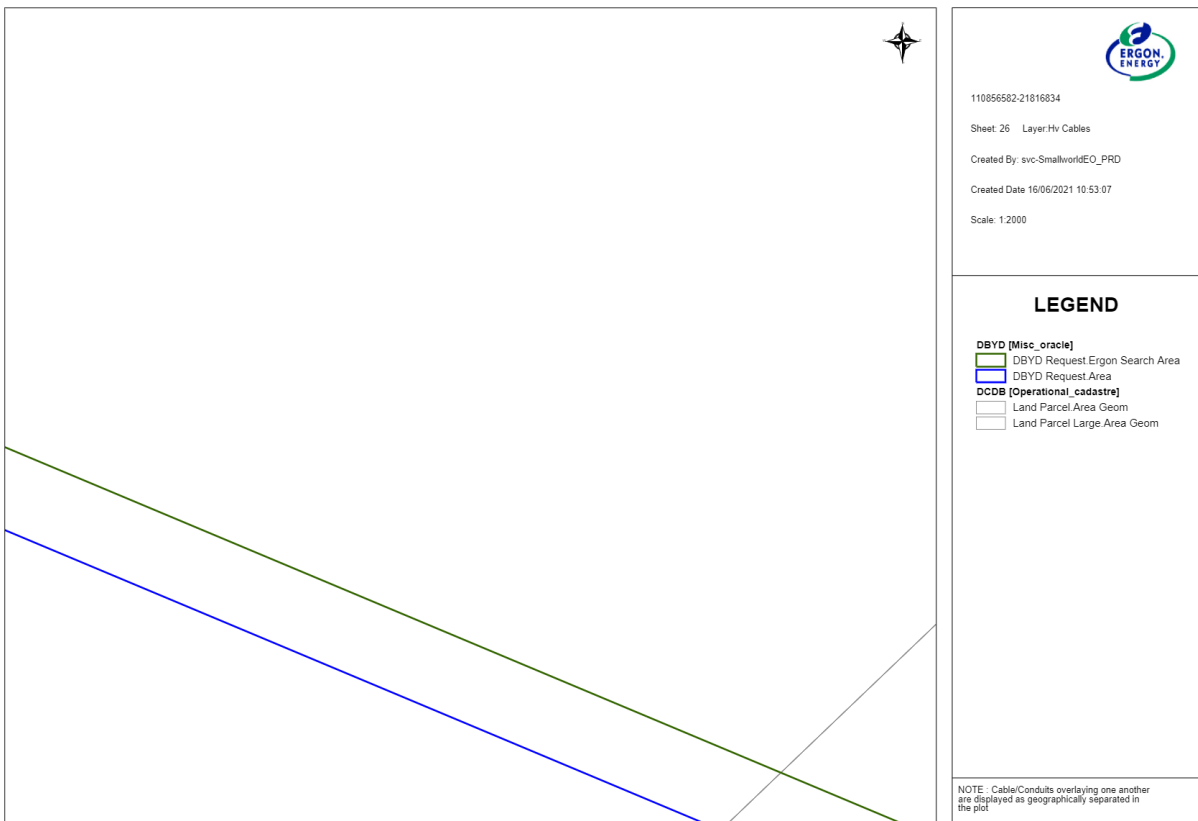
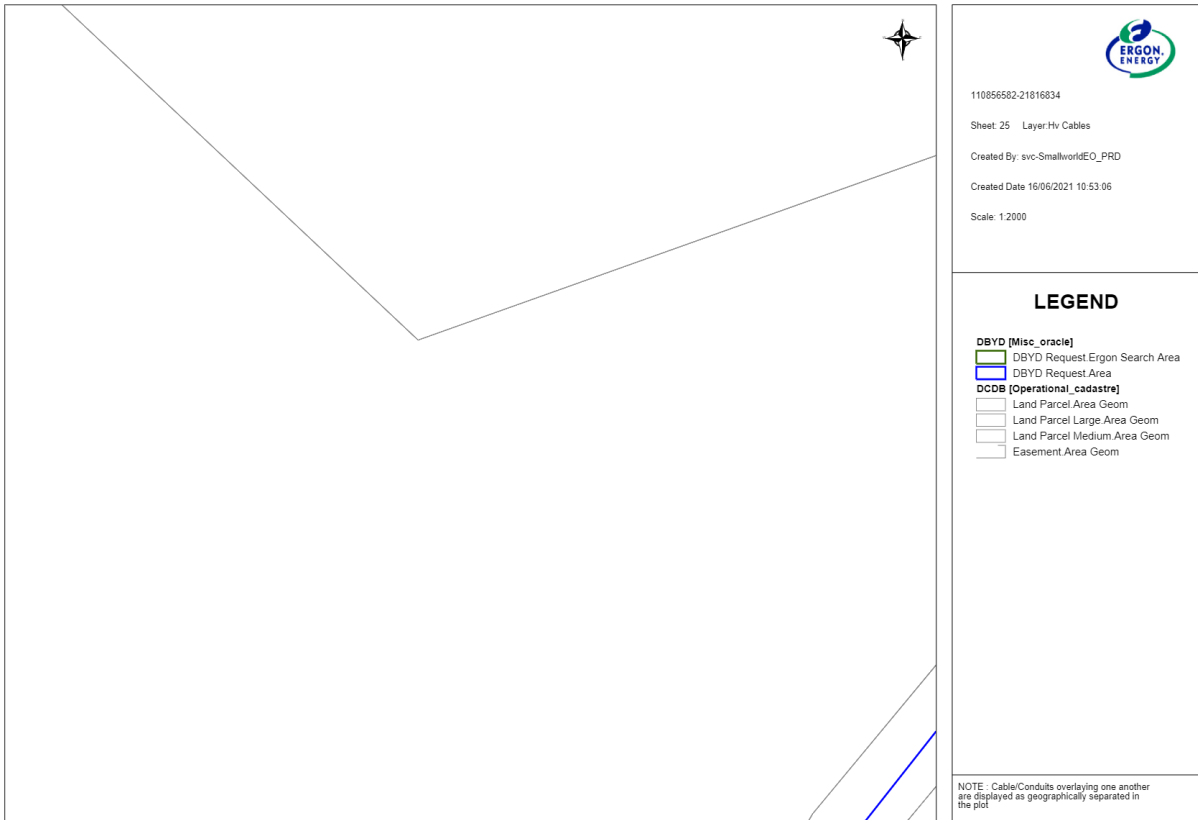
DBYD [Misc_oracle]

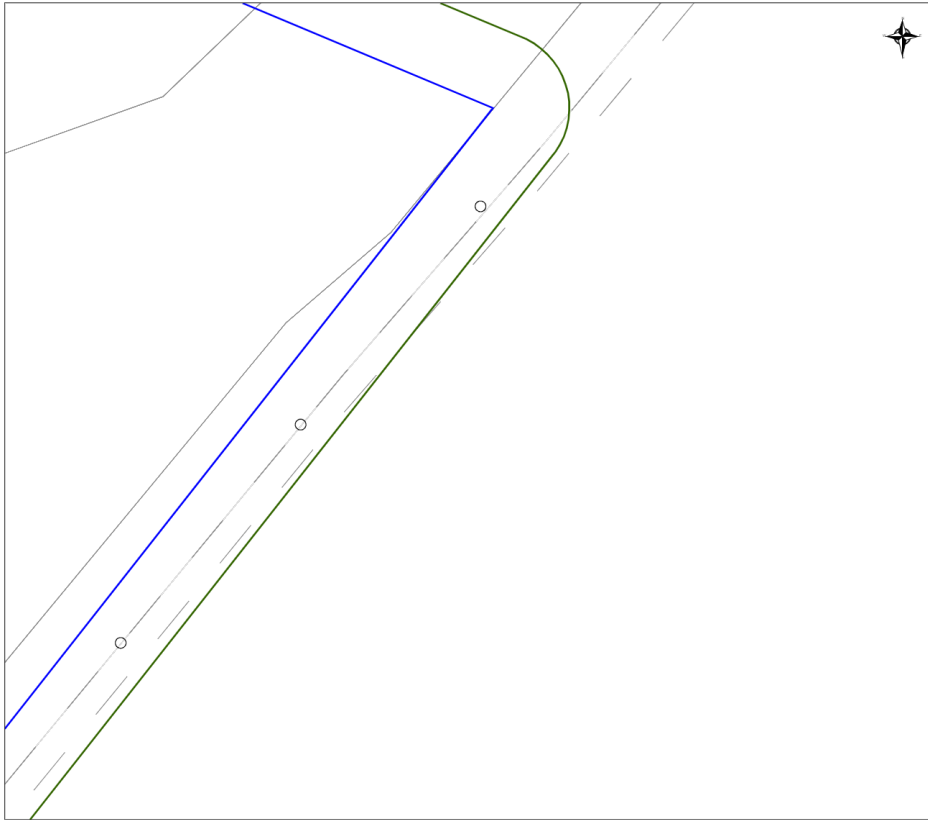
- DBYD Request Ergon Search Area
- DBYD Request Area

DCDB [Operational_cadastre]

- Land Parcel Area Geom
- Land Parcel Large Area Geom
- Land Parcel Medium Area Geom
- Easement Area Geom

NOTE : Cable/Conduits overlaying one another are displayed as geographically separated in the plot





110856582-21816834

Sheet: 27 Layer: Hv Cables

Created By: svc-SmallworldEQ_PRD

Created Date 16/06/2021 10:53:07

Scale: 1:2000

LEGEND

- Distribution Structures (Electric)
 - Pole Existing Location - HV
- DBVD (Misc_oracle)
 - DBVD Request Ergon Search Area
 - DBVD Request Area
- DCDB (Operational_cadastre)
 - Land Parcel Area Geom
 - Land Parcel Large Area Geom
 - Land Parcel Medium Area Geom
 - Easement Area Geom

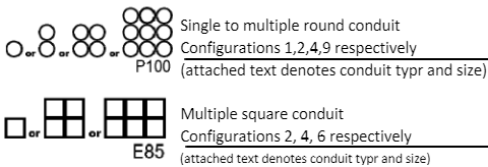
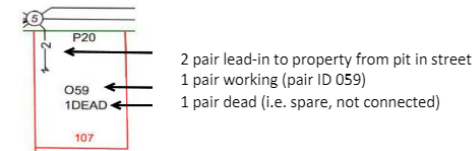
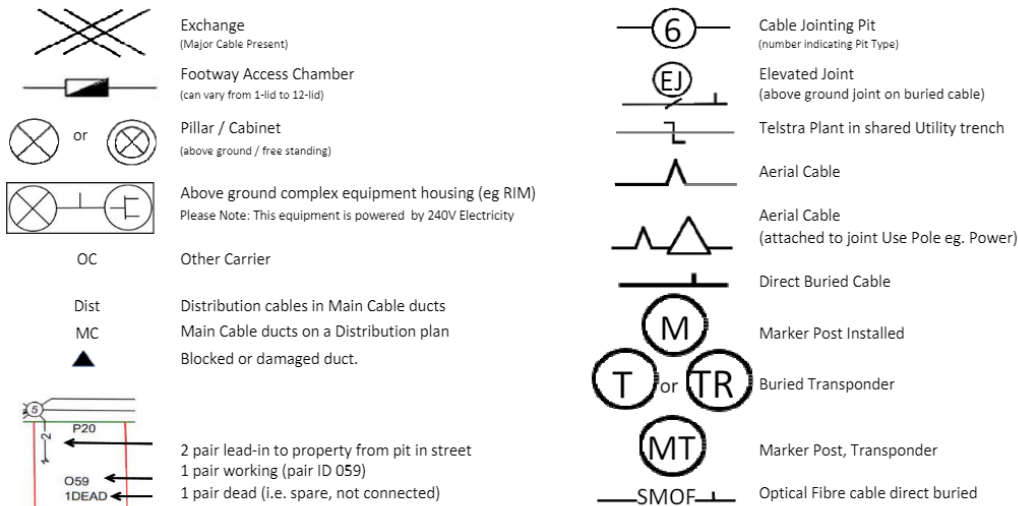
NOTE: Cable/Conduits overlaying one another are displayed as geographically separated in the plot

LEGEND

IT'S HOW
WE CONNECT



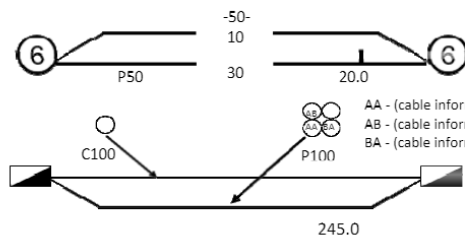
For more info contact a Certified Location Organisation or Telstra Plan Services 1800 653 935



Some examples of conduit type and size:

A - Asbestos cement, P - PVC / Plastic, C - Concrete,
GI - Galvanised iron, E - Earthenware
Conduit sizes *nominally* range from 20mm to 100mm
P50 50mm PVC conduit
P100 100mm PVC conduit
A100 100mm asbestos cement conduit

Some Examples of how to read Telstra Plans

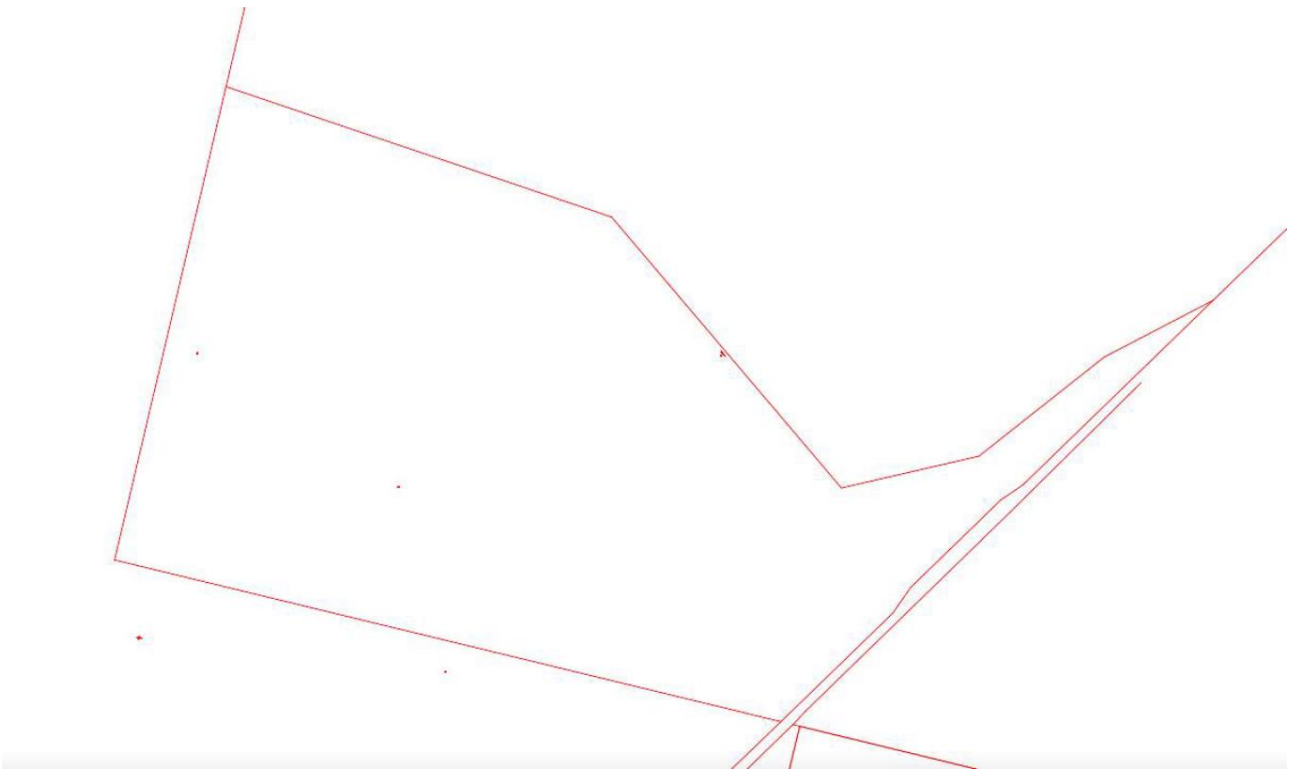


One 50mm PVC conduit (P50) containing a 50-pair and a 10-pair cable between two 6-pits. 20.0m apart, with a direct buried 30-pair cable along the same route

Two separate conduit runs between two footway access chambers (manholes) 245m apart A nest of four 100mm PVC conduits (P100) containing assorted cables in three ducts (one being empty) and one empty 100mm concrete duct (C100) along

WARNING: Telstra plans and location information conform to Quality Level 'D' of the Australian Standard AS 5488 - Classification of Subsurface Utility Information. As such, Telstra supplied location information is indicative only. Spatial accuracy is not applicable to Quality Level D. Refer to AS 5488 for further details. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans. **FURTHER ON SITE INVESTIGATION IS REQUIRED TO VALIDATE THE EXACT LOCATION OF TELSTRA PLANT PRIOR TO COMMENCING CONSTRUCTION WORK.** A plant location service is an essential part of the process to validate the exact location of Telstra assets and to ensure the asset is protected during construction works. The exact position of Telstra assets can only be validated by physically exposing it. Telstra will seek compensation for damages caused to its property and losses caused to Telstra and its customers.

TELSTRA CORPORATION ACN 051 775 556





Search for the closest Certified Locating Organisation (CLO) to your work-site at the following website: <https://dbydlocator.com/certified-locating-organisation/> Read the terms of use - Click accept.

A national map and an A-Z list of all Certified Locating Organisations is now available.

Use the map to zoom to your work area and then choose the closest Locator indicated.

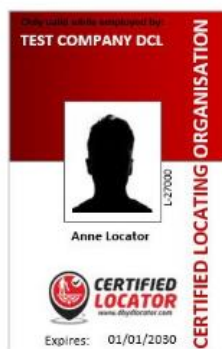
OR SEARCH BY POSTCODE OF YOUR WORK AREA

1. Enter the postcode
2. Choose your search radius
3. Click Filter

If there is no result, you may have to increase the search radius



Chose the closest Locator indicated OR scroll down to see all search results.



Telstra is aware of each Certified Locating Organisation **and** their employee locators.

Locator skills have been tested, and the Organisation has calibrated location and safety equipment.

Each Certified Locator working for a CLO is issued with a photo ID Card, authorising them to access Telstra pits and manholes for the purpose of cable and plant locations.

Please ask to see your Locators' CLO ID Card.

DUTY OF CARE



TELSTRA CORPORATION ACN 051 775 556

IMPORTANT:

When working in the vicinity of telecommunications plant you have a "Duty of Care" that must be observed. Please read and understand all the information and disclaimers provided below.

Telstra network is complex and requires expert knowledge to interpret information, to identify and locate components, to pothole underground assets for validation and to safely work around assets without causing damage. If you are not an expert and/or qualified in these areas, then you must not attempt these activities. Telstra will seek compensation for damages caused to its property and losses caused to Telstra and its customers. The 5 P's to prevent damage to Telstra assets are listed below. Construction activities and/or any activities that potentially may impact on Telstra's assets must not commence without first undertaking these steps. Construction activities can include anything that involves breaking ground, potentially affecting Telstra assets.

If you are designing a project it is recommended that you also undertake these steps to validate underground assets prior to committing to your design.

All damages to Telstra Network must be reported immediately

- Call **13 22 03** Say "Damages" at the voice prompt, then press 1 to speak to an Operator
- Or report online
<https://service.telstra.com.au/customer/general/forms/report-damage-to-telstra-equipment>

(The following pages contain more detail on each step below and the contact details to seek further advice. AS5488-2013 is the Australian Standard for the Classification of Subsurface Utility Information.)

1 PLAN:

The essential first step in preventing damage -

You must have current Telstra plans via the DBYD process. Telstra advises that the accuracy of the information provided by Telstra conforms to Quality Level D as defined in AS5488-2013. This means the information is indicative only, not a precise location. **The actual location may differ substantially from that shown on the plans** - refer to steps 2 & 3 to determine actual location prior to proceeding with construction.

2 PREPARE:

The essential second step in preventing damage -

Engage a Telstra Accredited Plant Locator. To be able to trace and identify individual subsurface cables and ducts requires access to Telstra pits and manholes. Only a Telstra Accredited Plant Locator (TAPL) is authorised to access Telstra network for locating purposes. A TAPL can interpret plans, validate visible assets and access pits and manholes to undertake electronic detection of underground assets prior to further validation. All Telstra assets must be located, validated and protected prior to commencing construction. **If you are not authorised to do so by Telstra, you must not access Telstra network or locate Telstra network.** All Telstra Accredited Plant Locators are required to have DBYD Locator Certification.

3 POTHOLE:

The essential third step in preventing damage -

All Telstra assets must be positively identified (i.e. validated), by physically sighting them. For underground assets this can be done by potholing by hand or using non-destructive vacuum extraction methods (Refer to 'validation' as defined in AS5488-2013 QL-A). **Underground assets located by electronic detection alone (step 2), are not deemed to be 'validated' and must not be used for construction purposes.** Some TAPL's can assist with non-destructive potholing for validation purposes. **If you cannot validate the Telstra network, you must not proceed with construction.** Telstra will seek compensation for damages caused to its property and losses caused to Telstra and its customers.

4 PROTECT:

The essential fourth step in preventing damage -

Telstra assets must be protected to avoid damage from construction activities. Minimum working distances around Telstra network must be maintained. These distances are provided in this document. Telstra can also provide advice and assistance in regards to protection – refer to the following pages.

5 PROCEED:

Only proceed when the above steps have been completed.

STEP 1 - PLAN

Dial Before You Dig / Telstra Plans

The actual location of Telstra assets may differ substantially from that shown on the plans. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for the accuracy shown on the plans. Steps 2 and 3 must also be undertaken to determine actual location of network.

- Telstra DBYD plans are not suitable for displaying Telstra network within a Telstra exchange site. For advice on Telstra network within a Telstra exchange site contact Telstra Plan Service on 1800 653 935.
- Telstra owns and retains the copyright in all plans and details provided in conjunction with the applicant's request. The applicant is authorised to use the plans and details only for the purpose indicated in the applicant's request. The applicant must not use the plans or details for any other purpose.
- Telstra plans or other details are provided only for the use of the applicant, its servants, agents or Telstra Accredited Plant Locators. The applicant must not give the plans or details to any parties other than these, and must not generate profit from commercialising the plans or details.
- Please contact Telstra Plan Services immediately should you locate Telstra assets not indicated on these plans.
- Telstra, its servants or agents shall not be liable for any loss or damage caused or occasioned by the use of plans and/or details so supplied to the applicant, its servants and agents, and the applicant agrees to indemnify Telstra against any claim or demand for any such loss or damage.
- Please ensure Telstra plans and information provided remains on-site at all times throughout the inspection, location and construction phase of any works.
- Telstra plans are valid for 60 days after issue and must be replaced if required after the 60 days.
- **Emergency situations - receiving Telstra plans** Telstra's automated mapping system (TAMS) will provide a fast response for emergency situations (faster than an operator can provide manually via a phone call - see below for fast response requirements). Automated responses are normally available 24/7.

To receive a fast automated response from Telstra your request must -

- Be a web request lodged at DBYD (www.1100.com.au). The request will be then forwarded to Telstra.
 - Contain your current email address so you can receive the automated email response.
 - Be for the purposes of 'mechanical excavation' or other ground breaking DBYD activity. (Requests with activity types such as conveyancing, planning & design or other non-digging activities may not be responded to until the next business day).
 - Be for an area less than 350 metres in size to obtain a PDF map (over 350 metres will default to DWF due to size) this does not include congested CBD areas where only DWF may be supplied.
 - Be for an area less than 2500 metres in size to obtain a DWF map (CBD's less)
- **Data Extraction Fees.** In some instances a data extraction fee may be applicable for the supply of Telstra information. Typically a data extraction fee may apply to large projects, planning and design requests or requests to be supplied in non-standard formats. For further details contact Telstra Plan Services.
 - **Electronic plans - PDF and DWF maps** If you have received Telstra maps via email you will have received the maps as either a PDF file (for smaller areas) or DWF file (for larger area requests). All requests over approximately *350m or in congested CBD areas can only be supplied in DWF format. There are size limits on what can be provided. (* actual size depends on geographic location of requested area). If you are unable to launch any one of the softcopy files for viewing and printing, you may need to download and install one or more of the free viewing and printing products such as Adobe Acrobat Reader (for PDF files) or Autodesk Design Review (for DWF files) available from the internet

- **Pdf files** - PDF is the default softcopy format for all requests for areas up to approx *350m in length. (*depends on geographic location of request). The PDF file is nominally formatted to A3 portrait sheet however it can be printed on any size sheet that your printer supports, e.g. either as the full sheet or selected areas to suit needs and legibility. (to print a selected area zoom up and print 'current view') If there are multiple layers of Telstra network you may receive up to 2 sheets in the single PDF file attachment supplied. There are three types or layers of network normally recorded - local network, mains cables or a combined layer of local and mains (usually displayed for rural or semi-rural areas). If mains cable network is present in addition to local cables (i.e. as separate layer in a particular area), the mains will be shown on a separate sheet. The mains cable information should be read in conjunction with the local cable information.
- **DWF files** – DWF is the default softcopy format for all requests for areas that are over 350m in length. Maximum length for a DWF automated response is approx 2500m - depending on geographic location of request (manually-processed plans may provide larger coverage). The DWF files differ from PDF in that DWF are vector files made up of layers that can be turned on or off and are not formatted to a specific sheet size. This makes them ideal for larger areas and for transmitting electronically.
 - **How to view Telstra DWF files –**
Telstra DWF files come with all layers turned on. You may need to turn individual layers on or off for viewing and printing clarity. Individual layer names are CC (main cable/conduit), DA (distribution area network) and sometimes a combined layer - CAC. Layer details can be viewed by either picking off the side menu or by selecting 'window' then 'layers' off the top menu bar. Use 'layers' to turn individual layers off or on (double click or right click on layer icon).
 - **How to print Telstra DWF files –**
DWF files can be printed on any size sheet – either their entirety or by selected areas of interest. Some DWF coverage areas are large and are not suited to printing legibly on a single A4 sheet - you may need several prints if you only have an A4 printer. Alternatively, an A3, A1 or larger printer could be used. To print, zoom in or out and then, by changing the 'print range' settings, you can print what is displayed on your screen to suit your paper size. If you only have a small printer, e.g. A4, you may need to zoom until the text is legible for printing (which is why you may need several prints). To print what is displayed on your screen the 'view' setting should be changed from 'full page' to 'current view'. The 'current sheet' setting should also be selected. You may need to print layers separately for clarity and legibility. (Details above on how to turn layers on or off)
 - **How to change the background colour from white to black (when viewing) Telstra DWF files –**
If using Autodesk Design Review the background colour can be changed by selecting 'Tools' then 'options' then 'sheet'. Tick the box 'override published paper colours' and select the colour required using the tab provided.

STEP 2 – PREPARE

Telstra Accredited Plant Locator (TAPL):

Utilising a TAPL is an essential part of the process to identify network and to trace subsurface network prior to validating. A TAPL can provide plan interpretation, identification and electronic detection. This will assist in determining the position of subsurface assets prior to potholing (validating). Some TAPL's can also assist in validating underground detected network. Electronic detection is only an indication of the existence of underground network and can be subject to interference from other services and local conditions. Electronic detection must not be used solely to determine location for construction purposes. The electronic (indicative) subsurface measurements must be proven by physically sighting the asset (see step 3 – Pothole).

- All TAPL's locating Telstra network must be able to produce a current photo ID card issued by Telstra. A list of TAPL's is provided with the Telstra Dial Before You Dig plans.
- All TAPL's in addition to the Telstra photo ID card must also have current DBYD Locator Certification with ID card.

- Telstra does not permit external parties (non-Telstra) to access or conduct work on Telstra network. Only Telstra staff, Telstra contractors or locators whom are correctly accredited are authorised to work on or access Telstra manholes, pits, ducts, cables etc. This is for safety as well as for legal reasons.
- The details of any contract, agreement or retainer for site assistance to locate telecommunications plant shall be for you to decide and agree with the Telstra Accredited Plant Locator engaged. Telstra is not a party to any contract entered into between you and a Telstra Accredited Plant Locator.
- Payment for the site assistance will be your responsibility and payment details must be agreed before the engagement is confirmed.
- Telstra does not accept any liability or responsibility for the performance of or advice given by a Telstra Accredited Plant Locator. Accreditation is an initiative taken by Telstra towards the establishment and maintenance of competency standards. However, performance and the advice given will always depend on the nature of the individual engagement.
- Neither the Telstra Accredited Plant Locator nor any of its employees are an employee or agent for Telstra. Telstra is not liable for any damage or loss caused by the Telstra Accredited Plant Locator or its employees.

• **Electronically derived subsurface measurements (e.g. depths/alignments by locating devices)**

All locator provided measurements for Telstra assets must have the AS5488-2013 quality level specified - (e.g. QL-A, B, C or D). These quality levels define the accuracy of subsurface information and are critical for determining how the information is later used – for example if suitable for excavation purposes.

1) **An example of a subsurface measurement with no quality level specified – (i.e. not to be used)**

Telstra cover - 0.9m

*The measurement above has no AS5488-2013 quality level specified and **must not** be provided by a locator or used for design or construction. This is because it is not known whether the measurement is actual or derived (where 'actual' means validated and 'derived' means assumed and not validated, e.g. electronic or other). Typically damages occur by constructors incorrectly using unvalidated measurements as actual measurements.*

2) **An example of a subsurface measurement with quality level B specified –**

Telstra cover - 0.9m (QL-B)

Where (QL-B) complies with AS5488-2013 QL-B (for example an electronic location that complies with QL-B)

(Note QL-B means it has not been validated and must not be used for construction purposes around Telstra network, however it would assist further investigation to determine the actual location)

3) **An example of a subsurface measurement with the quality level A specified –**

Telstra cover - 0.6m (QL-A)

Where (QL-A) complies with AS5488-2013 QL-A (and is deemed suitable for excavation purposes). In this example the asset has been electronically located first, (QL-B) and then physically exposed (QL-A).

Note -Telstra will seek compensation for damages caused to its property and losses caused to Telstra and its customers if unvalidated subsurface measurements are used for construction and subsequently result in damage to Telstra assets. Only measurements conforming to AS5488-2013 (QL-A) are deemed by Telstra to be validated measurements.

- **Rural landowners - Rural Locations Subsidy Scheme** Where Telstra-owned cable crosses agricultural land, Telstra may provide on-site assistance with cable location. **You must contact Telstra Plan Services to determine eligibility and to request the service.**

Please note the following –

- If eligible, the location assistance must be approved and organised by Telstra. Telstra will not pay for a location that has not been approved and facilitated by Telstra (Telstra is not responsible for payment assistance when a customer engages a locator directly).
- Telstra will only "subsidise" the location up to \$330 (Incl. GST). This will cover one hour on-site location only, private lead-in locations are for lead-ins 100m or longer. Any time required in addition to Telstra-funded time can be purchased directly from the assigned Telstra Accredited Plant Locator.
- This service does NOT include the use Mechanical Aids or Hydro Excavation (Vac Trucks) to locate and should be discussed between the Accredited Plant Locator and the private rural landowner
- The exact location, including depth of cables, must be validated by potholing, which may not be covered by this service.

- This service is nominally only available to assist private rural land owners.
- This service nominally covers one hour on-site only, private lead-in locations are for lead-ins 100m or longer. Any time required in addition to Telstra-funded time can be purchased directly from the assigned Telstra Accredited Plant Locator.
- This service does not apply to previously located network at the same location (i.e. it is a once off).
- This service does not apply to other carriers' cables (marked as 'OC' on Telstra plans).

STEP 3 – POTHOLE

Validation as defined in AS5488-2013 (QL-A).

After utilising a Telstra Accredited Plant Locator and prior to commencing construction, any electronically detected underground network must be positively identified (validated) by physically sighting it. This can be done by careful hand digging or using non-destructive water jet methods to expose the network.

Manual potholing needs to be undertaken with extreme care and by employing techniques least likely to damage cables. For example, align shovel blades and trowels parallel to the cable rather than digging across the cable. Some Telstra Accredited Plant Locators are able to provide or assist with non-destructive potholing methods to enable validation of underground cables and ducts.

If you cannot validate the underground network then you must not proceed with construction. Telstra will seek compensation for damages caused to its property and losses caused to Telstra and its customers.

Important note: The construction of Telstra's network dates back over many years. Some of Telstra's pits and ducts were manufactured from asbestos-containing cement. You must take care in conducting any works in the vicinity of Telstra's pits and ducts. You must refrain from in any way disturbing or damaging Telstra's network infrastructure when conducting your works. We recommend that before you conduct any works in the vicinity of Telstra infrastructure that you ensure your processes and procedures eliminate any possibility of disturbing, damaging or interfering in any way with Telstra's infrastructure. Your processes and procedures should incorporate appropriate measures having regard to the nature of this risk. For further information -

<https://www.telstra.com.au/consumer-advice/digging-construction/relocating-network-assets>

STEP 4 – Protect:

You must maintain the following minimum clearance distances between construction activity and the validated position of Telstra plant.

Jackhammers/Pneumatic Breakers	<i>Not within 1.0m of actual validated location.</i>
Vibrating Plate or Wacker Packer Compactor	<i>Not within 0.5m of actual validated location of Telstra ducts. 300mm compact clearance cover before compactor can be used across Telstra ducts.</i>
Boring Equipment (in-line, horizontal and vertical)	<i>Not within 2.0m of actual validated location. Constructor to hand dig or use non-destructive water jet method (pothole) and expose plant.</i>
Heavy Vehicle Traffic (over 3 tonnes)	<i>Not to be driven across Telstra ducts (or plant) with less than 600mm cover. Constructor to check actual depth via hand digging.</i>
Mechanical Excavators, Farm ploughing and Tree Removal	<i>Not within 1.0m of actual validated location. Constructor to hand dig or use non-destructive water jet method (pot-hole) and expose plant.</i>

- For blasting or controlled fire burning please contact Telstra Plan Services.
- If conducting roadworks all existing Telstra pits and manholes must be a minimum of 1.2m in from the back of kerb after the completion of your work.
- After the completion of any ground work in footways or roadway whereby the existing levels are being changed the depth of cover of the existing Telstra asset at the completion of work must not be less than the existing level before work commenced.

Regardless of whether the surface is being raised or lowered, any work impacting the depth of cover of Telstra underground assets should not commence before consultation with Telstra Network Integrity representatives, to discuss the possibility of 'protection' or relocation (including lowering of the asset)".

- For clearance distances relating to Telstra pillars, cabinets and RIMs/RCMs please contact Telstra Plan Services.
- If Telstra plant is situated wholly or partly where you plan to work (i.e. in conflict, where a pit or manhole would be in a driveway or other vehicle thoroughfare), then Telstra's Network Integrity Group must be contacted to discuss possible engineering solutions to protect Telstra assets. Please phone **1800 810 443** or email NetworkIntegrity@team.telstra.com
- You are not permitted to relocate or alter or repair any Telstra assets or network under any circumstances.

It is a criminal offence under the *Criminal Code Act 1995* (Cth) to tamper or interfere with communication facilities owned by a carrier. Heavy penalties may apply for breach of this prohibition, and any damages suffered, or costs incurred by Telstra as a result of any such unauthorised works may be claimed against you.

Only Telstra and its contractors may access and conduct works on Telstra's network (including its plant and assets). This requirement is to ensure that Telstra can protect the integrity of its network, avoid disruption to services and ensure that the relocation meets Telstra's requirements.

- If Telstra relocation or protection works are part of the agreed solution, then payment to Telstra for the cost of this work shall be the responsibility of the principal developer, constructor or person for whom the work is performed. The principal developer or constructor will be required to provide Telstra with the details of their proposed work showing how Telstra's plant is to be accommodated and these details must be approved by the Regional Network Integrity Manager prior to the commencement of site works. Please phone 1800 810 443 or email NetworkIntegrity@team.telstra.com
Further information - <https://www.telstra.com.au/consumer-advice/digging-construction/relocating-network-assets>

Damage to Telstra's network must be reported immediately –

132 203 Say "Damages" at the voice prompt, then press 1 to speak to an Operator

Or report online:

<https://service.telstra.com.au/customer/general/forms/report-damage-to-telstra-equipment>

- You will be held responsible for all plant damage that occurs or any impacts to Telstra's network as a result of your construction activities. This includes interfering with plant, conducting unauthorised modification works and interfering with Telstra's assets in a way that prevents Telstra from accessing or using its assets in the future.
- Telstra reserves all rights to recover compensation for loss or damage to its cable network or other property including consequential losses.

FURTHER INFORMATION - CONTACTS

NATURAL DISASTERS

Natural Disasters include (amongst other things) earthquakes, cyclones, floods and tsunamis. In the case of such events, urgent requests for plans or information relating to the location of Telstra network can be made directly to Telstra Network Integrity Team Managers as follows:

NSW –	John McInerney	0419 485 795
NT/WA/QLD –	Glenn Swift	0419 660 147
SA/VIC/TAS –	David Povazan	0417 300 947

TELSTRA PLAN SERVICES

- for all Telstra Dial Before You Dig related enquiries

Email - Telstra.Plans@team.telstra.com

Phone - 1800 653 935 (general enquiries, business hours only)

Accredited plant locator enquiries - Glen (07)34551011

Telstra easements - Glen (07)34551011

**Please note - to make a Telstra plan enquiry the plans must be current (within 60 days of issue). If your plans have expired you will need to submit a new request via DBYD prior to contacting Telstra Plan Services.*

Information for new developments (developers, builders, home owners)

Telstra Smart Communities - <https://www.telstra.com.au/smart-community>

Asset relocations

Please phone 1800 810 443 or email NetworkIntegrity@team.telstra.com

<https://www.telstra.com.au/consumer-advice/digging-construction/relocating-network-assets>

Telstra offers free Cable Awareness Presentations, if you believe you or your company would benefit from this offer please contact Network Integrity on 1800 810 443 or NetworkIntegrity@team.telstra.com

PRIVACY NOTE

Your information has been provided to Telstra by DBYD to enable Telstra to respond to your DBYD request. Telstra keeps your information in accordance with its privacy statement entitled "Protecting Your Privacy" which can be obtained from Telstra either by calling 1800 039 059 or visiting our website at www.telstra.com.au/privacy



Appendix D Site Inspection Log and Site Photos

Inspection Information	
Site Name	Red Mountain RMI CHPP
Project Number	1001062
Site Address	Red Mountain
Lot Number / Location	Lot 4/SP190266
Date of Inspection	02/06/2021
Site Inspector	Lionel Meynadier
Purpose of Site Inspection	Inform CSM

General Site Information	
Site Area	RMI
Current Site Tenant	BMC
Site Contact	Tyson Lavender Phone: 0408 813 629 Email: Tyson.lavender@bhp.com
Current Site Use	Coal handling and preparation
Adjacent Land Uses / Receptors	Poitrel Mining lease to the south Millennium Mining Lease to the north
General Site Description / Features.	CHHP Photos: \\cdm\internal.cdm.com\offices\AUST\Project\1001062 - BHP Red Mountain PRCP QLD\6Fieldwork\2Photos\CHPP Floc provided by BASF in a powdered form (Magnafloc-336) 5 Tailing Drying Cells Mobile diesel AST for front loaders located near front loader workshop MIBC 22.7kL AST And Diesel 22.7kL AST in a concrete bund. Adjacent loading area equipped with rollover concrete bund. Concrete delivery pad for Diesel and MIBC ASTs in good condition with diesel stains. Small subsidence of the delivery pad meaning that liquid spilled on the delivery pad can flow into ground. 2 AFFF fire extinguishers noted near the MIBC and diesel ASTs The five Tailings Drying Cells are clay lined. CHPP stated that clay liner integrity is monitored and maintained. After dewatering, rejects taken from the five Tailing Drying Cells are loaded in trucks with long reach excavators and taken off site for disposal or retreatment

1001062_PSI Site Inspection Log and Photos REV1_LM

General Site Information

Workshops have DG storage in cabinets

ROM pad drains into western pond

Process:

- Coal dropped in large hopper
- Screener and crushed
- Separation done by floatation using mix of diesel and water (17L for 100,000L) and MIBC and water 10 ppm
- Reject taken to ROM by conveyor belt and taken in an offsite pit for disposal

Finished product stockpiled in eastern coal handling area

Under finished product stockpile, tunnel with conveyor belts to train loader

Environmental Dam

Photos: <\\cdm\internal.cdm.com\offices\AUST\Project\1001062 - BHP Red Mountain PRCP QLD\6Fieldwork\2Photos\Eastern pond>

Eastern portion of site drains to Environmental Dam (include finished product handling area, and CHPP)

Environmental Dam capacity limited due to high level of fines

Spillway of Environmental Dam discharge into New Chum Creek

Telemonitoring to be moved – currently in filled area

Environmental Dam is connected to Process Water Dam and Poltrel Dams by a network of pumps and pipeline to transfer water from the Environmental Dam into other dams and mitigate the Environmental Dam overflow risk.

Process Water Dam

Photos: <\\cdm\internal.cdm.com\offices\AUST\Project\1001062 - BHP Red Mountain PRCP QLD\6Fieldwork\2Photos\Western pond>

2 AFFF empty vessels (unknown origin) were found near SE corner of the Process Water Dam.)

The Process Water Dam does not have a lining (HDPE or Clay)

Process Water Dam used to store process water

Tele-monitored for Level, EC and pH

Connection with Environmental Dam and other Dam within Poltrel mine lease allow to manage level the Process Water Dam level by transferring water if required.

Process Water Dam is sometimes topped up with groundwater extracted ~50km from site

Northern pond

Photos: <\\cdm\internal.cdm.com\offices\AUST\Project\1001062 - BHP Red Mountain PRCP QLD\6Fieldwork\2Photos\northern pond>

Not managed / monitored

Rubbish present (concrete, plastic pipes, coal waste)

Laydown Area

Photos: <\\cdm\internal.cdm.com\offices\AUST\Project\1001062 - BHP Red Mountain PRCP QLD\6Fieldwork\2Photos\Laydown area>

IBCs of coolant transmission fluid and oil in the laydown area are uncovered and not placed within bunds

Large bags of lime stored under cover but on unsealed surface

Creek

General Site Information	
	Photos: \\cdm\internal.cdm.com\offices\AUST\Project\1001062 - BHP Red Mountain PRCP QLD\6Fieldwork\2Photos\Creek Creek was dry at the time of the site inspection There were no significant evidence of distressed vegetation in the vicinity of the Creek No noticeable coal fines observed within the creek bed Other Some rehab areas and topsoil area noted (refer to map and photos)
Water Supply	Process Water Dam is used to store process water. Additional supply from groundwater bore located ~50km from site
Tenancy Period	Since ~2005

Site Inspection Information								
Current Land Use Activities	Coal Handling and Preparation Plant (CHPP)							
Local Topography								
Environmentally Sensitive Features	New Chum Creek and Tributaries							
Buildings and Condition	CHPP infrastructure CHPP offices (temp buildings) Good condition							
Groundwater Wells	Bores that were within the lease and accessible at the time of the site inspection were gauged Photos: \\cdm\internal.cdm.com\offices\AUST\Project\1001062 - BHP Red Mountain PRCP QLD\6Fieldwork\2Photos\Monitoring wells							
	Well ID	RB ID	Well Depth (mBTOC)	SWL (mBTOC)	Stickup (m)	TOC elevation	Eastings AMG84K55	Northings AMG84K55
	MB04	141750		20.280	0.58	236.148	630316.042	7563205.903
	MB03B		63	15.625	0.55	235.374	629940.451	7562187.92
	MB03A		30	17.384	0.46	235.359	629947.351	7562197.552
	MB11A		60	22.533	0.98	226.593	631707.209	7562542.955
	MB11B		30	20.110	0.48	226.276	631709.19	7562543.154
		182264	1.68	6.080	0.73			
Yellow shading: data provided by client								
Northern wells (RN number 162248 to 162251) are located on Millennium Mining lease (offsite)								

Site Inspection Information	
Hazardous Substances Storage	Floc provided by BASF in a powdered form (Magnafloc-336the 5 long dewatering ponds) Mobile diesel AST for front loaders located near front loader workshop MIBC 22.7kL AST - concrete bund Diesel 22.7kL AST- concrete bund Firefighting using water and argonite (gas mixture argon + nitrogen)
Other Potential Sources or Evidence of Contamination	Coal fines in stormwater drains Northern pond not managed Stockpiles of containing waste coal noted at several locations
Environmental Management Practices Observed	Management practices in plan to reduce risk of pond overflowing Stockpiles of topsoil are vegetated to reduce erosion
Solid/Liquid Waste Management	Ponds are used to managed stormwater run-off and process water Measures in place to monitor level in pond and transfer water between ponds when required Process water recycling in place to reduce water consumption
Other General Site Observations	

Site Inspector Details	
Name/Role	Lionel Meynadier
Date	08/06/2021
Signature	

CHPP Infrastructure



1. CHPP infrastructure



2. Conveyor belt to refuse loading area (view from CHPP carpark)

	
3. Electricity infrastructure at the CHPP	4. Stormwater drain near CHPP, large amount of coal fines visible
	
5. CHPP Infrastructure	6. CHPP Infrastructure and bulk flocculant storage tank in foreground

	
7. Flocculant storage	8. Concrete banded ASTs – Diesel and MIBC
	
9. Bunded delivery pad – subsidence noted in the center of the photo	10. One of the five Tailing Drying Cells

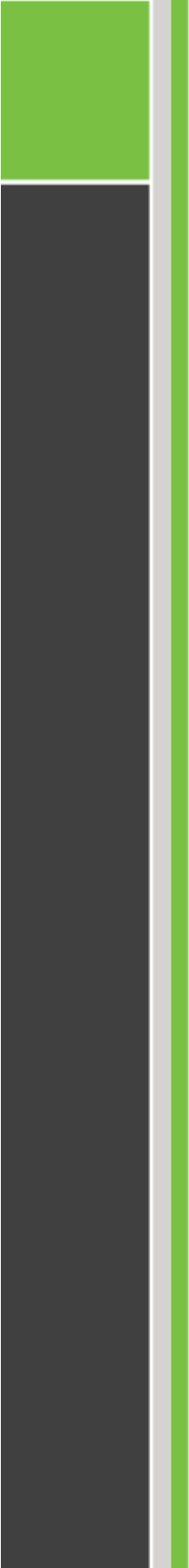
	
11. Workshop	12. Dangerous good storage
	
13. Coal stockpiles	
Creek	
	
14. Creek bed	15. New Chum Creek crossing haul road – north western corner of the Lease

	
16. Creek bed	
Environmental Dam	
	
17. Environmental dam pond	18. Environmental dam
	
19. Environmental dam	20. Environmental dam spillway to Creek

Energex substation	
	
21. Electricity substation	22. Electricity Substation
Laydown Area	
	
23. Laydown area	24. Waste oil drums and transmission fluid IBC
	
25. Lime storage	
Monitoring Wells	

	
26. Monitoring well MB4 Northern Pond	27. Monitoring well MB11B
	
28. Northern pond	29. Northern pond
Western Pond	
	
30. Process water dam	31. Process water dam

	
32. Electricity infrastructure	33. Pump infrastructure



Appendix E Current Certificate of Title

Queensland Titles Registry Pty Ltd
ABN 23 648 568 101

Title Reference:	50635007	Search Date:	02/08/2021 12:56
Date Title Created:	08/11/2006	Request No:	38064387
Previous Title:	50028014		

ESTATE AND LAND

Estate in Fee Simple

LOT 4 SURVEY PLAN 190266
Local Government: ISAAC

REGISTERED OWNER

Dealing No: 720692334 31/03/2021
BHP MITSUI COAL PTY LTD A.C.N. 009 713 875

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by Deed of Grant No. 30550078 (Lot 1 on CP GV119)
2. LEASE No 709464433 24/03/2006 at 10:40
QUEENSLAND RAIL
LEASE B ON SP184912
TERM: 27/5/2015 TO 26/5/2025 OPTION NIL
3. VESTING No 713319561 29/06/2010 at 12:22
LEASE: 709464433
QR NETWORK PTY LTD A.C.N. 132 181 116
4. AMENDMENT OF LEASE No 714669528 11/09/2012 at 15:29
LEASE: 709464433
TERM: 27/5/2015 TO 26/5/2025 OPTION NIL
5. EASEMENT IN GROSS No 709556832 02/05/2006 at 14:37
burdening the land
ERGON ENERGY CORPORATION LIMITED A.C.N. 087 646 062
over
EASEMENT C ON SP178454
6. EASEMENT No 710069721 03/11/2006 at 11:13
burdening the land to
LOT 3 ON SP190266 OVER
EASEMENT F ON SP190266
7. EASEMENT No 710069744 03/11/2006 at 11:15
benefiting the land over
EASEMENT D ON SP190252
8. AMENDMENT No 713928917 28/06/2011 at 14:52
EASEMENT: 710069744
9. EASEMENT No 710069770 03/11/2006 at 11:16
benefiting the land over
EASEMENT E ON SP190253
10. AMENDMENT No 714574050 17/07/2012 at 16:00
EASEMENT: 710069770
11. EASEMENT No 710090758 10/11/2006 at 15:13
benefiting the land over
EASEMENTS R AND T ON SP184915

Queensland Titles Registry Pty Ltd
ABN 23 648 568 101

Title Reference:	50635007
------------------	----------

EASEMENTS, ENCUMBRANCES AND INTERESTS (Continued)

12. EASEMENT No 710090791 10/11/2006 at 15:17
benefiting the land over
EASEMENT Q ON SP184914 AND
EASEMENT V ON SP189490
13. EASEMENT No 710090810 10/11/2006 at 15:19
benefiting the land over
EASEMENTS S, U AND Z ON SP184916
14. EASEMENT No 711041383 28/09/2007 at 10:18
benefiting the land over
EASEMENT P ON SP184913
15. EASEMENT No 711176060 13/11/2007 at 14:55
benefiting the land over
Easement X on SP210085
16. EASEMENT No 716054350 02/10/2014 at 16:03
benefiting the land over
EASEMENT B ON SP262651
17. EASEMENT No 716274417 22/01/2015 at 12:05
benefiting the land over
EASEMENT G ON SP262650

ADMINISTRATIVE ADVICES

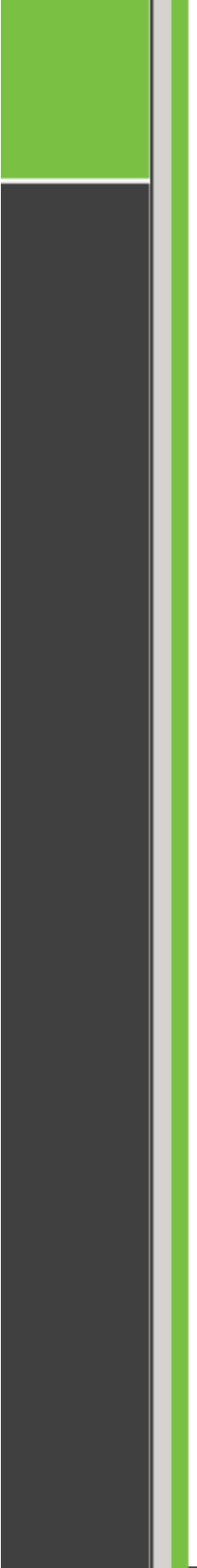
NIL

UNREGISTERED DEALINGS

NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **



Appendix F EMR/CLR Search Results



Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

lionel meynadier
4/51 Alfred street
Fortitude valley QLD 4006

Transaction ID: 50707128 EMR Site Id: 02 August 2021
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 4 Plan: SP190266
POITREL RD
COPPABELLA

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

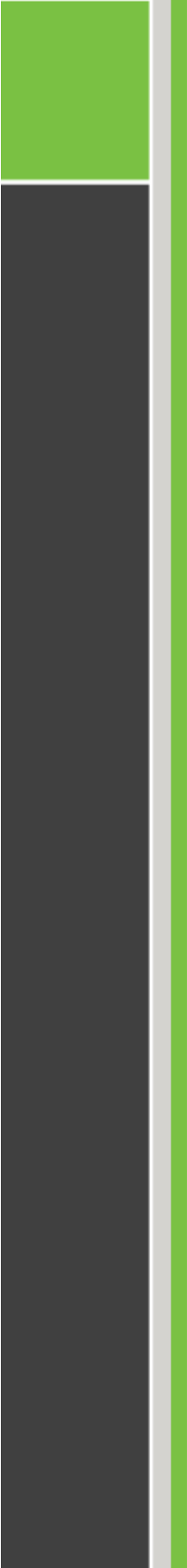
All search responses include particulars of land listed in the EMR/CLR when the search was generated.

The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



Appendix G Summary of Recorded Incidents relating to Runoff from Chemical or Fuel/Oil Spills

Actual - CHPP - Chemical Spillage - Tailings Flocculant Station

Event details		Photo from the event	
Physical location	Minerals Australia > BHP Billiton Mitsui Coal > Red Mount CHPP		
Impact type & Severity	Environment Actual (AL1, PL1)		
Date & Time	Dec 17, 2020 7:15 AM	Event number	1000166281
Reporting category	Category 1 reportable	Employment status of involved	N/A
Risk	N/A	Risk category	N/A
Event Owner	Susan Watkins (20002992)	Org unit of Event Owner	CHPP (30066110)
Event status	Closed	Investigation status	N/A
Description	Operator went to repair a broken fitting on flocculent line at tailings flocculent bunding area. During the repairs noticed that the split flocculent was coming out of the ground outside the bunded area. On closer inspection operator found there was a drain hole in the concrete bunded underground which was not designed to be blocked off that cause the discharge of flocculent.		
Immediate actions	Contained spillage with earth bund of approximately 500lts of flocculent and water mixed solution (Remaining run off was from water in bunded from recent rain event) Temporarily blocked drain hole to stop further spillage.		



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BHP

Land

Type of land incident:
Spill or discharge (SPILL/DSCH)

Spilled or could have been spilled substance:
Chemicals/hazardous substances (CHEMICAL)

Released or could have been released quantity:
500.00000 Litres

Area affected or could have been affected:
100.00 M2

Where did it go or could have gone:
Spilt within tailings floc station and area surrounding

If a spill / discharge, was it contained :
Yes

Is or could have been a non-compliance or a license exceedance:
No

Actual - Reject bin Hydraulic hose failure

Event details				Photo from the event
Physical location	Minerals Australia > BHP Billiton Mitsui Coal > Red Mount CHPP			
Impact type & Severity	Environment Actual (AL1, PL1), Financial (AL1, PL1)			
Date & Time	May 1, 2021 2:00 PM	Event number	1000226851	
Reporting category	Category 1 reportable	Employment status of involved	N/A	
Risk	N/A	Risk category	N/A	
Event Owner	Susan Watkins (20002992)	Org unit of Event Owner	CHPP (30066110)	
Event status	Closed	Investigation status	N/A	
Description	During CHPP production operations, pump A on the reject bin hydraulic pack had a hydraulic hose fitting failure causing the contents of the hydraulic tank to discharge to the concrete apron below.			
Immediate actions	Supervisor informed. Equipment isolated, clean up of area. Production time lost to repair and cleanup.			



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BHP

Land

Type of land incident:
Spill or discharge (SPILL/DISCH)

Spilled or could have been spilled substance:
Hydrocarbons (HYDROCARB)

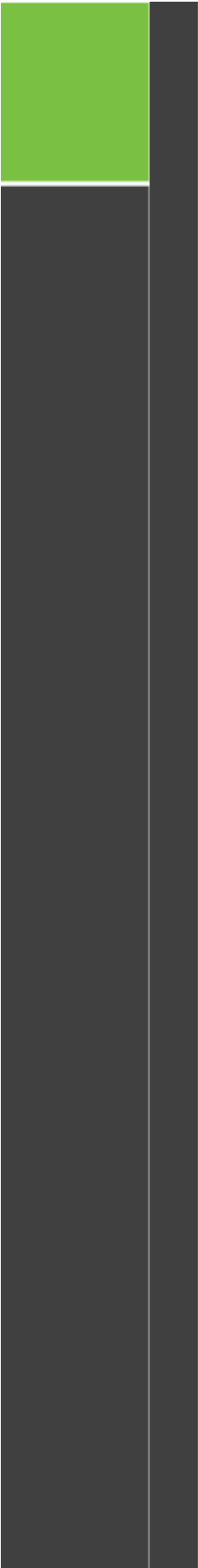
Released or could have been released quantity:
50.00000 Litres

Area affected or could have been affected:
2.00 M2

Where did it go or could have gone:
Contained in area

If a spill / discharge, was it contained :
Yes

Is or could have been a non-compliance or a license exceedance:
No



Appendix H Stock Register

Stock Register

(Entire Stock Register)
(Sort By: Product Name, Filter By: None)

Stock Number	Product Name				Supplier (Emergency Contact)				
	Hazardous	Dangerous Good	UN number	Packing Group	Hazchem Code	Status	In Stock Inventory	Risk Assessment	SDS Date
3378	"BLUE MIST" HAND SOAP LIQUID				ECOCLEAN UTILITY AGENCIES PTY LTD (13 11 26)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
174	5.56 AEROSOL				CRC INDUSTRIES (AUST) PTY LIMITED (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	13-Jul-2021
99	587 BLUE 20LT GB				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	No	-	-	-	None	Yes	Available	07-Oct-2020
1902	693-LINE BERGER JET DRY AQUATREAD				DULUX GROUP (AUSTRALIA) PTY LTD (1800 033 111/ 0800 734 607)				
	No	No	-	-	-	None	Yes	-	01-Oct-2020
4119	88500				ECOLAB PTY LTD (1800 205 506, +64 7 958 2372)				
	No	No	-	-	-	Approved	Yes	-	17-Apr-2018
144	ACETYLENE				BOC LIMITED (AUSTRALIA) (1800 663 672 (24/7) (Australia only))				
	Yes	DG 2.1	UN 1001	-	2SE	None	Yes	Available	24-Jun-2021
64	AEROGARD BODY TROPICAL STRENGTH INSECT REPELLENT AEROSOL				RB (HYGIENE HOME) AUSTRALIA PTY LTD (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2YE	Approved	Yes	Available	23-May-2017
4121	AFTEK CURECON W				RLA POLYMERS PTY LTD ((03) 9728 1644/ 132 766 (Security))				
	Yes	No	-	-	-	Approved	Yes	-	07-Aug-2017
1937	AIR WICK FRESHMATIC - TURQUOISE OASIS				RB (HYGIENE HOME) AUSTRALIA PTY LTD (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	-	14-Dec-2016
961	AIRCOL PD 100				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	13-Jun-2017
4146	AIRCOL SR 46				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	Approved	Yes	-	17-Oct-2019
4177	AJAX SPRAY N WIPE ANTIBACTERIAL ALL PURPOSE CLEANER SPRAY OCEAN FRESH				COLGATE-PALMOLIVE PTY LTD ((02) 9037 2994)				
	Yes	No	-	-	-	Approved	Yes	Available	11-Apr-2017
3328	ALL CLIMATE MOTOR OIL 20W50				VALVOLINE (AUSTRALIA) PTY LTD (1800 804 658, New Zealand (02) 8603 2300)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
163	ALPHA SP 100				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	10-Jul-2020
260	ALPHA SP 150				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	10-Jul-2020

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Stock Register

(Entire Stock Register)
(Sort By: Product Name, Filter By: None)

Stock Number	Product Name				Supplier (Emergency Contact)				
	Hazardous	Dangerous Good	UN number	Packing Group	Hazchem Code	Status	In Stock Inventory	Risk Assessment	SDS Date
164	ALPHA SP 220				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	10-Jul-2020
165	ALPHA SP 320				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	10-Jul-2020
261	ALPHA SP 460				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	29-Oct-2019
4145	ALPHASYN EP 320				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	Approved	Yes	-	13-Feb-2017
263	ALPHASYN EP 460				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	02-Jul-2019
3377	ALPINE FRESH				NORTH QUEENSLAND CHEMICALS & PAINTS ((07) 4951 3988)				
	Yes	No	-	-	-	None	Yes	-	22-Dec-2016
672	AMBRA MULTI G				FL SELENIA S.P.A ((03) 9300 6400)				
	No	No	-	-	-	None	Yes	-	SDS DISCONTINUED
809	ANHYDRONE, MAGNESIUM PERCHLORATE CA-171				CHOICE ANALYTICAL PTY LTD ((02) 9980 6240; 1800 535 5053)				
	Yes	DG 5.1	UN 1475	PG II	1Y	None	Yes	Available	26-Mar-2017
3180	ARADUR 2958 - WEARSTOP RAPID SET PART B (ARADUR 2958 - WEARSTOP RAPID SET PART B)				WEIR MINERALS AUSTRALIA LTD (NSW) ((02) 9934 5100/ 1800 039 008)				
	Yes	DG 8	UN 2735	PG II	2X	None	Yes	Available	01-Nov-2019
3160	ARC BX1 (PART B), ARC I BX1 (PART B)				IMATECH PTY LTD (13 11 26)				
	Yes	DG 8	UN 3259	PG III	2X	None	Yes	-	24-May-2018
4141	ARC BX1 (PART B), ARC I BX1 (PART B)				IMATECH PTY LTD (13 11 26)				
	Yes	DG 8	UN 3259	PG III	2X	Approved	Yes	-	24-May-2018
3244	ARC BX2 (PART A) (RD), ARC BX5 (MX5) (PART A) (RD)				IMATECH PTY LTD (13 11 26)				
	Yes	No	-	-	-	None	Yes	Available	13-Jan-2017
500	ARC BX2 (PART B)				IMATECH PTY LTD (13 11 26)				
	Yes	DG 8	UN 3259	PG III	2X	Approved	Yes	Available	28-Jun-2018
3243	ARC BX5 (MX5) (PART B)				IMATECH PTY LTD (13 11 26)				
	Yes	No	-	-	-	None	Yes	Available	20-Jan-2017
3159	ARC I BX1 (PART A)				IMATECH PTY LTD (13 11 26)				
	Yes	No	-	-	-	None	Yes	-	26-Apr-2018

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Stock Register

(Entire Stock Register)
(Sort By: Product Name, Filter By: None)

Stock Number	Product Name				Supplier (Emergency Contact)				
	Hazardous	Dangerous Good	UN number	Packing Group	Hazchem Code	Status	In Stock Inventory	Risk Assessment	SDS Date
1181	ARDROX 800/3				CHEMETALL (AUSTRALASIA) PTY LTD ((03) 9663 2130)				
	Yes	No	-	-	-	None	Yes	-	21-Dec-2016
924	ARDROX 800/3, AEROSOL				CHEMETALL (AUSTRALASIA) PTY LTD ((03) 9663 2130)				
	Yes	DG 2.1	UN 1950	-	2Y	None	Yes	Available	12-Dec-2018
3321	ARGONITE				KIDDE AUSTRALIA ((03) 9518 5588; 1800 672 171)				
	Yes	DG 2.2	UN 1956	-	2TE	None	Yes	-	17-Jul-2019
146	ARGOSHIELD UNIVERSAL				BOC LIMITED (AUSTRALIA) (1800 653 672 (24/7) (Australia only))				
	Yes	DG 2.2	UN 1956	-	2TE	None	Yes	Available	22-Jun-2021
4198	ARMOR ALL PROTECTANT ORIGINAL				ENERGIZER AUSTRALIA PTY LTD (13 11 26 (Poisons Information Centre))				
	No	No	-	-	-	Approved	Yes	-	30-Jun-2019
693	ARTLINE WHITEBOARD CLEANER				ACCO BRANDS AUSTRALIA PTY LTD (13 11 26 (Poison Information Centre))				
	Yes	DG 3	UN 1219	PG II	•2YE	None	Yes	Available	04-Jan-2018
4156	ASSOCIATE HERBICIDE				NUFARM AUSTRALIA LIMITED (1800 033 498)				
	No	DG 9	UN 3077	PG III	2Z	Approved	Yes	-	29-Aug-2016
1901	ATLAS COPCO ROTO INJECT FLUID ULTRA 68				VIVA ENERGY AUSTRALIA LTD (1800 651 818/ 13 11 26)				
	No	No	-	-	-	None	Yes	-	26-Apr-2021
24	AUTOMOTIVE DIESEL FUEL				AMPOL AUSTRALIA PETROLEUM PTY LTD (FORMERLY CALTEX AUSTRALIA) (1800 033 111)				
	Yes	No	-	-	-	Approved	Yes	Available	23-Jun-2021
108	AUTOMOTIVE DIESEL FUEL				BP AUSTRALIA PTY LTD (1800 14 14 74 within Australia or +61 2 8014 4558)				
	Yes	No	-	-	-	None	Yes	Available	08-Jun-2019
86	BELTGRIP (AEROSOL)				CRC INDUSTRIES (AUST) PTY LIMITED (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2Y	None	Yes	Available	31-Jul-2020
3592	BENZOIC ACID				LECO CORPORATION (800-424-9300/ +1 (703) 527-3887)				
	Yes	DG 9	UN 3077	PG III	2Z	None	Yes	-	21-Sep-2016
4160	BIFENTHRIN 100 SC				GARRARDS PTY LTD (13 11 26)				
	Yes	No	-	-	-	Approved	Yes	-	29-Nov-2018
216	BONDCRETE				BONDALL PTY LTD (1800 638 556)				
	No	No	-	-	-	None	Yes	-	04-Sep-2020
508	BOSTIK CONTACT BOND				BOSTIK AUSTRALIA PTY LTD (1800 033 111)				
	Yes	DG 3	UN 1133	PG II	•3YE	Approved	Yes	Available	07-Oct-2019

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Stock Register

(Entire Stock Register)
(Sort By: Product Name, Filter By: None)

Stock Number	Product Name				Supplier (Emergency Contact)				
	Hazardous	Dangerous Good	UN number	Packing Group	Hazchem Code	Status	In Stock Inventory	Risk Assessment	SDS Date
609	BOSTIK INDUSTRIAL GRADE SILICONE				BOSTIK AUSTRALIA PTY LTD (1800 033 111)				
	Yes	No	-	-	-	None	Yes	-	06-Feb-2017
1940	BOSTIK MULTI-PURPOSE SILICONE SEALANT				BOSTIK AUSTRALIA PTY LTD (1800 033 111)				
	Yes	No	-	-	-	None	Yes	-	06-Feb-2017
3175	BRAKLEEN (AEROSOL)				CRC INDUSTRIES (AUST) PTY LIMITED (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	13-Jul-2021
1918	BRAKLEEN (BULK)				CRC INDUSTRIES (AUST) PTY LIMITED (13 11 26 (PIC))				
	Yes	DG 3	UN 1993	PG II	•3YE	None	Yes	-	31-Mar-2021
4173	CALCIUM HYPOCHLORITE, HYDRATED (UN2880)				REDOX PTY LTD (1800 261 525/ 13 11 26/ 1800 127 406)				
	Yes	DG 5.1	UN 2880	PG II	1W	Approved	No	Available	20-Sep-2016
4178	CANON NPG-41 BLACK TONER				CANON AUSTRALIA PTY LTD (13 11 26)				
	No	No	-	-	-	Approved	Yes	-	01-Sep-2017
4179	CANON NPG-41 CYAN TONER				CANON AUSTRALIA PTY LTD (13 11 26)				
	No	No	-	-	-	Approved	Yes	-	01-Sep-2017
4180	CANON NPG-41 MAGENTA TONER				CANON AUSTRALIA PTY LTD (13 11 26)				
	No	No	-	-	-	Approved	Yes	-	01-Sep-2017
4181	CANON NPG-41 YELLOW TONER				CANON AUSTRALIA PTY LTD (13 11 26)				
	No	No	-	-	-	Approved	Yes	-	01-Sep-2017
4182	CANON NPG-67 TONER BLACK				CANON AUSTRALIA PTY LTD (13 11 26)				
	No	No	-	-	-	Approved	Yes	-	29-Nov-2018
4183	CANON NPG-67 TONER CYAN				CANON AUSTRALIA PTY LTD (13 11 26)				
	No	No	-	-	-	Approved	Yes	-	29-Nov-2018
4184	CANON NPG-67 TONER MAGENTA				CANON AUSTRALIA PTY LTD (13 11 26)				
	No	No	-	-	-	Approved	Yes	-	29-Nov-2018
4185	CANON NPG-67 TONER YELLOW				CANON AUSTRALIA PTY LTD (13 11 26)				
	No	No	-	-	-	Approved	Yes	-	29-Nov-2018
829	CASTROL AP3 GREASE				CASTROL AUSTRALIA PTY LTD ((02) 8014 4568; 1800 141 474)				
	Yes	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
4137	CASTROL AXLE AP 85W-140				CASTROL AUSTRALIA PTY LTD ((02) 8014 4568; 1800 141 474)				
	No	No	-	-	-	Approved	Yes	-	13-Aug-2020

Company - BHP MINERALS AUSTRALIA
User - DOBECAS

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Print Date: 09-Aug-2021

Stock Register

(Entire Stock Register)
(Sort By: Product Name, Filter By: None)

Stock Number	Product Name				Supplier (Emergency Contact)				
	Hazardous	Dangerous Good	UN number	Packing Group	Hazchem Code	Status	In Stock Inventory	Risk Assessment	SDS Date
166	CASTROL EPX 85W-140				BP AUSTRALIA PTY LTD (1800 14 14 74 within Australia or +61 2 8014 4558)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
724	CASTROL HIGH TEMPERATURE GREASE				CASTROL (UK) LIMITED (+44 (0) 1793 512 712)				
	No	No	-	-	-	None	Yes	Available	11-Jan-2019
860	CASTROL MULTIPURPOSE DEGREASER				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	Yes	No	-	-	-	None	Yes	Available	07-May-2018
978	CASTROL PREMIUM COOL PLUS 50				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	Yes	No	-	-	-	Approved	Yes	Available	08-Jan-2019
264	CASTROL PREMIUM HEAVY DUTY				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	29-Jun-2021
671	CASTROL QB100 DEGREASER				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	Yes	No	-	-	-	None	Yes	Available	08-May-2018
1939	CASTROL RX DIESEL 15W-40				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	07-Jan-2019
276	CASTROL RX SUPER 15W-40				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	16-May-2018
862	CASTROL TFC 430				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	Approved	Yes	-	20-Oct-2020
861	CASTROL TFC 450				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	Approved	Yes	-	20-Oct-2020
721	CASTROL TQ-D III				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
501	CAT COOLING SYSTEM CLEANER				CATERPILLAR OF AUSTRALIA PTY LTD (13 11 26/ +81 3 248 0585)				
	Yes	No	-	-	-	Approved	Yes	Available	16-Jan-2017
169	CAT DEO 15W-40 (DIESEL ENGINE OIL)				CATERPILLAR OF AUSTRALIA PTY LTD (13 11 26/ +81 3 248 0585)				
	No	No	-	-	-	None	Yes	-	03-May-2019
513	CAT ELC (EXTENDED LIFE COOLANT)				CHEVRON PRODUCTS COMPANY (+1 (800) 231-0623)				
	Yes	DG 9	UN 3082	PG III	3Y	Approved	Yes	Available	SDS DISCONTINUED
170	CAT GEAR OIL 85W-140				CATERPILLAR OF AUSTRALIA PTY LTD (13 11 26/ +81 3 248 0585)				
	No	No	-	-	-	None	Yes	-	05-Oct-2018

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173	CAT TRANSMISSION & DRIVE TRAIN OIL 50				CATERPILLAR OF AUSTRALIA PTY LTD (13 11 26/ +81 3 248 0585)				
	No	No	-	-	-	None	Yes	-	12-Feb-2018
3054	CAT TRANSMISSION AND DRIVE TRAIN OIL (TDTO) 30				CATERPILLAR OF AUSTRALIA PTY LTD (13 11 26/ +81 3 248 0585)				
	No	No	-	-	-	None	Yes	-	12-Dec-2016
3585	CHEMSET 101 PLUS				RAMSETREID AU (A DIVISION OF ITW AUSTRALIA PTY LTD) (1800 033 111)				
	Yes	DG 3	UN 3269	PG III	2Y	None	Yes	Available	29-Apr-2021
4129	CHUBB PEFS F3 VEHICLE FIRE SUPPRESSION SYSTEM				CHUBB FIRE & SECURITY (1300 369 309)				
	Yes	DG 2.2	UN 1044	-	-	Approved	Yes	-	17-Apr-2017
4190	CLEANING FLUID R4, CFC FREE				REMA TIP TOP AUSTRALIA PTY LTD (1800 638 556/ (02) 8755 8400)				
	Yes	DG 3	UN 1263	PG II	•3YE	Approved	Yes	Available	15-Oct-2019
3129	CO CONTACT CLEANER (AEROSOL) (POST JUNE 2010)				CRC INDUSTRIES (AUST) PTY LIMITED (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2Y	Approved	Yes	Available	13-Jul-2021
3689	CONSOLIDATED ALLOYS TIN/LEAD SOLDERS - LOW GRADE, HIGH TEMP				CA GROUP (FORMERLY CONSOLIDATED ALLOYS) ((03) 8301 7100; (03) 8301 7107; 0428 904 506)				
	Yes	No	-	-	-	None	Yes	-	27-Jun-2017
4163	CONSOLIDATED AQUASAFE SOLDER-CONTAINING SILVER				CA GROUP (FORMERLY CONSOLIDATED ALLOYS) ((03) 8301 7100; (03) 8301 7107; 0428 904 506)				
	No	No	-	-	-	Approved	No	-	04-Dec-2017
1930	CORE SHELL 71305				NALCO WATER, AN ECOLAB COMPANY (AUST: 1800 205 506; NZ: 0800 734 607)				
	No	No	-	-	-	None	Yes	-	19-Jan-2021
1907	CRC (NZ) 2018 LECTRA CLEAN (AEROSOL)				CRC INDUSTRIES (NEW ZEALAND) (0800 764 766/ 111)				
	Yes	DG 2.2	UN 1950	-	2Y	None	Yes	-	02-Sep-2017
506	CRC 3013 SOFT SEAL (AEROSOL)				CRC INDUSTRIES (AUST) PTY LIMITED (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2Y	Approved	Yes	Available	30-Jul-2020
4168	CRC SURFACE SANITISER SPRAY				CRC INDUSTRIES (AUST) PTY LIMITED (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2YE	Approved	Yes	Available	30-Jul-2020
3379	CREME CLEANSER				ECCLEAN UTILITY AGENCIES PTY LTD (13 11 26)				
	Yes	No	-	-	-	None	Yes	-	19-Jul-2021
4166	CSA ALCO-SAN				CHEMICAL SYSTEMS AUSTRALIA (03 9572 4700)				
	Yes	DG 3	UN 1170	PG III	•2Y	Approved	Yes	Available	27-Jun-2017
4167	CSA VIRA-CIDE				CHEMICAL SYSTEMS AUSTRALIA (03 9572 4700)				
	Yes	No	-	-	-	Approved	Yes	Available	21-Mar-2017

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4130	CUSSONS MORNING FRESH DISHWASH LIQUID - ORIGINAL FRESH				PZ CUSSONS PTY LTD (13 11 26)				
	Yes	No	-	-	-	Approved	Yes	-	01-Nov-2019
684	DAMP RID MOISTURE ABSORBERS				W.M. BARR (+1 (800) 451-8346)				
	Yes	No	-	-	-	None	Yes	Available	03-Dec-2019
3320	DELO SYN ATF HD				AMPOL AUSTRALIA PETROLEUM PTY LTD (FORMERLY CALTEX AUSTRALIA) (1800 033 111)				
	Yes	No	-	-	-	None	Yes	-	29-May-2018
666	DEMINERALISED WATER				RECOCHEM INC ((07) 3308 5200; 1300 131 001 (After hours)/ 0800 764 766)				
	No	No	-	-	-	None	Yes	-	29-Apr-2021
4134	DEVCON PLASTIC STEEL PUTTY (A) HARDENER				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 8	UN 2735	PG II	2X	Approved	Yes	-	01-Nov-2019
665	DEVCON PLASTIC WELDER ADHESIVE				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 3	UN 1133	PG II	•3YE	None	Yes	Available	01-Nov-2019
956	DEVCON STOP SEIZE NICKEL				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	No	-	-	-	None	Yes	-	01-Nov-2019
855	DEVCON ZINC				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	-	01-Nov-2019
962	DIATOMACEOUS EARTH ORGANIC				MAIDENWELL DIATOMITE AUSTRALIA PTY LTD (+61 (0)459 073 213)				
	No	No	-	-	-	None	Yes	-	29-Apr-2019
214	DO INK-WHITE				SIGNET PTY LTD ((07) 3245 5798; (07) 3364 2100)				
	Yes	DG 3	UN 1210	PG III	•3Y	None	Yes	-	23-Sep-2016
3591	DOW CORNING HIGH VACUUM GREASE				DOW CORNING AUSTRALIA PTY LTD (1300 360 732)				
	No	No	-	-	-	None	Yes	-	10-Mar-2017
4172	DPD NO.1				WOBLEA PTY LTD ((03) 5629 5424; 0417 168 990/ (03) 5997 1690; 0427 367 561)				
	No	No	-	-	-	Approved	No	-	13-May-2016
1922	DS INK-WHITE				SIGNET PTY LTD ((07) 3245 5798; (07) 3364 2100)				
	Yes	No	-	-	-	None	Yes	-	26-Sep-2016
3056	DURACELL ZINC CHLORIDE/MALLORY SUPER BATTERIES				PROCTER & GAMBLE AUSTRALIA PTY LTD (1800 641 280)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
3453	DVS4U041				NALCO WATER, AN ECOLAB COMPANY (AUST: 1800 205 506; NZ: 0800 734 607)				
	Yes	No	-	-	-	None	Yes	Available	PRODUCT OBSOLETE

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612	DY-MARK BALLMARKER INK T400 ALL COLOURS				DY-MARK AUSTRALIA ((07) 3327 3099)				
	Yes	DG 3	UN 1210	PG II	•3YE	None	Yes	Available	01-Nov-2019
492	DY-MARK SPRAY WRITER STD ALL COLOURS				DY-MARK AUSTRALIA ((07) 3327 3099)				
	Yes	DG 2.1	UN 1950	-	2YE	Approved	Yes	Available	04-Dec-2019
660	DYMON GRAFFITI & SPRAY PAINT REMOVER				ITW DYMON (+1 800 535 5053; +1 362 323 3500)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	31-Aug-2018
4136	EAL SILVER GRADE ANTI-SEIZE				ENGINEERING ADHESIVES & LUBRICANTS ((07) 5531 4242)				
	No	No	-	-	-	Approved	Yes	-	31-Jan-2018
1906	ECONO SLIDE CABLE PULLING LUBRICANT				WATTMASTER PTY LTD ((03) 9775 1186)				
	No	No	-	-	-	None	Yes	-	23-Aug-2016
1231	ELECTRODE FOR FLUX CORED ARC WELDING				WESTERN WELDING SERVICES ((08) 9418 4511)				
	Yes	No	-	-	-	None	Yes	Available	24-Jul-2018
218	EPIGEN 0907 "A"				PEERLESS INDUSTRIAL SYSTEMS PTY LTD (13 11 26)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	Available	20-Dec-2016
219	EPIGEN 0907 "B"				PEERLESS INDUSTRIAL SYSTEMS PTY LTD (13 11 26)				
	Yes	No	-	-	-	None	Yes	Available	23-Dec-2016
3476	EQUIVIS ZS 15				TOTAL OIL AUSTRALIA PTY LTD ((02) 8014 4558/ +64 9801 0034)				
	Yes	No	-	-	-	None	Yes	-	31-Dec-2018
678	ERA AD-1147				ERAPOLYMERS PTY LTD (1800 039 008; (02) 9186 1132)				
	Yes	DG 3	UN 1133	PG II	•3YE	None	Yes	Available	27-Jun-2017
593	ETHYL ACETATE (EA011, ET011)				CHEM-SUPPLY PTY LTD (1-800-498-5701; 1-303-389-1414/ 1-800-424-9300; 1-703-527-3887/ (02) 9037 2994/ 1800-127-406 (Australia); +64-4-917-9888 (International))				
	Yes	DG 3	UN 1173	PG II	•3YE	None	Yes	Available	31-Jan-2021
3478	EZ STREET ASPHALT				THE EZ STREET COMPANY (+1 800 734 1476/ +1 305 663 3090)				
	No	No	-	-	-	None	Yes	-	14-Jan-2019
3325	EZI-CLEAN GERM BUSTER				EZI-CLEAN PRODUCTS (1800 039 008)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
2015	FLOPAM AN 934 SH				SNF AUSTRALIA PTY LTD (1800 033 111)				
	No	No	-	-	-	None	Yes	-	05-Jun-2020
10	FLSMIDTH WEAR RESIST (TROWELABLE) PART A				FLSMIDTH (1800 039 008)				
	Yes	No	-	-	-	Approved	Yes	Available	01-Nov-2019

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104	FLSMIDTH WEAR RESIST (TROWELABLE) PART A				FLSMIDTH (1800 039 008)				
	Yes	No	-	-	-	None	Yes	Available	01-Nov-2019
1899	FLSMIDTH WEAR RESIST QUICK SET (TROWELABLE) PART A				FLSMIDTH (1800 039 008)				
	Yes	No	-	-	-	None	Yes	-	01-Nov-2019
105	FLSMIDTH WEAR-RESIST QUICK SET (TROWELABLE) PART B (HARDENER)				FLSMIDTH (1800 039 008)				
	Yes	DG 8	UN 2079	PG II	2X	None	Yes	Available	23-Feb-2018
4128	FLUID FILM GEL BW				STOTT INDUSTRIAL SUPPLIES (SUPPLIER FOR EUREKA CHEMICAL CO) (+61 2 4966 8020)				
	No	No	-	-	-	Approved	Yes	-	17-Jan-2019
4123	FOSROC NITOBOND HAR				PARCHEM CONSTRUCTION SUPPLIES PTY LTD (1800 033 111)				
	No	No	-	-	-	Approved	Yes	-	04-Sep-2018
4120	FOSROC RENDEROC HB70 (NEW & IMPROVED)				PARCHEM CONSTRUCTION SUPPLIES PTY LTD (1800 033 111)				
	Yes	No	-	-	-	Approved	Yes	-	29-Oct-2017
4124	FOSROC RENDEROC LA55				PARCHEM CONSTRUCTION SUPPLIES PTY LTD (1800 033 111)				
	Yes	No	-	-	-	Approved	Yes	-	21-Dec-2016
955	GALMET RUSTPAINT (ALL COLOURS)				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	Available	01-Nov-2019
20	GALMET SPRAYPAINT AEROSOL (ALL COLOURS EXCEPT SILVER)				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 2.1	UN 1950	-	2YE	Approved	Yes	Available	01-Nov-2019
1100	GALMET SPRAYPAINT AEROSOL (ALL COLOURS EXCEPT SILVER)				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	01-Nov-2019
4191	GARNET				KUHMICHEL ABRASIV LIMITED (+61 480 182 595 (Office Hours))				
	No	No	-	-	-	Approved	No	-	12-Nov-2020
3327	GEAR OIL 80W-90				PENRITE OIL COMPANY PTY LTD (1300 736 748/ 0800 533 698)				
	Yes	No	-	-	-	None	Yes	-	07-Aug-2018
642	GENERAL PURPOSE (GP) LIQUID LANOLIN AEROSOL				LANOTEC AUSTRALIA PTY LTD (0417 638 004)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	16-Oct-2017
3597	GLASS WOOL (20411)				SIGMA-ALDRICH PTY. LTD. (1800 448 465/ (02) 9037 2994)				
	No	No	-	-	-	None	Yes	-	18-Apr-2021
130	GLEN 20 ALL IN ONE SPRAY DISINFECTANT - ALL SCENTS				RB (HYGIENE HOME) AUSTRALIA PTY LTD (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	23-Jan-2020

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1798	GMA GARNET				BLASTONE INTERNATIONAL (13 11 26 (Poisons Information Centre))				
	No	No	-	-	-	None	Yes	-	30-Sep-2019
664	GRAPHITE PIPE JOINT COMPOUND AND WHITE PIPE JOINT COMPOUND				THOMAS GROZIER & SON ((02) 9869 7324)				
	No	No	-	-	-	None	Yes	-	01-Mar-2019
388	GUMPTION MULTI PURPOSE CLEANSER				CLOROX AUSTRALIA PTY LIMITED (13 11 26)				
	No	No	-	-	-	None	Yes	-	31-Jan-2018
3587	HAMILTON FAMILY SUNSCREEN SPF15				VALEANT PHARMACEUTICALS AUSTRALASIA PTY LTD ((02) 8757 5100)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
4169	HAND SANITIZER; HAND SANITIZER GEL; HAND WASH				COS (1300 882 244)				
	Yes	DG 3	UN 1170	PG II	•2YE	Approved	Yes	Available	08-Apr-2020
330	HANDIGAS				BOC LIMITED (AUSTRALIA) (1800 653 572 (24/7) (Australia only))				
	Yes	DG 2.1	UN 1075	-	2YE	None	Yes	Available	24-Jun-2021
1897	HARDENER TL-T70				NILOS GMBH & CO. KG (+49 (0) 173 530 6827)				
	Yes	DG 6.1	UN 1593	PG III	2Z	None	Yes	-	PRODUCT OBSOLETE
4170	HARVEYS INSTANT HAND SANITISER				WIS SOLUTIONS PTY LTD (1800 638 556 (AU); 0800 154 666 (NZ))				
	Yes	DG 3	UN 1170	PG II	•2YE	None	Yes	Available	16-Jan-2018
4171	HARVEYS INSTANT HAND SANITISER				WIS SOLUTIONS PTY LTD (1800 638 556 (AU); 0800 154 666 (NZ))				
	Yes	DG 3	UN 1170	PG II	•2YE	Approved	No	Available	16-Jan-2018
3596	HELIUM, COMPRESSED				BOC LIMITED (AUSTRALIA) (1800 653 572 (24/7) (Australia only))				
	Yes	DG 2.2	UN 1046	-	2T	None	Yes	-	23-Jun-2021
1914	HEMPADUR FAST DRY 15569 BASE (1556912170)				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	-	05-May-2021
4150	HEMPADUR MASTIC 45889 BASE (458891V820)				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	-	05-May-2021
4151	HEMPADUR MULTI-STRENGTH 45549 BASE				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	-	05-May-2021
4149	HEMPAQUICK ENAMEL 5384010000				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	-	05-May-2021
4148	HEMPEL'S CURING AGENT 95880				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	-	05-May-2021

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1912	HEMPEL'S CURING AGENT 95881				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	-	05-May-2021
1913	HEMPEL'S CURING AGENT 97560				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3 / 8	UN 3469	PG III	•3W	None	Yes	-	05-May-2021
1911	HEMPEL'S CURING AGENT 97880				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	-	04-Jul-2017
1909	HEMPEL'S CURING AGENT 97883 (9788300000)				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	No	-	-	-	None	Yes	-	05-May-2021
1910	HEMPEL'S PRO ACRYLIC 55889 (5588910000)				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	-	05-May-2021
4152	HEMPEL'S THINNER 08080				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	-	05-May-2021
1908	HEMPEL'S THINNER 08450				HEMPEL (AUSTRALIA) PTY LTD (A/H (03) 9479 4969; (03) 5797 2427/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	-	05-May-2021
1938	HONEYDEW				ED OATES PTY LTD (T/A CITRUS RESOURCES & RESEARCH PRODUCTS) ((03) 9355 6900; 13 11 26 (PIC))				
	Yes	No	-	-	-	None	Yes	-	31-Oct-2016
3051	HPR 30				PENRITE OIL COMPANY PTY LTD (1300 736 748/ 0800 533 698)				
	No	No	-	-	-	None	Yes	-	09-Mar-2018
167	HYSPIIN AWH 32				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	21-May-2021
674	HYSPIIN AWH 46				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	21-May-2021
4144	HYSPIIN AWH 46				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	Approved	Yes	-	21-May-2021
418	HYSPIIN AWH 68				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	18-May-2021
269	HYSPIIN AWS 32				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	14-Aug-2020
270	HYSPIIN AWS 46				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	14-Aug-2020

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1898	INDUSTRIAL METHYLATED SPIRITS 95% (IMS95)				AUSCHEM (NSW) PTY LTD (+61 413339787; +61 412620120/ +61 402143581)				
	Yes	DG 3	UN 1170	PG II	•2YE	None	Yes	-	11-Aug-2016
282	INOVA PEDOZ				INOVA PHARMACEUTICALS (AUSTRALIA) PTY LIMITED (13 11 26)				
	No	No	-	-	-	None	Yes	-	27-Jun-2017
4192	INTERCURE 200 PART B				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	Available	22-Sep-2020
4193	INTERCURE 200 RED PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	Available	22-Sep-2020
3598	INTERCURE 200 SAND PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	-	13-Nov-2020
294	INTERFINE 629 GOLDEN YELLOW PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	Available	23-Sep-2020
296	INTERFINE 629 PART B				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	Available	01-Jun-2020
296	INTERFINE 629 WHITE PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	Available	11-Feb-2019
4153	INTERGARD 251HS GREY PART B TROPICAL				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	-	01-Sep-2020
4142	INTERGARD 251HS PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	-	02-Sep-2020
971	INTERGARD 348 PART B				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	Available	18-Sep-2020
970	INTERGARD 348 RED PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	Available	18-Sep-2020
3075	INTERNATIONAL INTERPLUS 1180 PART B PF				AKZO NOBEL (1800 680 071)				
	Yes	DG 3 / 8	UN 3469	PG III	•3W	None	Yes	-	27-Jun-2017
1925	INTERNATIONAL THINNER (GTA056 / T-9)				INTERNATIONAL PAINT INC. (USA) ((800) 424-9300/ (703) 527-3887)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	-	06-Oct-2016
316	INTERNATIONAL THINNER-EQPT CLEANER (GTA220)				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	Available	11-Sep-2020

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4140	INTERNATIONAL THINNER-EQPT CLEANER (GTA713)				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	-	11-Sep-2020
4194	INTERPLUS 1180 BASE LIGHT PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	Approved	Yes	Available	13-Nov-2020
4195	INTERPLUS 1180 PART B				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3 / 8	UN 3469	PG III	•3W	Approved	Yes	Available	23-Sep-2020
3077	INTERPLUS 1180 WHITE PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	-	23-Jul-2020
305	INTERZINC 315 GREY PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	Available	13-Nov-2020
306	INTERZONE 954 PART B (EAA984)				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3 / 8	UN 3469	PG III	•3W	None	Yes	Available	03-Sep-2020
307	INTERZONE 954 WHITE PART A				AKZO NOBEL PTY LTD (1800 680 071/ 13 11 26)				
	Yes	DG 3	UN 1263	PG III	•3Y	None	Yes	-	13-Nov-2020
4176	ISOPROPYL ALCOHOL WIPES				BASTION PACIFIC PTY LTD ((02) 9714 1110)				
	Yes	DG 3	UN 1219	PG II	•2YE	Approved	Yes	Available	26-Jul-2017
60	JOSEPH LYDDY DUBBIN NEUTRAL				WAPROO PTY LTD ((03) 9238 9888)				
	No	No	-	-	-	Approved	Yes	-	06-Mar-2017
702	KLENSORB, NURSERY GRADE, GRANULAR DIATOMITE, DIATOMITE FINES				MOUNT SYLVIA DIATOMITE PTY LTD. (02 6161 5992)				
	No	No	-	-	-	None	Yes	-	30-Apr-2019
4122	KONSTRUKT ROOF & GUTTER TRANS				H.B. FULLER COMPANY AUSTRALIA PTY LTD (1800 074 234)				
	Yes	No	-	-	-	Approved	Yes	-	18-Aug-2016
608	LANOTEC ANTI-SPATTER AEROSOL				LANOTEC AUSTRALIA PTY LTD (0417 638 004)				
	Yes	DG 2.2	UN 1950	-	2RE	None	Yes	Available	PRODUCT OBSOLETE
243	LASER				ECOLAB PTY LTD (1800 205 506, +64 7 968 2372)				
	No	No	-	-	-	None	Yes	Available	03-May-2017
3380	LAZER SUPER FLOOR STRIPPER				PEERLESS JAL PTY LTD ((03) 9416 6700)				
	Yes	DG 8	UN 1760	PG II	2X	None	Yes	Available	21-Oct-2016
3381	LEMON SPARKLE				NORTH QUEENSLAND CHEMICALS & PAINTS ((07) 4951 3988)				
	No	No	-	-	-	None	Yes	-	31-Jan-2017

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3590	LICO WAX C MICROPOWDER				ROWE SCIENTIFIC PTY LTD ((08) 9302 1911)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
155	LIQUEFIED PETROLEUM GAS (LPG)				ELGAS LTD (1800 819 783 (24 hours))				
	Yes	DG 2.1	UN 1075	-	2YE	None	Yes	-	31-Jan-2019
4189	LIQUID NITROGEN				BOC LIMITED (AUSTRALIA) (1800 653 572 (24/7) (Australia only))				
	Yes	DG 2.2	UN 1977	-	2T	Approved	Yes	Available	29-Jun-2021
3064	LOCTITE 243 THREADLOCKER				HENKEL CORPORATION (CT) (+1 860 571 5100)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	Available	06-Aug-2019
614	LOCTITE 262 THREADLOCKER HIGH STRENGTH				HENKEL CORPORATION (CT) (+1 860 571 5100)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	Available	12-Oct-2017
3035	LOCTITE 263				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	Available	22-Jan-2020
663	LOCTITE 406				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	No	-	-	-	None	Yes	Available	17-Jan-2020
96	LOCTITE 515 GASKET ELIMINATOR KNOWN AS LOCTITE 515 300ML AU				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	No	-	-	-	None	Yes	Available	25-Aug-2020
97	LOCTITE 567 THREAD SEALANT				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	No	-	-	-	None	Yes	Available	08-May-2020
98	LOCTITE 577				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	No	-	-	-	None	Yes	Available	18-Jan-2018
100	LOCTITE 620				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	No	-	-	-	None	Yes	Available	25-May-2020
3796	LOCTITE EA 3450A				HENKEL LOCTITE ADHESIVES LTD. UK (+353-1-4599301)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	-	14-Jun-2018
3330	LOCTITE MOLY PASTE				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
4138	LOCTITE PC 7227 (PART B) KNOWN AS NORDBAK BRUSHABLE CERAMIC GREY (PART B)				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	DG 8	UN 2735	PG III	2X	Approved	Yes	-	22-Jul-2016

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1895	LOCTITE PC 7227 PART A KNOWN AS LOCTITE NORDBAK BRUSHABLE CERAMIC GREY (PART A)				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	No	-	-	-	None	Yes	-	21-Jul-2016
3329	LOCTITE PC 8008 C5-A KNOWN AS LOCTITE C5A CO BSE A/S 42LB EN.				HENKEL AUSTRALIA PTY LTD (1800 032 379)				
	Yes	No	-	-	-	None	Yes	-	14-Nov-2019
581	M714C				CONTITECH AUSTRALIA PTY LTD (+61 3 9721 0611; +61 13 11 26)				
	Yes	DG 3	UN 3295	PG II	3YE	None	Yes	Available	31-Dec-2017
4196	MA TOLUENE				MINEHAN AGENCIES PTY LTD (13 11 26)				
	Yes	DG 3	UN 1294	PG II	3YE	Approved	Yes	Available	09-May-2017
22	MAGNAFLOC 1425				BASF AUSTRALIA LIMITED (1800 803 440 (24h)) (03) 8855 6666				
	No	No	-	-	-	Approved	Yes	-	13-Jul-2017
519	MAGNAFLOC 336				BASF AUSTRALIA LIMITED (1800 803 440 (24h)) (03) 8855 6666				
	No	No	-	-	-	Approved	Yes	-	14-Jul-2017
235	MAGNAFLOC 5250				BASF AUSTRALIA LIMITED (1800 803 440 (24h)) (03) 8855 6666				
	No	No	-	-	-	None	Yes	-	15-Nov-2020
505	MAGNAFLOC X110				BASF AUSTRALIA LIMITED (1800 803 440 (24h)) (03) 8855 6666				
	No	No	-	-	-	Approved	Yes	-	PRODUCT OBSOLETE
23	MAGNAFLOC X125				BASF AUSTRALIA LIMITED (1800 803 440 (24h)) (03) 8855 6666				
	No	No	-	-	-	Approved	Yes	-	PRODUCT OBSOLETE
4157	MAK BLOCK WEATHER PROOF RODENTICIDE				DE SANGOSSE AUSTRALIA PTY LTD (1800 033 111)				
	No	No	-	-	-	Approved	Yes	-	24-May-2021
3323	MARBIG ANTI-STATIC OFFICE WIPES (25620)				ACCO BRANDS AUSTRALIA (13 11 26 (Poison Information Centre))				
	No	No	-	-	-	None	Yes	-	28-Dec-2016
1820	MASTERFLOW 870				BASF AUSTRALIA LIMITED (1800 803 440 (24h)) (03) 8855 6666				
	Yes	No	-	-	-	None	Yes	-	06-Jun-2018
222	MEGAPOXY PF - PART A				VIVACITY ENGINEERING PTY LTD ((02) 9875 3044)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	-	05-Jan-2017
223	MEGAPOXY PF - PART B				VIVACITY ENGINEERING PTY LTD ((02) 9875 3044)				
	Yes	No	-	-	-	None	Yes	-	03-Jun-2021
8	MEGAPOXY PM - PART A				VIVACITY ENGINEERING PTY LTD ((02) 9875 3044)				
	Yes	DG 9	UN 3082	PG III	•3Z	Approved	Yes	Available	03-Jun-2021

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9	MEGAPOXY PM - PART B				VIVACITY ENGINEERING PTY LTD ((02) 9875 3044)				
	Yes	No	-	-	-	Approved	Yes	Available	03-Jun-2021
4132	MEGAPOXY RMF - PART A				VIVACITY ENGINEERING PTY LTD ((02) 9875 3044)				
	Yes	DG 9	UN 3082	PG III	•3Z	Approved	Yes	-	20-Jan-2017
4133	MEGAPOXY RMF - PART B				VIVACITY ENGINEERING PTY LTD ((02) 9875 3044)				
	Yes	No	-	-	-	Approved	No	-	20-Jan-2017
710	METHYL ISOBUTYL CARBINOL				INTERCHEM PTY LTD (1800 033 111; (03) 9663 2130)				
	Yes	DG 3	UN 2053	PG III	•3Y	None	Yes	Available	25-May-2021
110	METHYL ISOBUTYL CARBINOL				IXOM OPERATIONS PTY LTD (1800 033 111)				
	Yes	DG 3	UN 2053	PG III	•3Y	None	Yes	Available	13-Feb-2017
124	METHYLATED SPIRITS				RECOCHEM INC ((07) 3308 5200; 1300 131 001 (After hours)) 0800 764 766				
	Yes	DG 3	UN 1170	PG II	•2YE	None	Yes	Available	27-Aug-2020
4162	MICROWAX C POWDER				XRF CHEMICALS PTY LTD ((08) 9244 9600)				
	Yes	No	-	-	-	Approved	No	-	21-Sep-2020
3324	MIGHTY WIPE				NORTH QUEENSLAND CHEMICALS & PAINTS ((07) 4951 3988)				
	Yes	No	-	-	-	None	Yes	Available	22-Dec-2016
641	MOLYTEC NICKELTEC ANTI-SEIZE AEROSOL				MOLYTEC AUSTRALIA P/L ((07) 3245 2355)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	31-Jan-2021
274	MOLYTEC NICKELTEC ANTI-SEIZE LEAD FREE PASTE				MOLYTEC AUSTRALIA P/L ((07) 3245 2355)				
	Yes	No	-	-	-	None	Yes	-	31-Jan-2021
3383	MOP AND SHINE				GENESIS INDUSTRIAL PTY LTD (13 11 26)				
	Yes	No	-	-	-	None	Yes	-	09-May-2017
3300	MSA LENS CLEANER TOWLETTES CLEAR+CLEAN BX MINI (BOX 100)				OPTICA LIFE ACCESSORIES LIMITED (1800 199 860)				
	No	No	-	-	-	None	Yes	Available	27-Jun-2019
687	MULTOWEAR HARDENER				MULTOTEC PTY LTD ((07) 3200 8777)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	Available	PRODUCT OBSOLETE
688	MULTOWEAR RESIN				MULTOTEC PTY LTD ((07) 3200 8777)				
	Yes	DG 8	UN 1759	PG III	2X	None	Yes	Available	PRODUCT OBSOLETE
3891	MUNDICARE SKIN RELIEF POWDER				MUNDIPHARMA PTY LIMITED (1800 188 009)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE

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3581	NALCO 85395				NALCO WATER, AN ECOLAB COMPANY (AUST: 1800 205 506; NZ: 0800 734 607)				
	Yes	No	-	-	-	None	Yes	-	28-Mar-2019
1927	NALCOAG 3268				NALCO WATER, AN ECOLAB COMPANY (AUST: 1800 205 506; NZ: 0800 734 607)				
	No	No	-	-	-	None	Yes	-	17-Jun-2016
3747	NALFLOTE 9840				NALCO WATER, AN ECOLAB COMPANY (AUST: 1800 205 506; NZ: 0800 734 607)				
	No	No	-	-	-	None	Yes	-	24-Jun-2016
1931	NALFLOTE 9840 PLUS				NALCO WATER, AN ECOLAB COMPANY (AUST: 1800 205 506; NZ: 0800 734 607)				
	Yes	No	-	-	-	None	Yes	-	SDS DISCONTINUED
1929	NALFLOTE 9852				NALCO WATER, AN ECOLAB COMPANY (AUST: 1800 205 506; NZ: 0800 734 607)				
	No	No	-	-	-	None	Yes	-	SDS DISCONTINUED
1932	NALFLOTE 9858AU				ECOLAB PTY LTD (1800 205 506, +64 7 958 2372)				
	Yes	No	-	-	-	None	Yes	-	09-Jun-2016
3593	NITROGEN COMPRESSED				COREGAS PTY LTD (1300607577)				
	Yes	DG 2.2	UN 1066	-	2T	None	Yes	-	02-Jul-2019
662	NITROGEN, COMPRESSED				BOC LIMITED (AUSTRALIA) (1800 653 572 (24/7) (Australia only))				
	Yes	DG 2.2	UN 1066	-	2T	None	Yes	Available	23-Jun-2021
972	NYLOBOND				CONTITECH AUSTRALIA PTY LTD (+61 3 9721 0611; +61 13 11 26)				
	Yes	DG 3	UN 1133	PG II	•3YE	None	Yes	-	29-May-2017
1935	ONE SHOT KILLING POWER RAID KILLS INSECTS IN ONE SHOT MULTIPURPOSE INSECT KILLER ODOURLESS (APVMA 64887)				S.C. JOHNSON & SON PTY. LTD. (AUS) (13 11 26 (Poisons Information Centre)) (02) 9428 9111				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	-	19-Feb-2018
1926	OPTIMER 83372				ECOLAB PTY LTD (1800 205 506, +64 7 958 2372)				
	No	No	-	-	-	None	Yes	-	16-Aug-2017
3385	ORGANIC PLUS				NORTH QUEENSLAND CHEMICALS & PAINTS ((07) 4951 3988)				
	No	No	-	-	-	None	Yes	Available	31-May-2017
453	OXYGEN COMPRESSED				COREGAS PTY LTD (1300607577)				
	Yes	DG 2.2 / 5.1	UN 1072	-	2S	None	Yes	-	02-Jul-2019
179	OXYGEN, COMPRESSED				BOC LIMITED (AUSTRALIA) (1800 653 572 (24/7) (Australia only))				
	Yes	DG 2.2 / 5.1	UN 1072	-	2S	None	Yes	Available	23-Jun-2021
4127	OZCROP XTRAQATIC 450 HERBICIDE				OZCROP PTY LTD (1800 033 111)				
	Yes	DG 9	UN 3082	PG III	•3Z	Approved	Yes	-	31-Aug-2018

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4165	P10				COREGAS PTY LTD (1300607577)				
	Yes	DG 2.1	UN 1954	-	2SE	Approved	Yes	Available	29-Nov-2018
33	PALMOLIVE REGULAR DISHWASHING LIQUID ORIGINAL				COLGATE-PALMOLIVE PTY LTD ((02) 9037 2994)				
	Yes	No	-	-	-	Approved	Yes	-	16-Mar-2018
701	PARAGON ISO (ALL GRADES)				WHITMORE MANUFACTURING (1-800-699-6318; (972) 771-1000)				
	No	No	-	-	-	None	Yes	-	26-Feb-2019
491	PEA BEU LOW ALLERGENIC ODOURLESS INSECT KILLER AEROSOL				RB (HYGIENE HOME) AUSTRALIA PTY LTD (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2YE	Approved	Yes	Available	PRODUCT OBSOLETE
3486	PEA BEU LOW IRRITANT AEROSOL				RB (HYGIENE HOME) AUSTRALIA PTY LTD (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	-	15-Dec-2016
3318	PEA BEU RAPID KILL INSECT KILLER AEROSOL				RB (HYGIENE HOME) AUSTRALIA PTY LTD (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	-	PRODUCT OBSOLETE
133	PENETRENE BULK				QUICK SMART PRODUCTS (13 11 26 (Poisons Information Centre))				
	Yes	No	-	-	-	None	Yes	Available	03-Sep-2020
3485	PENETRENE SOFT SEAL				QUICK SMART PRODUCTS (13 11 26 (Poisons Information Centre))				
	Yes	DG 3	UN 1300	PG III	3Y	None	Yes	-	03-Sep-2020
960	PERFECTO T 32				CASTROL AUSTRALIA PTY LTD ((02) 8014 4568; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	19-Aug-2020
3595	PINE O CLEEN MULTIPURPOSE CLEANER TRIGGER EUCALYPTUS				RB (HYGIENE HOME) AUSTRALIA PTY LTD (13 11 26 (PIC))				
	Yes	No	-	-	-	None	Yes	-	14-Feb-2020
3049	POWERS POWERFOAM				STANLEY BLACK & DECKER AUSTRALIA PTY LTD (FORMERLY POWERS) ((02) 9186 1132; 1800 039 008)				
	Yes	DG 2.1	UN 1950	-	2Y	None	Yes	Available	PRODUCT OBSOLETE
429	PROBLOC SPF 50+ SUNSCREEN				PARAMOUNT SAFETY PRODUCTS (WA) ((08) 9301 7888)				
	No	No	-	-	-	None	Yes	Available	23-Jul-2020
1838	PROBLOC SPF 50+ SUNSCREEN				PARAMOUNT SAFETY PRODUCTS (WA) ((08) 9301 7888)				
	No	No	-	-	-	Approved	Yes	Available	23-Jul-2020
1919	PURE150 PRO COMPONENT B				STANLEY BLACK & DECKER AUSTRALIA PTY LTD (FORMERLY POWERS) ((02) 9186 1132; 1800 039 008)				
	Yes	DG 8	UN 3259	PG III	2X	None	Yes	Available	29-May-2018

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3319	Q QIK KLEAN [DELETED]				QUALITY AUTO TREATMENTS ((07) 3204 8511)				
	Yes	DG 3	UN 1300	PG III	3Y	None	Yes	-	08-Oct-2014
825	RAID COMMERCIAL INSECTICIDE ODOURLESS FLY AND INSECT KILLER				DIVERSEY AUSTRALIA PTY. LIMITED (1800 033 111 (24 hrs))				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	02-Feb-2018
3427	RAMSET CHEMSET INJECTION REO 502 (PART A)				RAMSETREID AU (A DIVISION OF ITW AUSTRALIA PTY LTD) (1800 033 111)				
	Yes	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
3428	RAMSET CHEMSET INJECTION REO 502 (PART B)				RAMSETREID AU (A DIVISION OF ITW AUSTRALIA PTY LTD) (1800 033 111)				
	Yes	DG 8	UN 3267	PG III	2X	None	Yes	-	PRODUCT OBSOLETE
661	RAMSET FOMOFILL				RAMSETREID AU (A DIVISION OF ITW AUSTRALIA PTY LTD) (1800 033 111)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	02-Jun-2021
4139	RAPP-IT PIPE REPAIR BANDAGE				MARINE & INDUSTRIAL MARKETING (13 11 26 (PIC))				
	Yes	No	-	-	-	Approved	Yes	-	24-Apr-2019
680	RHEOMAX ETD 9010				BASF AUSTRALIA LIMITED (1800 803 440 (24h)) (03) 8855 6666				
	No	No	-	-	-	None	Yes	-	15-Nov-2020
4197	RICHGRO GYPSUM CLAY BREAKER				RICHGRO GARDEN PRODUCTS ((08) 6258 7100; 1800 455 132)				
	No	No	-	-	-	Approved	Yes	-	09-Apr-2021
183	ROCOL NICKEL ANTI-SEIZE SPRAY				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	01-Nov-2019
48	ROCOL RTD COMPOUND				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 9	UN 3077	PG III	2Z	Approved	Yes	-	15-Apr-2021
184	ROCOL RTD SPRAY				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	01-Nov-2019
681	ROCOL WIRE ROPE SPRAY				ITW POLYMERS & FLUIDS PTY LTD (1800 385 556 / 0438 465 960/ 1800 039 008/ (03) 9573 3112)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	-	01-Nov-2019
1229	ROTO SYNTHETIC FLUID XTEND DUTY				ATLAS COPCO COMPRESSORS AUSTRALIA (1800 951 288/ (02) 9186 1132)				
	No	No	-	-	-	None	Yes	-	30-Oct-2019
498	ROTO-INJECT FLUID				ATLAS COPCO COMPRESSORS AUSTRALIA (1800 951 288/ (02) 9186 1132)				
	Yes	No	-	-	-	Approved	Yes	Available	01-Nov-2019
1915	RTD LIQUID #239-4852, 330-6244				RS COMPONENTS PTY LTD (1800 039 008; (03) 9573 3112)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	-	17-Feb-2017

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	Hazardous	Dangerous Good	UN number	Packing Group	Hazchem Code	Status	In Stock Inventory	Risk Assessment	SDS Date
3317	S-316L.16N				HYUNDAI WELDING CO. LTD. (+82 2 6230 6051~66)				
	Yes	No	-	-	-	None	Yes	-	10-Jan-2017
3998	S7E SPLICE SOLUTION				FENNER DUNLOP AUSTRALIA ((03) 9680 4500)				
	Yes	DG 6.1	UN 1710	PG III	2Z	None	Yes	-	05-Feb-2020
4175	SCOTT ALCOHOL ANTIBACTERIAL WIPE				KIMBERLY-CLARK AUSTRALIA PTY LTD ((02) 9963 8888; or 1800 647 994)				
	Yes	DG 4.1	UN 3175	PG II	1Z	Approved	Yes	Available	24-May-2017
1921	SELLEYS ARAIDITE SUPER STRENGTH EPOXY ADHESIVE - PART A				SELLEYS, A DIVISION OF DULUXGROUP (AUSTRALIA) PTY LTD (1800 033 111)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	-	23-Jul-2019
698	SEPTONE BODYGUARD SUNSCREEN 30+ INSECT REPELLENT				ITW AAMTECH AUSTRALIA (1800 039 008)				
	No	No	-	-	-	None	Yes	-	05-Jul-2017
3316	SEPTONE C-THRU				ITW AAMTECH AUSTRALIA (1800 039 008)				
	No	No	-	-	-	None	Yes	Available	01-Nov-2019
3482	SEPTONE C-THRU				ITW AAMTECH AUSTRALIA (1800 039 008)				
	No	No	-	-	-	None	Yes	Available	01-Nov-2019
115	SEPTONE CITRA SCRUB				ITW AAMTECH AUSTRALIA (1800 039 008)				
	Yes	No	-	-	-	None	Yes	Available	01-Aug-2017
119	SEPTONE DEGREASE IT DEGREASER 20L				ITW AAMTECH AUSTRALIA (1800 039 008)				
	Yes	DG 8	UN 1760	PG III	2X	None	Yes	Available	03-Sep-2020
4143	SEPTONE HEAVY DUTY DEGREASER				ITW AAMTECH AUSTRALIA (1800 039 008)				
	Yes	DG 3	UN 1223	PG III	3Y	Approved	Yes	-	03-Sep-2020
134	SEPTONE PROTECTA GRIT				ITW AAMTECH AUSTRALIA (1800 039 008)				
	No	No	-	-	-	None	Yes	-	01-Nov-2019
246	SEPTONE PROTECTA GUARD				ITW AAMTECH AUSTRALIA (1800 039 008)				
	No	No	-	-	-	None	Yes	-	01-Nov-2019
617	SEPTONE PROTECTA SUNSCREEN 30+				ITW AAMTECH AUSTRALIA (1800 039 008)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
135	SEPTONE SPRAY & WIPE				ITW AAMTECH AUSTRALIA (1800 039 008)				
	No	No	-	-	-	None	Yes	Available	01-Nov-2019
251	SEPTONE TW20				ITW AAMTECH AUSTRALIA (1800 039 008)				
	No	No	-	-	-	None	Yes	-	01-Nov-2019

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	Hazardous	Dangerous Good	UN number	Packing Group	Hazchem Code	Status	In Stock Inventory	Risk Assessment	SDS Date
3050	SHELL TELLUS S2 M 68 (FORMERLY TELLUS OIL 68)				VIVA ENERGY AUSTRALIA LTD (1800 651 818/ 13 11 26)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
4174	SIBELCO ATTUNGA HYDRATED LIME				SIBELCO AUSTRALIA LIMITED (1800 638 556)				
	Yes	No	-	-	-	Approved	Yes	Available	PRODUCT OBSOLETE
284	SIGNET STENCIL SPRAY - VARIOUS COLOURS				SIGNET PTY LTD ((07) 3245 5798; (07) 3364 2100)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	03-Feb-2017
3425	SIKADUR 52 PART A				SIKA AUSTRALIA PTY LTD (1800 033 111 (or 02 9757 5634 business hours))				
	Yes	DG 9	UN 3082	PG III	•3Z	Approved	Yes	Available	10-Aug-2018
3426	SIKADUR 52 PART B				SIKA AUSTRALIA PTY LTD (1800 033 111 (or 02 9757 5634 business hours))				
	Yes	DG 8	UN 1760	PG III	2X	None	Yes	Available	13-Oct-2018
102	SIKAFLEX 11FC				SIKA AUSTRALIA PTY LTD (1800 033 111 (or 02 9757 5634 business hours))				
	Yes	No	-	-	-	None	Yes	Available	22-Sep-2019
4186	SIKAFLEX PRO				SIKA AUSTRALIA PTY LTD (1800 033 111 (or 02 9757 5634 business hours))				
	Yes	No	-	-	-	Approved	Yes	-	29-Jul-2019
4188	SIKAFLEX PRO				SIKA AUSTRALIA PTY LTD (1800 033 111 (or 02 9757 5634 business hours))				
	Yes	No	-	-	-	Approved	No	-	29-Jul-2019
3594	SILICA GEL ORANGE				CHEM-SUPPLY PTY LTD (1-800-498-5701; 1-303-389-1414/ 1-800-424-9300; 1-703-527-3887/ (02) 9037 2994/ 1800-127-406 (Australia); +64-4-917-9888 (International))				
	No	No	-	-	-	None	Yes	-	31-Jul-2019
417	SIMALUBE				SIMATEC INC. ((704) 588 3320)				
	Yes	No	-	-	-	None	Yes	-	16-Jan-2020
3586	SKIN BASICS SORBOLENE LOTION & 10% GLYCERIN				PROBIOTEC PHARMA PTY LTD ((03) 9278 7555; 1800 620 898)				
	No	No	-	-	-	None	Yes	-	21-Aug-2018
1727	SODIUM HYDROXIDE PELLETS EXTRA PURE				THERMO FISHER SCIENTIFIC AUSTRALIA PTY LTD ((03) 9757 4559/ (02) 8014 4558)				
	Yes	DG 8	UN 1823	PG II	2W	Approved	Yes	-	04-Jul-2020
4147	SPHEEROL AP 3				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	Approved	Yes	-	14-Aug-2020
1166	SPOT MARKING PAINT - FLUORO COLOURS (RED, BLUE, ORANGE, PINK, GREEN, YELLOW, PURPLE)				SIGNET PTY LTD ((07) 3245 5798; (07) 3364 2100)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	01-Nov-2019

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	Hazardous	Dangerous Good	UN number	Packing Group	Hazchem Code	Status	In Stock Inventory	Risk Assessment	SDS Date
1130	SPREE TRADITIONAL DISHWASH HAND LIQUID - LEMON				COLGATE-PALMOLIVE PTY LTD ((02) 9037 2994)				
	No	No	-	-	-	None	Yes	-	30-Sep-2016
1190	SPRINGTIME				NORTH QUEENSLAND CHEMICALS & PAINTS ((07) 4951 3988)				
	No	No	-	-	-	None	Yes	-	31-Jan-2017
3477	STYRALUX - LEADED				AMERON (AUSTRALIA) (PAST DISTRIBUTOR - SEE PPG INDUSTRIES AUST) ((02) 9421 8000)				
	Yes	DG 3	UN 1263	PG II	•3YE	None	Yes	-	PRODUCT OBSOLETE
692	SUPERFINE TRANSFORMER OIL				HYDRODEC AUSTRALIA PTY LTD (+61 (02) 6382 5387)				
	Yes	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
4158	TALON XT PRO RODENTICIDE WAX BLOCKS				SYNGENTA AUSTRALIA PTY LIMITED (1800 033 111)				
	No	No	-	-	-	Approved	Yes	-	30-Nov-2016
3403	TANGIT KS CLEANER PE/PP/PB/PVDF SPECIAL CLEANER (UK)				HENKEL LTD (+44 (0)1442 278497)				
	Yes	DG 3	UN 1170	PG II	•2YE	None	Yes	-	16-Apr-2019
3384	TANGO				NORTH QUEENSLAND CHEMICALS & PAINTS ((07) 4951 3988)				
	No	No	-	-	-	None	Yes	-	31-Jan-2017
4159	TEMPRID 75 RESIDUAL INSECTICIDE				BAYER CROPSCIENCE PTY LTD (1800 033 111 (XOM Operations))				
	Yes	DG 9	UN 3082	PG III	•3Z	Approved	Yes	-	03-Feb-2021
4155	TERMIDOR RESIDUAL TERM.+INS.				BASF AUSTRALIA LIMITED (1800 803 440 (24h)/ (03) 8865 6666)				
	Yes	DG 9	UN 3082	PG III	•3Z	Approved	Yes	-	20-Jul-2018
4187	THERMIT SAND MOULDS				THERMIT AUSTRALIA PTY LTD ((02)4340 4988; (02) 9639 2486)				
	No	No	-	-	-	Approved	Yes	Available	15-Feb-2017
754	TIP TOP CEMENT SC 2000				REMA TIP TOP AUSTRALIA PTY LTD (1800 638 556/ (02) 8755 8400)				
	Yes	DG 6.1	UN 1710	PG III	2Z	None	Yes	Available	25-Jul-2017
4135	TIP TOP CEMENT SC 4000				REMA TIP TOP AUSTRALIA PTY LTD (1800 638 556/ (02) 8755 8400)				
	Yes	DG 3	UN 1133	PG II	•3YE	Approved	Yes	Available	25-Nov-2016
4154	TIP TOP HARDENER ER-42				REMA TIP TOP AUSTRALIA PTY LTD (1800 638 556/ (02) 8755 8400)				
	Yes	DG 3	UN 1133	PG II	•3YE	Approved	Yes	-	25-Apr-2018
4161	TIP TOP PRIMER PR 200				REMA TIP TOP AG (+49 (0) 6132 / 84463)				
	Yes	DG 3	UN 1263	PG II	•3YE	Approved	Yes	-	02-Mar-2018
1896	TOPGUM TL-T70 TRI-FREE				NILOS GMBH & CO. KG (+49 (0) 173 530 6827)				
	Yes	DG 6.1	UN 2810	PG III	2X	None	Yes	-	18-Mar-2019

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	Hazardous	Dangerous Good	UN number	Packing Group	Hazchem Code	Status	In Stock Inventory	Risk Assessment	SDS Date
690	TOTAL CARE				ITW AAMTECH AUSTRALIA (1800 039 008)				
	Yes	DG 8	UN 3264	PG III	2X	None	Yes	-	31-Dec-2016
277	TQ DEXRON III				BP AUSTRALIA PTY LTD (1800 14 14 74 within Australia or +61 2 8014 4558)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
4077	TRICHLOROETHYLENE				IXOM OPERATIONS PTY LTD (1800 033 111)				
	Yes	DG 6.1	UN 1710	PG III	2Z	None	Yes	-	15-Nov-2019
604	TRIX ANTI-BACTERIAL DISHWASH CONCENTRATE 1LTR				AWARE ENVIRONMENTAL PRODUCTS P/L (1800 061 801)				
	No	No	-	-	-	None	Yes	Available	31-May-2018
4125	ULTIMATE 2.0 ECO MAT				HYGIENE INNOVATIONS PTY LTD (+61 418985143)				
	No	No	-	-	-	Approved	Yes	-	24-May-2017
4126	ULTRAMAXX GRIT MASTER BLUE				ECOLAB PTY LTD (1800 205 506, +64 7 958 2372)				
	Yes	No	-	-	-	Approved	Yes	-	PRODUCT OBSOLETE
3326	ULTRATAK				CASTROL AUSTRALIA PTY LTD ((02) 8014 4558; 1800 141 474)				
	No	No	-	-	-	None	Yes	-	PRODUCT OBSOLETE
1928	ULTRION 44697				NALCO WATER, AN ECOLAB COMPANY (AUST: 1800 205 506; NZ: 0800 734 607)				
	No	No	-	-	-	None	Yes	-	10-Jun-2016
109	UNLEADED 91 (REGULAR UNLEADED PETROL)				BP AUSTRALIA PTY LTD (1800 14 14 74 within Australia or +61 2 8014 4558)				
	Yes	DG 3	UN 1203	PG II	3YE	None	Yes	Available	26-May-2021
25	UNLEADED PETROL				AMPOL AUSTRALIA PETROLEUM PTY LTD (FORMERLY CALTEX AUSTRALIA) (1800 033 111)				
	Yes	DG 3	UN 1203	PG II	3YE	Approved	Yes	-	26-Mar-2019
3746	VIOLET METHYLATED SPIRITS				RECOCHEM INC ((07) 3308 5200; 1300 131 001 (After hours)/ 0800 764 766)				
	Yes	DG 3	UN 1170	PG II	•2YE	None	Yes	-	27-Aug-2020
137	VISTA GREEN WHITEBOARD CLEANER				VISTA VISUALS AUSTRALIA (+61 (8) 9355 8200)				
	No	No	-	-	-	None	Yes	Available	01-Jan-2017
4164	VIVA BITUMEN C170				VIVA ENERGY AUSTRALIA LTD (1800 651 818/ 13 11 26)				
	No	DG 9	UN 3257	PG III	2Y	Approved	Yes	Available	06-Nov-2020
3599	WATERSHED 82258				ECOLAB PTY LTD (1800 205 506, +64 7 958 2372)				
	No	No	-	-	-	None	Yes	-	26-Sep-2016
659	WATTYL COLOURTHANE HARDENERS				VALSPAR PAINT (AUSTRALIA) PTY LTD (13 11 26)				
	Yes	DG 3	UN 1866	PG II	•3Y	None	Yes	Available	PRODUCT OBSOLETE

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685	WATTYL SPRAYMATE QD MATT BLACK				VALSPAR PAINT (AUSTRALIA) PTY LTD (13 11 26)				
	Yes	DG 2.1	UN 1950	-	2Y	None	Yes	Available	PRODUCT OBSOLETE
1917	WCC AEROSOL PAINTS				WHOLESALE CHEMICAL COMPANY PTY LTD ((02) 9673 4488)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	30-Apr-2021
3150	WCC AEROSOL PAINTS				WHOLESALE CHEMICAL COMPANY PTY LTD ((02) 9673 4488)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	Available	30-Apr-2021
409	WCC SILVER ZINC AEROSOL				WHOLESALE CHEMICAL COMPANY PTY LTD ((02) 9673 4488)				
	Yes	DG 2.1	UN 1950	-	2YE	Approved	Yes	Available	01-Nov-2019
4131	WD-40 AEROSOL (2018)				WD-40 COMPANY (AUST) PTY LTD (1800 024 973)				
	Yes	DG 2.1	UN 1950	-	2YE	Approved	Yes	-	05-Jul-2018
3179	WEARSTOP RAPID SET TROWELABLE - PART A				WEIR MINERALS AUSTRALIA LTD (NSW) ((02) 9934 5100/ 1800 039 008)				
	Yes	DG 9	UN 3082	PG III	•3Z	None	Yes	Available	01-Nov-2019
676	WEATHERBLOCK ACRYLIC SEMI GLOSS				APCO COATINGS (A DIVISION OF ASIAN PAINTS (QLD) PTY LTD) (1800 033 111)				
	No	No	-	-	-	None	Yes	-	10-Jul-2017
4087	WEEDMASTER DST DUAL SALT TECHNOLOGY HERBICIDE				NUFARM AUSTRALIA LIMITED (1800 033 498)				
	Yes	No	-	-	-	None	Yes	-	22-May-2017
1916	WHITE KNIGHT SQUIRTS GOLDEN YELLOW AEROSOL				PPG ARCHITECTURAL COATINGS (1800 883 254/ 0800 000 096)				
	Yes	DG 2.1	UN 1950	-	2YE	None	Yes	-	26-Oct-2020
980	WIAAUSTARC 12P				WELDING INDUSTRIES OF AUSTRALIA (WIA) (+61 8 8372 0609; +61 419 864 812 (After Hours))				
	Yes	No	-	-	-	None	Yes	Available	11-Jan-2019
1050	WIAAUSTARC 16 TC				WELDING INDUSTRIES OF AUSTRALIA (WIA) (+61 8 8372 0609; +61 419 864 812 (After Hours))				
	Yes	No	-	-	-	None	Yes	Available	22-Mar-2018
3382	WILD RANGE OF LIQUID SOAPS				NORTH QUEENSLAND CHEMICALS & PAINTS ((07) 4951 3988)				
	No	No	-	-	-	None	Yes	-	31-Jan-2017
35	WINDEX GLASS ORIGINAL				S.C. JOHNSON & SON PTY. LTD. (AUS) (13 11 26 (Poisons Information Centre)/ (02) 9428 9111)				
	No	No	-	-	-	Approved	Yes	Available	14-Aug-2017
12	WRM 80T PART A				CHEMTURA SPECIALTIES AUSTRALIA PTY LTD (+61 2 8814 5546)				
	Yes	No	-	-	-	Approved	Yes	Available	12-Jul-2016
13	WRM 80T PART B				CHEMTURA SPECIALTIES AUSTRALIA PTY LTD (+61 2 8814 5546)				
	Yes	No	-	-	-	Approved	Yes	Available	12-Jul-2016

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14	WRM 80T PART C				CHEMTURA SPECIALTIES AUSTRALIA PTY LTD (+61 2 8814 5546)				
	No	No	-	-	-	Approved	Yes	Available	12-Jul-2016
287	ZINC IT				CRC INDUSTRIES (AUST) PTY LIMITED (13 11 26 (PIC))				
	Yes	DG 2.1	UN 1950	-	2Y	None	Yes	Available	13-Jul-2021
658	ZINCPREP 358 PRIMER				AMERON (AUSTRALIA) (PAST DISTRIBUTOR - SEE PPG INDUSTRIES AUST) ((02) 9421 8000)				
	Yes	DG 3	UN 1263	PG II	•3YE	None	Yes	Available	PRODUCT OBSOLETE

Appendix 10 Red Mountain Infrastructure PRCP Risk Assessment Matrix

Red Mountain Infrastructure Risk Assessment Progressive Rehabilitation and Closure Plan Risk Event* (Unplanned/unwanted event)		Scenario	Causes (Related to risk event)	Impact Description*	MFL Basis* (Absolute worst-case scenario, with no controls in place)	Highest MFL	Mitigating Controls	Severity Impact Description* (Taking into account the effectiveness of existing mitigating controls)	Highest Severity		Preventative Controls	Likelihood Basis* (Chance of the impact at the severity which is being used in the calculation of the RRR, taking into account the effectiveness of existing preventative)	Likelihood	Likelihood*	RRR
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	2	Alteration of hydrogeological conditions	Release of contaminants to groundwater Change in groundwater recharge and discharge characteristics resulting in changes to the hydrogeological system. (As there are no voids/underground workings or groundwater extraction on site, RMI closure landforms will not include significant influences on groundwater levels)	Groundwater chemistry altered rendering it not suitable for extraction and use within PMLU. Degradation of stygofauna ecosystems, if present Degradation of terrestrial and aquatic groundwater dependant ecosystems (GDEs) Groundwater quality not supporting the establishment/maintenance of Environmental Values and Water Quality Objectives for the basins in which the site is located	Changes to the quality of groundwater aquifers that render water within the aquifers unsuitable for stock watering and maintenance of ecosystems. Groundwater treatment unlikely to be a feasible to return groundwater quality to condition similar to pre-impact in a MFL scenario. If this occurred: a Site Management Plan (prepared under the EP Act) may be required to manage groundwater impacts in the impacted area; landforms/rehabilitation designs may need to be altered; and existing groundwater bores may need to be relocated. Implementation of the SMP, design	3	Assessment and remediation of impacted material, where appropriate Development and approval of a Site Management Plan to assist with on-going management and restriction to future land use activities where appropriate. Implementation of management controls and monitoring programs outlined in an approved Site Management Plan Re-establishment of impacted ecosystems and rehabilitation landforms Decommissioning of impacted extraction wells and re-instatement in suitable location	Degradation of groundwater quality. Regional groundwater likely to report to surrounding mining voids acting as a sink (low risk receptor). Low AMD risks identified. Rehabilitated landforms will not be dominant influence on groundwater elevations. GDE's, if present, would be associated with the Alluvial perched aquifer which is not known to be beneath the operational areas of the site. Restriction to future site use could include: no groundwater extraction for stock watering, no construction of dams or other landforms that	2	30	All imported hazardous materials are to be stored and used in accordance with relevant standards and removed from site on completion of the processing works. At the completion of operations, all hazardous materials and infrastructure that have the potential to release contaminants to groundwater will be removed from site. Contaminated land investigation to be undertaken at the completion of operations to identify contamination that has the potential to cause impacts to groundwater. Implementation of remediation and/or management plans as required to reduce potential groundwater impact risks Dams and tailing drying cells to be backfilled and contoured to minimise standing water and generation of leachate Groundwater and ecosystem monitoring to be undertaken	Low potential for AMD issues identified. Existing monitoring data has not confirmed the presence of groundwater impacts that would currently impact future land uses or the receiving environments. GDEs if present would be associated with the alluvial aquifer beneath New Chum Creek, which is assumed to be perched and unlikely to be recharged by the regional aquifer (CDM Smith 2021).	Unlikely	0.1	3

Red Mountain Infrastructure Risk Assessment Progressive Rehabilitation and Closure Plan Risk Event* (Unplanned/unwanted event)		Scenario	Causes (Related to risk event)	Impact Description*	MFL Basis* (Absolute worst-case scenario, with no controls in place)	Highest MFL	Mitigating Controls	Severity Impact Description* (Taking into account the effectiveness of existing mitigating controls)	Highest Severity		Preventative Controls	Likelihood Basis* (Chance of the impact at the severity which is being used in the calculation of the RRR, taking into account the effectiveness of existing preventative)	Likelihood	Likelihood*	RRR
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
					and implementation of landforms/rehabilitation and relocation of bores likely to take 1 to 3 years. Natural attenuation of groundwater impacts likely to take >10years.			could increase generation of leachate, maintenance of cover material used to prevent complete exposure pathways; and restriction of rehabilitation species used to minimise potential uptake and bioaccumulation. This will not prevent attainment of PMLUs associated with grazing or woodland. Site Management Plan and other controls could be implemented within 1-3 years.			in accordance with EA conditions				

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Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	3	Alteration of surface water systems	Release of contaminants to surface water resources Changes to alignments and ecosystems of drainage lines and creek Changes to hydraulic flows Changes to flood patterns/distribution Alteration of surface water infiltration rates Surface water flows over unvegetated/disturbed soils where rehabilitation has not re-established Overland discharges from neighbouring landforms and rehabilitated areas	Surface water chemistry altered rendering it not suitable for PMLU Degradation of ecosystems and land uses connected to surface water flows and floodplains on and down gradient of the mine Sedimentation of downstream surface water drainage lines resulting in changes to their hydraulic properties and impacting ecosystems Surface water quality not supporting the establishment/maintenance of Environmental Values and Water Quality Objectives for the basins in which the mine is located. Accelerated erosion rates from surface water	Changes to the quality and quantity of surface waters that render it not suitable for proposed final land use of grazing or results in degradation of ecosystems. If this occurred additional remediation, alteration of final landforms, or implementation of a Site Management Plan may be required. Alteration of landforms and implementation of Site Management Plan likely to take 1-3 years, and re-establishment of ecosystems and rehabilitation likely to take 3-5 years in MFL scenario.	3	Surface water monitoring data to be collected in accordance with the EA. If impacts are identified, further investigations will be undertaken to determine appropriate remedial measures Any loss of hazardous contaminants that cause contaminated land/environmental harm will be reported and investigated as appropriate Remedial works will be undertaken where releases from site result in impacts to surface waters, which may include alteration of the landforms, implementation of a Site Management Plan, implementation of additional controls/measures	Low potential for AMD risks. Final landform does not include voids, waste dumps with AMD risks, tailing disposals or significant landforms with the potential for erosion. 100m buffer to the creek to be reinstated at the existing creek crossings. Rectification works to resolve factors contributing to surface water impacts likely to take less than 1 year.	2	30	All imported hazardous materials to be stored and used in accordance with relevant standards and removed from site on completion of operations Dams and drying cells will be backfilled / free draining Surface water monitoring to be undertaken in accordance with EA conditions 100 m buffer bordering New Chum Creek to remain and culverts associated with the haul road and rail to be removed from buffer Monitoring of surrounding ecosystems will be undertaken in accordance with EA conditions A contaminated land investigation will be undertaken at the completion of operations and remediation works undertaken as appropriate. Rehabilitation of disturbed areas will be undertaken as soon as practical after the completion of operations	AMD very low risk, final landform low risk and any infrastructure with potential to cause contamination and are to be removed at the completion of works. Culverts to be removed and creek alignments to be reinstated.	Unlikely	0.1	3

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Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
				flows in disturbed areas and degraded ecosystems. Reduction in rehabilitation success rates due to reduced surface water quality Alteration of soil properties associated with contaminants carried by surface waters, including erodability and geotechnical qualities			that reduce the potential for surface water impacts and/or re-establishment of impacted ecosystems where appropriate								
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	4	Contaminated land impacting on environmental receptors, rehabilitation and attainment of PMLUs at RMI	Discharges and accumulation of hazardous contaminants from operational activities.	Contaminants present within soil or water that present an unacceptable risk to the environment or PMLU Alteration of soil chemistry that impacts on structural characteristics Contaminants reducing the soil suitability for rehabilitation species	Impact to surrounding and receiving ecosystems Failure of landforms Failure of revegetation Failure to attain closure criteria Regulatory enforcement action Active remediation and ongoing management requirement	3	Cleaning up of spills upon identification Investigate and remediate contamination incidents Implement a Site Management Plan to manage impacts Restrict site usage Undertake ongoing monitoring to manage contaminated land risks	Investigation and remediation/management of contamination upon identification will reduce the risk of potential impacts. Contaminated land impacts that present an unacceptable risk to the environment or PMLU could be reasonably remediated/managed within 1 to 3 years.	3	100	All hazardous materials including tailings and operational materials to be removed at closure Contaminated land investigation to be undertaken at closure and areas of contamination remediated and/or managed as appropriate On-going surface water and groundwater monitoring will provide an indication of contamination	The contaminated land investigation and remediation/management works will render the site suitable for the intended PMLUs and reduce the potential for any environmental harm. With operational sources of hazardous materials and all tailings removed from site, the likelihood of contaminated land impacts preventing attainment of closure criteria is highly unlikely.	Highly Unlikely	0.03	3

Red Mountain Infrastructure Risk Assessment Progressive Rehabilitation and Closure Plan Risk Event* (Unplanned/unwanted event)		Scenario	Causes (Related to risk event)	Impact Description*	MFL Basis* (Absolute worst-case scenario, with no controls in place)	Highest MFL	Mitigating Controls	Severity Impact Description* (Taking into account the effectiveness of existing mitigating controls)	Highest Severity		Preventative Controls	Likelihood Basis* (Chance of the impact at the severity which is being used in the calculation of the RRR, taking into account the effectiveness of existing preventative)	Likelihood	Likelihood*	RRR
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
					Indefinite reduction in site suitability and/or contaminated land management MFL scenario potentially could include contamination that is not viable to remediate and requires indefinite on-going management. Remediation/installation of management measures (including capping, redesign of landforms and reinstatement of rehabilitation) could take between 5 to 10 years.										
Risk Event* (Unplanned/unwanted event)	Scenario #	Scenario	Causes (related to risk event)	Impact Description*	MFL Basis* (Absolute worst case scenario, with no controls in place)	Highest MFL	Mitigating Controls	Severity Impact Description* (taking into account the effectiveness of existing mitigating controls)	Highest Severity	Severity Factor	Preventative Controls	Likelihood Basis* (chance of the impact at the severity which is being used in the calculation of the RRR, taking into account the effectiveness of existing preventative)	Likelihood	Likelihood*	RRR

Red Mountain Infrastructure Risk Assessment Progressive Rehabilitation and Closure Plan Risk Event* (Unplanned/unwanted event)		Scenario	Causes (Related to risk event)	Impact Description*	MFL Basis* (Absolute worst-case scenario, with no controls in place)	Highest MFL	Mitigating Controls	Severity Impact Description* (Taking into account the effectiveness of existing mitigating controls)	Highest Severity		Preventative Controls	Likelihood Basis* (Chance of the impact at the severity which is being used in the calculation of the RRR, taking into account the effectiveness of existing preventative)	Likelihood	Likelihood*	RRR
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
						Level			Severity						
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	5	Flooding influences on rehabilitation and RMI final landforms	Water inundation of landforms Saturation of materials within landforms Velocities of floodwaters on rehabilitated landforms	Reduction in geotechnical stability of landforms causing failure of the landforms Activation of dispersive materials resulting in accelerated erosion and sedimentation Mobilisation of any contaminants contained within the landforms and impacts to downstream water and groundwater quality Alteration of terrestrial ecology through introduction of weeds, sedimentation, or	MFL Scenario: Failure of landforms potentially resulting in: accelerated mobilisation of material; physical and ecological damage; spreading of weeds; failure of rehabilitation; failure to meet closure criteria and PRC plan schedules; damage to transport infrastructure; increased flooding of upstream catchments and damage to infrastructure/property.	3	Assessment of landform failure and required rectification works upon safe access to site immediately after the flood event. Assessment to include identification of measures that would limit potential for on-going impacts. Re-engineering of landforms to mitigate future failures followed by re-construction of landforms, and rehabilitation works. Assessment of downstream impacts and undertake	Mitigation controls do not reduce Highest Severity	3	100	Removal of all BMC infrastructure, decommissioning of dams and removal of tailings and other contaminated material where required for disposal off site Re-establishment of landforms that are safe and stable with slopes ≤10% and at least 100m from New Chum Creek Re-shaping of the ROM pad to reduce batter grades or implementation of other measures that stabilise the landform, where appropriate Removal of the Millennium haul road and rail line fill material and culvert from the 100m New Chum Creek buffer zone Fill dams and tailing drying cells to form free draining surface	Preventative controls include returning rehabilitated landforms to a condition that is consistent with the pre-operational setting and will not include dams, voids or other structures that have a higher potential of failure during flood events. Therefore, the likelihood of the impacts associated with landform and rehabilitation failures due to flooding, is highly unlikely and not expected to occur within a 50 year period.	Highly Unlikely	0.03	3

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Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
				damage to select rehabilitation species Erosion of landforms due to increased velocities of flood waters Introduction of weeds and impacts to rehabilitation vegetation establishment	Landform failure, resulting in mobilisation of sediment could impact on-site and downstream watercourses through sediment deposition which in-turn impacts stream hydraulics and ecosystems. Rectification works could require re-establishment of the landform, watercourse rectification works and re-establishment of vegetation and ecosystems both on and off site. Conservative estimate of time required would be 3-5 years however absolute worst case scenario would be 5- 10 years.		remediation/rehabilitation as required to re-establish drainage line hydraulics and ecosystems in liaison with the administering authority.				Establishment of vegetation suitable for the environment and reduces erosion risks Undertake monitoring for potential landform risks and undertake rectification works to attain PRC plan closure criteria			0.03	

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Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	6	Rehabilitated landforms resulting in alteration of flood hydrology upstream and downstream	Changes to drainage network hydraulics. Artificial landforms reducing or increasing flood extent and changing velocities/flows. Changes to vegetation cover and soil type which alter runoff and infiltration rates.	Final landforms that reduce the capacity of floodplains, concentrate flows or alter hydraulics of drainage lines have the potential to alter flood regimes by changing flood extents/depths, velocities, durations and frequency. This scenario considers impacts to surrounding areas that could result from altered flood regimes including: Increasing/decreasing of flood extents, frequency and severity Degradation of floodplain ecosystems Degradation of ecosystems which were not previously subject to flooding due to water inundation	MFL scenario could include: flooding of surrounding mine voids; degradation of the geotechnical stability or damage to rehabilitation on surrounding landforms including waste dumps and diversions; damage to infrastructure or property on surrounding properties; product delivery interruptions passing through surrounding transport corridors; stock loss on grazing areas; health and safety risks to transport corridor users; damage to ecosystems; and damage to creek lines/hydraulics. Rectification works likely to take 1 to 3 years.	3	Due to the off-site nature of the impacts, which occur during significant flood events, available mitigating controls at the time of the impact are limited due to safety and accessibility restrictions. After flooding has receded, landform design and alteration could be undertaken to reduce possible future events.	Mitigation controls do not reduce Highest Severity	3	100	Removal of all BMC infrastructure, decommissioning of dams and removal of tailings and other contaminated material for disposal off site. Removal of culverts associated with haul roads/rail/access roads over New Chum Creek and within the buffer 100m zone to reinstate to a condition similar to pre-operational landform. Establishment of landforms that are safe and stable Undertake monitoring and maintenance works where required to maintain landforms.	With preventative controls implemented, identified impacts associated with alteration of flood hydrology are highly unlikely and not expected to occur within a 50 year period.	Highly Unlikely		3

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Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
				Infrastructure damage Impacts to surrounding mine site landforms from increased flood heights or flood velocities Health and safety risks to on-site and off-site land users associated with increased flood heights, velocities and frequency											
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	7	Insufficient, inadequate or inappropriate soil and capping material required for rehabilitation activities	Poor soil fertility Unstable material (erosive, dispersive, saline materials) Weed infestation Disturbance by fauna (movement, burrowing, etc.) Potential insufficient placement depth and surface treatment Incorrect soil characterisation and amelioration requirements Insufficient topsoil quantity	Erosion Sediment transport Topsoil loss Failure of vegetation (poor vegetation growth or incorrect vegetation affecting PMLU) Saline run off from process areas into New Chum Creek	Total failure of vegetation in rehabilitation areas.	3	Monitoring of soil and spoil profile and landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works. Repair erosion areas, retest soil and revegetate.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Initial topsoil survey, mapping and material balancing Review the topsoil material balance periodically during operations to ensure sufficient volumes for the rehabilitation needs. Undertake rehabilitation planning and preparation in accordance with the specific requirements for soil, seed and management for a grazing and woodland habitat PMLU Management of topsoil stockpiles and application during rehabilitation. Topsoil assessment by suitably qualified person to determine ameliorant and fertiliser requirements.	With all controls in place including ongoing monitoring and maintenance would mean that insufficient, inadequate or inappropriate soil for use on rehabilitation is unlikely	Unlikely	0.1	1

Red Mountain Infrastructure Risk Assessment Progressive Rehabilitation and Closure Plan Risk Event* (Unplanned/unwanted event)		Scenario	Causes (Related to risk event)	Impact Description*	MFL Basis* (Absolute worst-case scenario, with no controls in place)	Highest MFL	Mitigating Controls	Severity Impact Description* (Taking into account the effectiveness of existing mitigating controls)	Highest Severity		Preventative Controls	Likelihood Basis* (Chance of the impact at the severity which is being used in the calculation of the RRR, taking into account the effectiveness of existing preventative)	Likelihood	Likelihood*	RRR
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
			Inappropriate topsoil stockpiling and management												
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	8	Insufficient identification and management of waste characterisation	Poor material characterisation Geochemistry not correctly defined for materials stored in permanent landforms Inappropriate placement of adverse material Poor landform execution Inappropriate management strategy Generation and release of AMD from coal processing waste and / or coal during operation accumulating in GW, SW, soils	Release of contaminants to surface and groundwater from rehabilitated landforms. Vegetation failure Water cannot be used by end user (human and ecosystem) Erosion	Significant quantities of carbonaceous interburden/overburden in ROM pad leading to vegetation failure and impact to water.	3	- Monitoring of soil and spoil profile and landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Material characterisation during operations if additional infill is required for the ROM pad Remove and / or cover undesirable materials and redo rehabilitation	With all controls in place including ongoing monitoring and maintenance would mean that insufficient, inadequate or inappropriate soil for use on rehabilitation is unlikely	Unlikely	0.1	1

Red Mountain Infrastructure Risk Assessment Progressive Rehabilitation and Closure Plan Risk Event* (Unplanned/unwanted event)		Scenario	Causes (Related to risk event)	Impact Description*	MFL Basis* (Absolute worst-case scenario, with no controls in place)	Highest MFL	Mitigating Controls	Severity Impact Description* (Taking into account the effectiveness of existing mitigating controls)	Highest Severity		Preventative Controls	Likelihood Basis* (Chance of the impact at the severity which is being used in the calculation of the RRR, taking into account the effectiveness of existing preventative)	Likelihood	Likelihood*	RRR
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
			Contaminants (including drying cells)												
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	9	Inadequate and/or inappropriate revegetation	Unfavourable climatic conditions and/or weather events Incorrect species mix Poor seed quality Weed contaminated seed Poor quality topsoil or seed bed preparation Erosion Land contaminants	Exposed soils due to poor vegetation establishment and growth, resulting in enhanced erosion rates. Increased weed establishment and growth. Reduction in land capability of PMLU (woodland habitat and/or grazing) - reduced availability of land for woodland habitat and / or grazing (erosion), as well as inhibited growth of preferred species Need for ongoing corrective action - soil sampling and analysis,	Total failure of vegetation in rehabilitation areas.	3	Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works. Repair erosion areas, retest soil, review seed mix and revegetate Rehabilitation monitoring of revegetated native species and pasture species presence and abundance	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Topsoil assessment by suitably qualified person to determine ameliorant and fertiliser requirements. Management of seed selection and quality. Plant at optimal time of year. Revegetation species aligned to growth media, landforms and PMLU	With all controls in place, including revegetating with species aligned to growth media, landforms and PMLUs, as well as monitoring and maintenance activities, would mean that total failure of revegetation is unlikely.	Unlikely	0.1	1

Red Mountain Infrastructure Risk Assessment Progressive Rehabilitation and Closure Plan Risk Event* (Unplanned/unwanted event)		Scenario	Causes (Related to risk event)	Impact Description*	MFL Basis* (Absolute worst-case scenario, with no controls in place)	Highest MFL	Mitigating Controls	Severity Impact Description* (Taking into account the effectiveness of existing mitigating controls)	Highest Severity		Preventative Controls	Likelihood Basis* (Chance of the impact at the severity which is being used in the calculation of the RRR, taking into account the effectiveness of existing preventative)	Likelihood	Likelihood*	RRR
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	1	Landform failure (Reshape of landform - 70% < 3% slope, free-draining)	Erosion instability Geotechnical instability Differential settlement (backfilled dams and drying cells) Insufficient surface cover to maintain PMLU. Flooding and/or extreme weather events	Erosion (including New Chum Creek) Sediment transport Topsoil loss Failure of vegetation Slumping and settlement Mass movement of landform Exposure of less desirable materials in the dump or backfill	Erosion 2x40m section of the creek impacted Take a year to remediate	2	- Monitoring of landform stability and rehabilitation success to be undertaken post operations to confirm stability and identify requirements for rectification works.	Monitoring identifies any failure and limits the time before repairs are scheduled.	1	10	Minimise slope gradients of landform structures. Landform structures reshaped to be free-draining and blended in with surrounding area. Surface cover including vegetation to provide erosion resistance. Rehabilitation associated with New Chum Creek will include re-profiling of the landform consistent with surrounding bed and banks and revegetation with riparian species in accordance with riverine protection permits and/or operational works permits as required.	With all controls in place including ongoing monitoring and maintenance would mean that landform failure on a large scale for this landform is unlikely	Unlikely	0.1	1
				amelioration and re-vegetation.											
Stable condition (safe, stable, non-polluting and sustainable) for land described as a post-mining land (reference PMLU table E1 - cattle grazing, woodland habitat, water course) use is not achieved	10	Deterioration of built infrastructure conditions	1. Potential soil contamination around mine industrial areas	Reduced soil fertility to support PMLU land capability (woodland habitat and grazing). Potential contamination of surface water runoff affecting integrity of local catchments.		1	Undertake a preliminary contaminated land assessment prior to the completion of the approved activities, identify if any areas require a further Detailed Site Investigation and remediation plan developed if required. Conduct ongoing maintenance		1	10	Clean up and remediate contamination during operational period. Undertake PSI contaminated land assessment post mining to identify any areas requiring further DSI	With all controls in place including ongoing monitoring and maintenance would mean that deterioration of built infrastructure is unlikely	Unlikely	0.1	1

Appendix 11 Approach to Evaluating Water Milestone Criteria

For the purpose of the PRCP Schedule, the application of the nominated water milestone criteria will follow the decision tree framework approach outlined in Section 3.3 of the *ANZECC/ARMCANZ 2000 Water Quality Guidelines* (ANZECC/ARMCANZ (2000): Water Quality Guidelines (Section 3.3 Physical and Chemical Stressors) as shown below in Figure 26.

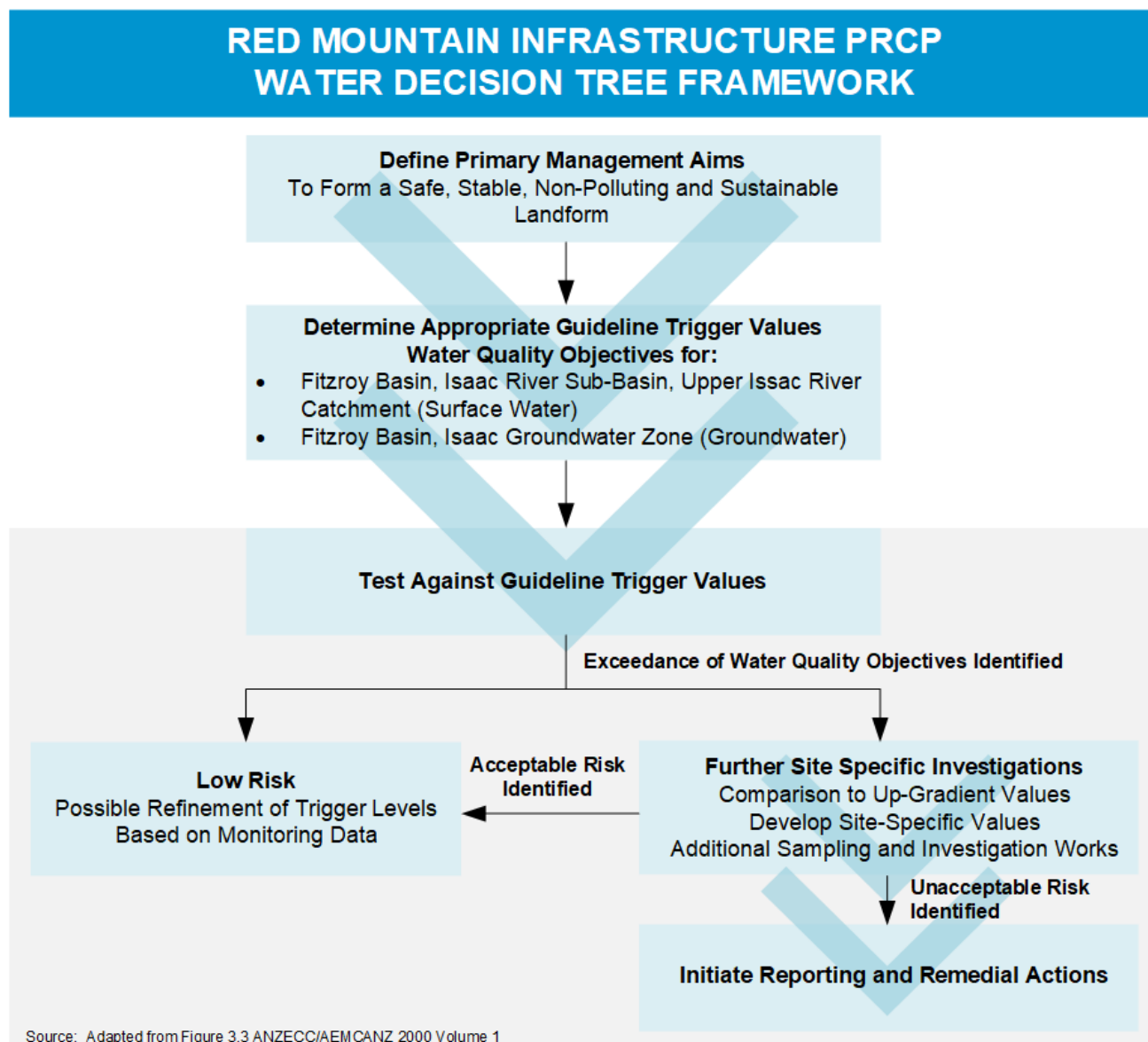


Figure 26: Water Decision Tree Framework (Adapted from ANZECC/ARMCANZ, 2000)

To evaluate compliance with the water quality related milestone criteria and to assist with the application of SMART principles, the following three step water data evaluation process will be undertaken.

Data Evaluation Step 1

This step will compare receiving environment/down gradient water monitoring results against the EPP Water Quality Objectives (WQOs) for the following:

- For surface water, the for the Fitzroy Basin, Isaac River Sub-Basin, Upper Isaac River Catchment; and
- For groundwater, the Fitzroy Basin, Isaac Groundwater Zone.

Sampling of surface waters will need to be undertaken opportunistically as outlined in Section 8.3.1. Should climatic conditions over extended periods prevent the collection of surface water samples due to insufficient

flows at the nominated receiving environment sample locations, the site will not be in breach of the milestone criteria, as no significant surface water discharges would have occurred.

Surface water quality variability within the temporal waters is anticipated due to factors outside of the control of BMC, such as: weather patterns; upstream land user activities; frequency/magnitude of surface water flows; and condition of groundcover up gradient and within the catchment. Therefore, further evaluation of collected surface water data may be required in the form of Step 2 outlined below.

Groundwater monitoring is to be undertaken at the frequency and methodologies outlined within Section 8 of the PRC plan for the EA rehabilitation acceptance criteria of electrical conductivity. Where groundwater monitoring results indicate an exceedance of the WQO, further evaluation of the collected data may be required in the form of Step 2 outlined below.

Data Evaluation Step 2

This step will compare the independent populations of the receiving and background/up gradient environments. The evaluation will be undertaken through statistical evaluation to determine if the mean results of the independent populations are significantly different. For the purpose of determining significantly different, the following statistical approach shall apply:

- Independent Populations: up gradient mean and down gradient mean (over a maximum monitoring period of five years, sample locations shown in Figure 22).
- Null Hypothesis: up gradient mean = down gradient mean.
- Alternative Hypothesis: up gradient mean $\neq$ down gradient mean.
- Significance level: 0.1
- The statistical method to be utilised will account for the sample population size and the distribution of the data.

Where Data Evaluation Step 2 identifies a potentially significant difference between the up gradient mean and down gradient mean results, further evaluation may be deemed required in the form of Step 3 outlined below.

Data Evaluation Step 3

In accordance with the ANZECC/ARMCANZ water decision tree framework and the preferential approach to the derivation of site-specific toxicant guideline values, Step 3 includes additional investigation and development of site-specific criteria where a statistical significant difference between up gradient mean and down gradient environment sample locations is identified.

The development of surface water site-specific criteria will be undertaken using the Commonwealth of Australia guidance: Assessing and managing water quality in temporary waters¹². The development of groundwater site-specific criteria will be undertaken using the latest version of the Queensland Water Quality Guidelines.

The aim of Step 3 is to take into consideration the specific environment in which the site is located including a more thorough investigation of the receptors and potential risks associated with any identified exceedance. This step will require suitable data sets and to be undertaken by appropriately qualified persons.

Figure 27 provides a flow diagram of the approach to surface water data evaluation.

RED MOUNTAIN INFRASTRUCTURE PRCP - WATER EVALUATION PROCESS

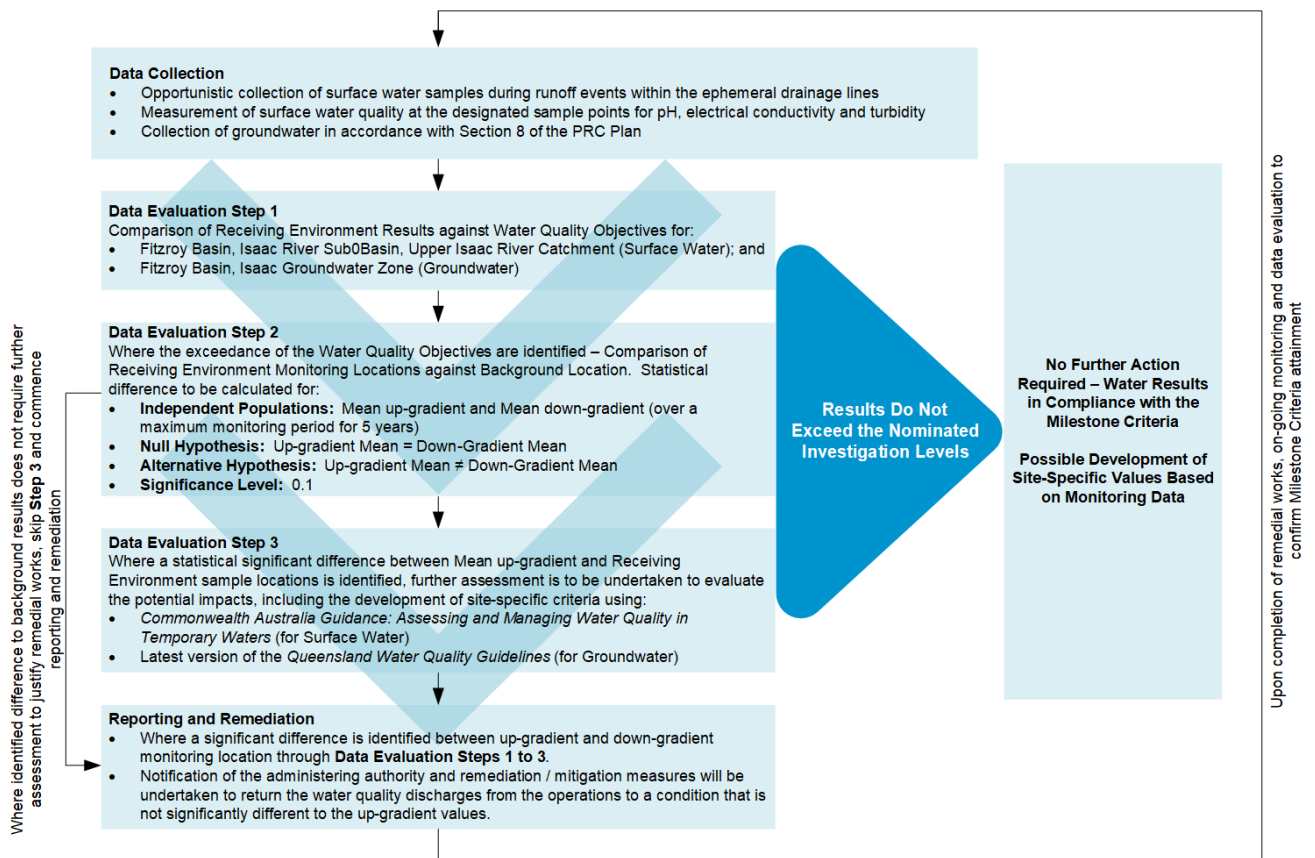


Figure 27: Red Mountain Infrastructure – Water Data Evaluation Flow Diagram