

Revegetation Plan

Blair Athol Coal Mine

Progressive Rehabilitation and Closure Plan

Prepared for TerraCom Limited | September 2025

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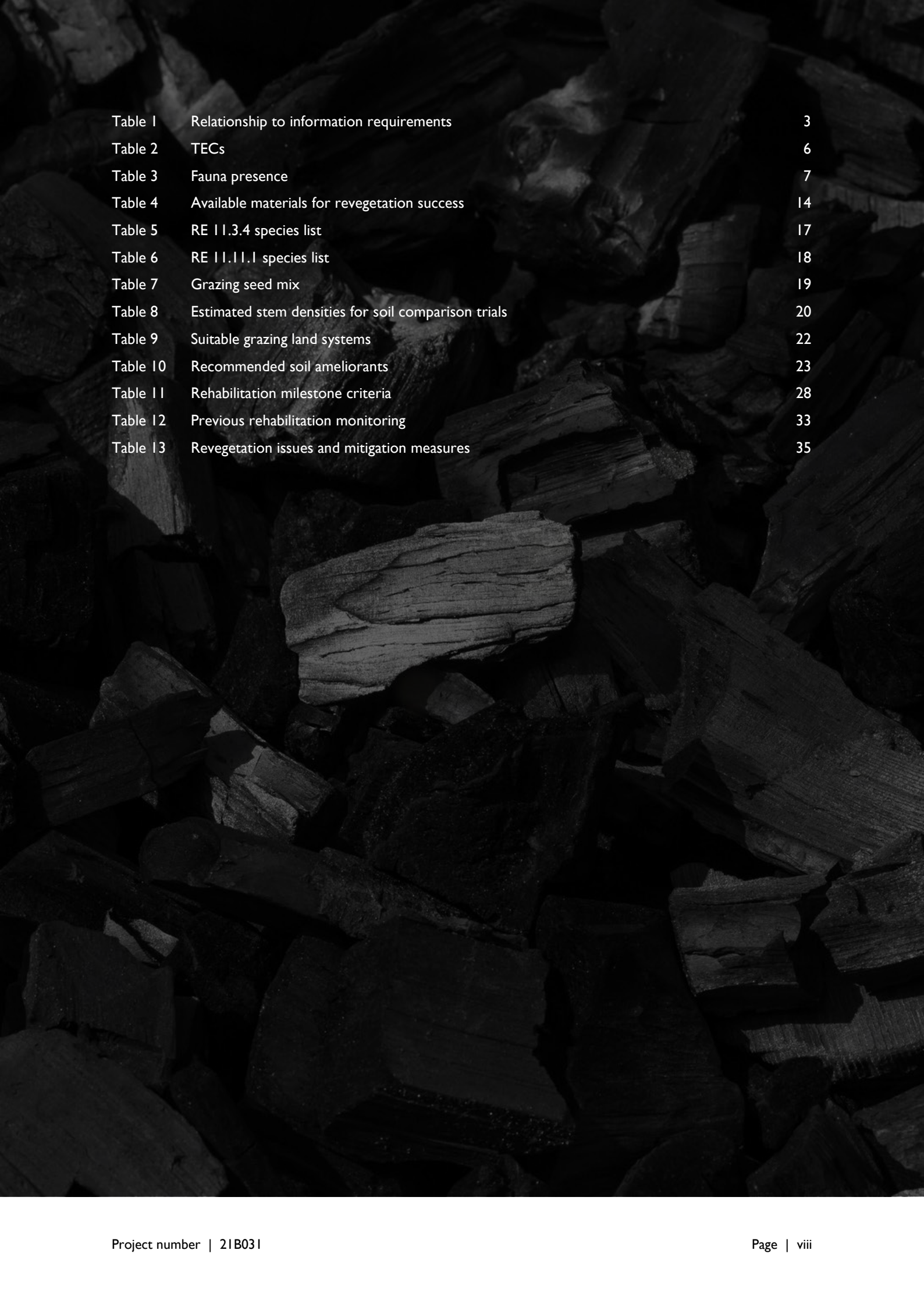


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1.0 Introduction

1.1 Blair Athol Coal Mine

Blair Athol Coal Mine (the Mine) is an open-cut coal mining operation owned and operated by TerraCom Limited (TCL). It was previously operated by Blair Athol Coal Pty Limited a subsidiary of Rio Tinto, in the 1980s until it was put into care and maintenance in 2012. Small scale mining operations date back to the 1890s.

TCL via its subsidiary bought the Mine grant of title transfer from the Queensland Government in 2017. The acquisition means that TCL can efficiently reshape and restore one of Queensland's oldest coal mines while cost effectively retrieving remnant resources.

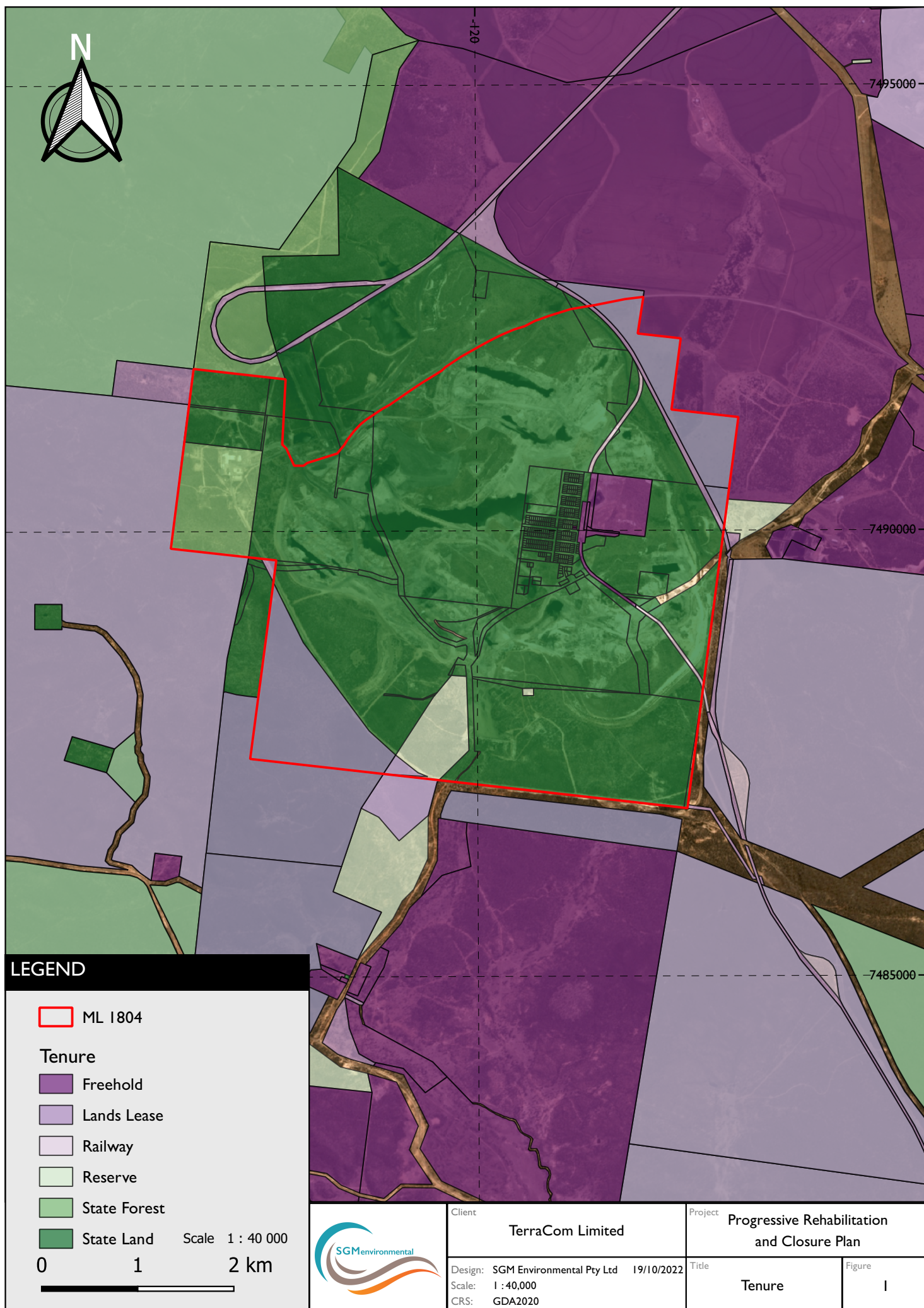
1.1.1 Location

The Mine is approximately (~) 240 kilometres (km) south-west of Mackay and ~17 km north-west of Clermont in Central Queensland. The Blair Athol State Forest adjoins the west of the Mine; the Apsley State Forest is located to the south-east.

1.1.2 Tenure

The Mine is authorised by the Department of Environment and Science (the department) under environmental authority (EA) EPML00876713 and mining lease (ML) 1804 (Figure 1).

It is predominately located on unallocated State Land but also includes State Forest, freehold, lands lease, railway and reserve land (Figure 1). It includes land that has a Permit to Occupy; allowing the permittee to graze the land.



1.2 Purpose and scope

This *Revegetation Plan* (this plan) has been prepared to support the *Progressive Rehabilitation and Closure Plan* (PRCP) and includes proposed activities that would establish self-sustaining vegetation communities that are appropriate for the intended post mining land uses (PMLUs), and non-use management areas (NUMAs).

Revegetation would therefore not only establish groundcover but also associated fauna habitat and other ecological services.

Table 1 describes the information requirements described in *Guideline: Progressive rehabilitation and closure plans* (PRC plans) (the PRC plan guideline), and where it has been addressed.

Table 1 Relationship to information requirements

Information requirements	Reference
Clearly articulate revegetation objectives that are consistent with the PMLUs, NUMAs and rehabilitation milestones identified in the PRC plan schedule	Section 6.0
Identify key flora species including pasture plants, tree and shrub species representative of the PMLU	Section 4.2.2
Identify any species of conservation significance relevant to the Mine's approval	Section 2.6
Identify any fauna habitat and use requirements — where fauna habitat is proposed, a management and monitoring plan to describe how rehabilitated land would be utilised by fauna and what other management measures would need to be implemented	Section 2.6.4
Include evidence and justification for analogue sites of the monitoring plan	Section 3.0
Describe the works for establishing and managing revegetation, including a description of preparation and the timeframe for work	Section 4.0
Identify what plant / seed mixes are appropriate for the PMLU and where the mixes would be sourced — locally sourced seed should be used where appropriate	Section 4.2.2
Identify seed density, spreading rate, and timing for application	Section 4.2.2 and Section 4.2.5
Identify the location of any infrastructure needed to protect revegetation	Section 5.5
Identify the growth media that would be suitable to sustain the PMLU and whether this is available	Section 4.1
Identify soil depth requirements for revegetation success and sustainable PMLU	Section 4.1.4

1.3 Rehabilitation objectives

The rehabilitation objectives, in accordance with condition F4 of the EA, is to return all land disturbed by mining activities, except for the residual voids, in a manner that ensure it is:

- safe for humans and wildlife;
- stable;
- able to sustain vegetation; and
- non-polluting.

The *Environmental Protection Act 1994* (EP Act) requires that all land disturbed within the relevant mining tenure must be rehabilitated to a PMLU or managed as a NUMA. Any undisturbed land within the relevant mining tenure must also be identified as having a PMLU.

Land must be rehabilitated to a stable condition for a PMLU in accordance with the definition in 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; and
- the land can sustain a PMLU.

2.0 Existing environment

The following sections describe the existing environment relating to revegetation including climate, topography, land use, local geology and soil, local catchment hydrology, and vegetation communities and ecological data.

2.1 Climate

The climate of the Mine is classified as subtropical using the Bureau of Meteorology (BoM) modified Köppen classification system (BoM 2016). These climates tend to experience hot humid summers and a cool to mild winter.

There is a distinct wet and dry season. The wet season generally falls between December and March with ~60% of the region's rainfall occurring then (BoM 2022). The dry season is generally between July and September (rainfall is less than 25 millimetres (mm)) (BoM 2022).

2.2 Topography

The Mine is located on relatively flat lying terrain at ~317 m above sea level. Topography is typical of an open-cut coal mine with spoil stockpile relief associated with the open-cut pits.

2.3 Land use

The Mine is located in the former Blair Athol township. The Blair Athol township was a coal mining town with operations dating back to the 1860s. In the mid-1970s, the Blair Athol township was closed to construct the Mine and residences were transferred to Clermont. The historic cemetery reserve remains.

The Apsley State Forest is to the south-east and the Blair Athol State Forest is located directly to the west. The region is made up of coal and gold mining and agriculture.

2.4 Local geology and soil

The Mine is located in the Blair Athol Basin, which is an isolated Permian basin near the western edge of the northern Bowen Basin on the northern extension of the Dennison Trough (JBT 2012).

A soil survey was done by Dames & Moore in 1983 to investigate the nature, disturbance and handling requirements of soil. Six soil types were identified including Soloth (soil type A), Alluvial (soil type B, C₁ and C₂), Solofic (soil type D) and Yellow Pozolic (soil type E) Great Soil Group (GSG) classifications (Dames & Moore 1983).

Dames & Moore (1983) found that:

- there were no significant elemental imbalances in the surface soils (A₁ and A₂ horizons); however, subsoils (B horizon) of soil types A, D and E were sodic;
- there were no soil acidity problems with pH concentrations above 5;
- levels of exchangeable calcium in all A horizons were greater than two times the levels of exchangeable magnesium;
- nitrogen was within normal range however phosphorus was relatively low; and
- percentages of organic material were relatively low.

2.5 Local catchment hydrology

The Mine is located at the top of Bath Creek, a tributary of Sandy Creek, in the foothills of the Drummond Range. Sandy Creek is a sub-catchment within the Theresa Creek part of the Nogo River catchment in the north-western corner of the Fitzroy Basin.

Diversions of Bath, Washpool and Breaker Creeks have been constructed around the Mine. The historical mine workings have created a depressed landform, where the majority of land drains internally.

2.6 Vegetation communities and ecological data

2.6.1 Matters of environmental significance

2.6.1.1 Matters of national environmental significance

Matters of national environmental significance (MNES) are listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). There is limited baseline information on MNES given the long history of the Mine

WSP (2019; 2020) was engaged by TCL to prepare an *Ecological Values Report* of areas south of mined land but within the Mine boundary (the study area).

A search of the EPBC Act *Protected Matters Search Tool* (PMST) identified three listed threatened ecological communities (TECs), 22 listed threatened species and nine listed migratory species within a 10 km buffer of the study area (WSP 2019).

The three TECs listed under the EPBC Act that are known or are likely to occur are in Table 2. The PMST identified five flora species listed as threatened under the EPBC Act as having been previously recorded or predicted to occur.

Table 2 TECs

TEC	EPBC Act status	Likelihood of occurrence
Brigalow	Endangered	Moderate — Brigalow ecosystems are mapped within the locality and were identified and field verified
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Low — Grassland not observed in aerial photography
Weeping Myall Woodlands	Endangered	Low — Broad alluvial not observed in aerial photography

Table 3.1 (WSP 2020)

2.6.1.2 Matters of state environmental significance

Matters of state environmental significance (MSES) are a component of biodiversity state interest and are listed under the *Environmental Offsets Regulation 2014* (Offset Regulation). There is no baseline information on MSES despite its long history of mining operations.

WSP (2019) found no high ecological significance wetlands, high ecological value waters or strategic environmental areas (SEAs).

The *Wildlife Online* database search identified five threatened flora species listed under the *Nature Conservation Act 1992* (NC Act) as having been previously recorded within 10 km of the study area; one threatened flora species (*Corymbia clandestine*) listed as Vulnerable under the NC was found to have a moderate likelihood of occurring in the study area (WSP 2019).

MSES recorded or likely to occur (WSP 2019) include:

- field verified regulated vegetation:
 - remnant regional ecosystems including:
 - > 14.7 hectares (ha) of regional ecosystems (REs) 11.3.4 listed as Of Concern under the *Vegetation Management Act 1999* (VM Act);
 - > 6.2 ha of RE 11.11.16 listed as Of Concern under the VM Act;
 - > 2.5 ha of RE 11.11.4 listed as Endangered under the VM Act;
 - Endangered or Of Concern High Value Regrowth regional ecosystems including:
 - > ~4.3 ha of RE 11.11.6 listed as Of Concern under the VM Act;
 - > ~1.1 ha of RE 11.3.4 listed as Of Concern under the VM Act;
 - ~33.7 ha Essential Habitat 860 (Koala) listed as Vulnerable under the NC Act;
- protected Wildlife Habitat including:
 - ~11.6 ha of potential Koala habitat listed as Vulnerable under the NC Act;
 - ~4.3 ha of potential Greater Glider habitat listed as Vulnerable under the NC Act;
- 2 ha of remnant vegetation within a defined distance from a Stream Order 1 watercourse and 3.5 ha of remnant vegetation within a defined distance from a Stream Order 3 watercourse.

Native ecosystem PMLU will be revegetated in line with RE 11.1.11 and 11.3.4. Species lists for native ecosystem PMLU are outlined in Section 4.2.2.

2.6.1.3 Matters of local environmental significance

A matter of local environmental significance (MLES) is a locally significant matter that is prescribed under a local planning instrument. There are no MLES identified in *Isaac Regional Planning Scheme* (IRC 2021).

2.6.2 Environmentally sensitive areas

Environmentally sensitive areas (ESAs) are described in the *Environmental Protection Regulation 2019* (EP Regulation). The majority of the Mine is not located in mapped ESAs. There is a small section to the west of the Mine boundary that is mapped as a Category C ESA (State Forest).

2.6.3 Regional ecosystems

Baseline field-verified REs are not available.

2.6.4 Fauna habitat considerations

Areas with a PMLU of native ecosystem can provide future habitat for native fauna species. An ecological survey by WSP (2019) recorded a total of 16 native fauna species. These species, along with their conservation status according to the *Nature Conservation Act 1992* (NC Act), are in Table 3.

Table 3 Fauna presence

Scientific name	Common name	NC Act status
<i>Anas superciliosa</i>	Pacific Black Duck	Least concern
<i>Aquila audax</i>	Wedge-tailed Eagle	Least concern

Scientific name	Common name	NC Act status
<i>Ardea ibis</i>	Cattle Egret	Least concern
<i>Ardea intermedia</i>	Intermediate Egret	Least concern
<i>Corvus orru</i>	Torresian Crow	Least concern
<i>Cracticus tibicen</i>	Australian Magpie	Least concern
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Least concern
<i>Eolophus roseicapilla</i>	Galah	Least concern
<i>Granilla cyanoleuca</i>	Magpie-lark	Least concern
<i>Manorina melancephala</i>	Noisy Miner	Least concern
<i>Pardalotus striatus</i>	Striated Pardalote	Least concern
<i>Philemon corniculatus</i>	Noisy Friarbird	Least concern
<i>Rhipidura leucophrys</i>	Willie Wagtail	Least concern
<i>Todiramphus macleayii</i>	Forest Kingfisher	Least concern
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	Least concern

WSP (2019) states that there have been numerous anecdotal sightings of *Phascolarctos cinereus* (Koala) in the area and that there is a moderate likelihood of *Petauroides* spp. (Greater Glider) occurring. The NC Act lists Koalas as endangered and Greater Glider species as either vulnerable or endangered.

It is anticipated that native ecosystem rehabilitation areas will attract native fauna. An indicator of fauna presence is to be monitored as part of rehabilitation monitoring and included as a milestone criterion.

2.7 Existing rehabilitation

The Mine was previously operated by Rio Tinto who did stages of progressive rehabilitation. Rio Tinto last completed rehabilitation in 2010.

Several rehabilitation methods (seeding, ground preparation and fertiliser) and rehabilitation monitoring techniques have been used. The rehabilitation methods together with other influential factors including terrain, soil characteristics and climate, have resulted in rehabilitation that is in varying condition and stages of development.

Rio Tinto placed the Mine into care and maintenance in 2012; the focus at this time was keeping the operation in compliance with all respective legislation and generally in a safe, stable and secure state. In September 2016, Rio Tinto did a review of rehabilitated land to evaluate its status against the rehabilitation criteria. The rehabilitation strategy used by Rio Tinto was consistent with a PMLU of native ecosystems. Since acquiring the Mine, TCL has progressively rehabilitated land disturbed by mining. As of 2025, 309.9 ha have been progressively rehabilitated, with areas shown in Figure 2.



LEGEND

ML 1804

Existing rehabilitation

Scale 1 : 17 500

0 0.5 1 km



Client	TerraCom Limited		Project		Revegetation plan		
Design:	SGME Pty Limited 2.09.2025		Title	Existing rehabilitation		Figure	2
Scale:	1 : 17,500						
CRS:	GDA2020						

3.0 Reference sites

Reference sites (also known as analogue sites) are an important source of information on the type of vegetation, species composition and structure that is proposed to be revegetated.

Reference sites are used to monitor rehabilitation success and:

- provide a guide on the level and type of vegetation cover and its influence on infiltration and runoff;
- allow evaluation of climatic and seasonal influences that may affect rehabilitation progress; and
- provide an understanding of the water availability and movement across reconstructed landforms and how it may affect nutrient availability in the rehabilitated system.

Where possible, a reference site should:

- be homogenous with regard to the relevant RE and condition status;
- represent an undisturbed site with no extensive chemical or mechanical disturbance (eg fire, erosion or weed infestation);
- be located within a reasonably large (greater than (>) 5 ha) intact patch of remnant vegetation;
- be located at least 50 m from a road or track; and
- exclude areas subject to recent significant management change.

3.1 Location and number of reference sites

Three native ecosystem reference sites were established in the 2019 rehabilitation monitoring program (WSP 2020).

Reference transects are monitored to collect data within vegetation communities' representative areas of naturally occurring RE 11.11.1 (*Eucalyptus crebra* +/- *Acacia rhodoxylon* woodland on old sedimentary rocks with varying degrees of metamorphism and folding) surrounding the Mine. The characteristics of the RE 11.11.1 community (structure, species abundance, diversity, etc) is representative of a self-sustaining native woodland ecosystem and has therefore been used to assess the current trajectory of rehabilitation. The community is also common, and as such, has been used as a reference site in order to assess the performance of rehabilitation.

Reference site locations are:

- REF1S – in the south-eastern extent of the ML, adjacent to Bath Creek East;
- REF1E – in the south-eastern extent of the ML, adjacent to Bath Creek East;
- REF2E – in the north-western extent of the ML, adjacent to Waterloo Creek West;
- REF2S – in the north-western extent of the ML, adjacent to Waterloo Creek West;
- REF3E – in the western extent of the ML, adjacent to Bath Creek West; and
- REF3S – in the western extent of the ML, adjacent to Bath Creek West.

Three proposed reference sites for grazing have been selected to be within areas of pre-existing grazing / cropping land within the ML. These grazing reference sites have yet to be monitored to establish baseline condition and confirm suitability.

Locations of all reference sites are provided in Figure 3.



LEGEND

- ML 1804
- Grazing
- Native ecosystem

Scale 1 : 15 000

0 0.5 1 km



Client TerraCom Limited		Project Revegetation plan	
Design: SGME Pty Limited 9.09.2025 Scale: 1 : 15,000 CRS: GDA2020		Title Reference sites	Figure 3

3.2 Assessment of reference sites

3.2.1 Pasture reference sites

The reference plots should be located adjacent to existing mining operations outside of planned future disturbance. The sites should be established based on a pasture grass land use and consider vegetation and soil attributes. Past and current grazing pressures would also be considered as part of selecting suitable sites. Multiple plots should be developed to enable appropriate statistical analysis to be applied.

3.2.2 Native reference sites

The native reference plots should be located adjacent to existing mining operations outside of planned future disturbance. The sites should represent vegetation communities used in revegetation and consider location and soil attributes. Multiple plots should be developed to enable appropriate statistical analysis to be applied.

3.2.3 Assessment framework for Queensland

BioCondition is an assessment framework for Queensland that provides a measure of how well a terrestrial ecosystem is functioning for biodiversity values. It is a site-based, quantitative and repeatable assessment procedure that can be used in any vegetative state. It provides a numeric score that can be summarised as a condition rating (1, 2, 3 or 4) or functional to dysfunctional condition for biodiversity.

Assessment of reference site vegetation structure and composition would be done using the BioCondition manual and framework (the site assessment) (Eyre et al 2015). The site assessment would be used to gauge vegetation condition and impact disturbance, and relevance for use as a comparison site for rehabilitated land.

3.2.4 When to assess reference sites

The site assessment would generally be done after the wet season (between March and May) to allow for adequate sampling of groundcover species. Floristic surveys would also be done close to the peak flowering period for the majority of species occurring in reference sites.

3.2.5 Data collection

Site-based attributes that would be measured at each reference site in accordance with the *Ecological Values Report* (WSP 2019; 2020) and the *Rehabilitation Monitoring Report* (Earthtrade 2021) include:

- plot characteristics;
- weed presence / absence;
- extent of disturbance (eg erosion);
- visual record;
- climate variables;
- lower-storey density and richness;
- lower-storey cover (vegetative cover);
- pasture yield;
- soil properties;
- basal cover;
- upper-storey and mid-storey density and richness; and
- species inventory.

3.2.5.1 Weeds and disease

Recording weed species, extent and density, or diseases present in plant species would help identify appropriate management techniques and support revegetation outcomes.

4.0 Revegetation method

4.1 Soil

Conservation and management of soil is critical for revegetation success. Current estimates indicate that there is a deficit of growth media required for rehabilitation. *Growth Media – Mitigation and Management Strategy* (GM-MMS), TCL (2017) have developed mitigation and management strategies either currently used or proposed to address the soil shortfall (Table 4). These include:

- reducing the depth of soil placement;
- strip placement (alternating strip of soil and no soil with predominantly tree species seeded);
- amelioration of subsoil / spoil to use as a soil substitute;
- direct seeding to spoil; and
- utilising specific treatments in specific areas, that is, hydromulching in diversions.

The GM-MMS indicates that trials have been undertaken to determine the germination and survival rates of vegetation resulting from direct seeding into spoil. Additionally, trials have been done to determine the effectiveness of soil stripping on areas with different disturbance types. For the latter, trials include the old helipad laydown, a scrap laydown area, a disused light vehicle road and an area with exposed spoil.

It is likely that the final strategy will be a combination of these approaches. Currently, the rehabilitation monitoring program includes the assessment of soil physical and chemical characteristics. It identifies potential challenges and remediation opportunities to support the intended PMLU. Additionally, the GM-MMS has been developed to manage soil integrity during stripping, stockpiling and spreading and to manage soil so that enough is available for rehabilitation.

4.1.1 Inventory

Following stockpile assessments by SKM (2012) and SEAM Surveys Pty Ltd (2016) the soil inventory and rehabilitation schedule was changed. Soil inventory available for rehabilitation was updated internally by TCL in 2024. The relocation of stockpiles from the north of the Mine to the south has reduced haulage for future rehabilitation.

There is currently 787,768.78 metres cubed (m³) of stockpiled soil available for rehabilitation (Table 4) (SGME 2023a).

Table 4 Available materials for revegetation success

Soil mitigation and management strategy		Placement ¹	Strip placement	Hydromulch	Direct seed spoil	Not required
Hectares	1,688	784	165.8	17.5	48.6	672.1
Needed (m ³)	1,300,350	1,176,000	124,350	-	-	-
Available (m ³)	787,768.78	-	-	-	-	-
Excess / deficiency	-512,581.22	-	-	-	-	-

1. Assumes a depth of 0.15 m

4.1.2 Stripping

After vegetation clearing, soil is stripped to the base of the A horizon (approximately 0.15 m depth). The B horizon is avoided to reduce the risk of sodicity and dispersion. It is either directly placed, or in circumstances where this is not possible, is stockpiled for later use (Section 5.2).

Soil stripping is timed to avoid the risk of soil compaction, loss of structure, seed viability and biological health. It should account for general condition of the soil (ie not saturated or hard set) and is done, where possible, after seed has set to maximise soil seed bank.

4.1.3 Surface preparation

Before spreading soil two factors are considered:

- characteristics of the underlying spoil; and
- physical preparation of soil.

For example, if spoil is dispersive (ie white sodic spoil) it is treated with gypsum to increase stability before spreading.

A fine tilth soil surface with deep spoil decompaction is considered the best landform preparation for establishing vegetation. Decompaction is done by deep ripping, which blends soil and spoil eliminating a sharp profile (GSS 2007). Ripped surface levelling is done to stop seed loss in deep crevices.

The following general site preparation is recommended:

- deep rip to approximately 0.4-0.5 m;
- rip lines would be no greater than 1 m apart;
- ripping should always be along (parallel) to the contour (even slight grades can result in gully erosion);
- ripping should always be done before seeding;
- seeding should always be done into a fresh surface tilth before rain; and
- excessive surface rock does not necessarily need to be removed since it would act as armouring, reducing the potential for erosion.

Soil spreading should be done at an appropriate time of year to minimise the potential for erosion before vegetation establishes. Where available, mulched vegetation or vegetative debris should also be spread. This supports the development of ecosystem services including nutrient cycling, habitat (for small invertebrate species) and reduces the uncovered surface area.

4.1.4 Spreading

Once the landform has been reshaped and spoil treated (if needed) the next step is soil spreading. Placement would largely be governed by its location; however, soil would first be used to cover landform that has steep slopes and / or erosive spoil.

Soil is spread onto prepared land to a depth of 0.15 m in accordance with the *Soil Management Program* (SMP; 2016) and GM-MMS.

The following measures are used to reduce soil loss during spreading and promote vegetation growth:

- a soil inventory is prepared before soil is spread, the inventory shows the depths and volume of soils to be reapplied to each rehabilitation area;
- soil and spoil characteristics (ie erosion potential) are taken into account during spreading, moderately and highly dispersive materials are placed below the final surface and on flatter land to minimise the potential for surface exposure and erosion;

- soils are spread immediately after disturbed land has been reshaped and deep-ripped;
- soil spreading is done in even layers to the thickness needed for the PMLU;
- the final surface is lightly scarified on the contour to encourage rainfall infiltration, minimise runoff and improve seed retention;
- direct seeding is done at the same time as soil spreading;
- erosion and sediment controls are implemented where needed before vegetation growth; and
- surface water management measures are installed eg rock lined drains to direct and manage runoff.

Hydromulching is a highly efficient and cost-effective method of establishing vegetation in areas which may be large, difficult to access or heavily sloped (TerraCom 2020c). It involves spraying a mix of water, seed, fertiliser, organic mulch fibres and a binder or tackifier onto the ground where vegetation establishment is desired. Hydromulching is scheduled for a portion of the Eastern Diversion and has previously been used on the Ramp 2 CDA.

4.2 Rehabilitation techniques

Progressive rehabilitation commenced in 1984 (WSP 2016). Since that time rehabilitation has been ongoing as land has become available as per condition G3 of the EA:

Progressive rehabilitation must commence within two years of areas becoming available within the operational land.

Rehabilitation has been done within the spoil disturbance domains. Other areas including the sediment dam walls, some infrastructure features and exploration domains have also been rehabilitated (Section 2.7)

4.2.1 Strategy

The rehabilitation strategy aims to reinstate disturbed land (excluding the residual void which is classified as a NUMA) to a PMLU of predominantly light grazing, and some areas as native ecosystem.

The strategy sets out to achieve rehabilitation goals outlined in the superseded *Queensland guideline — Guideline: Rehabilitation requirements for mining resource activities* (DES 2014).

Rehabilitation objectives, indicators and completion criteria have been developed for each domain. The rehabilitation strategy aims to ensure final landforms are stable and non-polluting and that the intended PMLU can be achieved.

Rehabilitation methods have been developed which reflect the rehabilitation goals and objectives (Section 1.3). Methods focus on creating safe, stable and non-polluting landforms that achieve the intended PMLU. These methods are periodically reviewed and adapted based on the outcomes of rehabilitation monitoring.

Current methods used for progressive rehabilitation are consistent with leading practice, which can be summarised as:

- decommissioning and removal of services;
- reshaping / recontouring;
- drainage management structure installation;
- soil management;
- land preparation;
- soil spreading, ripping and seeding; and
- inspection and monitoring.

4.2.2 Species selection and seed mix rate

Seeding would be guided by the allocation of final land, and would be specific according to the final land use. Seed viability testing and treatment for dormancy would be done as needed. Seed spreading techniques could include direct seeding, tube stock planting, and aerial seeding.

Species suitability, species ratio and seeding rates have been considered and would be specific to each land use (further detail is in AECOM 2013a and 2013b). Species would be selected based on their relative abundance in existing rehabilitation analogue sites.

Seed mixes would be developed through consultation with Traditional Owners and through site specific trials (ie Earthtrade 2021). Native seed would be collected from a suitable supplier within 100 km of the Mine because they:

- are acclimatised to the region;
- have developed resistance to local pests and diseases;
- provide suitable habitat that resembles pre-existing conditions;
- generally, require minimal inputs (ie fertiliser and water);
- support the occurrence of native species;
- have minimal risk of becoming a future weed;
- help to conserve biodiversity; and
- would blend in with the local plant communities.

The spreading rate of seeding mixes will be refined based on the desired density, seed viability, germinability and potential growth rates.

4.2.2.1 Native ecosystem

Areas to be returned to a PMLU of native ecosystem will be rehabilitated to meet remnant vegetation status for RE 11.3.4 and RE 11.11.1. The proposed species seeding lists for the two RE's are provided in Table 5 for RE 11.3.4 and Table 6 for RE 11.11.1.

Table 5 RE 11.3.4 species list

11.3.4	Species	Common name	Seeding rate (kg/ha)
Trees	<i>Eucalyptus tereticornis</i>	Forest Red Gum	0.3
	<i>Corymbia tessellaris</i>	Moreton Bay Ash	0.3
	<i>Angophora subvelutina</i>	Broad-leaved Apple	0.3
	<i>Corymbia clarksoniana</i>	Clarkson's Bloodwood	0.3
	<i>Lophostemon suaveolens</i>	Swamp Mahogany	0.3
	<i>Angophora floribunda</i>	Rough-barked Apple	0.3
	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	0.3
	<i>Eucalyptus populnea</i>	Poplar Box	0.3
Shrub	<i>Acacia glaucocarpa</i>	Hickory Wattle	0.25
	<i>Acacia disparrima</i> subsp <i>disparrima</i>	Southern Salwood	0.25
	<i>Alphitonia excelsa</i>	Red Ash	0.25

11.3.4	Species	Common name	Seeding rate (kg/ha)
	<i>Acacia crassa</i> subsp. <i>longicoma</i>	-	0.25
	<i>Acacia falcata</i>	Sickle Wattle	0.25
	<i>Acacia leiocalyx</i> subsp. <i>leiocalyx</i>	Black Wattle	0.25
Grasses	<i>Arundinella nepalensis</i>	Reed Grass	3
	<i>Heteropogon contortus</i>	Black Speargrass	2
	<i>Bothriochloa bladhii</i> subsp. <i>bladhii</i>	Forest Bluegrass	1
	<i>Dinebra decipiens</i>	Slender Canegrass	1
	<i>Cyperus gracilis</i>	Slender flat Sedge	1
	<i>Themeda triandra</i>	Kangaroo Grass	1
	<i>Capillipedium spicigerum</i>	Scented-top Grass	1
Forbs	<i>Cyanthillium cinerum</i>	Ironweed	0.2
	<i>Sida hackettiana</i>	Spiked Sida	0.2
	<i>Eustrephus latifolius</i>	Wombat Berry	0.2
	<i>Glycine tomentalla</i>	Rusty Glycine	0.2
	<i>Desmodium varians</i>	Slender Tick-trefoil	0.2
	<i>Euphorbia dallachyana</i>	Caustic Weed	0.2
Total	-	-	15.1

Table 6 RE 11.11.1 species list

11.11.1	Scientific name	Common name	Seeding rate (kg/ha)
Trees	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	0.3
	<i>Acacia rhodoxylon</i>	Rosewood	0.3
	<i>Corymbia clarksoniana</i>	Clarkson's Bloodwood	0.3
	<i>Acacia shirleyi</i>	Lancewood	0.3
	<i>Acacia falciformis</i>	Broad-leaved Hickory	0.3
	<i>Alstonia constricta</i>	Bitterbark	0.3
	<i>Corymbia dallachiana</i>	Dallachy's Gum	0.3
	<i>Alphitonia excelsa</i>	Red Ash	0.3
Shrubs	<i>Erythroxylum australe</i>	Dogwood	0.2

11.11.1	Scientific name	Common name	Seeding rate (kg/ha)
	<i>Acacia leiocalyx</i> subsp. <i>leiocalyx</i>	Curracabah	0.2
	<i>Capparis canescens</i>	Wild Orange	0.2
	<i>Carissa ovata</i>	Bush Plum	0.2
	<i>Alectryon subdenatus</i>	Hard Alectryon	0.2
	<i>Cassia brewsteri</i>	Brewster's Cassia	0.2
	<i>Grewia latifolia</i>	Dog's Balls	0.2
Grasses	<i>Aristida queenslandica</i> var. <i>dissimilaris</i>	Queensland Wiregrass	3
	<i>Themeda triandra</i>	Kangaroo Grass	2
	<i>Digitaria ramularis</i>	Finger Panic Grass	1
	<i>Aristida queenslandica</i> var. <i>queenslandica</i>	Three-Awn	1
	<i>Enteropogon unispicues</i>	-	1
	<i>Enneapogon lindleyanus</i>	Purple-Head-Nine-Awn	1
	<i>Eragrostis lacunaria</i>	Lovegrass	1
Forbs	<i>Cyanthillium cinereum</i>	Little Ironweed	0.2
	<i>Phyllanthus virgatus</i>	Creeping Phyllanthus	0.2
	<i>Sida hackettiana</i>	Spiked Sida	0.2
	<i>Breynia oblongifolia</i>	Coffee Bush	0.2
	<i>Cheilanthes distans</i>	Bristly Cloak Fern	0.2
Total	-	-	14.8 kg/ha

4.2.2.2 Grazing

The remaining area to be rehabilitated will meet a PMLU of grazing, for which the species list can be located in Table 7. These key species include native Australian grasses that are suitable for cattle grazing in addition to a number of trees local to the area. This is the most suitable seed mix for achieving the required PMLU.

Table 7 Grazing seed mix

Grazing	Scientific name	Common name	Seeding rate (kg/ha)
Grasses	<i>Dichanthium sericeum</i>	Queensland Bluegrass	3
	<i>Heteropogon contortus</i>	Black Speargrass	3
	<i>Cynodon dactylon</i>	Couch Grass	1.5
	<i>Astrebla lappacea</i>	Curly Mitchell Grass	1.5

Grazing	Scientific name	Common name	Seeding rate (kg/ha)
	<i>Bothriochloa insculpta</i>	Creeping Bluegrass	1
Forbs	<i>Cyanthillium cinereum</i>	Little Ironweed	0.6
	<i>Phyllanthus virgatus</i>	Creeping Phyllanthus	0.6
	<i>Sida hackettiana</i>	Spiked Sida	0.8
Shrubs	<i>Acacia falcata</i>	Sickle Wattle	0.25
	<i>Alphitonia excelsa</i>	Red Ash	0.25
	<i>Erythroxylum australe</i>	Dogwood	0.25
	<i>Acacia leiocalyx subsp. leiocalyx</i>	Curracabah	0.25
Trees	<i>Eucalyptus tereticornis</i>	Forest Red Gum	0.3
	<i>Corymbia tessellaris</i>	Moreton Bay Ash	0.3
	<i>Angophora subvelutina</i>	Broad-leaved Apple	0.3
Total	-	-	14.9 kg/ha

Direct seeding rates were assessed by GSS (2008) and TCL (2017) and examined a range of alternative soil spreading techniques, vegetation growth and seed specification options (Table 8). The assessment included rehabilitated land that was deep ripped and tree seeded with the same species mix used on Ramp 3 North and Ramp 4 East. The assessment found that black and grey soil was dominated by *Acacia* and / or *Dodonaea* species, while eucalypt species dominated red and grey soils and spoil.

Table 8 Estimated stem densities for soil comparison trials

Soil	Stems/100 m ²	Estimated stems/ha	Criteria	
			Species/ha	Stems/ha (min)
Ramp 3 North				
Red	25	2,500	two trees / four shrubs	150 trees / 500 shrubs 50-70% groundcover
Black	36	3,600	two trees / four shrubs	150 trees / 500 shrubs 50-70% groundcover
Grey	71	7,100	one tree / four shrubs	40 trees / 500 shrubs 50-70% groundcover
Spoil	47	4,700	-	-
Broadacre Rehabilitation	19	1,900	-	-
Ramp 4 East				
Red	101	10,100	two trees / four shrubs	150 trees / 500 shrubs 50-70% groundcover

Soil	Stems/100 m ²	Estimated stems/ha	Criteria	
			Species/ha	Stems/ha (min)
Black	64	6,400	two trees / four shrubs	150 trees / 500 shrubs 50-70% groundcover
Grey	100	10,000	one tree / four shrubs	40 trees / 500 shrubs 50-70% groundcover
Spoil	123	12,300	-	-
Scalped Rehabilitation	12	1,200	-	-

4.2.3 Tube stock

A combination of regeneration from the seed bank, direct seeding and tube stock of trees and shrubs can improve landscape function and help to address current rehabilitation issues (ie poor soil nutrients, low species diversity and low vegetation density). Supplementary tube stock of native trees and shrubs would be used if needed.

4.2.4 Seed treatment

Seed germination rates for some native tree and shrubs is dramatically improved if the seeds are treated before planting. Treatment methods include:

- heat treatment;
- scarification;
- exposure to smoke; or
- smoked water.

Appropriate treatments would be investigated with seed suppliers as needed to maximise revegetation success and cost effectiveness.

4.2.5 Timing

Timing of direct seeding is important for success. For example, growth of grass at the right time is important for seed survival which requires specific moisture and temperature conditions to germinate. Generally, seed would be sown immediately before rain and before November each year.

There are no irrigation requirements.

4.3 Sustaining the PMLU

Soil quality should be checked to make sure that it can support the PMLU. Testing would be done following soil spreading to see if soil is dispersive. Depending on the PMLU, suboptimal soils may be applied with ameliorants (Section 4.3.3).

Other checks could include to see if soil has enough:

- infiltration capacity;
- available water capacity;
- aeration;

- rooting depth (ie mechanical and chemical inhibition);
- plant nutrients; and
- microbial associations needed for plant growth.

There is not enough soil to cover all land that would be rehabilitated (Table 4). Therefore, some land may be seeded directly into spoil. Land lacking in soil coverage may be particularly suited to final land uses requiring low biodiversity, as per AECOM (2013b).

Any testing of soils would be included in a soil database and used to keep the soil inventory up to date.

The recommended land systems, suited to a PMLU of light grazing pasture, are in Table 9 (SSA 2013).

Table 9 Suitable grazing land systems

No.	Land systems	Undisturbed soil	Equivalent soil after rehabilitation
1	Black soil grasslands	Black cracking clays (black soil)	Black
2	Alluvial woodlands	Grey silt clays and black soils	Black or spoil
3	Woodlands on sands and earths	Sandy red brown earths	Red / brown

4.3.1 Soil availability

A soil inventory detailing stockpile volumes is in Section 4.1.1, including quantities of soil, hydromulching and direct seeding resources needed for rehabilitation

4.3.2 Depth of cover

The spreading rate of soil to land would be 0.15 m and is consistent with profiles from the pre-mining soil survey (GSS 2008). Some areas may be directly seeded into spoil with the addition of ameliorant to improve spoil. Soil placement will be prioritised in native ecosystem PMLU rehabilitation areas.

As mentioned in Section 4.1, another management strategy of the soil deficit is to place soil in an alternating pattern of ~ 10 m wide soil strips and bare spoil strips of the same width (TerraCom 2017). Potential areas of this strategy include haul roads, minor roads, the MIA and spoil.

Alternating soil and bare spoil strips will have numerous benefits including:

- reducing the needed volume of soil and, therefore, doubling the potential coverage area;
- enabling the oil strip to be seeded with cover crops and native grasses to reduce erosion and runoff;
- sowing woody species on the bare strips, decreasing the competition between grass and woody species;
- cross-propagating the native grasses, trees and shrubs into the adjacent media; and
- allowing the biological components of soil to migrate into the spoil strips.

Typically, soil is transported to re-profiled land in dump trucks before the wet season in November and spread by dozer. Contour banks are constructed at predefined intervals down the slope and the land is deep ripped along the contour to a depth of approximately 0.5 m.

4.3.3 Amelioration and fertiliser

Amelioration refers to the improvement of soil and / or spoil to:

- improve soil structure;
- reduce the exchangeable sodium percentage (gypsum);
- increase mineral content;
- correct pH; and
- enhance moisture holding capacity.

Soil organic carbon (SOC) has typically not been addressed during amelioration. SOC improvement may be needed, particularly for direct seeding in spoil and would be subject to future investigation. A summary of soil ameliorants for increasing SOC (SSA 2013) is in Table 10.

Table 10 Recommended soil ameliorants

Items	Rate	Estimated amount
Cow manure for composting	40 t / ha	58,400 tonnes
Inoculant for composting	50 g / tonne cow manure	2,920 kg
Gypsum	10 t /ha	14,600 tonnes
Basaltic rock dust	10 t/ ha	14,600 tonnes
Evergreen	2 L / ha	2,920 L
Green manure plus	1 L / ha	1,460 L

A *Soil and Capping Material Assessment* by SGME (2023a) found that:

- soil stockpiles will be suitable for rehabilitation, but may need amelioration to satisfy rehabilitation outcomes;
- the majority of soil would benefit from gypsum due to high salinity which increases the erosion potential;
- P-based fertiliser may be required for soil that is phosphorus deficient;
- the majority of spoil is considered low-risk indicating that it is suitable for use in rehabilitation;
- only spoil with an ESP<15% can be used as cover material for the co-disposal waste (high-risk).

5.0 Revegetation management

5.1 Rehabilitation criteria

Applicable rehabilitation success criteria are specified in the EA. As rehabilitation knowledge and techniques improve, revised criteria may be developed and applied. Proposed rehabilitation criteria are:

- the maximum slope for rehabilitated spoil is >15%, except for sections of Ramp 3 which is cut through competent rock which will be ripped parallel to the slope;
- spoil stockpiles would be reshaped so they are internally draining, undulating landforms with slopes up to 15%;
- minimum distances between contour banks on rehabilitated spoil slopes are maintained;
- maximum slope of final void highwalls and end walls are needed to be geotechnically stable and certified by an Appropriately Qualified Professional (AQP);
- ramps and low walls would be breached and graded with a maximum slope >15%;
- tailings and sodic spoil with exchangeable sodium percentage (ESP) >30% must be covered with not less than one metre of benign material (ie with ESP <15%);
- landforms of tailings would be externally draining and capped;
- successfully rehabilitated land would have gully erosion consistent with surrounding landscapes;
- regulated dams, other than those for tailings disposal, would have the walls breached and the dam drained. Salt impacted residue would be taken to the tailings storage facility (TSF), or capped;
- water storages would be drained and breached;
- revegetation would meet species and abundance criteria;
- all other land would be rehabilitated to a stable landform with self-sustaining vegetation and able to sustain a PMLU.

The rehabilitation schedule is built around five benchmarks:

- re-contouring (reshaped to final grade);
- soil spreading;
- seeding (ripped and seeded, irrespective of germination success);
- PMLU established (vegetation has established, minor reseeding / erosion repairs may be needed); and
- successfully rehabilitated (compliance with rehabilitation success criteria).

5.2 Soil management plan

The objective of the *Soil Management Plan* (SMP) (SSA 2013) is to improve soil management protocols and maximise the probability of a successful rehabilitation outcome. It has drawn from historical experiences, including rehabilitation programs, trials, studies and monitoring.

After clearing of vegetation, soil is stripped to the bottom of the A horizon and where appropriate, directly placed on re-profiled land. In circumstances where this is not possible, it is stockpiled for later use. Soil stockpiles are kept below three metres to limit potential for biological degradation. Where storage space is limited, soil is stockpiled to four metres, but only if alternative options are not viable. Revegetation using grass cover is promoted to further mitigate biological, physical and chemical impacts.

The amount of time soil is stockpiled is kept to a minimum. Stockpile management procedures are designed to minimise soil degradation which could impact vegetation growth. The following measures are consistent with leading practice (DISER 2016), and aim to reduce soil degradation:

- stockpiles are placed a suitable distance from drainage lines or trafficked areas;
- runoff is diverted around stockpiles;

- the amount of time soil is stockpiled is kept to a minimum;
- stockpiles are kept as low as possible and to a maximum height of 3-4 m with a large surface area;
- stockpiles are seeded (revegetated) to prevent erosion, discourage weed growth and improve biological activity with suitable grasses;
- stockpiles are surveyed and included on mine plans;
- machinery and vehicles are excluded for general access (except for maintenance works);
- stockpiles are protected from future disturbance to prevent compaction and minimise degradation;
- growth of weeds is monitored and control programs implemented (as needed) to avoid a weed seed bank from developing; and
- soil and spoil are stockpiled separately (where possible).

5.3 Weeds and pests

Rehabilitated land is routinely inspected for weeds and pest species, with management controls developed and implemented where needed. Management and monitoring focuses on pest species identified in previous rehabilitation monitoring; particularly *Cryptostegia grandiflora* (Rubber Vine), *Opuntia spp.* (Tree Pear), *Parthenium hysterophorus* (Parthenium), *Vachellia farnesiana* (Vachellia), and *Leucaena leucocephala* (Leucaena) (Earthtrade 2021).

The exotic pasture species Buffel (*Cenchrus ciliaris*) and Red Natal (*Rhynchelytrum repens*) are well established and have become naturalised. These species compete with emerging native plants which are slow to emerge. A high content of weed is known to be present in the soil stockpiles and following soil spreading this is likely to lead to dense weed coverage in short timeframes. Incorporating a cover crop is a proven option to alleviate this impact.

Dingoes, feral dogs, foxes, rabbits, feral pigs and cats are common. These would be managed in accordance with the requirements of the *Land Protection (Pest and Stock Route Management) Act 2002* (Land Protection Act 2002) and the *Queensland Invasive Plants and Animals Strategy 2019-2024* (QDAF 2019).

Surveys would be conducted annually to identify weed proliferation. Weed species to be targeted are declared weeds within the Land Protection Act. Remedial action would be taken on land identified through monitoring.

Weeds and pest animal management includes:

- rehabilitated land would be routinely inspected for weeds, with management controls developed and implemented where needed;
- vehicle wash-downs for all new vehicles (including earthmoving and other construction machinery);
- disposal and storage of putrescible wastes is done appropriately to limit feral animals being attracted;
- laydown areas are maintained to limit pest fauna; and
- domestic animals, including pets, are not permitted onsite.

Methods to prevent weeds include spreading of annual cover crops and mulches. The cover crop would help to prevent weeds by establishing rapidly, it would provide an in-situ mulch and would allow for natives to grow through as the cover crop dies off. Directly applied mulch creates a weed free zone, reduces the erosive impact of raindrops and increases humidity at the soil / seed interface.

Weed management would be done in combination with the following soil management practices:

- soil stockpiles scalped before spreading, scalped soil is used for drainage contours in zones with low biodiversity requirements;
- after spreading soil is sown with a cover crop; and
- further seeding is only done if natural vegetation does not volunteer.

5.4 Fire regimes

Protection from fire is important during vegetation growth. Juvenile plants may be killed by fire preventing successful rehabilitation and achieving rehabilitation criteria.

Fire management includes the following measures:

- monitoring of weather conditions during high-risk conditions;
- maintaining communication with local emergency services including the Queensland Fire and Emergency Services (QFES);
- establishing and maintaining fire breaks around revegetation and key infrastructure (assessed as needed);
- serviceable firefighting equipment and appropriate training;
- a fire management plan would be developed to limit fire risk and provide response procedures.

5.5 Infrastructure

5.5.1 Fencing and signage

If needed, fencing may be installed to restrict access to stock, particularly during early stages of germination. It may also be needed to stop compaction, surface stability degradation (caused by grazing animals) and rill and gully erosion.

Vegetated corridors would be retained where practicable and land disturbance would be restricted. Undisturbed land would be fenced and buffers around sensitive habitats would minimise human interaction with wildlife.

5.5.2 Erosion and sediment control

Erosion is a significant factor stopping successful rehabilitation because of soil, seed and nutrient losses and an overall decrease in surface stability. At the time of preparation, the SMP noted that over 50% of monitored rehabilitation exhibit slight to severe soil erosion (SSA 2016).

The majority of rehabilitated slopes range from 0-15%. Rehabilitation on steeper slopes (13-18%) substantially reduces costs associated with landform reshaping; however, it increases the risk of rehabilitation failure because steeper slopes cause greater runoff and increase erosion. Steep slopes have already been rehabilitated, for example Ramp 4 West; however, the area exhibits severe erosion. So far, there has been no evaluation of rehabilitation on steep slopes.

Erosion control on rehabilitated land primarily focuses on surface water management and surface protection. Soil stability can be increased by building organic carbon which would lead to the formation of stable humus. Stable humus binds soil clay particles together, thereby reducing particle movement and capacity for erosion. Soil stability and the building of organic carbon is discussed in Section 4.3.3.

An *Erosion and Sediment Control Plan 2020* (ESCP) has been developed in accordance with the International Erosion Control Association (IECA) guidelines for *Best Practice Erosion and Sediment Control* (2008). The purpose of the ESCP is to define the overall erosion hazard of land disturbance and to provide appropriate management strategies to make sure that adverse effects from sediment are controlled.

Current sediment and erosion control measures on disturbed and rehabilitated land include:

- erosion and sediment control during clearing such as minimising time soil is left exposed, limiting clearing to essential works, and directing runoff from cleared areas to sediment dams;
- erosion and sediment control for exposed soil and spoil, including the use of gravelling, mulching, revegetation, sediment fences, check dams, grass and rock filter traps, and gypsum application on dispersive soils;

- contour cultivation and contour deep ripping or furrowing to minimise soil compaction and improve water infiltration;
- contour levee and diversion banks to reduce or eliminate the catchment to the heads of gullies;
- grassed waterways to confine runoff from structures into a stable vegetated flow path;
- the use of sediment (settling) dams to confine the movement of soil and/or mineral waste for disturbed areas with >150 cubic metres per year (m³/yr) estimated soil loss;
- the use of sediment control structures to intercept and convey disturbed area runoff water to sediment dams; and
- sediment fences and / or coir logs for retention/filtration of suspended sediments.

6.0 Revegetation objectives

Revegetation objectives must be consistent with the PMLU (light grazing or native ecosystem) and NUMAs, and rehabilitation and management milestones in the PRC plan.

Specific rehabilitation milestone criteria targets are in Table 11.

Table 11 Rehabilitation milestone criteria

Milestone reference	Rehabilitation milestone	Strategies
RM1	Infrastructure decommissioning and removal	a) decommissioning and removing services; b) removing infrastructure; c) decommissioning dams; d) removing all general and regulated waste; and e) decommissioning or converting water or monitoring bores, exploration drill holes.
RM2	Remediation of contaminated land	a) removing or remediating contaminated land to a PMLU of light grazing pasture or native ecosystem; b) all contaminated sediment is removed; c) all plastic liners are removed and disposed; d) site investigation report is prepared by an AQP; and e) certification from an AQP that all contaminated land has been removed.
RM3	Cover system installation	a) certification by an AQP that waste products generated from the washing of coal are buried under spoil with a minimum of thickness of five metres.
RM4	Landform construction and reshaping or reprofiling	a) reshaping or recontouring the landform; b) install drainage management structures; c) all major earthworks completed; d) stable landform and slope angles ~15 % average; and e) landform is assessed as geotechnically stable by an AQP. Diversions (RA12) f) certification from an AQP that diversions are constructed as per the requirements of the certified design, and in accordance with DNRME's Guideline: <i>Works that interfere with water in a watercourse for a resource activity — watercourse diversions under the Water Act 2000 (OSW/2019/4599)</i>.
RM5	Surface preparation	a) placement of a minimum of 0.15 m of soil; b) contour ripping finished; and c) fertiliser applied at rates of 250 kg/ha.
RM6	Revegetation (light grazing pasture)	a) direct seeding at application rate determined by an AQP;

Milestone reference	Rehabilitation milestone	Strategies
		b) seed mix applied contains a suitable range of trees, shrubs and perennial grass species and suitable leguminous species consistent with the surrounding area; and c) stock exclusion fencing installed until achieving surface requirements for grazing pasture.
RM7	Revegetation (native ecosystem)	a) Seed mix applied contains species consistent with RE 11.1.11 or RE 11.3.4; b) Species comprise ≥ 20 % of the average number of species described in RE 11.1.11 or RE 11.3.4 technical descriptions; c) Average height of each layer is ≥ 70 % of average layer height described in RE 11.1.11 or RE 11.3.4 technical descriptions; d) Average fractional cover of each layer is ≥ 50 % of average fractional cover described in RE 11.1.11 or RE 11.3.4 technical description.
RM8	Achievements of surface requirements (light grazing pasture)	a) species richness and diversity achieved is consistent with the sown seed mix and similar to reference sites; b) revegetation $\geq 70\%$ comparable to analogue site; c) no active areas of gully erosion and drainage follows appropriate drainage paths; d) certification from an AQP that rehabilitation is resilient to fire; and e) certification by an AQP that weeds and pest species are in densities no greater than at analogue sites. Diversions (RA12) f) an AQP prepares an assessment report annually based on the Index of Diversion Condition (IDC) assessment, where: a. the diversions have achieved a target Geomorphic Index score of ≥ 95 % relative to baseline condition. b. the riparian corridor has achieved a target Riparian Index score of ≥ 70 % relative to baseline condition.

Milestone reference	Rehabilitation milestone	Strategies
RM9	Achieving surface requirements (native ecosystem)	a) for RE 11.1.11 species richness ≥ 15 native species: – tree species richness ≥ 2 species, including Yellow Jacket (<i>Corymbia liechgardtii</i>); – shrub species richness ≥ 3 species; – grass species richness ≥ 5 species; and – forb and other species richness ≥ 5 species. b) For RE 11.3.4, species richness ≥ 18 native species: – tree species richness ≥ 3 species, including Forest Red Gum (<i>Eucalyptus tereticornis</i>); – shrub species richness ≥ 4 species; – grass species richness ≥ 6 species; and – forb and other species richness ≥ 5 species. c) revegetation $\geq$ average fractional cover derived from RE technical descriptions for RE 11.1.11: – trees cover ≥ 57.7 %; – shrubs ≥ 36.9 %; and – grasses and forbs cover ≥ 29.3 %. d) revegetation $\geq$ average fractional cover derived from RE technical descriptions for the RE 11.3.4: – trees cover ≥ 37.1 %; – shrubs ≥ 4.3 %; and – grasses and forbs cover ≥ 61.6 %. e) no active areas of gully erosion and drainage follow appropriate drainage paths; f) certification from an AQP that rehabilitation is resilient to fire; and g) certification by an AQP that weeds and pest species are in densities no greater than at analogue sites.
RM10	Achieving PMLU to a stable condition (light grazing pasture)	a) certification from an AQP that the area has achieved stable condition; b) certification from an AQP that the landform achieved a factor of safety ≥ 1.5; c) maximum erosion rate of < 10 t/ha/yr; d) total percentage groundcover (vegetation, litter and rock combined) is > 70 %; e) there are no declared Noxious Class 1 or Class 2 weeds; f) native fauna identified at reference sites are present or indicators of these species are recorded; g) water quality complies with Table C7 of EPML00876713. Diversions (RA12) h) prepare assessment report by an AQP certifying that the diversion is operating in accordance with,

Milestone reference	Rehabilitation milestone	Strategies
		DNRME Guideline: <i>Works that interfere with water in a watercourse for a resource activity — watercourse diversions under the Water Act 2000</i> (OSW/2019/4599) criteria and is in a stable condition. The report will include data from the IDC assessment, showing that Geomorphic Index has maintained a score of $\geq 95\%$ and the Riparian Vegetation Index has maintained a score of $\geq 70\%$ for two consecutive years. i) certification from AQP that the diversions have achieved a stable condition, and are able to sustain a 0.1% AEP flood event.
RM11	Achieving PMLU to stable condition (native ecosystem)	a) certification from an AQP that the area has achieved stable condition; b) certification from an AQP that the landform achieved a factor of safety ≥ 1.5; c) total percentage groundcover (vegetation, litter and rock combined) is $\geq 50\%$; d) maximum erosion rate of < 10 t/ha/yr; e) there are no declared Noxious Class 1 or Class 2 weeds; f) native fauna at reference sites are present or indicators of these species are recorded; and g) water quality complies with Table C7 of EPML00876713.
MM1	Conversion of the void into a permanent waterbody	a) all major earthworks finished.
MM2	Highwall and low wall treatment	a) maximum slope of 30% in competent rock; b) maximum slope of 15% in incompetent rock; c) factor of safety ≥ 1.5; and d) void complies with condition F17 of EA EPML00876713.
MM3	Achieving surface requirements	a) fencing of 1.8 m high erected around the perimeter of the void; b) warning signage posted around the perimeter of the void following the <i>Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland</i>; c) safety bund constructed at two metres in height, four metres in base width and 10 m beyond the area which may be affected by void edge instability; and d) direct seeding of low walls with species and application rates determined by an AQP.

Milestone reference	Rehabilitation milestone	Strategies
MM4	Achieving improvement	a) certification from an AQP that the void will not cause environmental harm outside of the tenure boundary; b) certification from an AQP that the void is safe to humans and livestock; and c) certification from an AQP that the water level in the void will not cause environmental harm to the surrounding environment.

7.0 Revegetation monitoring and maintenance

7.1 Rehabilitation performance

7.1.1 Key revegetation issues

Rehabilitation monitoring has found several issues that may impact rehabilitation outcomes including:

- erosion;
- unstable landform;
- poor soil nutrients;
- low species diversity;
- low vegetation density;
- bushfire resilience; and
- poor plant available water.

7.1.2 Historic rehabilitation monitoring

Several rehabilitation monitoring campaigns have been done and are described in *Rehabilitation Status Review* (WSP 2016). Rehabilitation monitoring is classified under the following 'eras' in Table 12:

Table 12 Previous rehabilitation monitoring

Year	Consultant	Comments
Pre 2008		
1995	Centre for Mined Land Rehabilitation	Field measurements taken across four rehabilitation sites completed in 1984.
1999	Unnamed consultancy	Comparison between 1997 and 1998 work.
2000	Unnamed consultancy	Field measurement of nine rehabilitation sites
2000	Centre for Mined Land Rehabilitation	Two monitoring campaigns relating to specific target areas based on the year rehabilitation was completed.
2001-2003	AustralAsian Resource Consultants	Annual monitoring of 11 sites.
2005	Emerton and Elsol	Broad rehabilitation assessment including review of past monitoring activities from 1995 to 2003.
2008-2012		
2007	Rio Tinto (internal)	Rio Tinto Coal Australia (RTCA) internally developed a rehabilitation monitoring program centred around landscape function analysis (LFA). The plan incorporated vegetation assessment, soil and spoil sampling, and rill and gully erosion assessment. 33 sites were monitored in 2008, which was proposed to increase to 85 sites by 2016.
2012 – Present		

Year	Consultant	Comments
2016	WSP	WSP were engaged to prepare the Blair Athol Coal Mine (BACM) <i>Rehabilitation Monitoring Program</i> (RMP)
2019	WSP	Rehabilitation monitoring was done across 12 sites, using methods detailed in the RMP (WSP 2016).
2020	WSP	Rehabilitation monitoring was done across 12 sites, using methods detailed in the RMP (WSP 2016).
2021	Earthtrade	Monitoring of 15 existing rehabilitation sites, establishment and monitoring of two new sites located in the TSF. Vegetation monitoring of three existing reference sites, monitoring of five existing gully locations, and soil monitoring at two persistent bare areas (PBAs).

7.2 Monitoring objectives

7.2.1 Vegetation monitoring

Vegetation monitoring objectives for the Mine are to:

- measure total lower-storey cover (foliage and basal), species density and richness in the rehabilitation block compared to reference sites;
- measure pasture yield compared to reference sites;
- measure the cover (foliage and basal), presence / absence of upper-storey (tree) and mid-storey (shrub) species;
- measure the presence of declared weeds to identify weed management issues
- assess the success of sown species by comparing seeding mixes to monitoring data; and
- obtain data to statistically indicate trends and demonstrate success.

7.3 Monitoring methods

The following monitoring methods ensure that revegetation monitoring is cost effective, measurable, accurate and repeatable.

7.3.1 Data collection and data analysis

Rehabilitation data will be collected and assessed against milestone criteria to identify changes and monitor trends. This includes the use of data predictions to ensure rehabilitation performance is on target to meet rehabilitation milestones. Remedial or maintenance actions will be conducted as needed.

Permanent vegetation monitoring transects have been established in previous rehabilitation trials. This approach is scientifically robust, simple to execute and easily established.

Monitoring would be done along a standardised 50 m long transect, with a 10 m wide plot, at ~45 degrees across the slope. The parameters to be recorded within each rehabilitation site transect include:

- canopy height (ecological dominant layer);
- canopy cover;
- groundcover;
- species richness;

- relative abundance;
- weed presence / absence;
- stem count;
- erosion gully monitoring; and
- soil sampling;

7.3.2 Schedule

Successful rehabilitation requires continuous monitoring and evaluation of performance in order to achieve the intended PMLU outcomes.

Vegetation growth is rapid in the early stages and slows as the community matures. Initial monitoring (ie 1-2 years) would enable the Mine to identify trends in vegetation growth and success, with improvements or remedial actions implemented as needed. Therefore, rehabilitation would be assessed at 1, 2, 5, 10 and 15 years after establishment; then every 5 years until progressive certification is achieved (Earthtrade 2021).

To minimise differences in seasonal effects (ie temperature, rainfall, likelihood of severe weather events) monitoring would be done during May and August, following the wet season.

7.3.3 Maintenance

Appropriate maintenance and/or remedial works will be done if issues impacting completion criteria are identified by rehabilitation monitoring. Current maintenance issues and mitigation measures are in Table 13.

Table 13 Revegetation issues and mitigation measures

Revegetation issue	Mitigation measure
Historical rehabilitation	Augment as per current rehabilitation method, as needed.
Gully erosion	Fill and clad gully, modify drainage as needed, revegetate infill areas as soon as possible.
Poor vegetation cover	Adjust fertiliser or ameliorant inputs and reseed during appropriate seasonal conditions.
Erosion control device failure	Assess against design specifications, as needed.

7.3.4 Reporting

The following framework is leading practice for summary information to be included in annual rehabilitation reporting:

- methodology (field sampling and data statistical analysis);
- site establishment and descriptions, including photos (reference and rehabilitation plots);
- results for all assessments;
- comparison of the rehabilitation data (vegetation) with the data obtained from the reference plots, including statistical analysis to compare results between rehabilitation and reference plots;
- assessment and discussion on the soil chemical and physical properties and soil nutrient status of the reconstructed soil profile, identifying potential properties that may contribute to any areas of rehabilitation not meeting the desired objectives;
- statistical analysis to identify trends between soil and vegetation measurements;
- establishment success of seeded species;
- description of management and land use potential;

- graphical presentation (ie heat mapping) and description of key settlement / subsidence and progression of erosion features;
- detail type and global positioning system (GPS) location of erosion identified within, or near each monitoring plot;
- map outlining the blocks and transect locations of rehabilitation and reference plots; and
- discussion including, but not limited to:
 - trends in the vegetation and soil data; and
 - recommendations for managing erosion and weeds.

7.3.5 Adaptive management

Adaptive management controls would be developed and implemented as needed to improve revegetation practices. Appropriate investigations would be done with remediation programs and specific management measures to be prepared as part of adaptive management, where improvement opportunities are identified.

7.3.6 Adverse and unplanned events

Reporting of any adverse or unplanned event would be done in accordance with legislative requirements. A report would be prepared and include at a minimum:

- the nature and extent of the adverse event;
- actions taken to limit the extent of an impact at the time of the event;
- the proposed monitoring and remediation of any adverse event;
- actions currently taken to remediate and potential outcomes of remediation; and
- schedule of reporting for ongoing event management and reporting.

7.3.7 Quality assurance and quality control

Monitoring, data assessment and reporting would be done by an AQP. All monitoring data files would be stored onsite. Project staff would be responsible for reviewing monitoring data, analysis, reports and managing consultants.

Aspects to consider when reviewing the data, analysis and reports include quality assurance and quality control of data, methodologies used, fluctuating trends in data from previous years, accuracy of figures and graphs and general conclusions made about rehabilitation progress.

7.4 Rehabilitation trials

7.4.1 Historic rehabilitation trials

7.4.1.1 Direct seeding trials

Two separate direct tree seeding trials site were established at Ramp 3 (North) and Ramp 4 (East) in late December 2007. The purpose of the direct seeding trials was to assess the effect of direct tree seeding a standard tree seed mix onto four different surface material including the three main soil types (Section 4.2.2).

7.4.2 Future rehabilitation trials

Rehabilitation trials can improve the chances of achieving a nominated rehabilitation outcome, providing valuable ecological insights on the success of revegetation methods. At this stage, no further rehabilitation trials are planned. If trials are planned, the following would need to be included:

- 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) would be done;
- when the trial(s) would commence;
- the duration of the trial(s);
- how the trial(s) would be assessed for success; and
- how the results of the trial(s) would be incorporated into rehabilitation strategies and the development of milestones.

Rehabilitation trials must not result in the delay of rehabilitation.

7.5 Review

For continual improvement, revision of this plan would be done when monitoring identifies deficiencies in revegetation or in response to a significant event (ie natural disturbance), or if rehabilitation trials are planned, as needed.

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Management Plan

Mine closure

Blair Athol Mine

Prepared for TerraCom Limited | September 2025



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Management Plan

Mine closure

Blair Athol Mine

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1.0 Introduction

1.1 Context and purpose

The Blair Athol Mine (the mine), approved under mining lease (ML) 1804 and environmental authority (EA) EMPL 00876713, is owned and operated by Orion Mining Pty Ltd, wholly owned by TerraCom Limited (TerraCom). TerraCom took over ownership in May 2017 and recommissioning activities commences immediately.

The mine is located in Clermont, Central Queensland, approximately 14 kilometres (km) north-west of Clermont, 110 km north-west of Emerald, 320 km south-west of Point Abbot and 240 km south-west of Hay Point.

The mine is located within the Blair Athol Basin, which covers approximately 25 square kilometres (km²). The surrounding land use at the mine includes state forest, grazing and limited cropping. Blair Athol State Forest adjoins the east, south and west sides of the ML.

The purpose of this *Mine Closure Management Plan* (the plan) is to describe the systems, processes and procedures used at the operation to decommission and rehabilitate affected land (the closure strategy) for the benefit of communities and to minimise environmental risks to the rehabilitated land and the receiving environment.

1.2 Scope

1.2.1 Inclusions

This plan has been prepared to formalise the proposed closure activities, including decommissioning and rehabilitation that are being undertaken — as well as those yet to be done at the mine. This plan is based on a review of documentation provided by TerraCom related to closure planning at the mine. This plan includes:

- gap analysis of areas identified as requiring further consideration or action;
- obligations including statutory and legal;
- alternative land use options; and
- risk assessment of inherent and residual risks to closure.

This plan covers all land within ML1804.

1.2.2 Framework and report structure

This plan has been prepared using a risk-based approach. The objective of a risk-based approach is to reduce both cost and uncertainty of mine closure. The analysis of risk is based on a review of legislation, leading practice standards and obligations and available literature. The risk assessment (Section 4.0) has been used to determine the most effective strategies to close the various operational domains of the mine (Section 3.0) to create a safe, stable, sustainable and non-polluting post-mining land use.

This plan proposes six simple closure risk topics that describe potential root causes of failure in mine closure activities, namely:

- climate and air quality;
- human factors;
- surface and groundwater;
- ecology;
- underlying materials; and
- landform constructability.

The risk categories are used throughout the plan so that the risks listed in Section 4.0 (Risk assessment) are intuitive to the reader.

1.3 Objectives

This plan has been designed and developed to provide a framework for the closure (including decommissioning) and rehabilitation of the mine.

The objective of this plan is to lay the foundation for the establishment of a set of clear indicators that demonstrate the successful completion of the closure process and tasks.

2.0 Rehabilitation goals and objectives

2.1 Goals

The general rehabilitation goals identified by the *Progressive Rehabilitation and Closure Plan* (PRC plan) guidelines (ESR2019/4964) include:

- the mine will be safe to humans, livestock and fauna;
- disturbed land will be rehabilitated so that it is non-polluting; and
- rehabilitation will aim to create a landform that is stable and conducive to the post-mining land use.

The nominated post-mining land use goals for the mine are to:

- implement successful design and rehabilitation to ensure the landform is stable and safe to humans, livestock and fauna;
- ensure design and rehabilitation is non-polluting;
- ensure rehabilitation and revegetation is self-sustaining; and
- ensure that disturbed land is generally returned to one of the following land uses:
 - grassland rehabilitated area, noting that some old rehabilitation areas have trees on them, these areas are still considered grassland;
 - undisturbed woodland;
 - native ecosystem (disturbed areas located on State Forest Land); or
 - voids (open-pits that are no longer mined and will not be backfilled).

2.2 Objectives

TerraCom intends to return most of the disturbed area to grazing which is consistent with the *Environmental Protection Act 1994* (EP Act) and EA conditions regarding rehabilitation. For areas disturbed by the mine the following overarching objectives will apply:

- the landform will be safe to humans, livestock and fauna in the foreseeable future;
- rehabilitation will aim to create a landform that is stable and conducive to the post-mining land use, unless an alternative next use is pre-determined and agreed;
- mineral waste and disturbed land will be rehabilitated so that they are non-polluting and self-sustaining or to a condition where the maintenance requirements are consistent with the next land use;
- surface water leaving the landform will not be degraded to levels that cause environmental harm, i.e. current and future water quality will be maintained at levels that are acceptable for users downstream of the mine and does not cause environmental harm; and
- rehabilitation will be completed to a standard that is conducive to the post-mine land use.

It is important that this plan recognises the limits of how the described overarching objectives can be applied. Table I outlines how the objectives will be achieved in the short, medium and long term.

Table I Continuum of objectives

Short term objectives
Progressively reshape and stabilise disturbed areas
Provide ongoing maintenance of rehabilitated areas including erosion control measures
Manage soil to ensure suitability and beneficial reuse
Obtain stakeholder acceptance of proposed land use and criteria
Ameliorate soils as necessary to address physical and chemical constraints to revegetation and erosion stability
Refine rehabilitation methods through continuing review and update of this plan
Medium term objectives
Demonstrate rehabilitation success (or refine as necessary by adapting practices) in comparison with reference sites
Reduce reliance on structural drainage and erosion control methods through landform design and construction that lends itself to the surrounding undisturbed drainage
Long-term objectives
Demonstrate rehabilitation performance against agreed criteria
Relinquish the ML

3.0 Final land use closure strategy

3.1 Rehabilitation area domains

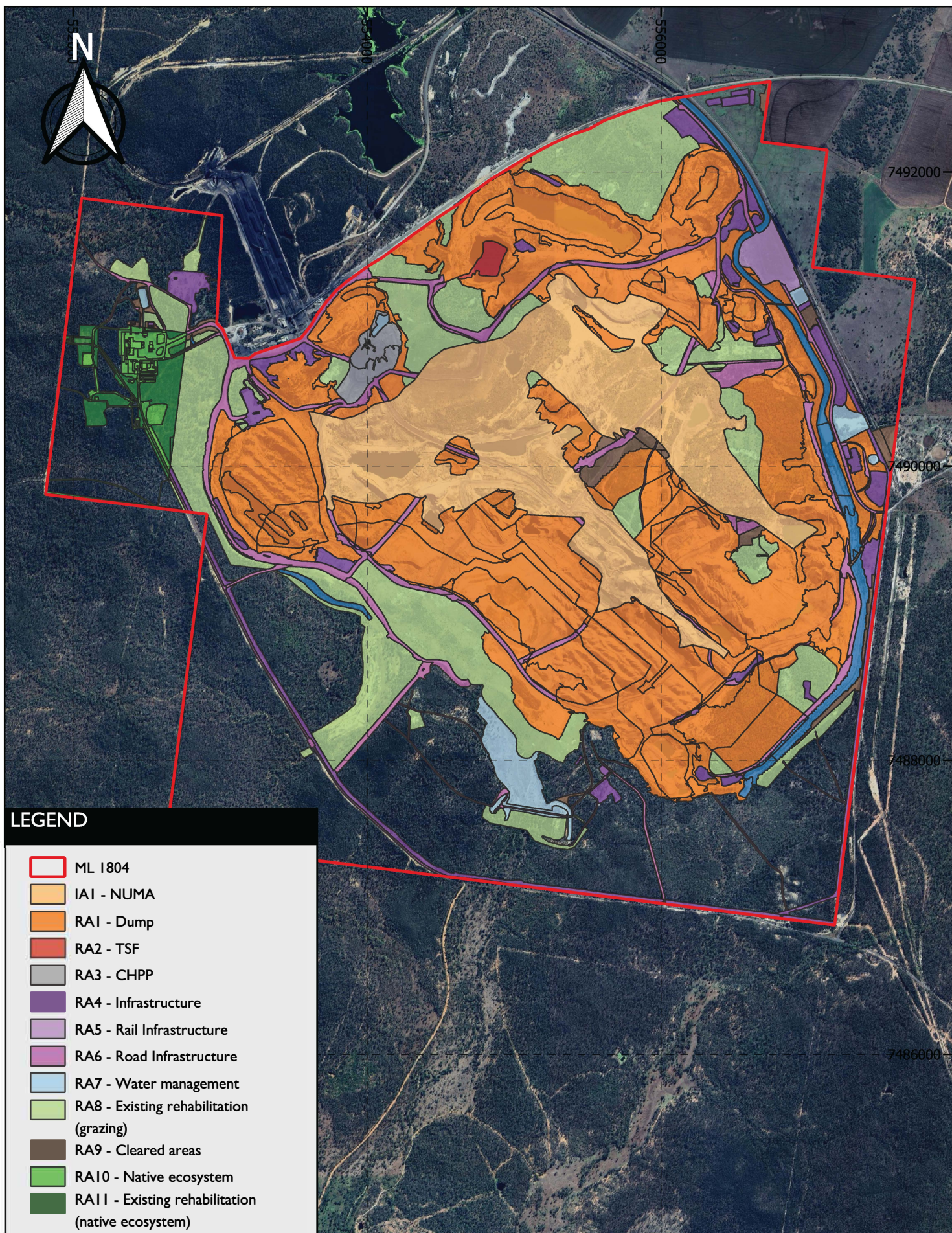
Operational domains are defined based on land management units within the ML, usually with unique operational and functional purpose and therefore similar geophysical characteristics. Sub domains are used to provide further delineation of geophysical characteristics within operational domains.

Figure 1 shows the distribution of the rehabilitation area domains for the mine.

Table 2 summarises the progressive rehabilitation area domains within the ML.

Table 2 Progressive rehabilitation area domains

Rehabilitation area	Relevant activity / domain	Approximate area (ha)
IA1	Residual Void	291.6
RA1	Dump	735.75
RA2	TSF	3.97
RA3	CHPP	12.87
RA4	Infrastructure	73.15
RA5	Rail infrastructure	11.21
RA6	Road infrastructure	104
RA7	Water management	27.08
RA8	Existing rehabilitation (grazing)	289.01
RA9	Cleared area	21.03
RA10	Native ecosystems	20.7
RA11	Existing rehabilitation (native ecosystem)	20.89
RA12	Diversions	34.88
Total		1,646.14



LEGEND

- ML 1804
- IAI - NUMA
- RA1 - Dump
- RA2 - TSF
- RA3 - CHPP
- RA4 - Infrastructure
- RA5 - Rail Infrastructure
- RA6 - Road Infrastructure
- RA7 - Water management
- RA8 - Existing rehabilitation (grazing)
- RA9 - Cleared areas
- RA10 - Native ecosystem
- RA11 - Existing rehabilitation (native ecosystem)
- RA12 - Diversions

Scale 1 : 17 500

0 0.5 1 km



Client TerraCom Limited		Project Mine closure management plan	
Design: Scale: CRS:	SGME Pty Limited 2.09.2025 1 : 17,500 GDA2020	Title Rehabilitation areas	Figure 1

3.2 Final land use

Mining is a temporary use of land. Upon closure, TCL aims to return all disturbed areas, other than the void, to a PMLU of either grazing or native ecosystem. Rehabilitation will be done in a manner which is consistent with the PRC plan guidelines (*ESR2019/4964*) and EA conditions regarding rehabilitation, ie Conditions F3-F9. The basic strategy for how this will be achieved is described in Section 3.4.

There will be areas of the disturbance footprint, ie voids, where rehabilitation will not be possible, and an alternate land use has been considered.

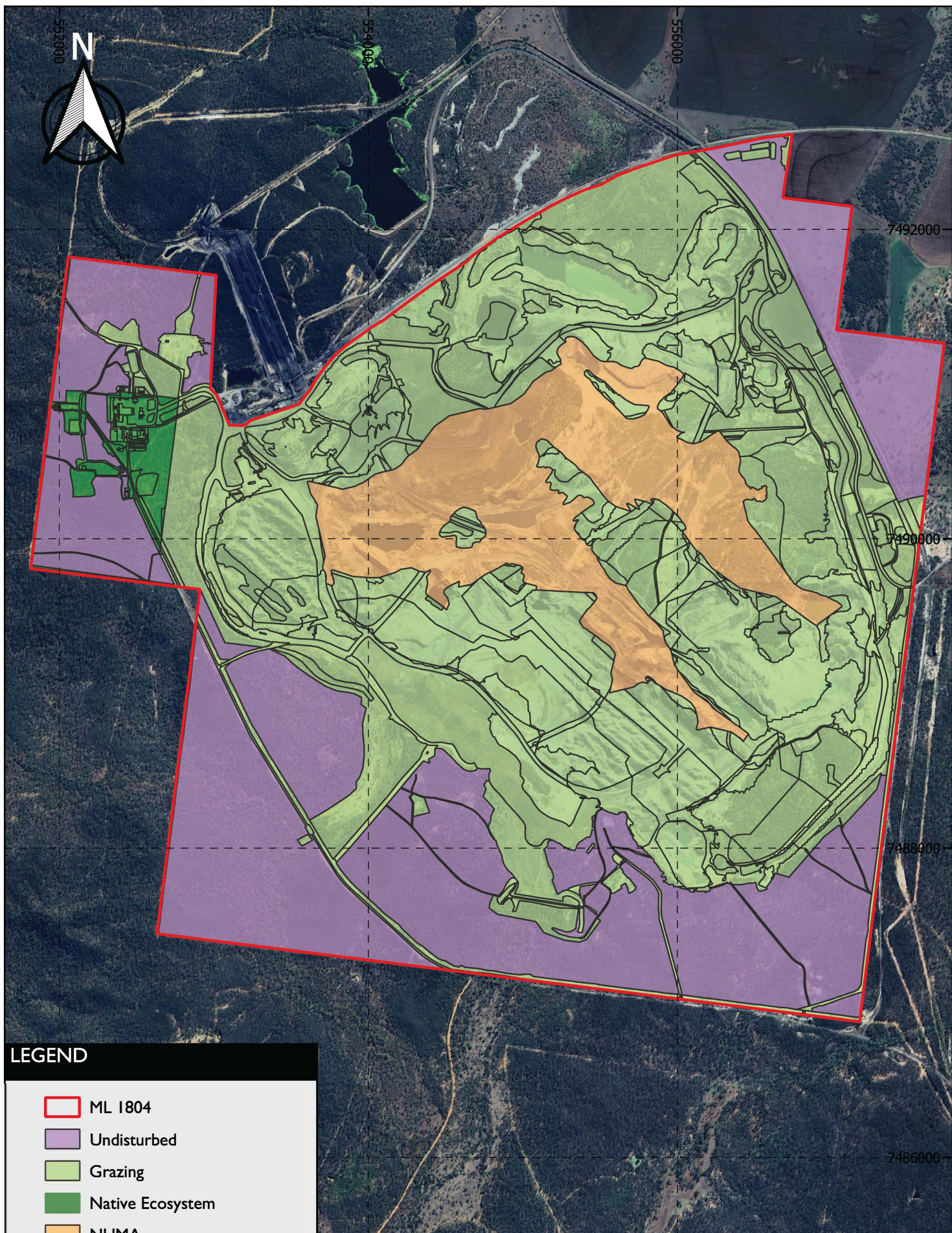
Overall, the final proposed land uses for the mine include:

- grazing;
- native ecosystem (State Forest Land); and
- voids.

The landscape will however be dominated by grazing. Table 3 summarises the area for each proposed final land use, with locations provided in Figure 2.

Table 3 Summary of final land uses

Final land use	Rehabilitation area	Approximate area (ha)
Grazing	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9, RA12	1308.45
Native ecosystem	RA10, RA11	41.59
Voids	IA1	296.1



LEGEND

- ML 1804
- Undisturbed
- Grazing
- Native Ecosystem
- NUMA

Scale 1 : 17 500

0 0.5 1 km



Client

TerraCom Limited

Project

Mine closure management plan

Design: SGME Pty Limited 2.09.2025
Scale: 1 : 17,500
CRS: GDA2020

Title

Final land use

Figure

2

3.3 Further studies

Further studies will be conducted during the operational life of the mine which will inform the review and amendment of this plan.

3.3.1 Water quality criteria

The mine has a database of background monitoring samples spanning the duration of the mining operation from several water bodies (on-lease storage and creeks). This data will form the basis of further assessment which will be required to determine appropriate criteria for surface water:

- in the voids;
- water storages; and
- downstream receiving environment surface water monitoring location.

The void water balance modelling for the mine will require review to determine surface water criteria for voids as mining progresses.

3.3.2 Void water balance modelling

The void water balance model may require review to determine surface water criteria. It may also be required to determine if remnant coal in the open-pit walls will be exposed to oxygen and heat. This information is required to evaluate the combustion risk of the coal seams in the voids. If the coal seam in the voids are not inundated with water, they will be covered with a buttress of low-risk mineral waste.

3.3.3 Flood modelling

Flood modelling will be completed for the landform to make sure that voids are protected against inundation and that the landform is protected from erosion damage from flooding to an annual exceedance probability of 0.0003 (1 in 3,000 years). Most recent flood modelling has been completed in August 2025 (HydroBalance 2025).

3.4 Closure strategy

3.4.1 Earth structures

3.4.1.1 Spoil emplacement areas

Where landforms need to be constructed, they will be built by excavating, loading and hauling suitable materials for the landform (mineral waste) and cover (soil). The landform grade will be built by pushing with a dozer to a maximum slope angle of 15%. The mine has generally placed most of the medium-risk mineral waste low in the landform during operations. Notwithstanding, pockets of medium-risk mineral waste may be encountered during reshaping earthworks on historical disturbance.

The final land use of the domain will be biodiversity with a mix of woodland and grassland rehabilitation area and some riparian vegetation along the creek diversions.

3.4.1.2 ROM pad and soil stockpiles

All coal stockpiled on the ROM will be processed prior to executing the sub domain closure strategy.

The ROM area will have at least 300 millimetres (mm) of coal material removed from the surface and hauled to the spoil emplacement area. Remaining coal on the ROM pad will be encapsulated by low-risk mineral waste as part of rehabilitation. Once the coal has been encapsulated, the sub domain will be graded by dozer to a maximum 15% and natural drainage lines will be re-established. Slopes will be designed to drain along established contours created by the surface. The graded surface will be ripped to alleviate compaction and seeded to promote vegetation establishment.

3.4.2 Voids

The remaining voids may or may not be partially backfilled by mineral waste.

Any coal rejects emplacement areas within voids will be covered with a minimum of 5 metres (m) of spoil.

An abandonment bund will be constructed to prevent accidental access to the voids.

A risk assessment will be completed to determine the risk of intentional entry into the voids.

Land around the void perimeters has been cleared as part of the mine operations. Cleared land around the void perimeters will be rehabilitated by selectively spreading soil followed by grading and ripping to remove compaction followed by seeding.

3.4.2.1 Ramp 2 TSF and coal rejects emplacement area

Most of this domain has been covered with low-risk mineral waste. An assessment of the sub domain will be completed prior to closure to determine that the landform is stable and can be rehabilitated.

3.4.2.2 Water storages

Water storages, where appropriate and self-filling, will be retained as a mine asset for future landowners if written agreement from the landowner is received. All other water containment facilities will be decommissioned and removed. Associated infrastructure will be removed as part of the demolition contractor works. Any contaminated material and silt within the facilities will be removed and hauled to the voids or to the earthen structures for encapsulation.

Water storage embankment batter slopes will be graded by dozer and shaped to establish drainage away from the toe of the embankments. Soil will be selectively placed over the embankment batters. Contour ripping, and seeding will be selectively completed.

3.4.3 Facilities and structures

3.4.3.1 Heavy industrial

The industrial infrastructure area includes facilities that are required to process coal and support coal handling:

- mine industrial area;
- mine offices, stores and workshop;
- explosives storage area;
- power reticulation;
- train load facility; and
- rail easement.

The closure strategy for this domain includes:

- removing demountable and moveable buildings off mine;
- disconnection, decommissioning, demolition and removal of all large plant items and equipment and infrastructure including but not limited to crushing plant screens, drives, generators, etc;
- removal of any buried services for scrap and recycling including electrical cabling, fluid piping including drained fuel lines and compressed air lines;
- demolition of building foundations, down to 1 m below ground level, and dispose of concrete rubble in the void following DES approval;
- general mine clean-up of contaminated soil which will be disposed of in void or encapsulated in the earthen structures; and
- rehabilitation of all heavy industrial footprints including storage areas and lay downs.

All approvals and permits for demolition will be completed by TerraCom prior to demolition work commencing. Demolition will be completed in accordance with the mine health, safety and environment policies and standards.

Any concrete rubble and steel that is not viable to be removed from the mine will be broken up and placed into the voids. Infrastructure steel, ie sheds and small buildings, will be broken down into a manageable size and removed from the mine for sale if viable. Failing this, scrap metal will also be placed in voids. Approval from DES will be required to place demolition material into the voids.

Fuel storage facilities and other storage tanks not owned by a third party, will be completely emptied of all hazardous materials and decontaminated prior to demolition. During demolition, the decontamination, treatment and disposal of hazardous waste materials will be completed as required and the *Waste Management Plan* will be updated accordingly.

All services including power, compressed air, and water to all buildings, plant and equipment and heavy infrastructure will be isolated and disconnected prior to any demolition works being commenced. Any additional services (power, water, compressed air, communications etc.) required by the demolition contractor will be supplied in isolation to the disconnected services.

The contamination survey will be updated at the end of demolition to determine if further clean-up is required. Remediation of contamination will be undertaken as required.

All disturbed footprints will be graded by dozer to re-establish natural drainage. Soil will be selectively placed (if required) over the footprints. This process will end in contour ripping and revegetation.

3.4.3.2 Light industrial

Light industrial includes:

- mine offices;
- power reticulation; and
- crib huts.

The light industrial infrastructure area consists of all remaining industrial features not included in the heavy industrial area.

All services including power, compressed air, water to buildings, plant and equipment and associated light infrastructure will be isolated and disconnected by suitably qualified personnel or contractors prior to demolition works. A phase I contamination investigation will be completed prior to the removal of light industrial infrastructure.

Mobile crib huts will be decommissioned and removed from the mine. Where buildings are unable to be moved, they will be demolished and removed from the mine or, if approval is granted, to the voids. An investigation has identified asbestos material in some buildings which may require removal prior to demolition.

All concrete paths and building foundations will be broken up using a dozer, following approval by DES, hauled to the voids. The office car park will have the bitumen material removed from its footprint which will be hauled to the voids for disposal.

All industrial facilities will require power disconnection prior to removal. Specifically, this will include the decommissioning and removing all switching substations, transformers, reticulation aerials, and powerlines back to the high voltage feeder (owned by power supplier).

Mine power requirements will decline during the closure period, meaning sufficient portable power will be needed. This will be installed and remain active during the closure period to maintain office and workshop operations.

All disturbed footprints will be graded by dozer to re-establish natural drainage. Soil will be selectively placed (if required) over the footprints. This process will end in contour ripping and revegetation.

3.4.4 Flood and sediment control structures

This domain covers the closure and rehabilitation of the creek diversions and drainage control structures including silt traps, and drains.

Creek diversions will remain in place; however, a riparian zone will be established along the sides to improve their ecological value.

Sediment and silt will be removed from silt traps and placed in the voids. A risk assessment will be completed prior to closure to determine what erosion and sediment control must remain in place.

3.4.5 Roads

Domain 5 includes haul roads and light vehicle access.

This domain includes the closure and rehabilitation of all mine access bitumen roads, and tracks.

Earthworks will include relieving compaction by ripping, grading, culvert removal (if any), soil haulage (and placement where required), and revegetation of road footprints.

The mine access road will be rehabilitated at the end of the post-closure monitoring period unless required for the future land owner's use.

Closure activities for the access road surface will include the following:

- removal of any culverts (if required) and road furnishings;
- ripping and scarifying of the sub-base including the bitumen surface in-situ (for burial);
- reshaping the footprint to establish drainage across the road;
- placing soil (sourced from reserves beside the roads and tracks) over the road surface; and
- light ripping followed by seeding.

3.4.6 Groundwater infrastructure

Groundwater infrastructure includes above ground pipelines, and monitoring wells.

Removal of above ground pipeline sections will be completed as necessary as part of the closure process.

Pipeline corridors will be rehabilitated as part of other works around the mine, including the haul roads where pipeline is located.

Monitoring wells will be decommissioned unless required by the future land owner. They will be decommissioned by removing the casing to 1.5 m below ground level and plugging, grouting and capping in accordance with *Minimum Construction Requirements for Water Bores in Australia* (Australian Government 2012). The area around the well or bore will be cleaned-up, graded, ripped and seeded as required.

3.4.7 Structural pads

Hardstand areas will be closed and rehabilitated along with lay down areas. Earthworks will include removal of any contaminated materials, ripping, grading and application of soil and seeding as required.

The clean-up and removal of any remnant infrastructure and scrap that may remain on the hard stand areas will be included in the closure process. The removal of this infrastructure and scrap will be undertaken as a part of the contract demolition works.

Any contaminated material and coal fines to a depth of 0.3 m below ground level will be dug up and removed. The hardstand areas will be graded by dozer so that they are free draining. Soil will be applied as necessary. Light contour ripping, and seeding will be done.

A phase I contaminated land investigation will be completed prior to hardstand rehabilitation. If contaminated soil is found, then it will be removed or remediated in-situ.

3.4.8 Exploration disturbance

The closure and rehabilitation of exploration activities including drill holes, sumps, exploration tracks, and gridlines will be undertaken. Any other exploration infrastructure will be closed appropriately. Where appropriate agreements are in place infrastructure may remain and be handed over to the responsible party, such as the land holder.

3.4.9 Rehabilitated earth structures and undisturbed land

An audit of rehabilitated land and undisturbed land will be undertaken to confirm that no rehabilitation works are required.

3.4.10 Progressive rehabilitation

A mine rehabilitation schedule based on current approved dates of mine closure is provided in Table 4 for primary domains.

Many of the decommissioning closure tasks will be undertaken concurrently and the duration shown are indicative of each specific task only. Any infrastructure including dams, and buildings, which has beneficial future use by post-mine landowners, will be left in place.

3.4.11 Surrender of ML

The ML will be surrendered when rehabilitation is complete, and evidence has been acquired to demonstrate the rehabilitation milestones in Section 4.0 have been achieved. Suitable evidence to demonstrate achievement of some criteria will require completion of the post rehabilitation monitoring program described in Section 6.0. This will be done by submission of a *Progressive Rehabilitation Report* to DES for part of the mine or a *Final Rehabilitation Report* for the whole project or a part being surrendered.

DETSI will consider the relevant completion criteria in Section 4.0 when deciding whether to certify progressive rehabilitation or whether to approve a surrender application.

Table 4 Summary of proposed progressive rehabilitation area domains and completion dates

RA	Activities	Total (ha)	Rehabilitation milestones	2032	2038	2043	2048	2049	2050	2055
IA1	Residual void	291.6	MM1,2,3,4			291.6				
RA1	Dump	735.75	RM4, 5, 6, 8, 10				735.75			
RA2	TSF	40.6	RM 3,4,5,6,8,10					3.97		
RA3	CHPP	77.9	RM 1,2,4,5,6,8,10						12.87	
RA4	Infrastructure	104.2	RM 1,2,4,5,6,8,10						73.15	
RA5	Rail infrastructure	11.21	RM 1,2,4,5,6,8,10						11.21	
RA6	Road infrastructure	104	RM 1,2,4,5,6,8,10						104	
RA7	Water management	27.08	RM 1,2,4,5,6,8,10						27.08	
RA8	Existing rehabilitation (grazing)	289.01	RM 6,8,10	289.01						
RA9	Cleared areas	21.03	RM 4,5,6,8,10		21.03					
RA10	Native ecosystem (NE)	20.7	RM 1,2,4,5,7,9,11							20.7
RA11	Existing rehabilitation (NE)	20.89	RM 7,9,11	20.89						
RA12	Diversions	34.88	RM 4,6,8,10				34.88			

Rehabilitation milestones (RMs) are detailed in PRC plan and schedule.

4.0 Rehabilitation requirements

4.1 Rehabilitation milestone and strategies

Rehabilitation milestones identify each significant event or step needed to reach a stable condition. Milestone criteria are used to demonstrate each rehabilitation milestone. Rehabilitation milestones and milestone criteria for each rehabilitation area (PMLU) are in Table 5. Management milestones and milestone criteria for the NUMA are in Table 6.

Amendments to final mine rehabilitation milestone criteria will be subject to regulatory approval. The process for amending final mine rehabilitation requirements is described in PRC plan guidelines (*ESR2019/4964*).

The mine rehabilitation requirements need to demonstrate that the closure objectives in Section 2.2 have been achieved. Determining whether mine rehabilitation requirements have been met depends on the trending of measurements over time.

4.2 Reporting and monitoring

Reporting and monitoring are presented in Section 6.0.

Table 5 Rehabilitation milestones and milestone criteria

Milestone reference	Rehabilitation milestone	Milestone criteria	Rehabilitation area
RM1	Infrastructure decommissioning and removal	a) decommissioning and removing services; b) removing infrastructure; c) decommissioning dams; d) removing all general and regulated waste; and e) decommissioning or converting water or monitoring bores, exploration drill holes.	RA3, RA4, RA5, RA6, RA7 and RA10
RM2	Remediation of contaminated land	a) removing or remediating contaminated land to a PMLU of light grazing pasture or native ecosystem; b) all contaminated sediment is removed; c) all plastic liners are removed and disposed; d) site investigation report is prepared by an AQP; and e) certification from an AQP that all contaminated land has been removed.	RA3, RA4, RA5, RA6, RA7, and RA10
RM3	Cover system installation	a) certification by an AQP that waste products generated from the washing of coal are buried under spoil with a minimum of thickness of five metres.	RA2
RM4	Landform development and reshaping or reprofiling	a) reshaping or recontouring the landform; b) install drainage management structures; c) all major earthworks completed; d) stable landform and slope angles ~15 % average; and e) landform is assessed as geotechnically stable by an AQP. Diversions (RA12) f) certification from an AQP that diversions are constructed as per the requirements of the certified design, and in accordance with DNRME's Guideline: <i>Works that interfere with water in a watercourse for a resource activity — watercourse diversions under the Water Act 2000 (OSW/2019/4599)</i>.	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA9, RA10 and RA12

Milestone reference	Rehabilitation milestone	Milestone criteria	Rehabilitation area
RM5	Surface preparation	a) placement of a minimum of 0.15 m of soil; b) contour ripping finished; and c) fertiliser applied at rates of 250 kg/ha.	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA9 and RA10
RM6	Revegetation (light grazing pasture)	a) direct seeding at application rate determined by an AQP; b) seed mix applied contains a suitable range of trees, shrubs and perennial grass species and suitable leguminous species consistent with the surrounding area; and c) stock exclusion fencing installed until achieving surface requirements for grazing pasture.	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9 and RA12
RM7	Revegetation (native ecosystem)	a) Seed mix applied contains species consistent with RE 11.1.11 or RE 11.3.4; b) Species comprise ≥ 20 % of the average number of species described in RE 11.1.11 or RE 11.3.4 technical descriptions; c) Average height of each layer is ≥ 70 % of average layer height described in RE 11.1.11 or RE 11.3.4 technical descriptions; d) Average fractional cover of each layer is ≥ 50 % of average fractional cover described in RE 11.1.11 or RE 11.3.4 technical description.	RA10 and RA11

Milestone reference	Rehabilitation milestone	Milestone criteria	Rehabilitation area
RM8	Achieving surface requirements (light grazing pasture)	a) species richness and diversity achieved is consistent with the sown seed mix and similar to reference sites; b) revegetation $\geq 70\%$ comparable to analogue site; c) no active areas of gully erosion and drainage follows appropriate drainage paths; d) certification from an AQP that rehabilitation is resilient to fire; and e) certification by an AQP that weeds and pest species are in densities no greater than at analogue sites. Diversions (RA12) f) an AQP prepares an assessment report annually based on the Index of Diversion Condition (IDC) assessment, where: a. the diversions have achieved a target Geomorphic Index score of $\geq 95\%$ relative to baseline condition. b. the riparian corridor has achieved a target Riparian Index score of $\geq 70\%$ relative to baseline condition.	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9 and RA12

Milestone reference	Rehabilitation milestone	Milestone criteria	Rehabilitation area
RM9	Achieving surface requirements (native ecosystem)	a) for RE 11.1.11 species richness $\geq$ 15 native species: – tree species richness $\geq$ 2 species, including Yellow Jacket (<i>Corymbia liechgardtii</i>); – shrub species richness $\geq$ 3 species; – grass species richness $\geq$ 5 species; and – forb and other species richness $\geq$ 5 species. b) For RE 11.3.4, species richness $\geq$ 18 native species: – tree species richness $\geq$ 3 species, including Forest Red Gum (<i>Eucalyptus tereticornis</i>); – shrub species richness $\geq$ 4 species; – grass species richness $\geq$ 6 species; and – forb and other species richness $\geq$ 5 species. c) revegetation $\geq$ average fractional cover derived from RE technical descriptions for RE 11.1.11: – trees cover $\geq$ 57.7 %; – shrubs $\geq$ 36.9 %; and – grasses and forbs cover $\geq$ 29.3 %. d) revegetation $\geq$ average fractional cover derived from RE technical descriptions for the RE 11.3.4: – trees cover $\geq$ 37.1 %; – shrubs $\geq$ 4.3 %; and – grasses and forbs cover $\geq$ 61.6 %. e) no active areas of gully erosion and drainage follow appropriate drainage paths; f) certification from an AQP that rehabilitation is resilient to fire; and g) certification by an AQP that weeds and pest species are in densities no greater than at analogue sites.	RA10 and RA11

Milestone reference	Rehabilitation milestone	Milestone criteria	Rehabilitation area
RM10	Achieving PMLU to stable condition (light grazing pasture)	a) certification from an AQP that the area has achieved stable condition; b) certification from an AQP that the landform achieved a factor of safety ≥ 1.5; c) maximum erosion rate of < 10 t/ha/yr; d) total percentage groundcover (vegetation, litter and rock combined) is > 70 %; e) there are no declared Noxious Class 1 or Class 2 weeds; f) native fauna identified at reference sites are present or indicators of these species are recorded; g) water quality complies with <i>Table C7</i> of EPML00876713. Diversions (RA12) h) prepare assessment report by an AQP certifying that the diversion is operating in accordance with, DNRME Guideline: <i>Works that interfere with water in a watercourse for a resource activity — watercourse diversions under the Water Act 2000</i> (OSW/2019/4599) criteria and is in a stable condition. The report will include data from the IDC assessment, showing that Geomorphic Index has maintained a score of ≥ 95 % and the Riparian Vegetation Index has maintained a score of ≥ 70 % for two consecutive years. i) certification from AQP that the diversions have achieved a stable condition, and are able to sustain a 0.1% AEP flood event.	RA1, RA2, RA3, RA4, RA5, RA6, RA7, RA8, RA9, and RA12
RM11	Achieving PMLU to stable condition (native ecosystem)	a) certification from an AQP that the area has achieved stable condition; b) certification from an AQP that the landform achieved a factor of safety ≥ 1.5; c) total percentage groundcover (vegetation, litter and rock combined) is ≥ 50 %; d) maximum erosion rate of < 10 t/ha/yr; e) there are no declared Noxious Class 1 or Class 2 weeds; f) native fauna at reference sites are present or indicators of these species are recorded; and g) water quality complies with <i>Table C7</i> of EPML00876713.	RA10 and RA11

Table 6 Management milestones and milestone criteria

Milestone reference	Management milestone	Milestone criteria	Improvement area
MM1	Conversion of the void into a permanent waterbody	a) all major earthworks finished.	IA1
MM2	Highwall and low wall treatment	a) maximum slope of 30% in competent rock; b) maximum slope of 15% in incompetent rock; c) factor of safety ≥ 1.5 ; and d) void complies with condition F17 of EA EPML00876713.	IA1
MM3	Achieving surface requirements	a) fencing of 1.8 m high erected around the perimeter of the void; b) warning signage posted around the perimeter of the void following the <i>Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland</i> ; c) safety bund constructed at two metres in height, four metres in base width and 10 m beyond the area which may be affected by void edge instability; and d) direct seeding of low walls with species and application rates determined by an AQP.	IA1
MM4	Achieving enough improvement	a) certification from an AQP that the void will not cause environmental harm outside of the tenure boundary; b) certification from an AQP that the void is safe to humans and livestock; and c) certification from an AQP that the water level in the void will not cause environmental harm to the surrounding environment.	IA1

5.0 Risk assessment

Identifying environmental, social and economic impacts and risks associated with closure is critical for effective closure planning. The following sections present a preliminary risk assessment for the mine based on the review of relevant material.

5.1 Objectives

The overall objective of the closure risk assessment (the assessment) is to identify the inherent risks associated with closure of the mine and threats to achieving relinquishment of the ML.

Specific objectives of the assessment are to:

- identify and define risks from closure and associated rehabilitation activities;
- identify risks which have the potential to adversely affect the environment;
- identify community and other stakeholder risks, eg economic, health and safety, etc;
- identify social risks;
- identify controls currently in place mitigating against identified risks;
- identify additional controls required to mitigate against identified risks; and
- systematically rank the risk magnitudes for closure.

5.2 Method

The following sections outline the approach used for the assessment.

5.2.1 Framework for assessment

The risk assessment has been completed based on a review of relevant literature for the mine. The risk assessment also considered any risks identified from regulation, leading best practice and obligations.

The risk assessment has been structured into six risk categories that can describe potential root causes of failure of mine closure:

- climate and air quality;
- human factors;
- surface and groundwater;
- ecology;
- underling materials; and
- landform constructability.

5.2.2 Assessment of risk

The assessment was conducted using a risk assessment approach that is consistent with *Australian Standard 4360: Risk Management Standards (AS 4360)*, and the mine risk evaluator developed by TerraCom.

In accordance with the risk standard, risk was assessed semi qualitatively via expert judgement for two scenarios:

- without closure control measures and actions in place; and
- with closure control measures and actions in place.

By:

- assessing the consequence of the potential impact as if it had caused a loss; and
- assessing the probability of the impact occurring.

The risk matrix used to evaluate each risk event is in Table 7.

The likelihood ratings and descriptions are in Table 8.

The consequence categories and definitions are in Table 9.

Table 7 Risk matrix

Likelihood	Consequence					
	1	2	3	4	5	6
A	Medium	High	High	Very High	Very High	Very High
B	Medium	Medium	High	High	Very High	Very High
C	Low	Medium	Medium	High	High	Very High
D	Low	Low	Medium	Medium	High	High
E	Low	Low	Low	Medium	Medium	High

Table 8 Likelihood ratings and descriptions

Likelihood	Rating	Description
Almost certain	A	Likely to occur multiple times a year.
Likely	B	Might occur once a year.
Possible	C	Might occur multiple times during the LOM.
Unlikely	D	Might occur once during the LOM.
Rare	E	Unlikely to occur during the LOM.

Table 9 Risk assessment and treatment plan for land with a PMLU not achieving stable condition

Rehabilitation milestone		Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating
RM1	Infrastructure decommissioning and removal.	Buildings which are not being formally retained by the landholder are not demolished and removed.	Poor communication.	Failure to meet PMLU.	Low (D x 2)	Ensure that all buildings which are not being formally retained by the landholder are demolished and removed.	Contractor and work teams will be made aware of buildings which require demolition and removal.	Written landholder agreement.	Written landholder agreement.	Visual inspection.	During engagement of relevant contractors or work teams.	General manager or senior executive.	Low (E x 2)
		Bitumen and concrete has not been removed and disposed of.	Poor communication.	Failure to meet PMLU.	Low (D x 2)	No proposed risk treatment — all bitumen and concrete will be removed.	-	-	-	-	-	-	-
		Historic exploration boreholes have not been decommissioned or converted to groundwater monitoring bores.	Poor communication.	Failure to meet PMLU.	Low (D x 2)	Ensure that all historic boreholes are decommissioned or converted to groundwater monitoring bores.	Contractor and work teams will be notified.	Monitoring and maintenance program.	Monitoring and maintenance program.	Internal reporting.	During infrastructure decommissioning and removal.	General manager or senior executive.	Low (E x 2)
		Asbestos has not been appropriately removed and disposed of.	Poor removal and disposal of asbestos.	Failure to meet PMLU and potential harm to humans and wildlife.	High (C x 4)	Ensure asbestos is been appropriately removed and disposed of.	Contractor and work teams will be notified and appropriate measures will be implemented and done by an AQP.	Licenced professional for asbestos removal.	Certification by an AQP that all asbestos has been appropriately removed and disposed.	Internal reporting.	During infrastructure decommissioning and removal.	General manager or senior executive.	Medium (E x 4)
RM2	Remediation of contaminated land.	Residual contaminated land.	Refuelling, spills and leaks or historic notifiable activities.	Soil is unable to support the PMLU and there is potential mobilisation of contaminants to the receiving environment.	Medium (C x 3)	Ensure contaminated land has been removed or remediated.	A contaminated land survey is done by an AQP to verify removal or remediation of contaminated soils.	Contaminated land survey by an AQP.	Contaminated land survey by an AQP.	Contaminated land survey by an AQP.	During remediation of contaminated land.	General manager or senior executive.	Low (E x 2)
						Reduce the risk of land contamination	Managed under the standard operating procedure of	Standard operating procedure for	Reduced risk of land contamination	Internal reporting.	During operation and rehabilitation.	General manager or senior executive.	

Rehabilitation milestone		Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating	
							during mining operations.	hazardous substances.	hazardous substances.	during mining operations.				
							Spill kits are made available.	Spill kits.	Reduced risk of land contamination during mining operations.	Visual inspection.	During operation and rehabilitation.	General manager or senior executive.		
		Effluent irrigation area has been poorly managed.	Dried sewage sludge has not been removed and buried under spoil as per the EA.	Failure to meet condition JI of the EA and inability to support the PMLU.	Low (C × I)	Reduce the risk of land contamination.	Operate effluent irrigation area in accordance with condition JI of the EA.	Monitoring and maintenance program.	Condition JI of the EA.	Internal reporting.	During operation and rehabilitation.	General manager or senior executive.	Low (C × I)	
		Plastic liners have not been removed or disposed of.	Impervious liners have not been removed with the dried sewage sludge.	Unable to support the PMLU.	Low (C × I)	No proposed risk treatment — plastic liners will be removed with the dried sewage sludge.	-	-	-	-	-	-	-	
RM3	Installation of cover system.	Waste products generated from the washing of coal has not been buried under a minimum cover thickness of 5 m.	Spoil cover thickness is less than 5 m.	Failure to meet condition E9 of the EA.	Medium (C × 3)	Ensure that waste products generated on or after the 30 August 2017 from the washing of coal are disposed of within mine voids and covered with spoil to a depth of at least 5 m.	Certification by an AQP that waste products generated from the washing of coal are buried under spoil with a minimum cover thickness of 5 m.	Certification by an AQP, GPS and survey guidance.	Condition E9 of the EA.	Certification by an AQP, GPS and survey guidance.	Prior to installation of the cover system.	General manager or senior executive.	Low (E × 3)	
						Ensure that there is sufficient spoil available to cover rejects to a depth of at least 5 m.	Update reshape modelling if there is a significant change to mine schedule.	Reshape modelling software.	15% grade constraint.	Reshape assumptions report.	If there is a significant change the mine schedule.	General manager or senior executive.		

Rehabilitation milestone		Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating
RM4	Landform construction and reshaping or reprofiling.	Landform includes excessive slopes.	Landform has not been reshaped in accordance with condition F6 of the EA.	Failure to meet condition F6 of the EA and failure to meet PMLU.	High (C × 4)	Ensure that rehabilitation landform slope angles do not exceed 15% with the exception of Ramp 3 cut through competent rock.	An AQP will verify and audit construction compliance with the final landform design.	Final landform design.	Performance measured against condition F6 of the EA.	LiDAR monitoring.	During landform construction and reshaping or reprofiling.	General manager or senior executive.	Medium (E × 4)
		Contour or graded drains have not been installed where required.	Contour or graded drains have not been installed.	Increased risk of erosion and sedimentation to the receiving environment.	Medium (C × 3)	Ensure that contour or graded drains have been installed where required as per the construction design.	Certification by an AQP that contour or graded drains have been installed as required in accordance with the construction design.	Construction design.	Certification by AQP against the construction design.	As built report.	During landform construction and reshaping or reprofiling.	General manager or senior executive.	Low (E × 3)
		Landform is geotechnically unstable	Landform has a geotechnical factor of safety less than 1.5	Failure to meet PMLU	High (C × 4)	Ensure that the landform is geotechnically stable	Assessment of the landform by a suitably qualified geotechnical engineer	Landform geotechnical stability assessment	Geotechnical factor of safety of greater than or equal to 1.5	Landform geotechnical stability assessment	Prior achievement of landform construction and reshaping / reprofiling	General manager / senior executive	Medium (E × 4)
RM5	Surface preparation.	Insufficient or unknown topsoil availability to complete surface preparation.	Historic mining disturbance to topsoil resources, long-term stockpile storage or poor topsoil and subsoil stripping, handling or stockpiling.	Unable to support target vegetation, causing disturbance to undisturbed areas, costs to import topsoil and failure to meet condition F1 of the EA.	Medium (C × 3)	Ensure there is sufficient topsoil or growth media to complete rehabilitation.	Prepare a topsoil and subsoil inventory.	Survey support and inventories of topsoil and subsoil.	Performance measured by survey data and assessed against the completion criteria.	Survey data recorded in topsoil and subsoil inventory.	During construction, operation, closure and rehabilitation.	General manager or senior executive.	Low (E × 3)
							Implement soil stripping and stockpile management procedures.	Soil stripping and stockpile management procedures.	Soil stripping and stockpile management procedures.	Visual inspection and internal reporting.	During construction, operation, closure and rehabilitation.	General manager or senior executive.	
			Unsuitable growth media used in combination with,	Failure to ensure growth media compatibility	Failure to meet condition F2 of the EA, inability to support	Medium (C × 3)	Ensure that growth media used for rehabilitation is	Demonstrate suitability of proposed growth media through	Rehabilitation trials.	Rehabilitation trials.	Rehabilitation trial monitoring.	Prior to surface preparation there if	General manager or senior executive.

Rehabilitation milestone	Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating
	or instead of topsoil.	with rehabilitation vegetation.	target vegetation and failure to meet PMLU.		suitable for rehabilitation through rehabilitation trials.	rehabilitation trials.				insufficient topsoil.		
	Topsoil or growth media depth is too shallow to support target vegetation.	Topsoil or growth media is less than 100 mm.	Unable to support target vegetation.	Medium (C x 3)	Demonstrate the topsoil is applied to a minimum depth of 100 mm.	Survey to show depth of topsoil applied.	Survey to show depth of topsoil applied.	Survey data.	Survey data and internal reporting.	During surface preparation.	General manager or senior executive.	Low (E x 3)
	Topsoil or growth media health is unable to support target vegetation.	Failure to ensure topsoil or growth media health is compatible with vegetation.	Unable to support target vegetation.	Medium (C x 3)	Ensure topsoil or growth media health is able to support target vegetation.	AQP to assess soil health and suitability.	Soil health and suitability assessment.	Soil health and suitability assessment.	Soil health and suitability assessment.	Prior to surface preparation.	General manager or senior executive.	Low (E x 3)
	Ripping of surface has not been completed.	Poor communication.	Unable to support target vegetation.	Medium (C x 3)	Ensure surface ripping has been completed.	Survey to evidence ripping of surface.	Survey to evidence ripping of surface.	Survey data.	Survey data and internal reporting.	During surface preparation.	General manager or senior executive.	Low (E x 3)
	Ameliorants have not been applied.	Poor communication.	Unable to support target vegetation.	Medium (C x 3)	Ensure ameliorants have been applied where necessary.	Survey to evidence application of ameliorants.	Survey to evidence application of ameliorants.	Survey data.	Surface data and internal reporting.	Prior to surface preparation.	General manager or senior executive.	Low (E x 3)
RM6	Revegetation	Poor seed germination rates.	Seed germination rates are unable to support the establishment of target vegetation.	Medium (C x 2)	Ensure the seed germination rates can support the establishment of target vegetation.	Implement rehabilitation trials to verify the seed germination rates.	Rehabilitation trials.	Rehabilitation trials.	Rehabilitation trials.	During operation.	General manager or senior executive.	Low (D x 2)
		Insufficient seed available.	Native seed is not collected or is unable to be sourced from a supplier.	Medium (C x 2)	Ensure sufficient seed is available for rehabilitation.	Seed collection, storage and treatment procedures.	Seed collection, storage and treatment procedures.	Seed collection, storage and treatment procedures.	Seed collection database.	During operation, closure and rehabilitation.	General manager or senior executive.	Low (D x 2)

Rehabilitation milestone		Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating
		Poor seed mix and application rate.	Seed mix and application rate are unable to support the establishment of target vegetation.	Poor vegetation establishment and potential for increased weed species.	Medium (C × 2)	Ensure that the seed mix and application rate can support the establishment of target vegetation.	Implement rehabilitation trials to confirm the seed mix and application rate.	Rehabilitation trials.	Rehabilitation trials.	Rehabilitation trials.	During operation.	General manager or senior executive.	Low (D × 2)
		Insufficient seasonal rainfall.	Rainfall volume is too low for vegetation establishment.	Poor vegetation establishment, potential for increased weed species.	Medium (C × 2)	Ensure compatibility of target vegetation with seasonal rainfall volume.	Complete seeding before the start of the wet season (December).	Data from rehabilitation monitoring.	Inspections and assessment against completion criteria.	Rehabilitation monitoring report.	Ongoing.	General manager or senior executive.	Low (E × 2)
		Damaged or destroyed seed bank from bushfires.	Lightning strike, extended dry season, poor fire management or high fuel load.	Poor vegetation establishment and potential for increased weed species.	Medium (C × 2)	Ensure protection of seeds from bushfires.	Implementation of a fire management plan.	Fire management controls detailed in the fire management plan.	Inspections for the implementation of the fire management plan.	Internal reporting and monitoring in accordance with the fire management plan.	Before and throughout rehabilitation.	General manager or senior executive.	Low (E × 2)
RM7	Achievement of surface requirements.	Vegetation is not striking due to insufficient seasonal rainfall.	Insufficient rainfall for vegetation establishment.	Failure to establish vegetation and increased weed species.	Medium (C × 2)	Ensure compatibility of vegetation with the seasonal rainfall.	Complete seeding before the start of the wet season (December).	Data from rehabilitation monitoring.	Inspections and assessment against completion criteria.	Rehabilitation monitoring report.	Ongoing.	General manager or senior executive.	Low (E × 2)
		Vegetation groundcover is not comparable to reference sites.	Poor rehabilitation monitoring and maintenance.	Vegetative groundcover is not self-sustaining and failure to meet PMLU.	Medium (C × 2)	Ensure vegetative groundcover is comparable to reference sites or target REs.	Monitoring and maintenance program.	Monitoring and maintenance program.	Performance measured by inspections and assessed against milestone criteria.	Rehabilitation monitoring report.	Ongoing.	General manager or senior executive.	Low (E × 2)
		Weed and pest species abundance is greater than at reference sites.	No weed or pest management and maintenance.	Failure to meet PMLU, biodiversity loss and increased costs to	Medium (C × 2)	Ensure weed and pest species abundance are similar to	Monitoring to identify pest species presence and abundance.	Data from rehabilitation monitoring.	Inspections and assessment against completion criteria.	Rehabilitation monitoring report.	Ongoing.	General manager or senior executive.	Low (D × 2)

Rehabilitation milestone		Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating
				undertake remediation.		reference sites or target REs.	Weed and pest management plan.	Weed and pest management plan.	Weed and pest management plan.	Weed and pest management plan.	Prior to construction.	General manager or senior executive.	
		Vegetation is not resilient to fire.	Bushfire while vegetation is too young for fire resilience.	Damage to vegetation and biodiversity loss.	Medium (C x 2)	Ensure vegetation is protected from bushfires until resilience is built.	Exclude rehabilitated areas from planned burns until resilience is built.	Data from rehabilitation monitoring.	Inspections and assessment against completion criteria.	Rehabilitation monitoring report.	Ongoing.	General manager or senior executive.	Low (D x 1)
		Damaged or destroyed juvenile plants from bushfire.	Lightning strike, extended dry season, poor fire management and high fuel load.	Poor establishment of target vegetation and potential for increased weed species and abundance.	Medium (C x 2)	Ensure juvenile plants are protected from bushfires.	Implement a fire management plan.	Fire management controls detailed in the fire management plan.	Performance measured by inspections for the implementation of the fire management plan.	Internal reporting and monitoring completed in accordance with the fire management plan.	During operation and rehabilitation until plant resilience to fire is demonstrated.	General manager or senior executive.	Low (E x 2)
		Areas of rill or gully erosion.	Extreme weather events.	Potential for mobilisation of sediment.	Medium (C x 3)	Monitor for rill or gully erosion.	Monitor for rill or gully erosion.	Data from rehabilitation monitoring.	Performance measured by inspections and assessed against milestone criteria.	Rehabilitation monitoring report.	During operation, closure and rehabilitation.	General manager or senior executive.	Low (E x 3)
		Land is not suitable for grazing.	Contamination of land, low soil health or insufficient soil depth.	Failure to meet PMLU of grazing.	Medium (C x 2)	To sustain a PMLU.	Remediate land contamination, increase soil health or alter PMLU to forestry.	Data from rehabilitation monitoring.	Performance measured by inspections and assessed against milestone criteria.	Rehabilitation monitoring report.	During closure and rehabilitation.	General manager or senior executive.	Low (E x 2)
RM8	Achievement of PMLU to stable condition	Landform is not stable.	Excessive slopes.	Unable to sustain a stable PMLU.	Low (E x 3)	Ensure that the landform is safe for humans and wildlife.	Certification by an AQP that the area is stable.	AQP to assess landform stability.	Inspections and assessment against milestone criteria.	Certification in a report.	Prior to relinquishment.	General manager or senior executive.	Low (E x 2)
		Landform is not safe for humans and wildlife.	Contaminated land unsuitable for the PMLU	Unable to sustain a stable PMLU.	Low (E x 3)	Ensure there is no contamination unsuitable for the PMLU.	Certification by an AQP that there is no land contamination.	AQP to confirm absence of land contamination.	Rehabilitation milestone.	Certification by an AQP that there is no land contamination.	Prior to the achievement of a stable PMLU.	General manager or senior executive.	Low (E x 2)

Rehabilitation milestone	Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating
		or heating of remnant coal.			Ensure that there is no heating of remnant coal.	Certification by an AQP that there is no heating of remnant coal.	AQP to confirm absence of remnant coal heating.	Rehabilitation milestone.	Certification by an AQP that there is no heating of remnant coal.	Prior to the achievement of a stable PMLU.	General manager or senior executive.	
	The maximum erosion rate is exceeded.	Unfavourable climate or weather events and inappropriate landform design.	Exceedingly high erosion rates which violate condition F16 of the EA.	Medium (C x 3)	To minimise the risk of erosion and comply with condition F16 of the EA.	Monitor erosion and ensure the landform design mitigates climatic and weather risks.	Data from rehabilitation monitoring.	Performance measured by inspections and assessed against milestone criteria.	Erosion and sediment control plan as per condition C25 of the EA.	During rehabilitation.	General manager or senior executive.	Low (E x 2)
	Unable to meet surface water quality requirements.	Contamination of surface water which has not been remediated.	Failure to meet condition C20 of the EA.	Medium (C x 3)	To ensure that surface water quality complies with condition C20 of the EA.	Monitor surface water quality and use treatment plans as per the receiving environment monitoring program (REMP).	REMP and monitoring data.	Performance measured by inspections and assessed against the REMF.	Rehabilitation monitoring report.	Ongoing.	General manager or senior executive.	Low (E x 2)
	Groundwater level is dissimilar to reference sites.	Disruption to groundwater flows.	Inappropriate groundwater levels.	Medium (C x 3)	To ensure groundwater levels are similar to that of reference sites.	Monitor groundwater levels and implement remediation plans where necessary.	Monitoring data.	Inspections and assessment against reference sites, milestone criteria and EA conditions.	Rehabilitation monitoring report.	Ongoing.	General manager or senior executive.	Low (E x 2)
	Unable to meet groundwater quality requirements.	Contamination of groundwater which has not been remediated.	Failure to meet conditions K2, K3 and K5 of the EA.	Medium (C x 3)	To ensure that groundwater quality complies with conditions K2, K3 and K5 of the EA.	Monitor quality and use treatment plans as per the groundwater monitoring program.	Groundwater monitoring program and monitoring data.	Inspections and assessment against milestone criteria, the groundwater monitoring program and EA conditions.	Rehabilitation monitoring report.	Ongoing.	General manager or senior executive.	Low (E x 2)
	Groundcover is dissimilar to reference sites.	Inappropriate groundcover species, soil quality or quantity,	Failure to establish appropriate	Medium (C x 3)	To ensure the establishment of appropriate	Seed before the wet season (December) and have an AQP verify suitability	Monitoring data.	Inspections and assessment against milestone	Rehabilitation monitoring report.	From rehabilitation until relinquishment.	General manager or senior executive.	Low (E x 2)

Rehabilitation milestone	Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating
		climate or bushfires.	groundcover vegetation.		groundcover vegetation.	of target species, soil quality and soil quantity.		criteria and reference sites.				
	Weed and pest species abundance is greater than at reference sites.	Failure to implement the weed and pest management plan.	An abundance of weed and pest species.	Medium (C x 3)	To ensure weed and pest species abundance is similar to reference sites.	Implementation of a weed and pest management plan.	Monitoring data.	Inspections and assessment against milestone criteria and reference sites.	Weed and pest management plan.	Ongoing.	General manager or senior executive.	Low (E x 2)

Table Y5 Risk assessment and treatment plan for land identified as a NUMA not achieving sufficient improvement

Management milestone	Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating	
MM1	Conversion of the void into a permanent waterbody	Major earthworks are not done	Non-conformance with the landform design plan	Failure to follow the landform design plan	High (C × 4)	To ensure major earthworks are done in accordance with the landform design plan.	Do all major earthworks in accordance with the landform design plan.	Personnel, trucks, excavators and earthmoving bulldozers.	Inspections and assessment against the landform design plan	Certification from an AQP that the surface reflects the landform design plan	After closure and before rehabilitation	GM or senior executive.	Low (C × 4)
MM2	Landform construction and highwall treatment.	Highwalls are battered to a slope greater than the specified angle.	Highwalls are battered incorrectly.	Unable to meet condition F18 of the EA.	Low (C × 3)	To ensure highwalls meet condition F18 of the EA.	Batter highwalls to the angles specified in the residual void management plan.	Residual void management plan and rehabilitation requirements.	Surveyed sections, contour plans and assessment against the residual void management plan.	Rehabilitation report.	At the start of rehabilitation.	Environmental officer.	Low (C × 1)
		The residual void is geotechnically unstable.	The void is geotechnical factor of safety is less than 1.5.	The void is geotechnically unstable.	Low (C × 3)	To ensure that the void is geotechnically stable.	Assessment of the void for the geotechnical factor of safety.	Geotechnical assessment.	Achievement of a geotechnical safety factor of 1.5 or greater.	Geotechnical assessment.	During landform construction and treatment of lowwall and highwall.	Environmental officer.	Low (C × 1)
MM3	Achievement of surface requirements.	The residual void is not safe to humans, wildlife and livestock.	Fencing, safety bunds and signage were not installed around the void perimeter.	Humans, wildlife, livestock and vehicles could access the void.	Low (C × 3)	To prevent access and ensure people are aware of the risks.	Bunding constructed, fencing is installed and warning signs are posted.	Safety bund plan, fencing installation plan and the Australian	Safety bund plan, fencing installation plan and the Australian	Visual inspection.	Prior to achieving surface requirements.	Environmental officer.	Low (C × 1)

Management milestone	Risk event	Causes	Impact description	Risk rating	Rationale for risk treatment option	Proposed actions	Resource requirements	Performance measures and constraints	Reporting and monitoring requirements	Timing and scheduling	Responsibility	Residual risk rating	
							Standard for warning signage.	Standard for warning signage.					
MM4	Achievement of sufficient improvement.	The residual void is harming the environment outside of the tenure boundary.	The void harms the regional groundwater aquifers and the surrounding environment.	Unable to achieve sufficient improvement within the NUMA.	Low (C x 2)	To evidence the lack of environmental harm being caused by the void.	Certification from an AQP that the void will not cause environmental harm.	Certification from an AQP.	Certification from an AQP.	Certification from an AQP.	From rehabilitation until relinquishment.	Environmental officer.	Low (C x 1)
		The residual void is not safe to humans, wildlife and livestock.	The void harms the regional groundwater aquifers and the surrounding environment.	Unable to achieve sufficient improvement within the NUMA.	Low (C x 2)	To evidence the lack of potential harm to humans, wildlife and livestock.	Certification from an AQP that the void is safe to humans, wildlife or livestock.	Certification from an AQP.	Certification from an AQP.	Certification from an AQP.	From rehabilitation until relinquishment.	Environmental officer.	Low (C x 1)
			Heating of remnant coal.	Unable to achieve sufficient improvement due to lack of safety.		Ensure there is no heating of remnant coal.	Certification by an AQP that there is no heating of remnant coal.	Certification from an AQP.	Certification from an AQP.	Rehabilitation milestone.	Certification from an AQP.	Environmental officer.	
		The water level in the residual void is harming the surrounding environment.	The void water level differs from, and impacts, the surrounding environment.	Unable to achieve sufficient improvement within the NUMA.	Low (C x 2)	To evidence similar water levels in the void to that of the surrounding environment.	Certification from an AQP that the void water level is appropriate.	Certification from an AQP.	Certification from an AQP.	Certification from an AQP.	From rehabilitation until relinquishment.	Environmental officer.	Low (C x 1)
		Batter slopes have not achieved the specified vegetation cover.	Unsuitable target vegetation, soil quantity or quality, climate or bushfires.	Failure to establish sufficient vegetation cover on batter slopes.	Medium (C x 3)	To ensure the establishment of appropriate vegetation cover.	Certification from an AQP that target species, soil quality and soil quantity are suitable.	Monitoring data and certification from an AQP.	Inspections and assessment against milestone criteria and reference sites.	Rehabilitation monitoring report.	From rehabilitation until relinquishment.	Environmental officer.	Low (E x 2)
		The residual void is unstable.	Excessive slopes or exceeded maximum erosion rate.	Unable to achieve stability.	Low (C x 2)	To ensure stability of the NUMA.	Certification by an AQP that the area is stable.	Certification from an AQP.	Inspections and assessment against milestone criteria.	Certification in a report.	From rehabilitation until relinquishment.	Environmental officer.	Low (E x 2)

6.0 Reporting and monitoring

6.1 Post-mine monitoring

This section describes monitoring that will be undertaken post mining. Information collected during monitoring will demonstrate achievement of the criteria and contribute to satisfying DES decision to progress surrender of the ML.

The post rehabilitation phase will commence when all the activities specified in this plan are completed. Monitoring will be conducted to assess whether the closure objectives and mine rehabilitation requirements are being met. At this stage, the identified monitoring is conceptual and will need to be refined as the strategy develops in the future.

Specific maintenance and monitoring activities will be conducted at time intervals depending on the criteria involved. Monitoring methods must be cost effective, measurable, exchangeable, accurate and repeatable. Components that require post-mining closure include:

- Spontaneous combustion and bushfire (to be completed periodically);
- Rehabilitation monitoring (one, two, five and ten years after seeding);
- Groundwater must comply with the REMP and comply with the Environmental Authority;
- Surface water must also comply with the REMP and comply with the Environmental Authority;
- Diversion monitoring is to be completed annually and must comply with relevant water licence conditions;
- Erosion monitoring is recommended once a year until relinquishment; and
- Geotechnical stability must be assessed and reported as per design criteria.

Details are in the PRC plan and outlined below.

6.1.1 Spontaneous combustion and bushfire

Spontaneous combustion of medium or high-risk mineral waste is a chemical fire which requires oxygen to fuel the fire and moisture to transfer heat, ie spread the fire. Encapsulation of high and medium-risk mineral waste with low-risk mineral waste will reduce the potential for spontaneous combustion because it will reduce available oxygen and water infiltration. The encapsulation will also protect the mineral waste material from radiant heat in a bushfire event.

Monitoring for spontaneous combustion will be undertaken periodically using visual observation and recorded on the observation sheet as contained in the *Disposal Plan | Overburden, Interburden, Spoil, Coal Washery Coarse Rejects and Tailings | Blair Athol Mine*.

6.1.2 Surface water quality

Monitoring of mine affected water will occur during controlled release events. Surface water samples of mine affected water will be collected in accordance with the EA conditions for the mine.

Upstream and downstream water samples will be collected daily during releases. The first sample will be taken within two hours of a release commencing or during a natural flow event and will be analysed for the following parameters:

- pH;
- EC;
- TSS; and
- sulfate.

Following commencement of release and thereafter weekly during release, water quality parameters will be assessed against characteristics in Table 10.

Table 10 Laboratory parameters for surface water quality

Parameter	WQO
Physical	pH
	6.5-8.0
	EC ($\mu\text{S}/\text{cm}$)
	1,000
	Turbidity (NTU)
	50
	Dissolved oxygen (% saturation)
	85-110
Major ions	Sulfate (mg/L)
	250
	Fluoride (mg/L)
	2,000
	Na (mg/L)
	115
	Ammonia ($\mu\text{g}/\text{L}$)
	900
Nutrients	Nitrate ($\mu\text{g}/\text{L}$)
	2,400
Dissolved metals and metalloids	Al ($\mu\text{g}/\text{L}$)
	55
	As ($\mu\text{g}/\text{L}$)
	13
	Cd ($\mu\text{g}/\text{L}$)
	$0.2 (\text{Hardness}/30 (\text{H}/30))^{0.89}$
	Cr ($\mu\text{g}/\text{L}$)
	1
	Cu ($\mu\text{g}/\text{L}$)
	2
	Fe ($\mu\text{g}/\text{L}$)
	300
	Pb ($\mu\text{g}/\text{L}$)
	$3.4 (\text{H}/30)^{1.27}$
	Hg ($\mu\text{g}/\text{L}$)
	0.2
	Ni ($\mu\text{g}/\text{L}$)
	$11 (\text{H}/30)^{0.85}$
	Zn ($\mu\text{g}/\text{L}$)
	$8 (\text{H}/30)^{0.85}$
	B ($\mu\text{g}/\text{L}$)
	370
	Co ($\mu\text{g}/\text{L}$)
	90
	Mn ($\mu\text{g}/\text{L}$)
	1,900
	Mo ($\mu\text{g}/\text{L}$)
	34
	Se ($\mu\text{g}/\text{L}$)
	10

Parameter	WQO	
	Ag (µg/L)	1
	U (µg/L)	1
	V (µg/L)	10
Petroleum hydrocarbons	C6-C9 (µg/L)	20
	C10-C36 (µg/L)	1,000

The monitoring described above will provide representative surface water samples from Washpool, Bath and Breaker Creeks with enough regulatory, spatial and temporal replication to make statistically valid conclusions about surface water quality.

6.1.3 Groundwater quality

Groundwater samples will be collected in accordance with the EA conditions.

6.1.3.1 Standing water levels

The standing groundwater levels that will be monitored are shown in Table 11.

Table 11 Standing water level monitoring locations

Monitoring point	Hydrogeological Unit	Baseline water level (mAHD)	Standing water level trigger threshold (mAHD)
BA Station (Mayes Bore)	Tertiary Basalt	TBA	TBA
Blair Athol station	Tertiary Basalt	TBA	TBA
Curtis Windmill	Permian Conglomerate	TBA	TBA

1. A groundwater monitoring program to monitor water quality and standing water level in any aquifers likely to be impacted by mining activities must be updated, submitted to the AA for approval by 30 June 2018 and implemented

The standing groundwater level monitoring described in Table 11 will provide representative levels with sufficient regulatory detail and replication to make statistically valid conclusions about the standing groundwater level.

Standing water level monitoring will identify any drawdown at monitoring points and will enable TerraCom to make management decisions to ensure other lawful users of groundwater are not adversely impacted by drawdown.

6.1.3.2 Groundwater quality

Groundwater quality samples will be taken at the locations and frequencies identified in Table 12.

Table 12 Groundwater monitoring location and frequency

Monitoring point	Latitude (GDA94)	Longitude (GDA94)	Hydrogeological Unit	Surface relative level (RL) (mAHD)	Monitoring frequency
Reference bores					
GW04B	-22.69090	147.55675	Permian conglomerate	314	Quarterly
Compliance bores					
BA Station (Mayes Bore)	-22.67855	147.55946	Tertiary Basalt	324	Quarterly
Curtis Windmill	-22.66615	147.56694	Tertiary Basalt	325	Quarterly

Groundwater samples will be taken quarterly and tested for parameters provided in Table 13. Results from groundwater quality from compliance bores identified in Table 12 must not exceed any of the limits defined in Table 13 on more than three consecutive monitoring occasions.

Table 13 Groundwater quality limits

Parameter	Units	Trigger value		Trigger type
		Curtis Windmill	BA Station	
EC	µS/cm	883	631	Bore specific
pH	pH units	6.5-8.5	6.5-8.5	WQO*
Sulfate	mg/L	19	24	Bore specific
Metals (dissolved)				
Aluminium	mg/L	0.055	0.055	ANZG
Arsenic	mg/L	0.013	0.027	ANZG and bore specific
Boron	mg/L	0.94	0.94	ANZG
Cadmium	mg/L	0.0002	0.0002	ANZG
Chromium	mg/L	0.001	0.001	ANZG
Copper	mg/L	0.005	0.004	Bore specific
Lead	mg/L	0.0034	0.0034	ANZG
Manganese	mg/L	1.9	1.9	ANZG
Mercury	mg/L	0.00006	0.00006	ANZG
Molybdenum	mg/L	0.034	0.034	ANZG
Nickel	mg/L	0.012	0.011	Bore specific and ANZG

Cadmium	mg/L	0.0002	0.0002	ANZG
Silver	mg/L	0.0005	0.0005	ANZG
Vanadium	mg/L	0.006	0.006	ANZG
Zinc	mg/L	0.021	0.009	Bore specific
Iron	mg/L	Iron is monitored for interpretation purposes		
Major ions	mg/L	Calcium, magnesium, potassium, sodium, chloride, bicarbonate and carbonate are monitored for interpretation purposes		

The method of groundwater sampling will comply with that set out in the latest edition of DES's *Water Quality Sampling Manual 2009* (EHP 2013).

The groundwater quality monitoring program is designed to detect changes in groundwater composition in aquifers potentially affected by previous mine operations and rehabilitation. If a review of groundwater quality monitoring data indicates the potential deterioration in water quality, TerraCom must complete an investigation into the potential for environmental harm.

6.1.4 Diversions

All surface water diversion is required to have a monitoring and evaluation program that demonstrates the performance of a diversion. This program is to be undertaken by a registered professional engineer (RPEQ) annually in accordance with the water licence conditions. The monitoring and evaluation program will be done in accordance with the with the Index of Diversion Condition (IDC) methodology which is outlined in the *Monitoring and Evaluation Program for Bowen Basin River Diversions* (ID&A 2001) to comply with water licence conditions. The IDC is a method of recording and monitoring the condition of diversions and adjacent upstream and downstream reaches. It provides an integrated suite of indicators that measures both geomorphic and riparian condition of a diversion, and its upstream control and downstream reaches.

Monitoring and evaluation program methodology and design is provided in:

- *Monitoring Design Report: Western Waterway Diversion — Blair Athol mine* (Alluvium 2011); and
- *Monitoring Design Report: Eastern Waterway Diversion — Blair Athol mine* (Alluvium 2012).

6.1.5 Geotechnical

Geotechnical monitoring will be undertaken by a qualified geotechnical engineer who will assess the stability of post rehabilitation features in the mine.

To comply with EA conditions, a geotechnical stability assessment must be prepared. The report must propose acceptance criteria to meet EA conditions and must investigate void geotechnical stability and make recommendations for safety management. Water quality analysis for end land uses must also be considered.

6.1.6 Vegetation monitoring and soil testing

Vegetation and soil monitoring and testing will be completed as per the *Rehabilitation Management Plan*.

7.0 Closure action plan

The purpose of this section is to describe key actions that will be undertaken to manage residual risks associated with closure of the mine.

7.1 Progressive rehabilitation

Progressive rehabilitation will be undertaken as per the schedule presented in Section 3.4.10.

7.2 Demolition and decommissioning

All infrastructure will be removed from the mine prior to relinquishment unless a written agreement is obtained from a future land holder stating that they will accept the asset.

Once infrastructure has been removed the mine will be remediated (if required) and rehabilitated. The following decommissioning strategy will be used:

TerraCom will appoint a specialist demolition and decommissioning contractor.

- Prior to commencing demolition, the following will be carried out:
 - identification and removal of any assets suitable for re-use and / or sale;
 - identification of infrastructure to remain post-closure and completion of associated written agreements with the future landholders;
 - review of services plan to ensure all underground services are included;
 - decommissioning, de-pressuring and isolation of all energy sources;
 - all chemical and materials storages and services emptied and decontaminated;
 - completion of an updated contaminated land assessment (phase 1 and phase 2 assessment);
 - emptying of storage facilities; and
 - removal and appropriate re-use, recycling or disposal of all dangerous goods and hazardous substances.
- TerraCom will apply to allow for demolition waste that cannot be practicably sold, re-used or recycled to be disposed and encapsulated in void. Waste will otherwise be trucked off-site for disposal in landfill.
- A report will be completed verifying that potentially contaminated land has been remediated as required.

Issues that impact on the demolition and decommissioning methodology will be further considered in a demolition and decommissioning management plan and may include:

- how to deal with live services that cross the demolition site that are being maintained for operations or adjacent facilities;
- identification of any hazardous materials (such as asbestos);
- safety, environmental and security requirements;
- waste management;
- sale of scrap and salvage of assets;
- lay down and storage areas for scrap; and
- contemporary legislative requirements.

7.2.1 Scrap and salvage items

Where practicable, consideration will be given to the Queensland's *Waste and Recycling Strategy* (EHP 2015) waste and resource management hierarchy, in decreasing order of preference as shown in Figure 3.

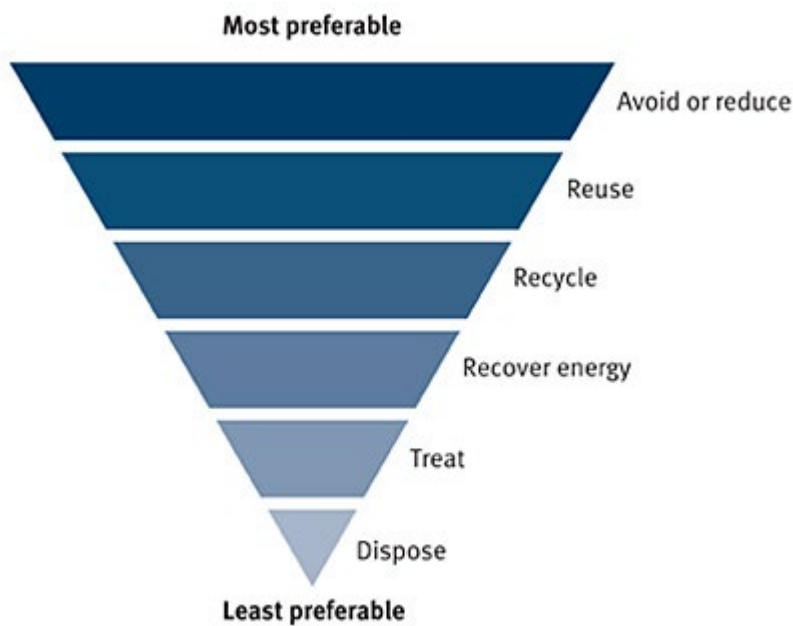


Figure 3 Waste and resource management hierarchy

It is likely that there will be a significant number of items across the mine that may have some residual scrap or salvage value at a sale or auction. Examples of these items include:

- aluminium cladding;
- copper from electrical services and some service pipe work;
- e-waste;
- steel from the CHPP and conveyors;
- mobile equipment; and
- pumps and pump parts.

7.3 Environmental management

7.3.1 Soil stockpiling and application

Appropriate soil management during site activities and rehabilitation is important to the successful rehabilitation of the mine. Soil management during the operation of the mine has included vegetation clearing, soil stripping, stockpiling, grading, ripping and de-compacting and soil conditioning / amelioration.

7.3.1.1 Stockpile measures

Where soil has been stockpiled it has been stored in a manner that ensures stability. Measures have included:

- vegetating stockpiles;
- minimising the height of stockpiles; and
- using stockpiles as soon as possible.

The following stockpile management measures have been adhered to where possible:

- all stockpiles are situated within the mine surface water catchment to prevent any off-lease dispersal of soil due to rainfall;
- weed control has been undertaken as required;

- following stockpile construction, the operation of machinery on stockpiles has been avoided to prevent compaction and maintain soil structure; and
- a stockpile register has been maintained.

7.3.2 Erosion and sediment control

During mine operation, erosion and sediment control plans have been developed using TerraCom's *Erosion and Sediment Control Plan*. General principles for erosion and sediment control have drawn from *Managing Urban Stormwater: Soils and Construction: Volume 1 March 2004* (Landcom 2004) and *Managing Urban Stormwater Volume 2E Mines and Quarries* (Landcom 2008).

The erosion and sediment control plans will continue to be reviewed and updated so that they remain applicable to the rehabilitated landform.

7.3.3 Surface water management

Surface water will be managed in accordance with the site *Water Management Plan*.

7.3.4 Groundwater management

Groundwater is largely confined to the coal seams acting as aquifers. Groundwater is generally saline and makes groundwater usage in the district limited.

The potential impacts on groundwater quality from mining activities include leachate to the groundwater containing dissolved salts and high or low pH from areas such as:

- voids containing pit water;
- landforms; and
- sumps and dams.

There is also potential for affecting the groundwater level at the mine because of pit dewatering operations.

A groundwater monitoring program for the operational phase of the mine has been developed.

Groundwater monitoring will continue during and post rehabilitation of the mine until bores are closed and rehabilitated or until relinquishment of the ML.

7.3.5 Contamination management

Contaminated soils or other potential sources of contamination will be preferentially treated on mine. If contamination cannot be treated, then it may be disposed of at an authorised facility. Treatment versus off-mine disposal will depend on whether domains are listed on the *Contaminated Land Register* (CLR) and *Environmental Management Register* (EMR) (administered by the Queensland Government) and whether it is deemed appropriate to have them removed from the registers as part of the rehabilitation process.

The process for assessing and adding / removing land from the CLR will need to be confirmed with DES at the time of rehabilitation.

7.3.6 Revegetation

The *Revegetation Plan* (SGME 2024) describes revegetation methods, management, objectives, monitoring and maintenance for the mine. Revegetation will entail seeding grasses and trees for a biodiversity land use. Ripping, seeding and fertilising (if required) will be undertaken following the placement of soil and construction of drainage structures on the reshaped landform. Ripping will be carried out to a depth of 0.3-0.5 m on the contour. The

maximum distance between any two rip lines and or rip sets will be 3 m. Seeding and fertilising (if required) will occur immediately after contour ripping, when appropriate.

Revegetated areas will be irrigated if required until vegetation is established or will be timed with the onset of the annual high rainfall periods to avoid the need for watering. Weed inspections and control will be undertaken regularly until vegetation criteria are met.

7.3.6.1 Fauna and vegetation

Most fauna habitat occurs within the undisturbed sections of the ML which were not impacted by mining operations.

7.3.7 Heritage

Cultural heritage will not be damaged in the rehabilitation process.

Plans for the management of cultural heritage will be addressed through stakeholder engagement.

7.4 Health and safety

The mine is operating under a safety and health management system as prescribed by legislation and in accordance with TerraCom internal standards. Any new activities will require appropriate risk management to ensure the mine meets its regulatory commitments.

Updates to the management system based on the assessment of risk will occur as necessary.

A mine based risk assessment will be completed to address mine security and prevention of unintentional access to the mine. Pending the outcome of the risk assessment, an action program will be developed.

The preparation of tender documents for significant works, eg demolition, will require a review of certain aspects of health, safety and the environment. Criteria for each element will be set to appropriately review tender applications. This approach will ensure tender documents provide contractors with appropriate information about potential site hazards and clarify TerraCom's expectations about the management of these hazards during execution of the contract. It also provides contractors with adequate time to plan how to meet TerraCom's expectations and this will reduce the potential for delays associated with non-compliant personnel, training and inductions, and equipment. For example, electrical testing and currency of maintenance schedule.

Post-relinquishment mine safety will be addressed through the achievement of the relevant criteria.

7.5 Landform establishment

The landform and drainage of the mine will direct surface flows preferentially to a void.

Rehabilitated slopes will be constructed no greater than 15% across the ML.

7.6 Geotechnical assessment

Geotechnical monitoring will be undertaken by a qualified geotechnical engineer who will assess the stability and quality of post-rehabilitation features in the mine.

The geotechnical monitoring and associated report must investigate void geotechnical stability and make recommendations to address any safety issues prior to ML surrender. For example, restriction of human access. Safety recommendations in the geotechnical monitoring report must be incorporated into the plan of operations for the mine.

An immediate priority is to complete a geotechnical assessment of rehabilitation landforms. The assessment is required so final rehabilitation criteria can be proposed.

7.7 Rehabilitation maintenance

Maintenance of rehabilitated areas must take place to demonstrate:

- stability of landforms;
- erosion control measures remain effective;
- stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters;
- plants show healthy growth and recruitment is occurring; and
- rehabilitated areas are managed to reduce the presence of declared pest plants.

Maintenance activities on rehabilitation areas will be guided by general inspections and rehabilitation monitoring results. Maintenance activities may include:

- addition of fertiliser or other ameliorants;
- re-planting of significant areas of failed vegetation;
- upkeep of water management structures; and
- replacement and repairs to fencing and signage.

The maintenance requirements of rehabilitated land are not to be more than that required for the land as expected for the next land use.

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SGM Environmental Pty Limited (SGME) is a boutique consulting firm of experienced industry experts working with our clients and their stakeholders to develop and deliver innovative solutions to complicated challenges that create enduring value.

SGME was established to provide services in soil science, geochemistry, mine closure and Environmental management, planning & approvals cost efficiently. When you engage SGME you engage a partner to your business, priding themselves on:

Honest – Straight-up and no nonsense.

Trust – We say what we mean and we will deliver on our promises. We will advocate strongly for you.

Innovation – We will always look for new ways to help and create enduring value because that is what friends do when they work together.

Safety – We do it right so we all go home safely.

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Rehabilitation Management Plan

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1 PURPOSE AND SCOPE

This Rehabilitation Management Plan (this plan) has been prepared to support the current Environmental Authority (EA) EPML00876713 and the *Progressive Rehabilitation and Closure Plan* (PRC plan). It includes proposed activities for rehabilitation, including rehabilitation areas, objectives and monitoring for the intended post-mining land uses (PMLUs).

2 PROCEDURE

The procedure is to review relevant site information and regulatory guidelines and assign management plan procedures that align with these components.

3 MANAGEMENT OF CONTRACTORS ROLES AND RESPONSIBILITIES

4 ACCOUNTABILITIES

Role	Accountabilities
NOTE	Only use this table if there is a role that is not mentioned in the S55 Mgt Structure e.g. Shotfirer, Document Controller

5 DOCUMENT INFORMATION

5.1 Definitions

Term	Definition
BACM	Blair Athol Coal Mine
RMP	Rehabilitation Management Plan
EA	Environmental Authority
PRCP	Progressive Rehabilitation and Closure Plan
EP Act	Environmental Protection Act (1994)
PMLU	Post-mining land use
NUMA	Non-use management area
DETSI	Department of Environment, Tourism, Science and Innovation (the administering authority)
RPR	Revegetation Planning Report
t/ha	Tonne per hectare

Term	Definition
ESP	Exchangeable sodium percentage
EC	Electrical conductivity

5.2 Related Documents

Reference	Title
SGME 2025	Blair Athol Progressive Rehabilitation and Closure Plan
EPML00876713	Environmental Authority

5.3 Reference Material

Reference	Title
AECOM. (2013).	<i>Revegetation Planning Report</i> . Brisbane : AECOM.
AECOM. (2013).	<i>Blair Athol Micro-habitat Planning Report</i> . Brisbane : AECOM.
Rio Tinto. (2016).	<i>Blair Athol Coal Mine - Rehabilitation Monitoring Program</i> . Brisbane : WSP Parsons Brinckerhoff.
Rio Tinto. (2016).	<i>Blair Athol Coal Mine Rehabilitation Status Review 2016</i> . Brisbane: WSP Parsons Brinckerhoff.
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5.4 Document Version and History

Only the history of the current version is recorded below. For prior version histories, please contact the site Document Controller.

Version	Date	Change Details
A	23/10/2020	Draft (WSP Pty Limited)

Version	Date	Change Details
B	28/10/2020	Final (WSP Pty Limited)
C	26/08/2025	Revision (SGME Pty Limited) – converted to TerraCom Document

6 INTRODUCTION AND BACKGROUND

This updated Blair Athol Coal Mine (BAC) Rehabilitation Management Plan (RMP) has been prepared for TerraCom Ltd (TerraCom), in accordance with condition F12 of the existing EA EPML00876713 issued 11 June 2025, as presented in Appendix A. This updated RMP includes specific details for guiding ongoing progressive rehabilitation and rehabilitation monitoring across the mine site.

TerraCom acquired BAC through its wholly owned subsidiary Orion Mining Limited in May 2017, following grant of Title Transfer from the Queensland Government.

The acquisition of the BAC brings with it the following benefits:

- 1 Progressive rehabilitation of one of Queensland's oldest coal mines.
- 2 Resumption of coal mining, and local and export sales from BAC, providing local, state, and federal economies with increased economic activity, employment, royalties, and taxation.
- 3 Forecast positive cash flow through a low overhead structure and operational efficiencies.

Since acquiring BAC, TerraCom have been undertaking ongoing progressive rehabilitation and rehabilitation monitoring at the mine in accordance with the previous Rehabilitation Management Plan (WSP 2018) and the Blair Athol Coal Mine Rehabilitation Monitoring Program (Rio Tinto 2016).

More specifically, since acquiring BAC, TerraCom have progressively rehabilitated the following areas:

- 2017/2018 – 51.5 ha (Area 53)
- 2019 – 37.3ha (Tailings Storage Facility).

In addition to undertaking progressive rehabilitation at the mine, TerraCom have also undertaken a 5.4 ha ProGanics direct seeding trial into mine spoil to determine the potential for achieving progressive rehabilitation directly into mine spoil in the absence of available topsoil or to support the strip spoil / soil rehabilitation method. If successful, using ProGanics Biotic Soil Media may be an efficient alternative method in the absence of sufficient topsoil, or to increase the rehabilitation success where the strip spoil / soil rehabilitation method is also used.

Additional rehabilitation studies have been undertaken by TerraCom, the results thereof are included in this update to the RMP, including:

- Blair Athol Coal Mine Growth Media Mitigation & Management Strategy (GMMM Strategy) (TerraCom 2017)
- Investigation of plant species naturally regenerating in spoil at Blair Athol Coal Mine (WSP 2018).

7 LEGISLATIVE CONTEXT

The Queensland *Environmental Protection Act 1994* (EP Act) is the key legislation for environmental management and protection in Queensland. The EP Act establishes a general environmental duty and a duty to notify environmental harm that applies to all persons and corporations.

Organisations carrying out mining activities in Queensland are legally obligated to rehabilitate the land. The EP Act requires that all areas disturbed within the relevant mining tenure must be rehabilitated to a post-mining land use (PMLU) or managed as a non-use management area (NUMA). Any undisturbed land within the relevant mining tenure must also be identified as a PMLU. NUMAs will only be considered appropriate where justified under section 126D (2) of the EP Act.

Since the preparation of the previous RMP (WSP 2018), the Queensland Government has delivered a broad package of legislative reforms to the mining sector associated with progressive rehabilitation and closure planning (PRCPs) and financial assurance. A key element of this reform package is the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (MERFP Act). Passed by Parliament on 30 November 2018, the MERFP Act:

- 1 replaces the financial assurance arrangements for resource activities under the EP Act with a new financial provisioning scheme
- 2 changes how the estimated rehabilitation cost for an EA is calculated
- 3 amends the EP Act to introduce new requirements for the progressive rehabilitation and closure plans (PRCP) of mined land.

A PRCP is a critical element of these reforms. The MERFP Act includes transitional provisions for the application of the PRCP requirement concerning existing mines. Holders of an existing EA, such as TerraCom, for a mining activity relating to a mining lease approved through a site-specific application, will be issued with a notice from the administering authority within the first three years following the PRCP start date. The notice will specify a date by which a PRCP must be developed and submitted to the Department of Environment, Tourism, Science and Innovation (DETSI), as the administering authority, for assessment and approval.

Table 1 outlines the information requirements described in *Guideline: Progressive rehabilitation and closure plan* (the PRC plan guideline) for rehabilitation monitoring and maintenance, and where it has been addressed within this plan.

Table 1: Relationship to information requirements

Information requirements	Reference
Schedule of monitoring, reporting and review for each milestone	Section 11.3
Description of methodologies and standards, which could include field-based assessments and the application of new remote sensing, GIS and other relevant emerging technologies	Section 11.3
Monitoring that enables the repeatable collection of relevant statistically valid data	Section 11.3
Monitoring using appropriate quality assurance and data management processes and systems	Section 11.3
Regular analysis of site data including multi-year comparison trends and bench-marking against analogue/reference sites	Section 11.3.1.3
Contingency strategies if monitoring data indicates milestone criteria are not being met	Section 12.3.1.1
Post-closure monitoring to ensure milestone criteria has been demonstrated	Section 11.3 and Section 11.4

Information requirements	Reference
Intent of monitoring reports, such as provision of results and key findings	Section11.3.1.3

This updated RMP has been prepared in accordance with condition F8 of the existing EA issued 11 June 2025, as presented in Appendix A. In addition, this updated RMP provides detailed information that can also be used to assist TerraCom in the preparation of a transitional PRCP for BAC, however this RMP does not constitute a PRCP or PRCP schedule under the EP Act.

7.1 Blair Athol Coal Mine Environmental Authority

The BAC mine currently operates under EA EPML00876713, issued 11 June 2025, by the administering authority under the EP Act (Appendix A).

This updated RMP has been developed to provide an ongoing strategy and management framework for site rehabilitation work and has been developed to meet the legislative requirements under the EA. The EA conditions that have informed the content of this plan include:

F4 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 F1 - Rehabilitation Requirements and as detailed in the Rehabilitation Management Plan described in condition F10.F8 Rehabilitation Management Plan

A Rehabilitation Management Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years. F9 At a minimum the Rehabilitation Management Plan must include:

- a) map existing areas of rehabilitation including classification of stage (i.e. time since establishment) and quality
- b) a strategy for progressive rehabilitation
- c) detail the design objectives for rehabilitation of each domain to achieve rehabilitation success criteria and the identified post mining land uses
- d) specify spoil characteristics, soil analysis, soil separation for use on rehabilitation
- e) specify the topsoil requirements for the site and provide details of how topsoil will be managed for use in rehabilitation
- f) detail any topsoil deficit and how any deficit will be managed for successful rehabilitation, including, if applicable, the proposal of surrogate growth media
- g) detail rehabilitation methods applied to areas
- h) detail landform design including end of mine design
- i) detail how landform design will be consistent with surrounding topography

- j) identify and detail planned native vegetation rehabilitation areas and corridors
- k) identify at least a minimum of three (3) reference sites for use in rehabilitation monitoring
- l) describe rehabilitation indicators and how these will be monitored
- m) describe management actions to address unsuccessful rehabilitation or redesign; and
- n) describe end of mine landform design planning and post mining land uses across the mine; and include a triple bottom line assessment (or a comparative alternative assessment method) of the proposed final landform design criteria and alternatives.

8 REHABILITATION STRATEGY

8.1 EA requirements

The EA conditions F9a – F9b requires TerraCom to plan for the following in relation to rehabilitation strategy:

- τ F9a: Map existing areas of rehabilitation including classification of stage (i.e. time since establishment) and quality
- τ F9b: A strategy for progressive rehabilitation.

These specific requirements have informed the requirements of the rehabilitation strategy for progressive rehabilitation across BAC.

8.2 Rehabilitation strategy

Rio Tinto operated BAC from 1984 until 2012 when the site was put into care and maintenance until TerraCom took over ownership in 2017 and undertook significant progressive rehabilitation in accordance with the previous EA EPML00876713 (EA 2015), the last of which was completed in 2010 with existing areas of rehabilitation including classification of staged year on year work (i.e. time since establishment), as shown on Figure 1. During the period, 1984 to present, a variety of rehabilitation methods (seeding, ground preparation, fertiliser, etc.) and rehabilitation monitoring techniques have been employed. The varying methods, along with other influential factors including terrain, soil characteristics and climate, have resulted in rehabilitation in variable conditions and stages of progressive development.

Rio Tinto mining operations ceased in November 2012, from which time the focus of site activities was keeping the operation in compliance with all respective legislation and generally in a safe, stable, and secure state. In September 2016, Rio Tinto undertook a review of the status of all areas of existing rehabilitation across the mine (Rio Tinto, 2016), to determine its status against the rehabilitation criteria within Rio Tinto's EA (EA 2015). Under Rio Tinto's EA (EA 2015) it was required that all areas significantly disturbed by mining activities, excluding residual voids and infrastructure areas, must be rehabilitated to a stable landform with a self-sustaining vegetation cover. This strategy is commensurate with a post mining land use (PMLU) associated with the development of grazing pasture and native ecosystems.

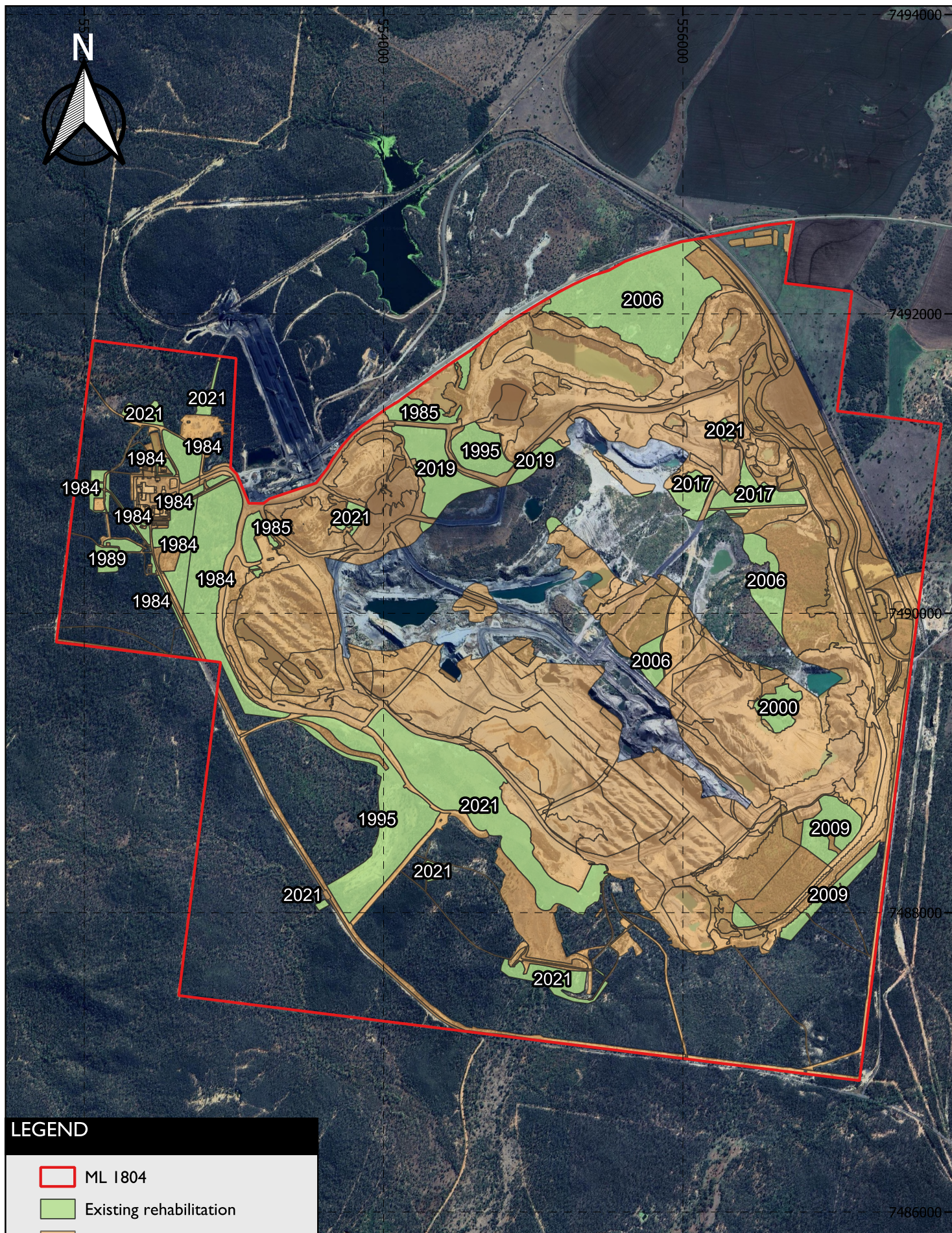
Since acquiring BAC on 31 May 2017, TerraCom have continued with the strategy of rehabilitating all post mining landform domains at BAC, excluding residual voids¹ and infrastructure areas, to a stable landform with a self-sustaining vegetation cover. This strategy is also in accordance with Table F1 of the current EA, whereby it is the goal that all areas disturbed by mining activities will be rehabilitated in a manner that ensures it is:

- τ safe for humans and wildlife
- τ stable
- τ able to sustain vegetation; and
- τ non-polluting.

To achieve this strategy, the post mining rehabilitation domains have been classified into broader landform units based on surrounding landform geomorphology, soil, and spoil types, and surrounding

¹ Residual voids are discussed in the Blair Athol Coal Mine Residual Void Management Plan (TerraCom 2025)

broad vegetation communities. The goals and objectives for rehabilitation domains at BAC are further discussed in Section 4.



Client		Project	
TerraCom Limited		Rehabilitation Management Plan	
Design:	SGME Pty Limited 04.09.2025	Title	Figure
Scale:	1 : 17,500	Existing rehabilitation	I
CRS:	GDA2020		

9 REHABILITATION AREAS AND OBJECTIVES

9.1 EA requirements

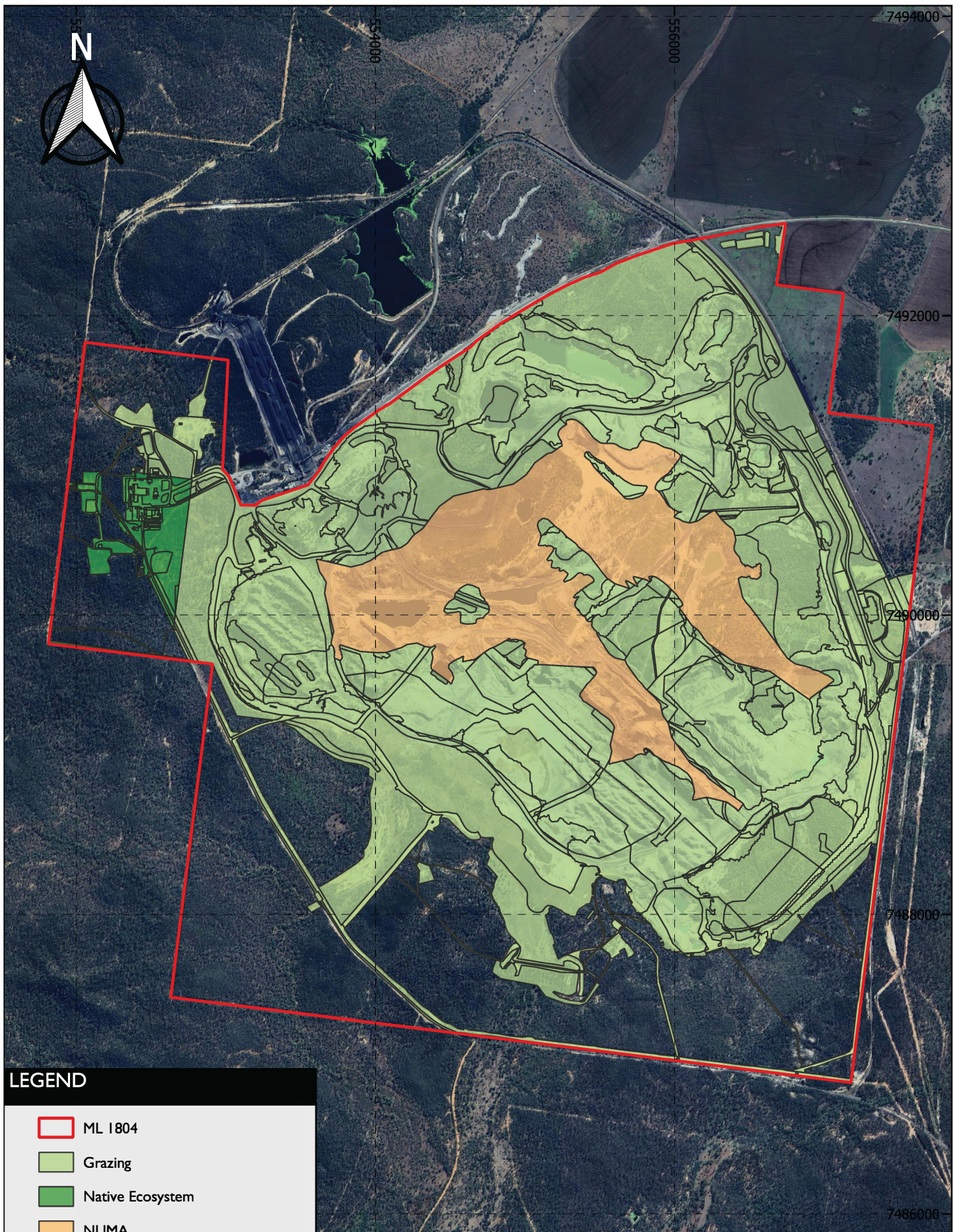
The EA conditions F9c – F9f requires TerraCom to plan for the following in relation to each rehabilitation domain:

- ⌞ F9c: detail the design objectives for rehabilitation of each domain to achieve rehabilitation success criteria and the identified post mining land uses
- ⌞ F9d: specify spoil characteristics, soil analysis, soil separation for use on rehabilitation
- ⌞ F9e: specify the topsoil requirements for the site and provide details of how topsoil will be managed for use in rehabilitation
- ⌞ F9f: detail any topsoil deficit and how any deficit will be managed for successful rehabilitation, including, if applicable, the proposal of surrogate growth media.

9.2 Rehabilitation goals and action plans

The final land use objective for each rehabilitation area is to reinstate disturbed land (excluding the residual void which is classified as a NUMA) to a PMLU of light grazing or native ecosystem. PMLUs and NUMAs identified in the final site design is in Figure 2. Relevant activities have been divided into the following rehabilitation areas, each with a common rehabilitation methodology and PMLU (Figure 3):

- ⌞ IA1 – Residual void
- ⌞ RA1 – Dump
- ⌞ RA2 – TSF
- ⌞ RA3 – CHPP
- ⌞ RA4 – Infrastructure
- ⌞ RA5 – Rail infrastructure
- ⌞ RA6 – Road infrastructure
- ⌞ RA7 – Water management
- ⌞ RA8 – Existing rehabilitation (grazing)
- ⌞ RA9 – Cleared area
- ⌞ RA10 – Native ecosystem
- ⌞ RA11 – Existing rehabilitation (native ecosystem)
- ⌞ RA12 – Diversions.



LEGEND

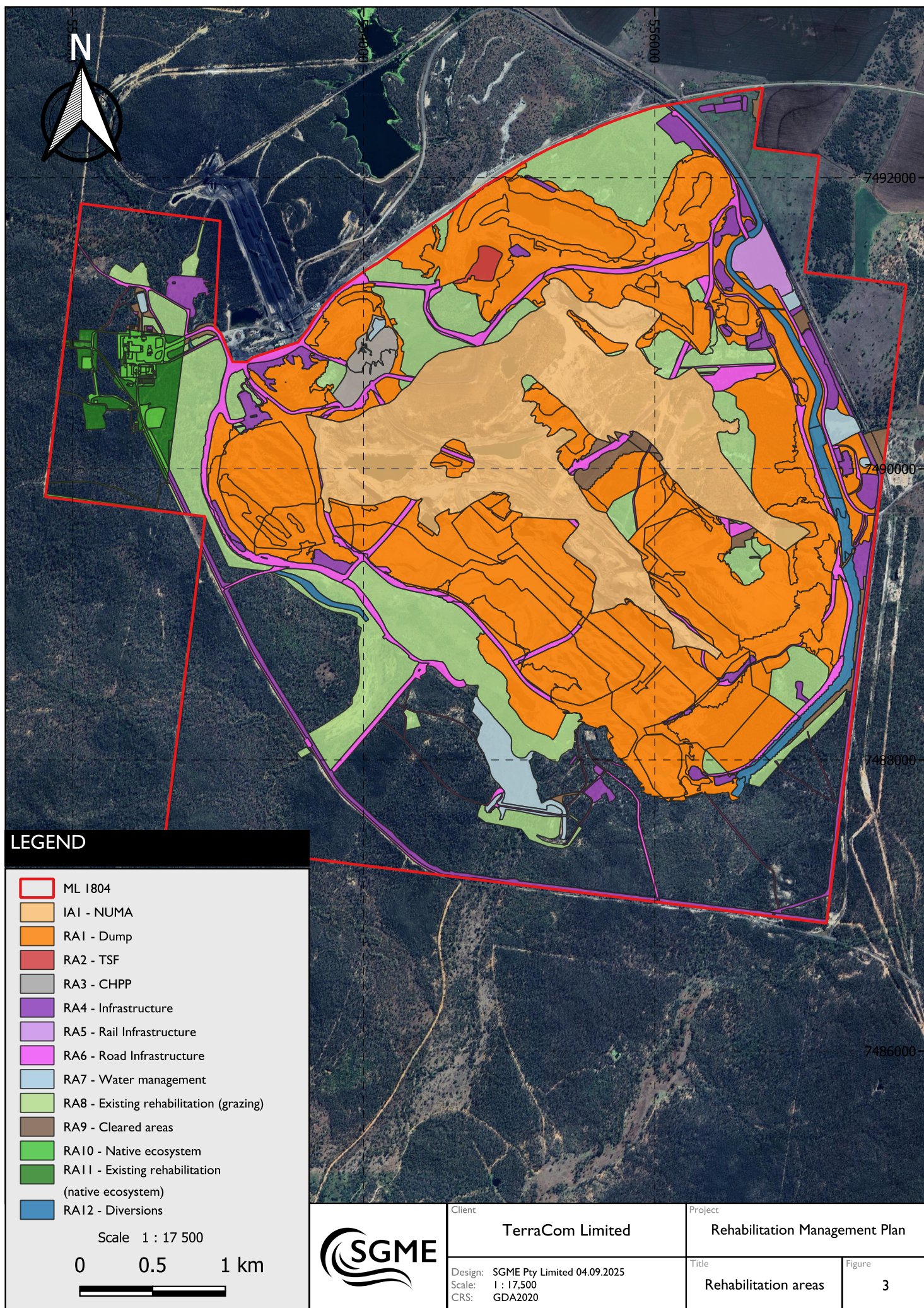
- ML 1804
- Grazing
- Native Ecosystem
- NUMA

Scale 1 : 17 500

0 0.5 1 km



Client	TerraCom Limited		Project	Rehabilitation Management Plan	
Design:	SGME Pty Limited 04.09.2025		Title	PMLU	Figure
Scale:	1 : 17,500				2
CRS:	GDA2020				



In 2013, Rio Tinto commissioned the development of a Revegetation Planning Report (RPR) for the mine that provided specific rehabilitation action plans for each rehabilitation domain including revegetation methods and species lists (AECOM , 2013).

In 2018 TerraCom commissioned an investigation of plant species naturally regenerating in spoil at Blair Athol Coal Mine (WSP 2018) to be used in updating the planned species mixes for each of the spoil types used in respective rehabilitation domains (WSP 2018). A Blair Athol Coal Mine Revegetation Plan (SGME 2025), in conjunction with the RMP, provides revegetation strategies for the intended PMLUs. The final land use objectives of each rehabilitation area are presented in Table 2.

Table 2: Rehabilitation area revegetation action plan

Rehabilitation area	Revegetation methods	Management actions
RA1 – Dump	• Gypsum up to 10 t/ha • Topsoil • Ripping and seeding • Seeding, season and volume to be determined.	• Focus on establishing a stable vegetated surface • Site provides biodiversity linkage for ground dwelling fauna • Weed control to be undertaken seasonally to mitigate risk of high density and distribution on areas, which are inaccessible due to safety aspects.
RA2 – TSF	• Gypsum up to 10 t/ha • Topsoil • Direct seeding inclusive of cover crop.	• Focus on establishing a stable vegetated surface • Site provides biodiversity linkage for ground dwelling fauna.
RA3 – CHPP	• Gypsum up to 10 t/ha • Topsoil • Ripping and seeding • Seeding, season and volume to be determined.	• Focus on establishing a stable vegetated surface • Site provides biodiversity linkage for ground dwelling fauna • Weed control to be undertaken seasonally to mitigate risk of high density and distribution on areas, which are inaccessible due to safety aspects.
RA4 – Infrastructure	• Gypsum up to 10 t/ha • Topsoil	• Focus on establishing a stable vegetated surface

Rehabilitation area	Revegetation methods	Management actions
	• Ripping and seeding • Seeding, season and volume to be determined.	• Site provides biodiversity linkage for ground dwelling fauna • Weed control to be undertaken seasonally to mitigate risk of high density and distribution on areas, which are inaccessible due to safety aspects.
RA5 – Rail infrastructure	• Gypsum up to 10 t/ha • Topsoil • Ripping and seeding • Seeding, season and volume to be determined.	• Focus on establishing a stable vegetated surface • Site provides biodiversity linkage for ground dwelling fauna • Weed control to be undertaken seasonally to mitigate risk of high density and distribution on areas, which are inaccessible due to safety aspects.
RA6 – Road infrastructure	• Gypsum up to 10 t/ha • Topsoil • Ripping and seeding • Seeding, season and volume to be determined.	• Focus on establishing a stable vegetated surface • Site provides biodiversity linkage for ground dwelling fauna • Weed control to be undertaken seasonally to mitigate risk of high density and distribution on areas, which are inaccessible due to safety aspects.
RA7 – Water management	• Gypsum up to 10 t/ha • Topsoil • Ripping and seeding • Seeding, season and volume to be determined.	• Focus on establishing a stable vegetated surface • Site provides biodiversity linkage for ground dwelling fauna • Weed control to be undertaken seasonally to

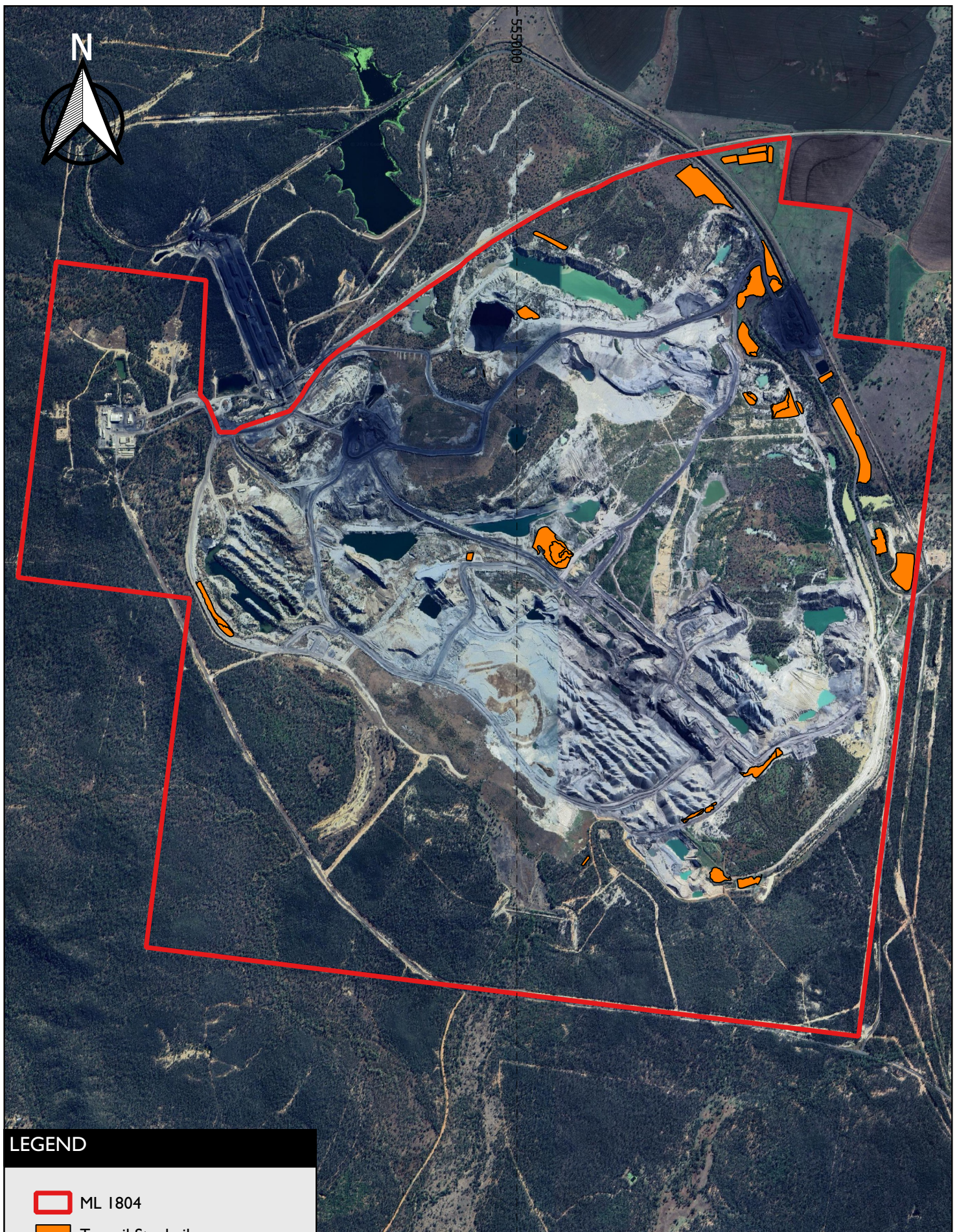
Rehabilitation area	Revegetation methods	Management actions
		mitigate risk of high density and distribution on areas, which are inaccessible due to safety aspects.
RA8 – Existing rehabilitation (grazing)	Assessment to determine if revegetation is required.	- Focus on establishing a stable vegetated surface - Site provides biodiversity linkage for ground dwelling fauna - Weed control to be undertaken seasonally to mitigate risk of high density and distribution on areas, which are inaccessible due to safety aspects.
RA9 – Cleared area	- Gypsum up to 10 t/ha - Topsoil - Ripping and seeding - Seeding, season and volume to be determined.	- Focus on establishing a stable vegetated surface - Site provides biodiversity linkage for ground dwelling fauna - Weed control to be undertaken seasonally to mitigate risk of high density and distribution on areas, which are inaccessible due to safety aspects.
RA10 – Native ecosystem	- Gypsum up to 10 t/ha - Topsoil - Ripping and seeding - Seeding, season and volume to be determined.	- Focus on establishing a stable vegetated surface which is free of listed weed species. - Site provides native ecosystem linkage along eastern side of mine site.
RA11 – Existing rehabilitation (native ecosystem)	Assessment to determine if revegetation is required.	Assessment of fuel loads to mitigate risk of fire spreading from these areas.

Rehabilitation area	Revegetation methods	Management actions
		• Weed control to be undertaken seasonally to mitigate risk of high density and distribution on areas which are inaccessible due to safety aspects. • Focus on establishing a stable vegetated surface which is free of listed weed species. • Site provides native ecosystem linkage along eastern side of mine site.
RA12 – Diversions	• Gypsum up to 10 t/ha • Topsoil • Ripping and seeding • Seeding, season and volume to be determined.	• Focus on establishing a stable vegetated surface • Site provides biodiversity linkage for ground dwelling fauna • Weed control to be undertaken seasonally to mitigate risk of high density and distribution on areas, which are inaccessible due to safety aspects.

Further discussion on rehabilitation landform objectives is provided in Section 5.

9.3 Topsoil and growth media management

Growing media refers to the soil / subsoil material in which plants grow, and upon which the revegetation program is based. The Blair Athol operation recognised early on that the historical activities in the region had impacted the soil reserves for re-use in rehabilitation activities. The short-term topsoil stockpile domains at BAC are illustrated in Figure 4.



LEGEND

- ML 1804
- Topsoil Stockpiles

Scale 1 : 17 500

0 0.5 1 km



Client	TerraCom Limited		Project	Rehabilitation Management Plan	
Design:	SGME Pty Limited 4.09.2025		Title	Topsoil Stockpiles	Figure
Scale:	1 : 17,500				4
CRS:	GDA2020				

To address the long-term requirements for topsoil, in 2017, shortly after acquiring the mine, TerraCom commissioned the Blair Athol Coal Mine Growth Media Mitigation & Management Strategy (GMMM Strategy) (TerraCom 2017). The purpose of the GMMM Strategy was twofold:

- 1 to enable the successful rehabilitation of Blair Athol within the budgeted financial assurance
- 2 to develop a growing media strategy to effectively utilise the required amount of topsoil to support ongoing progressive rehabilitation at BAC.

Topsoil stockpile report have been evaluated and amalgamated in a 2024 soil and capping material assessment report by SGME. As part of the development of the strategy, TerraCom engaged Seam Surveys Pty Ltd (August 2016) to survey and report on the current volumes of topsoil on the mine. The results of this assessment determined the final volume of topsoil at the site in 2017 totalled 1,060,994 m³ (TerraCom 2017).

To enable the existing topsoil reserves to be utilised effectively, to enable successful progressive rehabilitation of the mine, several mitigation and management measures were assessed as part of the GMMM Strategy, these included (TerraCom 2017):

- 1 Effectively use the remaining topsoil resources in the elevated risk zones (predominately mined areas).
- 2 Manage the depth of topsoil application to the original prescribed depth of 0.1m to 0.15m.
- 3 Ration defined areas to strip placement of topsoil – a beneficial process that reduces competition between grass species (sown into topsoil) and the tree and shrubs that are sown into bare spoil.
- 4 Applying ameliorants to overburden (i.e. gypsum) that improves its physical and chemical properties along with specific fertiliser types and rates.
- 5 Undertake trial onsite that shows satisfactory germination and survival from direct seeding into overburden.
- 6 Utilise specific treatments for the complex remediation projects (i.e. hydro-mulch) the diversion upgrade and tailings capping.
- 7 Review importation of organic complexes to enhance topsoil properties and as a potential standalone solution.

The results of the GMMM Strategy in combination with SGME topsoil accounting are summarised in Table 3. The results indicate that using a combination ameliorants and strip placement of topsoil will be required to enable progressive rehabilitation. Therefore, further assessments of spoil quality and quantity will be needed to determine the feasibility of replacing some of the soil deficit with spoil.

Table 3: Blair Athol Coal Mine Growth Media Mitigation & Management Strategy Summary Table

Growth median mitigation and management strategy		Placement @ 0.15 m	Strip placement	Hydro-mulch	Direct seed spoil	Not required
Hectares	1,688	784	165.8	17.5	48.6	672.1
Required topsoil (m ³)	1,300,350	1,176,000	124,350			

Growth median mitigation and management strategy		Placement @ 0.15 m	Strip placement	Hydro-mulch	Direct seed spoil	Not required
Available topsoil (m ³)	787,768.78					
Excess / (Deficiency) (m ³)	-512,581.22					

9.4 Soil ameliorants

The following soil ameliorants are discussed to improve success of revegetation and landform stability based on the limited availability of topsoil at BAC.

Where spoil is characterised as sodic (i.e. >6% Exchangeable Sodium Percentage (ESP) and/or where implementing the strip / spoil direct seeding method, it is recommended the application of Gypsum is used for sodic alkaline soils and the application of lime is used for acidic sodic soils (TerraCom 2017). The intent of adding gypsum and/or lime is to address the potential sodicity problem with the overburden as well as to support pH correction to reduce any acidic formation (tailings / rejects) (TerraCom 2017).

The rates of Gypsum and/or lime can vary depending on the nature of sodicity in the spoil however up to 10 t/ha may be required. It is recommended that Gypsum is applied via an agricultural spreader to the reshaped spoil then the area is either directly topsoiled or strip / spoiled and incorporated through ripping when seeding.

Additional soil ameliorants that can be considered by TerraCom for increasing both the quantity and quality of topsoil at BAC is the blending or mixing of biosolids or other organics into topsoil prior to spreading. This will increase the organic content of the upper horizon, increasing soil carbon levels, increase soil biology, improve soil structure, and enhance moisture holding capacity (TerraCom 2017).

10 REHABILITATION LANDFORM OBJECTIVES

10.1 EA requirements

The EA conditions F9g – F9j requires TerraCom to plan for the following in relation to rehabilitation landforms:

- ⌞ F9g: detail rehabilitation methods applied to areas
- ⌞ F9h: detail landform design including end of mine design
- ⌞ F9i: detail how landform design will be consistent with surrounding topography
- ⌞ F9j: identify and detail planned native vegetation rehabilitation areas and corridors.

10.2 Rehabilitation methods

All land available for progressive rehabilitation is rehabilitated with native grass, shrub, and tree species, as per the commitments made throughout the life of the mining activities at BAC. The aim of

the rehabilitation is to re-establish a native ecosystem on the mining leases after mining operations cease. This is achieved by the following rehabilitation methods:

- 1 Re-profiling of the angle of repose dragline spoil piles (overburden) remaining after the completion of the strip-mining process.
- 2 Overburden spoil piles are re-profiled to be stable against erosion and suitable for the re-establishment of native species and vegetation communities.
- 3 Water control structures are established where required depending on the landform.
- 4 Overburden is treated with gypsum or lime as required.
- 5 Prior to seeding, topsoil is replaced over the re-profiled spoil to a depth of at least 10-15cm (either directly or as per strip / spoil method).
- 6 The area is deep ripped by a dozer and seeded using native grasses, shrubs, and trees to establish rehabilitated vegetation communities and habitats that are:
 - a) safe for humans and wildlife
 - b) stable
 - c) able to sustain vegetation; and
 - d) non-polluting.

The BAC rehabilitation process is primarily a four-pass system with initial reshaping of spoil to the surrounding landform and appropriate rehabilitation domain, the addition of gypsum if required, topsoiling, ripping and seeding. Post rehabilitation, this process is supported by follow up monitoring and maintenance as illustrated in Figure 5.



Figure 5: Blair Athol Coal Mine Rehabilitation Work Flow

10.3 Landform design objectives

Environmental Authority Table F1 (refer to Appendix A) requires that all rehabilitated landform slope angles are not to exceed 15 percent, for both light grazing and native ecosystem PMLU's. All rehabilitation is therefore planned to conform within this parameter and is monitored via the use of LiDAR.

The rehabilitation areas (refer Figure 3) have been designed to mimic the landforms and broad vegetation types of the landscape surrounding the mine. In the first instance, landforms are generally created by the dragline, which are then reshaped using dozers to merge into the surrounding landforms. Depending on the type of spoil being rehabilitated, and the availability of topsoil, landforms are shaped into the desired rehabilitation domains.

Figure 6, Figure 7, and Figure 8 show slope percentages of rehabilitated areas from the 2023 current landform surface.



LEGEND

- ML 1804
- Existing rehabilitation

Slope (%)

- 0 - 10
- 10 - 15
- 15 - 20
- > 20

Scale 1 : 7 500

0 0.5



Client TerraCom Limited		Project Rehabilitation Management Plan	
Design: SGME Pty Limited 04.09.2025 Scale: 1 : 7,500 CRS: GDA2020		Title Slope	Figure 6



LEGEND

- ML 1804
- Existing rehabilitation

Slope (%)

- 0 - 10
- 10 - 15
- 15 - 20
- > 20

Scale 1 : 7 500

0 0.5



Client	TerraCom Limited	Project		Rehabilitation Management Plan
Design:	SGME Pty Limited 04.09.2025	Title	Slope	Figure
Scale:	1 : 7,500			
CRS:	GDA2020			



LEGEND

- ML 1804
- Existing rehabilitation

Slope (%)

- 0 - 10
- 10 - 15
- 15 - 20
- > 20

Scale 1 : 7 500

0 0.5



Client		Project	
TerraCom Limited		Rehabilitation Management Plan	
Design:	SGME Pty Limited 04.09.2025	Title	Figure
Scale:	1 : 7,500	Slope	8
CRS:	GDA2020		

11 REHABILITATION MONITORING

11.1 EA requirements

The EA conditions F9k – F9l requires TerraCom to plan for the following in relation to rehabilitation landforms:

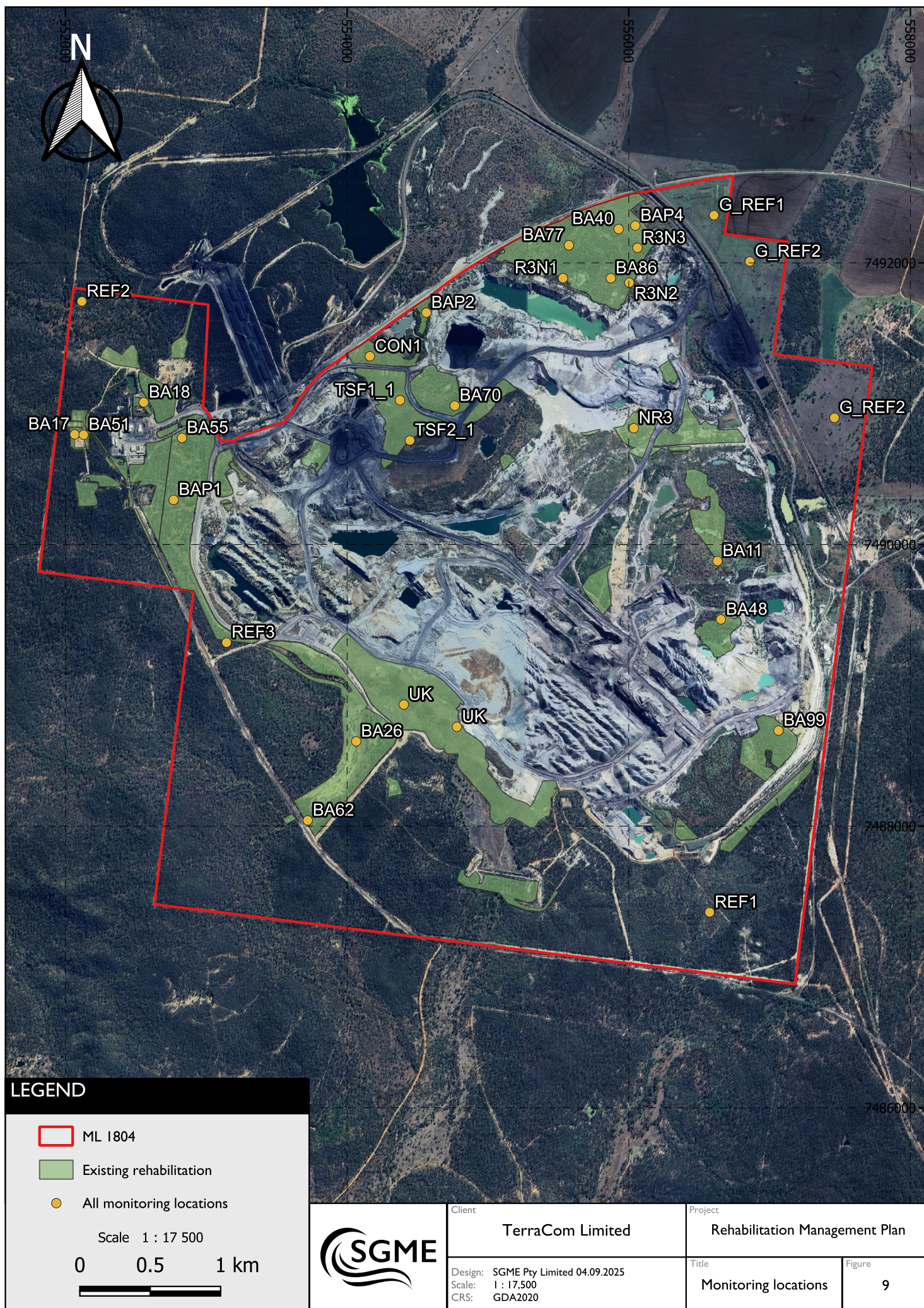
- ⌚ F9k: identify at least a minimum of three (3) reference sites for use in rehabilitation monitoring
- ⌚ F9l: describe rehabilitation indicators and how these will be monitored.

11.2 Rehabilitation monitoring

The current status review (Rio Tinto, 2016) noted that rehabilitation monitoring at BAC that had been undertaken from 1995 to 2012. The review noted the methods employed by the various monitoring teams differed and were not able to be directly cross referenced to assess the performance of the rehabilitation, as it related to the historic EA (2015) criteria.

To address this inconsistency, and to progress the monitoring program to include more modern standards, a revised rehabilitation monitoring program was developed by Rio Tinto for BAC in 2016. The revised Blair Athol Rehabilitation Monitoring Program (Rio Tinto 2016) introduced a strategic approach to monitoring the performance of rehabilitation using a combination of remote sensing and field survey methods. TerraCom have committed to conducting ongoing rehabilitation monitoring and performic assessments on an annual basis since acquiring the mine in accordance with the Blair Athol Rehabilitation Monitoring Program (Rio Tinto 2016).

The location of existing and planned rehabilitation monitoring sites at BAC is presented on Figure 9. In accordance with the methods outlined in the Blair Athol Rehabilitation Monitoring Program (Rio Tinto, 2016), sites are monitored for the following years post rehabilitation – years 1, 2, and 5, then every 5 years from there on (year 10, 15 and so on).



11.3 Monitoring methods

11.3.1.1 Reference sites

The current EA (condition F9k) requires at least three reference sites be established to understand the progression and ongoing performance of rehabilitation at the mine (Appendix A). These reference sites are required for comparative analysis against newly rehabilitated sites, established after May 2017.

The EA states that:

“a 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.”

In accordance with the EA, three native vegetation reference transects have been established at BAC since 2018 adjacent to the active mining areas within representative undisturbed vegetation communities within the mining lease (Appendix A). The reference sites are consistent with Regional Ecosystem 11.11.1 (*Eucalyptus crebra* +/- *Acacia rhodoxylon* woodland on old sedimentary rocks with varying degrees of metamorphism and folding).

Reference sites were selected within this regional ecosystem as it is a highly variable ecosystem, which represents a biodiversity PMLU (native ecosystems), and is representative of the natural vegetation communities near the Mine.

Reference sites were selected within this regional ecosystem as it is a highly variable ecosystem, which represents a biodiversity PMLU (native ecosystems), and is representative of the broad vegetation communities surrounding the site.

Three proposed reference sites have been selected for a grazing PMLU (refer to Figure 9). Rehabilitation monitoring will need to be completed on these sites to establish a baseline condition and confirm suitability.

Results of the reference sites will be included in the rehabilitation monitoring program to assist in assessing the trajectory of existing and future rehabilitation towards a self-sustaining ecosystem that supports a target biodiversity outcome.

11.3.1.2 Data collection and analysis

Permanent vegetation monitoring transects of 50 m in length and 10 m in width are used to measure and record species richness and relative abundance, canopy height and cover, groundcover and weed presence. Where applicable, the monitoring results are compared to the minimum requirements in the EA.

- ┐ slope stability
- ┐ presence of active gully erosion
- ┐ stable or stabilising gullies
- ┐ groundcover abundance as percentage cover
- ┐ native shrub abundance as stems per hectare (stems/ha)
- ┐ native tree diversity
- ┐ native tree abundance on rigid soils and cracking clay soils as stems/ha
- ┐ performance trajectory based on the state and transitional age.

LiDAR, and other spatial information and aerial imagery, may also be used within a desktop component of monitoring to:

- ┐ identify potential sites for landform and erosion monitoring
- ┐ generate an elevation slope model to assess landform design
- ┐ plan locations of accessible rehabilitation monitoring sites which represent:
 - rehabilitation slope
 - PMLUs of cattle grazing and native ecosystem.

11.3.1.3 Annual monitoring report inclusions

An annual report on monitoring results must be produced which includes:

- ┐ descriptions of the methods used
- ┐ descriptions and photographs of the monitoring sites
- ┐ results of assessments
- ┐ comparisons of vegetation to reference sites and statistical analyses
- ┐ assessments of chemical, physical and fertility characteristics of the soil
- ┐ identification of characteristics which are not consistent with the rehabilitation objectives
- ┐ descriptions of trends between soil and vegetation measurements as identified by statistical analyses
- ┐ establishment statuses of seed species
- ┐ descriptions of management and land use potential
- ┐ descriptions and graphical representations of the progression of erosion features
- ┐ locations of erosion in relation to rehabilitation
- ┐ descriptions and a map of the blocks and transect locations of reference sites and rehabilitation
- ┐ recommendations for appropriate management of weeds and erosion.

11.4 Performance criteria

The rehabilitation completion criteria for slope, landform stability and vegetation were historically listed in BAC's Environmental Authority (2015 EA). Separate criteria were prescribed for pre 2003 and post 2003 rigid and cracking clay soils.

Rehabilitation requirements and performance criteria are defined in EA condition Table F1 (Table 4). The results of progressive rehabilitation continue to be assessed against these performance criteria to identify those sites that are indicating successful development towards progressive rehabilitation, and those that require ongoing monitoring, and those that require maintenance or further rework. It is important that each annual rehabilitation monitoring report updates the overall performance areas of rehabilitation to assist in ongoing planning and management of rehabilitation.

Table 4: Rehabilitation requirements

Post mining land use	Mine domain	Goal	Objective	Indicator	Acceptance criteria
Grazing	All areas disturbed by mining activities	Safe for humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined land subject to the same land use	Hazard assessment	No significant difference
		Stable	Rehabilitation is geotechnically stable	Factor of safety	≥1.5
				Erosion	No gully erosion
				Slope gradient	Rehabilitated landform: <15%
					Ramp 3: <30%
				Groundcover	>50%
		Non-polluting	Rainfall runoff from rehabilitation achieves water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values
			Deep drainage from rehabilitation achieves relevant water quality	EC	Not significantly different to: (a) the EPP (Water) schedule documents water

Post mining land use	Mine domain	Goal	Objective	Indicator	Acceptance criteria
			objectives for groundwater		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 light grazing	Land suitability assessment for light grazing	Land suitability class ≤ 3 or not different from pre-mining class if ≥ 4 . <i>LSA Framework for Open-Cut Coal Mine Rehabilitation 2018 (A rule-set for land suitability assessment beef cattle grazing on land rehabilitated after open-cut coal mine in the Bowen Basin Queensland)</i> unless otherwise agreed in writing between the administering authority and the environmental authority holder.
Native ecosystem	Areas disturbed by mining activities that are located on State	Safe for humans and wildlife	Construct landforms that do not pose unacceptable hazards to humans, stock and wildlife.	Safety hazards in rehabilitation are not significantly different to surrounding unmined land	Hazard assessment

Post mining land use	Mine domain	Goal	Objective	Indicator	Acceptance criteria
	Forest Land			subject to the same land use	
		Stable	Demonstrate geotechnical stability.	Factor of safety	≥1.5
				Erosion	No gully erosion
			Not exhibiting excessive erosion	Slope gradient	Rehabilitated landform: <15%
				Groundcover	>50%
		Able to sustain vegetation	Rehabilitation landform (including land cover and water) is suitable for providing native ecosystem	Vegetation assessment	A vegetation assessment is completed by an APQ using a methodology as outlined in the Queensland Mine Rehabilitation Commissioner technical paper 'Evaluating methods for assessing native ecosystem mine rehabilitation success' (March 2023).
			Achieve self-sustaining systems that doesn't require additional maintenance except that of surrounding areas (e.g., weed and fire control via grazing/pastoral management etc.).		>70% total cover across rehabilitation area, includes multilevel canopy, groundcover, and leaf litter. At least four native tree or shrub species across the rehabilitation area.

Post mining land use	Mine domain	Goal	Objective	Indicator	Acceptance criteria
					Evidence of recruitment of native tree species over a representative climatic period.
		Non-polluting	Rainfall runoff from rehabilitation achieves 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

11.5 Transitional age

To determine appropriate management actions, it is also important to gain an understanding of the trajectory of each rehabilitation monitoring site as it relates to its state and transitional age, as listed in Table 5. The transitional age is based on a fundamental hierarchy of the development of rehabilitation as it aligns to the transitional continuum towards achieving completion criteria. The Rehabilitation State and Transition model, as shown in Figure 9: Existing and planned monitoring sites, is used to plot transitional age, as it relates to its performance against the rehabilitation hierarchy, and the sites actual rehabilitation age.

The purpose of plotting a site's transitional age against the rehabilitation age, is essential to highlighting if a site is on the trajectory towards achieving the performance criteria, or if a site is perhaps lagging in a transitional stage. If a site is lagging, it may need intervention (i.e. maintenance

or rework) to enable it to improve its trajectory. Ongoing monitoring for sites should be based on the transitional age (refer Table 5) in accordance with the overarching rehabilitation monitoring program (i.e. 1, 2, 5, 10 + years) until progressive certification is achieved.

Table 5: Rehabilitation transitional age indicators

Indicators	Transitional ages (years)
Stability	1
Cover	2
Species Diversity	3
Shrub Abundance	5
Tree Abundance	7

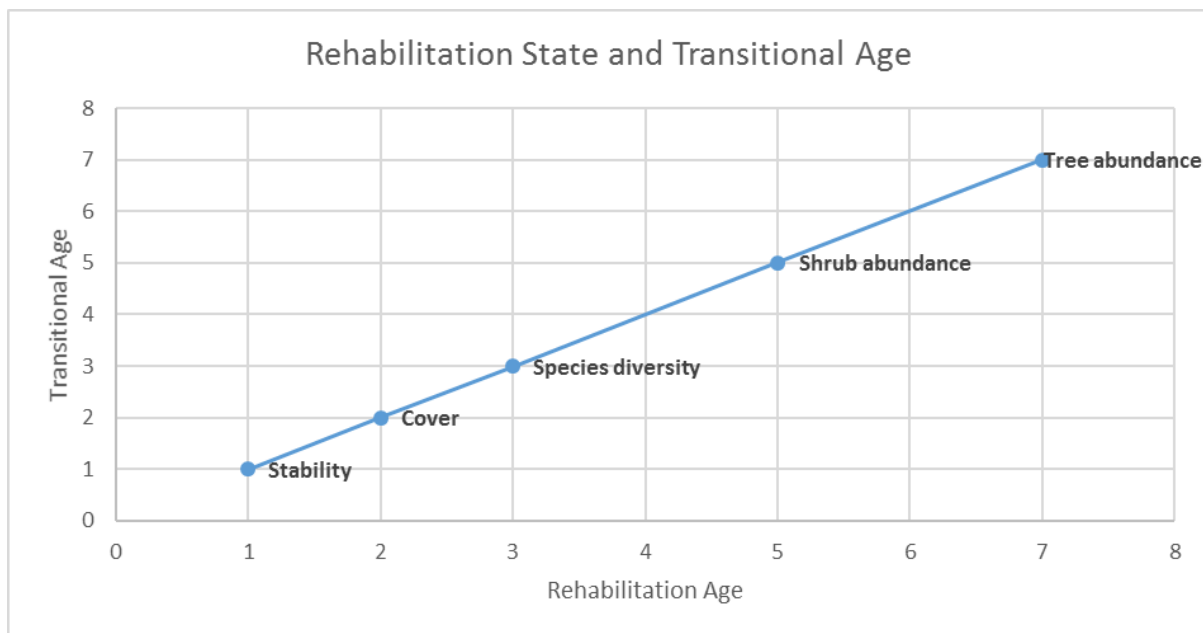


Figure 10: Blair Athol Rehabilitation state and transitional age model

11.6 Gully erosion

Environmental authority Condition F5 requires all successfully rehabilitated land to have no active gully erosion. Furthermore, the EA requires that gully erosion must be assessed by annually documented inspections and gully dimensions must be quantitatively assessed for a minimum of two years both containing a minimum of two rainfall events of more than 25 millimetres in less than three hours.

Gully erosion is to be assessed by an AQP via visual inspections and classified as either active or stabilising. A review of aerial photography and a landform analysis using light detection and ranging

(LiDAR) are to be done to identify differences between locations. Following this assessment, recommendations and management strategies are to be made accordingly.

12 REHABILITATION MANAGEMENT ACTIONS

12.1 EA requirements

The EA conditions F9m – F9n requires TerraCom to plan for the following in relation to rehabilitation management actions:

- F9m: Describe management actions to address unsuccessful rehabilitation or redesign; and
- F9n: Describe end of mine landform design planning and post mining land uses across the mine; and include a triple bottom line assessment (or a comparative alternative assessment method) of the proposed final landform design criteria and alternatives.

12.2 Management actions

12.3 Rehabilitation status

To determine if rework, maintenance, or ongoing monitoring is required for areas of rehabilitation, information is taken from the:

- State and transition model (refer Section 11)
- Gully erosion monitoring (refer Section 11.6)
- Results of annual rehabilitation monitoring – including conformance to rehabilitation milestones (refer Section 11.4)
- Recent spatial data and aerial imagery.

Appropriate recommendations are then provided based on the factors that are limiting a site's development. An example of the types of actions that may be required to manage areas of rehabilitation depending on their status have been provided in Table 6.

Table 6: Rehabilitation Management Actions

Rehabilitation status	Recommended actions
Rework	Major works associated with reshaping landforms and gully remediation
Maintenance	Minor works associated with gully remediation, groundcover maintenance, reseeding and planting
Monitor	Site is on a trajectory towards completion criteria and requires ongoing monitoring
Acceptable	Site meets all performance criteria, recommend progressive certification

12.3.1.1 Maintenance measures

Maintenance measures must be implemented where failures in fulfilling completion criteria occur, such as:

- ▮ insufficient drainage;
- ▮ insufficient vegetation cover;
- ▮ issues with soil fertility and erosive potential;
- ▮ occurrence of significant gully erosion;
- ▮ erosion control mechanism failure;

- sedimentation; and
- adverse effects from extreme climatic conditions or weather events.

12.4 End of mine landform planning

The end of mine landform planning and post mining land use (PMLU) design objectives for progressive rehabilitation of each mine closure domain, has been revised by TerraCom to be grazing and native ecosystem outcome focused.

Of interest, residual voids will also occur on the site due to the nature of the coal seam (confined basin) and the previous removal of 20–30 metres of coal seam creating a sunken landform. This will create areas that can be classed as non-use management areas (NUMA), although the voids have been shown to be an aquatic habitat refuge and of potential biodiversity value. The Residual Void Management Plan (WSP, 2020), has identified that the water quality of the pit lake(s) to be contained in the residual void domain is likely to be the limiting factor regarding use of residual water bodies for PMLU. The resulting pit lake(s) is likely to exhibit poor water quality over time and is unlikely to be suitable for use as a recreational area or for stock watering and native fauna watering. Although, it has been shown to provide an aquatic habitat refuge for more mobile native fauna species. The final salinity of the pit lake(s) is also likely to be too high to support freshwater fish species but will continue to function as an aquatic habitat refuge.

The presence of a final pit lake with poor water quality in the residual void is unavoidable. Therefore, the preferable land use management strategy is to minimise the area of the residual void and the pit lake, to maximise the amount of rehabilitation for grazing and native ecosystem within the residual void domain – noting that for legacy rehabilitation areas, it may not be possible to reduce the area of the void.

The final mine landform will consist of light grazing and native ecosystem PMLU's, as well as a final void (NUMA) which is identified within the EA (June 2025). The rehabilitation goals and objectives for all rehabilitation areas to be consistent with the four broad rehabilitation goals guided by the rehabilitation objectives, as listed in Table 4.

13 PLAN REVIEW AND UPDATE

The EA condition F8 requires TerraCom to revise and update this Rehabilitation Management Plan:

- The Rehabilitation Management Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every 2 years.

14 REFERENCES

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Blair Athol Coal Mine – Environmental Management System

TerraCom

APPENDIX A – ENVIRONMENTAL AUTHORITY



Permit

Environmental Protection Act 1994

Environmental authority EPML00876713

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

Environmental authority number: EPML00876713

Environmental authority takes effect on 11 June 2025.

Environmental authority holder(s)

Name(s)	Registered address
Orion Mining Pty Ltd	Blair Athol Mine Access Road, Clermont QLD 4721

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
Ancillary 08 - Chemical Storage 1: Storing a total of 50t or more of chemicals of dangerous goods class 1 or class 2, division 2.3 under subsection (1)(a)	ML1804
Ancillary 31 - Mineral processing 2: Processing, in a year, the following quantities of mineral products, other than coke (b) more than 100,000t	ML1804
Ancillary 63 - Sewage Treatment 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (b-i) more than 100 but not more than 1500EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	ML1804
Schedule 3 13: Mining black coal	ML1804

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.



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

Mobile and temporary activities

If you operate a mobile and temporary environmentally relevant activity (ERA), other than regulated waste transport, you are required to maintain a work diary. You must:

- use the approved form for a work diary (ESR/2015/1696);
- keep the work diary records for 2 years after the last entry;
- inform the administering authority within 7 days of the work diary being lost or stolen;
- record the information required in the work diary for each location within 1 day of leaving the location.

Contaminated land

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

- the presence of, or happening of an event involving, a hazardous contaminant on the land that is causing, or is reasonably likely to cause, serious or material environmental harm (notice must be given within 24 hours); or
- if the land is contaminated land – a change in the condition of the land that is causing, or is reasonably likely to cause, serious or material environmental harm (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 land (notice must be given within 20 business days).

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.

The anniversary day of this environmental authority is the same day each year as the effective date. 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.

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

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information or operating without a valid environmental authority.



Signature

11 June 2025

Date

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

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

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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).

Obligations under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

Matters of national environmental significance (MNES) are regulated under the Commonwealth EPBC Act rather than under state legislation. You may need to submit a referral if your project potentially impacts any matters protected under the EPBC Act. For more information on self-assessments, and referral and assessment processes please visit the Department of Climate Change, Energy, the Environment and Water webpage, <https://www.dcceew.gov.au/environment/epbc/advice>.

Obligations under the *Aboriginal Cultural Heritage Act 2003* and *Torres Strait Islander Cultural Heritage Act 2003* (the Cultural Heritage Acts)

The Cultural Heritage Acts require anyone who carries out a land-use activity to exercise a duty of care. This 'duty of care' means land users must take all reasonable and practicable measures to ensure their activity does not harm Aboriginal or Torres Strait Islander cultural heritage and applies to any activity where Aboriginal or Torres Strait Islander cultural heritage is located. For more information on your obligations under this legislation, please visit the Department of Women, Aboriginal and Torres Strait Islander Partnerships and Multiculturalism webpage at, <https://www.tatsipca.qld.gov.au/>.

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Conditions of environmental authority

The environmentally relevant activities conducted at the locations as described above may be conducted in accordance with the following site-specific conditions of approval. This environmental Authority consists of the following Schedules:

- Schedule A – General
- Schedule B – Air
- Schedule C – Water
- Schedule D – Acoustic
- Schedule E – Waste
- Schedule F – Land
- Schedule G – Regulated Structures
- Schedule H – Sewage Treatment
- Schedule I – Groundwater
- Definitions
- Figures

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Conditions of environmental authority

Schedule A: General	
Condition number	Condition
A1	Although this environmental authority authorises environmental harm to the extent stated in the conditions, all reasonable and practicable measures must be taken to prevent or minimise environmental harm caused by the activities.
A2	Maintenance of measures, plant and equipment All measures, plant and equipment necessary to comply with this authority must be: (a) installed in a proper and efficient condition; (b) maintained in a proper and efficient condition; (c) operated in a proper and efficient manner; and (d) properly calibrated.
A3	Monitoring The results and analysis of all monitoring and investigations required by this environmental authority must be: (a) kept for a period of at least five years; (b) be provided to the administering authority within a timeframe nominated by the administering authority; and (c) provided to the administering authority in the format requested.
A4	Any records kept or created in relation to this authority must be: (a) kept for a period of at least five years; and (b) provided to the administering authority on request.
A5	All monitoring and investigations required by this environmental authority must be undertaken by an appropriately qualified person.
A6	Upon request from the administering authority, copies of all records, plans and other documentation required by the conditions of this environmental authority must be made available and provided to the administering authority within: (a) ten (10) business days; or (b) an alternative timeframe agreed between the administering authority and the environmental authority holder.
A7	Risk management The holder of this environmental authority must develop and implement a risk management system for mining activities to the Standard for Risk Management (ISO31000:2009), or the latest edition of an Australian Standard for risk management, to the extent relevant to environmental management.
A8	Where a condition of this environmental authority requires compliance with a standard, policy or guideline published externally to this environmental authority and the standard is amended or changed subsequent to the issue of this environmental authority, the holder of this environmental authority must: (a) comply with the amended or changed standard, policy or guideline within two years of the amendment or change being made, unless a different period is specified in the amended standard or relevant legislation, or where the amendment or change relates specifically to regulated structures; and

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	(b) until compliance with the amended or changed standard, policy or guideline is achieved, continue to remain in compliance with the corresponding provision that was current immediately prior to the relevant amendment or change.
A9	Third-party Audits The environmental authority must: (a) ensure that an appropriately qualified third party conducts and documents an audit of compliance with all conditions of the environmental authority by 15 December 2018; and (b) ensure that further audits in accordance with condition A9(a) are conducted at intervals not exceeding once every two years from completion of initial audit.
A10	Notification of emergencies, incidents and exceptions The holder of this environmental authority must notify the administering authority by written notification within 24 hours , after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with, the conditions of this environmental authority.
A11	Within 10 business days following the initial notification of an emergency or incident, or receipt of monitoring results, whichever is the latter, further written advice must be provided to the administering authority, including the following: (a) results and interpretation of any samples taken and analysed; (b) outcomes of actions taken at the time to prevent or minimise unlawful environmental harm; and (c) proposed actions to prevent a recurrence of the emergency or incident.
A12	Complaints A record must be kept in a single location of all complaints received about the activities.
A13	The record required by condition A12 must include: (a) name, address and contact number for the complainant; (b) time and date of complaint; (c) investigations undertaken; (d) conclusions formed; (e) actions taken to resolve the complaint; (f) any abatement measures implemented; and (g) person responsible for resolving the complaint.
A14	The administering authority must be notified that a complaint has been made, within 48 hours of receiving the complaint.
A15	When requested by the administering authority, monitoring must be undertaken to investigate any complaint arising from the activity: (a) in the manner requested by the administering authority; and (b) within a reasonable timeframe nominated by or agreed to by the administering authority.
A16	Scope of activity This environmental authority authorises the mining of no more than 11 million tonnes of run of mine (ROM) coal per annum.
A17	The maximum area of disturbance that must not be exceeded in carrying out the mining activity is depicted in Figure 1 – Blair Athol Mine authorised disturbance footprint .

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Schedule B: Air	
Condition number	Condition
B1	Dust and particulate matter monitoring The environmental authority holder must ensure that the dust and particulate matter emissions generated by the mining activities do not cause exceedances of the following levels when measured at any sensitive or commercial place: (a) Dust deposition 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 Methods for sampling and analysis of ambient air-Determination of particulate matter-Deposited matter - Gravimetric method. (b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24-hour averaging time, when monitored in accordance with the most recent version of either: (i) Australian Standard AS3580.9.6 Methods for sampling and analysis of ambient air- Determination of suspended particulate matter-PM10 high volume sampler with size selective inlet - Gravimetric method; or (ii) Australian Standard AS3580.9.9 Methods for sampling and analysis of ambient air- Determination of suspended particulate matter-PM10 low volume sampler-Gravimetric method. (c) A concentration of particulate matter suspended in the atmosphere of 90 micrograms per cubic metre over a 1 year averaging time, when monitored in accordance with the most recent version of AS/NZS3580.9.3:2003 Methods for sampling and analysis of ambient air- Determination of suspended particulate matter-Total suspended particulate matter (TSP)-High volume sampler gravimetric method.
B2	Odour nuisance The release of noxious or offensive odour or any other noxious or offensive airborne contaminants resulting from the mining activities must not cause an environmental nuisance at any sensitive or commercial place.
B3	When requested by the administering authority, odour monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring.
B4	If the administering authority determines that condition B2 is not being met, then the environmental authority holder must: (a) address the complaint including the use of appropriate dispute resolution if required; and (b) immediately implement odour abatement measures so that emissions of odour from the activity do not result in further environmental nuisance.

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Schedule C: Surface Water	
Condition number	Condition
C1	Contaminant release Contaminants that will or have the potential to cause environmental harm must not be released directly or indirectly to any waters as a result of authorised activities, except as permitted under the conditions of this environmental authority.
C2	Unless otherwise permitted under the conditions of this environmental authority, the release of mine affected water to waters must only occur from the release points specified in Table C1 (Mine affected release points, Sources and Receiving Waters) and depicted in Figure X attached to this environmental authority.

Table C1 (Mine affected release points, sources and receiving waters) (1)

Release Point (RP)	Latitude (GDA2020)	Longitude (GDA2020)	Mine affected water source and location	Monitoring Point	Receiving waters description
Note: (1) There is no current authorised release point for Blair Athol Mine on ML1804.					

C3	The release of mine affected water to internal water management infrastructure installed and operated in accordance with a water management plan that complies with condition C24 is permitted.
C4	The release of mine affected water to waters in accordance with condition C2 must not exceed the release limits stated in Table C2 (Mine affected release limits) when measured at the monitoring points specified in Table C1 (Mine affected release points, sources and receiving waters) for each quality characteristic.

Table C2 (Mine affected release limits)

Quality Characteristic	Release limits	Monitoring frequency
Electrical conductivity (microsiemens per centimetre)	1000	Daily during release (the first sample must be taken within 2 hours of commencement of release)
pH (pH Unit)	6.5 (minimum), 9.0 (maximum)	Daily during release (the first sample must be taken within 2 hours of commencement of release)
Turbidity (NTU)	Current limit or limit derived from suspended solids limit and demonstrated correlation between turbidity to suspended solids historical monitoring data for dam water. To be provided to the administering authority following approval of a release point.	Daily during release (first sample within 2 hours of commencement of release)
Suspended Solids (mg/L)	1000	Daily during release (first sample within 2 hours of commencement of release)

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Sulfate (mg/L)	500	Daily during release (first sample within 2 hours of commencement of release)
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C5	The release of mine affected water to waters from the release points must be monitored at the locations specified in Table C1 (Mine affected release points, sources and receiving waters) for each quality characteristic and at the frequency specified in Table C2 (Mine affected release limits) and Table C3 (Release contaminant trigger investigation levels) .
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Table C3 (Release contaminant trigger investigation levels)

Quality Characteristic (1), (2)	Trigger Levels (micrograms per litre)	Comment on 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 SMD guideline	

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Molybdenum	34	For aquatic ecosystem protection, based on low reliability guideline	
Selenium	10	For aquatic ecosystem protection, based on LOR for ICPMS	
Silver	1		
Uranium	1		
Vanadium	10		
Ammonia	900	For aquatic ecosystem protection, based on SMD guideline	
Nitrate	1100	For aquatic ecosystem protection, based on ambient Qld WQ Guidelines (2006) for TN	
Petroleum hydrocarbons (C6-C9)	20		
Petroleum hydrocarbons (C10-C36)	100		
Fluoride (total)	2000	Protection of livestock and short term irrigation guideline	
Sodium	Limit to be determined based on receiving water reference data and achievable best practice sedimentation control and treatment. To be provided to the administering authority following approval of a release point.		

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 characteristics required to be monitored as per **Table C3 (Release contaminant trigger investigation levels)** can be reviewed once the results of **two years** monitoring data is available, or if sufficient data is available to adequately demonstrate negligible environmental risk, and it may be determined that a reduced monitoring frequency is appropriate or that certain quality characteristics can be removed from **Table C3 (Release contaminant trigger investigation levels)** by amendment.
- (3) SMD - slightly moderately disturbed level of protection, guideline refers ANZECC and ARMCANZ (2000).
- (4) LOR - typical reporting for method stated. ICPMS/CV FIMS – analytical method required to achieve LOR.

C6	If quality characteristics of the release exceed any of the trigger levels specified in Table C3 (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 C3 and; (1) where the trigger values are not exceeded then no action is to be taken. (2) where the downstream results exceed the trigger values specified Table C3 (Release contaminant trigger investigation levels) for any quality characteristic, compare the results of the downstream site to the data from background monitoring sites; (a) if the result is less than the background monitoring site data, then no action is to be taken. (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 within 90 days of receiving the result, outlining (i) details of the investigations carried out; and (ii) actions taken to prevent environmental harm.
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	Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with C6(2)(b)(ii) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.
C7	If an exceedance in accordance with condition C6(2)(b) is identified, the holder of the authority must notify the administering authority within 24 hours of receiving the result.
C8	Mine affected water release events The holder must ensure a stream flow gauging station/s is installed, operated and maintained to determine and record stream flows at the locations and flow recording frequency specified in Table C3 (Release contaminant trigger investigation levels) .
C9	Notwithstanding any other condition of this environmental authority, the release of mine affected water to waters in accordance with condition C2 must only take place during periods of natural flow in accordance with the receiving water flow criteria for discharge specified in Table C4 (Mine affected water release during flow events) for the release point(s) specified in Table C1 (Mine affected release points, sources and receiving waters) .

Table C4 (Mine affected water release during flow events)

Receiving water description	Release Point	Gauging station description	Latitude (GDA94)	Longitude (GDA94)	Minimum Flow in Receiving Water Required for a Release Event	Flow recording Frequency
Bath Creek	TBA	Gauging station 1	-22° 32' 16.8"	147° 32' 16.8"	3.6 cubic metres per second	Continuous (minimum daily)

C10	The release of mine affected water to waters in accordance with condition C2 must not exceed the Maximum Release Rate for each receiving water flow criterion for discharges specified in Table C4 (Mine affected water release during flow events) when measured at the monitoring points specified in Table C1 (Mine affected release points, sources and receiving waters) .
C11	The daily quantity of mine affected water released from each release point must be measured and recorded at the monitoring points in Table C1 (Mine affected release points, sources and receiving waters) .
C12	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.
C13	Notification of release event The authority holder must notify the administering authority as soon as practicable (no later than 6 hours of having commenced releasing mine affected water to the receiving environment). Notification must include the submission of written verification to the administering authority of the following information (a) release commencement date/time (b) expected release cessation date/time (c) release point/s (d) release volume (estimated) (e) receiving water/s including the natural flow rate (f) any details (including available data) regarding likely impacts on the receiving water(s).

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	Note: Notification to the administering authority must be via an email to WaTERS.
C14	The authority holder must notify the administering authority as soon as practicable (nominally within 24 hours after cessation of a release) of the cessation of a release notified under condition C13 and within 28 days provide the following information in writing: (a) release cessation date/time (b) natural flow volume in receiving water (c) volume of water released (d) details regarding the compliance of the release with the conditions of Department Interest: Water of this environmental authority (i.e. contamination limits, natural flow, discharge volume) (e) all in-situ water quality monitoring results (f) any other matters pertinent to the water release event.
C15	Notification of release event exceedance If the release limits defined in Table C2 (Mine affected release limits) are exceeded, the holder of the environmental authority must notify the administering authority within 24 hours of receiving the results.
C16	The authority holder must, within 28 days of a release that exceeds the conditions of this authority, provide a report to the administering authority detailing: (a) the reason for the release (b) the location of the release (c) all water quality monitoring results (d) any general observations (e) all calculations (f) any other matters pertinent to the water release event.
C17	Receiving Environment Monitoring and Contaminant Trigger Levels The quality of the receiving waters must be monitored at the locations specified in Table C8 (Receiving water upstream background sites and downstream monitoring points) for each quality characteristic and at the monitoring frequency stated in Table C7 (Receiving waters contaminant trigger levels).

Table C7 (Receiving waters contaminant trigger levels)

Quality Characteristic	Trigger Level	Monitoring Frequency
pH	6.5 - 8.0	Daily during the release
Electrical Conductivity (microsiemens per centimetre)	1000	
Suspended solids (mg/L)	1000	
Sulfate (mg/L)	250	

Table C8 (Receiving water upstream background sites and downstream monitoring points)

Monitoring point	Receiving Waters Location	Latitude	Longitude	Monitoring frequency
Upstream Background Monitoring Points				

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Monitoring Point 1	Washpool Creek, 10,700m upstream of GS1	-22° 40' 02.3"	147° 31' 52.7"	Daily during release
Monitoring Point 2	Back Creek, 6,600m upstream of GS 1	-22° 41' 17.5"	147° 33' 16"	Daily during release
Monitoring Point 3	Breaker Creek	-22° 41' 10.1"	147° 30' 40.7"	Daily during release
Downstream Monitoring Points				
Monitoring Point 4	Breaker Creek Diversion	-22° 42' 53"	147° 31' 17"	Daily during release
Monitoring Point 5	Bath Creek East	-22° 43' 27"	147° 32' 53"	Daily during release
Monitoring Point 6	Bath Creek Down Stream	-22° 44' 59"	147° 32' 13"	Daily during release
Note: The data from background monitoring points must not be used where they are affected by releases from other mines.				

C18	If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in Table C7 (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. (2) where the downstream results exceed the upstream results, complete an investigation in accordance with the ANZECC and ARMCANZ 2000 methodology, 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. [Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with C18(2)(ii) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.]
C19	All determinations of water quality monitoring must be performed by an appropriately qualified person.
C20	Receiving Environment Monitoring Program (REMP) The environmental authority holder must 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 the Bath Creek and connected or surrounding waterways within 12 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.
C21	A report outlining the findings of the REMP, including all monitoring results and

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	interpretations must be prepared annually. This must include an assessment of background reference water quality, the condition of downstream water quality compared with water quality objectives, and the suitability of current discharge limits to protect downstream environment values.
C22	Water reuse Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder or a third party (with the consent of the third party).
C23	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 the contaminants 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 with the conditions of this environmental authority (g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.
C24	Water Management Plan A Water Management Plan developed by an appropriately qualified person must be implemented for all stages of the mining activity.
C25	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 storm water.
C26	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 C25. (b) Water management infrastructure that is installed and operated, in accordance with a Water Management Plan that complies with condition C24, for the purpose of ensuring water does not become mine-affected water.

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Schedule D: Acoustic	
Condition number	Condition
D1	Noise limits The holder of this environmental authority must ensure that noise generated by the mining activities does not cause an environmental nuisance at any sensitive place or commercial place.
D2	When requested by the administering authority, noise monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive place, and the results must be notified within 14 business days to the administering authority following completion of monitoring.
D3	If monitoring indicates exceedance of the noise limits in Table D1 - Noise limits, then the environmental authority holder must: (a) address the complaint including the use of appropriate dispute resolution if required; or (b) immediately implement noise abatement measures so that noise from the activity does not result in further environmental nuisance.
D4	If monitoring indicates that noise from the mining activity is causing an environmental nuisance, then the environmental authority holder must: (a) address the complaint including the use of appropriate dispute resolution if required (b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance.
D5	Airblast overpressure nuisance The holder of this environmental authority must ensure that blasting does not cause the limits for peak particle velocity and air blast overpressure in Table D2 - Blasting noise limits to be exceeded at any sensitive place or commercial place.
D6	Monitoring and reporting Noise monitoring and recording must include the following descriptor characteristics and matters: (a) LAN,T (where N equals the statistical levels of 1, 10 and 90 and T = 15 mins) (b) background noise LA90 (c) the level and frequency of occurrence of impulsive or tonal noise and any adjustment and (d) penalties to statistical levels (e) atmospheric conditions including temperature, relative humidity and wind speed and directions (f) effects due to any extraneous factors such as traffic noise (g) location, date and time of monitoring (h) if the complaint concerns low frequency noise, Max LpLIN,T and one third octave band measurements in dB(LIN) for centre frequencies in the 10 - 200 Hz range.

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Table D1 (Noise limits)						
Sensitive place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	9am to 6pm	6pm to 10pm	10pm to 9am
LAeq, adj, 15 mins	CV = 50 AV = 5	CV = 45 AV = 5	CV = 40 AV = 0	CV = 45 AV = 5	CV = 40 AV = 5	CV = 35 AV = 0
LA1, adj, 15mins	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5
Commercial place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	7am to 6pm	6pm to 10pm	10pm to 7am
LAeq, adj, 15 mins	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5
Notes: (1) CV = Critical Value (2) AV = Adjustment Value (3) To calculate noise limits in Table D1: a. If $bg \leq (CV - AV)$: b. Noise limit = $bg + AV$ c. If $(CV - AV) / -$ LESS THAN $- / bg \leq CV$: d. Noise limit = CV If $bg / -$ GREATER THAN $- / CV$: e. Noise limit = $bg + 0$ (4) In the event that measured bg (LA90, adj, 15 mins) is less than 30 dB(A), then 30 dB(A) can be substituted for the measured background level (5) bg = background noise level (LA90, adj, 15 mins) measured over 3-5 days at the nearest sensitive receptor (6) If the project is unable to meet the noise limits as calculated above alternative limits may be calculated using the processes outlined in the "Planning for Noise Control" guideline.						

Table D2 (Blasting noise limits)		
Blasting noise limits	Sensitive or commercial place	
	7am to 6pm	6pm to 7am
Airblast overpressure	115 dB (Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 120 dB (Linear) Peak at any time	No blasting
Ground vibration peak particle velocity	5mm/second peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time	No blasting

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Schedule E: Waste	
Condition number	Condition
E1	All general and regulated waste must only be removed and transported from site by a person who has the authority to transport such wastes to a facility that is lawfully able to accept the waste under the <i>Environmental Protection Act 1994</i> .
E2	Storage of tyres Tyres stored awaiting disposal or transport for take-back and, recycling, or waste to- energy options, should be stockpiled in volumes less than 3 metres in height and 200 square metres in area and at least 10 metres from any other tyre storage area.
E3	All reasonable and practicable fire prevention measures must be implemented, including removal of grass and other materials within a ten (10) metre radius of the scrap tyre storage area.
E4	Disposal of tyres and conveyor belts Disposing of scrap tyres and conveyor belts resulting from the mining activities in spoil emplacements is acceptable, provided they are placed as deep in the spoil as reasonably practicable.
E5	Scrap tyres resulting from the mining activities disposed within the operational land must not impede saturated aquifers or compromise the stability of the consolidated landform.
E6	The location of tyre burial sites must be recorded.
E7	Burning Waste Unless otherwise permitted by the conditions of this environmental authority or with prior approval from the administering authority and in accordance with a relevant standard operating procedure, waste must not be burnt.
E8	The holder of this environmental authority may burn vegetation in accordance with the plan of operations, provided the activity does not cause environmental harm at any sensitive or commercial place.
E9	Mine waste and rejects management Waste products generated on or after the 30 August 2017 from the washing of coal must be disposed of within mining voids and covered with spoil to a depth of at least 5m.
E10	A Waste Rock, Spoil and Rejects Disposal Plan must be implemented and include, where relevant, at least: (a) effective characterisation of the waste rock, spoil and rejects to predict under the proposed placement and disposal strategy the quality of runoff and seepage generated concerning potentially environmentally significant effects including salinity, acidity, alkalinity and dissolved metals, metalloids and non-metallic inorganic substances; (b) a program of progressive sampling and characterisation to identify dispersive and non-dispersive spoil and the salinity, acid and alkali producing potential and metal concentrations of waste rock, spoil and rejects; (c) a materials balance and disposal plan demonstrating how potentially acid forming and acid forming waste rock, spoil and rejects will be selectively placed and/or encapsulated to minimise the potential generation of acid mine drainage; (d) where relevant, a sampling program to verify encapsulation and/or placement of potentially acid- forming and acid-forming waste rock, spoil and rejects; (e) how often the performance of the plan will be assessed; (f) the indicators or other criteria on which the performance of the plan will be assessed;

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	(g) a rehabilitation strategy; and (h) monitoring or rehabilitation, research and/or trials to verify the requirements and methods for decommissioning and final rehabilitation of the placed materials, including the prevention and management of acid mine drainage, erosion minimisation and establishment of vegetation cover.
E11	The Waste Rock, Spoil and Rejects Disposal Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years .
E12	Tailings dewatering cells must be designed and constructed to ensure that any runoff or seepage is contained within the mine water management system.

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Schedule F: Land	
Condition number	Condition
F1	Cover Material The topsoil requirements for rehabilitation of the mine and the availability of suitable topsoil on site must be detailed in a Rehabilitation Management Plan .
F2	Where a surrogate material (growth media) is proposed to be used for rehabilitation either in combination with, or instead of, topsoil, it must be demonstrated as being suitable for rehabilitation at the completion of rehabilitation trials.
F3	A description of the rehabilitation trials and monitoring results must be included in the Rehabilitation Management Plan .
F4	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 F1 - Rehabilitation Requirements and as detailed in the Rehabilitation Management Plan described in condition F10 . The final landform design is depicted in Figure 2 .

Table F1 (Rehabilitation Requirements)					
Post Mining Land Use	Mine domain	Goal	Objective	Indicator	Acceptance criteria
Grazing	All areas disturbed by mining activities	Safe for humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined land subject to the same land use	Hazard assessment	No significant difference
			Stable	Factor of safety	≥1.5
		Rehabilitation is geotechnically stable	Rehabilitation is erosionally stable	Erosion	No gully erosion
				Slope gradient	Rehabilitated landform: <15%
					Ramp 3: <30%
				Groundcover	>50%
		Non-polluting	Rainfall runoff from rehabilitation achieves water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values

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			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 light grazing	Land suitability assessment for light grazing	Land suitability class ≤ 3 or not different from pre-mining class if ≥ 4 . <i>LSA Framework for Open-Cut Coal Mine Rehabilitation 2018 (A rule-set for land suitability assessment beef cattle grazing on land rehabilitated after open-cut coal mine in the Bowen Basin Queensland)</i> unless otherwise agreed in writing between the administering authority and the environmental authority holder.
Native ecosystem	Areas disturbed by mining activities that are located on State Forest Land	Safe for humans and wildlife	Construct landforms that do not pose unacceptable hazards to humans, stock and wildlife.	Safety hazards in rehabilitation are not significantly different to surrounding unmined land subject to the same land use	Hazard assessment
		Stable	Demonstrate geotechnical stability.	Factor of safety	≥ 1.5
				Erosion	No gully erosion

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			Not exhibiting excessive erosion	Slope gradient	Rehabilitated landform: <15%
				Groundcover	>50%
		Able to sustain vegetation	Rehabilitation landform (including land cover and water) is suitable for providing native ecosystem	Vegetation assessment	A vegetation assessment is completed by an APQ using a methodology as outlined in the Queensland Mine Rehabilitation Commissioner technical paper 'Evaluating methods for assessing native ecosystem mine rehabilitation success' (March 2023).
			Achieve self-sustaining systems that doesn't require additional maintenance except that of surrounding areas (e.g., weed and fire control via grazing/pastoral management etc.).		>70% total cover across rehabilitation area, includes multilevel canopy, groundcover, and leaf litter. At least four native tree or shrub species across the rehabilitation area. Evidence of recruitment of native tree species over a representative climatic period.
		Non-polluting	Rainfall runoff from rehabilitation achieves 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

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Non-use Management Area (NUMA)	Final void	Safe for humans and wildlife, stable and non-polluting	Construct landforms that do not pose unacceptable hazards to humans, stock and wildlife	Highwall Criteria	(a) Maximum slope of 30% when measured from highwall toe to crest. (b) Buttressing at a minimum offset of 30m at the toe section of the highwall. (c) Fencing and warning signage posted at 50m intervals above the final void (d) Must be safe, stable and non-polluting.
				Low Wall Criteria	(a) Maximum slope of 15% slope. (b) Must be safe, stable, non-polluting.
			Demonstrate geotechnical stability Not exhibiting excessive erosion	Erosion	No gully erosion
			Maintain regional surface and groundwater quality	Maximum predicted water level (mAHD)	284.1
				Void maximum surface area	(a) Maximum NUMA extent no greater than 291.6 ha projected surface area. (b) Must be safe, stable and non-polluting
			Provide flood immunity.	Flood immunity	Upgrades of Eastern and Western Diversion Drains (EDD and WDD) and levees must provide flood

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					immunity to NUMA up to PMF flood. There must be no ingress.
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F5	Successfully rehabilitated land must have no active gully erosion. Erosion must be assessed by annual documented inspections. Gully dimensions must be quantitatively assessed for a minimum of two years both containing a minimum of two rainfall events of more than 25 millimetres in less than three hours.
F6	Rehabilitation activities Progressive rehabilitation of land disturbed by resource activities must be rehabilitated in accordance with Table F1 – Rehabilitation Requirements and must commence within 2 years of when areas become available within the operational land.
F7	The environmental authority holder must provide written notification to the administering authority that details how the progressive rehabilitation has been completed with each annual return.
F8	Rehabilitation Management Plan A Rehabilitation Management Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years .
F9	At a minimum, the Rehabilitation Management Plan must include: (a) map existing areas of rehabilitation including classification of stage (i.e. time since establishment) and quality; (b) a strategy for progressive rehabilitation; (c) detail the design objectives for rehabilitation of each domain to achieve rehabilitation success criteria and the identified post mining land uses; (d) specify spoil characteristics, soil analysis, soil separation for use on rehabilitation; (e) specify the topsoil requirements for the site and provide details of how topsoil will be managed for use in rehabilitation; (f) detail any topsoil deficit and how any deficit will be managed for successful rehabilitation, including, if applicable, the proposal of surrogate growth media; (g) detail rehabilitation methods applied to areas; (h) detail landform design including end of mine design; (i) detail how landform design will be consistent with surrounding topography; (j) identify and detail planned native vegetation rehabilitation areas and corridors; (k) identify at least a minimum of three (3) reference sites for use in rehabilitation monitoring; (l) describe rehabilitation indicators and how these will be monitored; (m) describe management actions to address unsuccessful rehabilitation or redesign; and (n) describe end of mine landform design planning and post mining land uses across the mine; and include a triple bottom line assessment (or a comparative alternative assessment method) of the proposed final landform design criteria and alternatives.
F10	Exchange Sodium Percentage Coal washery wastes and spoil with exchangeable sodium percentage (ESP) >30 percent must be covered with a minimum of one metre of benign material (i.e. with ESP <15 percent) prior to rehabilitation commencing.

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F11	Closure Management Plan A Closure Management Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years.
F12	At a minimum, the Closure Management Plan must include: (a) final landform design demonstrating rehabilitation requirements; (b) a schedule of rehabilitation that is integrated with the mine plan and identifies how rehabilitation will be completed progressively throughout the life of the mine; (c) the operation, monitoring and maintenance details of the following: (i) spontaneous combustion; (ii) wastewater collection and reticulation systems; (iii) wastewater treatment systems; (iv) groundwater quality monitoring network; (v) surface water quality; (vi) groundwater quality; (vii) seepage rates; (viii) erosion rates; (ix) integrity and stability of slopes, ramps and voids; and (x) the health and resilience of vegetation cover. (d) schematic representations of the proposed final landform including, landform type, slope, regional ecosystems, drainage designs and any post mining land or infrastructure use agreed with the landowner/holder and the administering authority; (e) details of the progressive rehabilitation program designed to demonstrate the trajectory of rehabilitated areas towards rehabilitation requirements; and (f) detail outlining potential residual risk with proposed strategies to reduce or manage these risks.
F13	Residual void outcome Residual voids must not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself and subject to any other condition within this environmental authority.
F14	Residual void design Residual voids must comply with the design criteria specified in Table F1 – Rehabilitation Requirements and as detailed in the Residual Void Management Plan described in condition F16.
F15	Residual Void Management Plan A Residual Void Management Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years.
F16	At a minimum, the Residual Void Management Plan must include: (a) options available for minimising final void area and volume; (b) design objectives for rehabilitation of final voids; (c) void hydrology, addressing the long-term water balance in the voids, connections to groundwater resources and water quality parameters in the long term; (d) pit wall stability, considering the effects of long-term erosion and weathering of the pit wall and the effects of significant hydrological events; (e) options available for minimising risk of flood interaction for all flood events up to and including the Probable Maximum Flood level; (f) void capability to support native flora and fauna; and

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	(g) void rehabilitation success criteria and final void areas and volumes to meet the outcomes defined in the Rehabilitation Management Plan described in condition F9 .
F17	Acid rock drainage and leachate management Subject to the release limits defined in Table C2 - Mine affected release limits , all reasonable and practicable measures must be implemented to prevent hazardous leachate being directly or indirectly released or likely to be released as a result of the activity to any groundwater or watercourse.

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Schedule G: Regulated 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 Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) at the following times: (a) prior to the design and construction of the structure, if it is not an existing structure; or (b) prior to any change in its purpose or the nature of its stored contents.
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 Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).
G4	Design and construction of a regulated structure Conditions G5 to G9 inclusive do not apply to existing structures.
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 Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).
G6	Construction of a regulated structure is prohibited unless: (a) the holder has submitted a consequence category assessment report and certification to the administering authority; and (b) certification for the design, design plan and the associated operating procedures has been certified by a suitably qualified and experienced person in compliance with the relevant condition of this 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 Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) and must be recorded in the Register of Regulated Structures.
G8	Regulated structures must: (a) be designed and constructed in compliance with the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933); (b) be designed and constructed with due consideration given to ensuring that the design integrity would not be compromised on account of: (i) floodwaters from entering 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; and (c) 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:

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	(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	Notification of affected persons All affected persons must be provided with a copy of the emergency action plan in place for each regulated structure: (a) for existing structures that are regulated structures, within 10 business days of this condition taking effect; (b) prior to the operation of the new regulated structure; and (c) if the emergency action plan is amended, within 5 business days of it being amended.
G11	Operation of a regulated structure Operation of a regulated structure, except for an existing structure, is prohibited unless the holder has submitted to the administering authority in respect of regulated structure, all of the following: (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 the '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 authority relating to the construction of the regulated structure have been met; (f) the holder has entered the details required under this authority, into a Register of Regulated Structures; and (g) there is a current operational plan for the regulated structure.
G12	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 holder must submit to the administering authority within 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.
G13	Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in compliance with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.
G14	Mandatory reporting level Conditions G15 to G16 inclusive only apply to Regulated Structures which have not been certified as low consequence category for 'failure to contain - overtopping'.
G15	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.
G16	The holder must, as soon as practicable but within 48 hours of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.
G17	The holder must, immediately on becoming aware that the MRL has been reached, act to prevent the occurrence of any unauthorised discharge from the regulated dam.
G18	The holder must record any changes to the MRL in the Register of Regulated Structures.

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G19	The holder must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to 1 July of each year.
G20	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).
G21	The holder must, as soon as practicable but within 48 hours of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, notify the administering authority.
G22	The holder must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.
G23	Annual inspection report Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.
G24	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 a recommendations section, with any recommended actions to ensure the integrity of the regulated structure or a positive statement that no recommendations are required.
G25	The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).
G26	The holder must within 20 business days of receipt of the annual inspection report, provide to the administering authority: (a) The recommendations section of the annual inspection report; (b) If applicable, any actions being taken in response to those recommendations; and (c) If, following receipt of the recommendations and (if applicable) recommended actions, the administering authority requests a copy of the annual inspection report from the holder, provide this to the administering authority within 10 business days of receipt of the request.
G27	Transfer arrangements The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.
G28	Register of Regulated Structures A Register of Regulated Structures must be established and maintained by the holder for each regulated structure.
G29	The holder must provisionally enter the required information in the Register of Regulated Structures when a design plan for a regulated dam is submitted to the administering authority.
G30	The holder must make a final entry of the required information in the Register of Regulated Structures once compliance with conditions G11 and G12 has been achieved.
G31	The holder must ensure that the information contained in the Register of Regulated Structures is current and complete on any given day.
G32	All entries in the Register of Regulated Structures must be approved by the chief executive officer for the holder of this authority, or their delegate, as being accurate and correct.

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G33	The 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.
G34	Transitional arrangements All existing structures that have not been assessed in accordance with either the Manual or the former Manual for Assessing Hazard Categories and Hydraulic Performance of Dams must be assessed and certified in accordance with the Manual within 6 months of amendment of the authority adopting this schedule.
G35	All existing structures must subsequently comply with the timetable for any further assessments in accordance with the Manual specified in Table G1 (Transitional hydraulic performance requirements for existing structures) , depending on the consequence category for each existing structure assessed in the most recent previous certification for that structure.
G36	Table G1 (Transitional hydraulic performance 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.
G37	Certification of the transitional assessment required by G34 and G35 (as applicable) must be provided to the administering authority within 6 months of amendment of the authority adopting this schedule.

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Table G1 (Transitional hydraulic performance requirements for existing structures)

Transition period for existing structures to achieve the requirements of the Manual for Assessing Consequence Categories and Hydraulic Performance of Dams

Compliance with criteria	High consequence	Significant consequence	Low consequence
>90 percent 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 percent - ≤90 percent	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-≤70 percent	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 percent	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.
Regulated levee designed to prevent the ingress of clean flood water <100 percent compliant	Within 5 years unless otherwise agreed with the administering authority		

Note: Levees designed for the diversion of contaminated waters or protection of the structural integrity of a dam is not to be considered as part of this provision. These levees are considered a key design element of the relevant dam and transitional periods should as such align to that relevant compliance criteria and consequence category.

Schedule H: Sewage treatment	
Condition number	Condition
H1	All effluent released from the sewage treatment plant must be evaporated in an impervious pond.
H2	Dried sewage sludge must be buried within spoil emplacements, records of the disposal volumes and locations must be kept.
H3	The Sewage Treatment Management Plan must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years .

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Schedule I: Groundwater	
Condition number	Condition
I1	The holder of this environmental authority must not release contaminants to groundwater.
I2	A groundwater monitoring program to monitor water quality and standing water level in any aquifers likely to be impacted by mining activities must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years .
I3	Groundwater monitoring Groundwater must be monitored: (a) at the locations and frequencies identified in Table I1 (Groundwater monitoring locations and frequency); and (b) for the quality characteristics specified in Table I2 (Groundwater quality trigger thresholds) and (c) for the standing water levels stated in Table I3 (Groundwater standing water level trigger thresholds).
I4	All groundwater sampling and monitoring methods must be in accordance with the latest version of the administering authority's ' <i>Monitoring and Sampling Manual 2018: Environmental Protection (Water) Policy 2009</i> ' unless otherwise approved by the administering authority.
I5	Groundwater quality Results of monitoring of groundwater quality from compliance bores identified in Table I1 (Groundwater monitoring locations and frequency) must not exceed any of the limits defined in Table I2 (Groundwater quality trigger thresholds) on more than three (3) consecutive monitoring occasions.
I9	Bore construction, maintenance and decommissioning The construction, maintenance and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimizes impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring.
I10	Transitional arrangements By 30 June 2026, the environmental authority holder must: (a) prepare a hydrogeological numerical groundwater model in accordance with the most recent version of the '<i>Australian Groundwater Modelling Guidelines</i>' (2012); and (b) submit a report to the administering authority proposing groundwater level trigger thresholds, derived from the results of the groundwater model, to populate Table I3 (Groundwater standing water level trigger thresholds).

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Table I1 (Groundwater monitoring locations and frequency)

Table I1 (Groundwater monitoring locations and frequency)					
Monitoring point	Location (GDA2020)		Hydrogeological Unit	Surface RL (mAHD)	Monitoring frequency
	Latitude	Longitude			
Reference bore-					
GW04B	-22.69090	147.55675	Permian conglomerate	314	Quarterly
Compliance bores					
BA Station (Mayes Bore)	-22.67855	147.55946	Tertiary Basalt	324	Quarterly
Curtis Windmill	-22.66615	147.56694	Tertiary Basalt	325	Quarterly
Notes:					
[1] Monitoring is not required where a bore has been removed as a direct result of the mining activity.					
[2] RL must be measured to the nearest 5cm from the top of the bore casing.					
[3] Reference sites must:					
(a) have a similar flow regime					
(b) be from the same bio-geographic and climatic region					
(c) have similar geology, soil types and topography					
(d) not be so close to the test sites that any disturbance at the test site also results in a change at the reference site.					

Table I2 (Groundwater quality trigger thresholds)

Parameter	Units	Trigger value		Trigger type
		Curtis Windmill	BA Station	
EC	µS/cm	883	631	Bore specific
pH	pH units	6.5-8.5	6.5-8.5	WQO*
Sulfate	mg/L	19	24	Bore specific
Metals (dissolved)				
Aluminium	mg/L	0.055	0.055	ANZG
Arsenic	mg/L	0.013	0.027	ANZG and bore specific
Boron	mg/L	0.94	0.94	ANZG
Cadmium	mg/L	0.0002	0.0002	ANZG
Chromium	mg/L	0.001	0.001	ANZG
Copper	mg/L	0.005	0.004	Bore specific

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Lead	mg/L	0.0034	0.0034	ANZG
Manganese	mg/L	1.9	1.9	ANZG
Mercury	mg/L	0.00006	0.00006	ANZG
Molybdenum	mg/L	0.034	0.034	ANZG
Nickel	mg/L	0.012	0.011	Bore specific and ANZG
Silver	mg/L	0.0005	0.0005	ANZG
Vanadium	mg/L	0.006	0.006	ANZG
Zinc	mg/L	0.021	0.009	Bore specific
Iron	mg/L	<i>Iron is monitored for interpretation purposes</i>		
Major ions	mg/L	<i>Calcium, Magnesium, Potassium, Sodium, Chloride, Bicarbonate and Carbonate are monitored for interpretation purposes</i>		

Table I3 (Groundwater standing water level trigger thresholds)

Monitoring location	Hydrogeological Unit	Baseline water level (mAHD)	Standing water level trigger threshold (mAHD)
BA Station (Mayes Bore)	Tertiary Basalt	TBD	TBD
Curtis Windmill	Tertiary Basalt	TBD	TBD
GW04B	Permian Conglomerate	TBD	TBD

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Definitions

Key terms and/or phrases used in this document are defined in this section. 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.

“20th percentile flow” means the 20th percentile of all daily flow measurements (or estimations) of daily flow over a 10 year period for a particular site. The 20th percentile calculation should only include days where flow has been measured (or estimated), i.e. not dry weather days.

“acid mine drainage” means drainage that is characterised by low pH, elevated metal concentrations, high sulfate concentrations and high salinity.

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

“administering authority” means the Department of Environment and Heritage Protection or its successor.

“affected person” is someone whose drinking water can potentially be impacted as a result of discharges from a dam or their life or property can be put at risk due to dwellings or workplaces being in the path of a dam break flood.

“airblast overpressure” means energy transmitted from the blast site

within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave, above ambient pressure is the peak airblast overpressure measured in decibels linear (dBL).

“ambient (or total) noise” at a place, means the level of noise at the place from all sources (near and far), measured as the Leq for an appropriate time interval.

“annual exceedance probability or AEP” 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;

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- (e) for conformance with the 'as constructed' drawings;
- (f) for the adequacy of the available storage in each regulated dam, based on an actual observation or observations taken after 31 May each year but prior to 1 November of that year, of accumulated sediment, state of the containment barrier and the level of liquids in the dam (or network of linked containment systems);
- (g) for evidence of conformance with the current operational plan.

"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;
- (b) and any land used for those operations.

"authority" means an environmental authority or a development approval.

"background" with reference to the water schedule means the average of samples taken prior to the commencement of mining from the same waterway that the current sample has been taken.

"blasting" means the use of explosive materials to fracture:

- (a) rock, coal and other minerals for later recovery or
- (b) structural components or other items to facilitate removal from a site or for reuse.

"certified" with respect to watercourse diversions, means assessed and approved by a suitably qualified and experienced person. In relation to 'as constructed' drawings and specifications, the certification must be by the suitably qualified person who supervised the construction of the watercourse diversion, or re-establishment of the watercourse.

"certification" means assessment and approval must be undertaken by a suitably qualified and experienced person in relation to any assessment or documentation required by this Manual, 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'.

"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

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- (b) a dangerous good under the Australian Code for the Transport of Dangerous Goods by Road and Rail approved by the Australian Transport Council, or
- (c) a lead hazardous substance within the meaning of the Workplace Health and Safety Regulation 1997, 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) 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
 - (v) a substance used for, or intended for use for mineral processing or treatment of metal, pulp and paper, textile, timber, water or wastewater, or
 - (vi) manufacture of plastic or synthetic rubber.

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

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

“compliance bore” refers to a groundwater monitoring bore which is the subject of compliance requirements for groundwater quality and/or level.

“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.

“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 (ESR/2016/1933).

“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 (ESR/2016/1933) 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.

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“designer” for the purposes of a regulated dam, means the certifier of the design plan for the regulated dam.

“development approval” means a development approval under the Planning Act 2016 (or under the repealed Sustainable Planning Act 2009 or Integrated Planning Act 1997) in relation to a matter that involves an environmentally relevant activity under the Environmental Protection Act 1994.

“disturbance” of land includes:

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

“EC” means electrical conductivity.

“effluent” means treated waste water released from sewage treatment plants.

“environmental offset” has the meaning in section 7 of the Environmental Offsets Act 2014.

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

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

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

“equilibrium” means a state where ‘balance’ is achieved despite changing variables.

“existing structure” means a structure that prior to 30 August 2017 meets any or both of the following, a structure:

- (a) with a design that is in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1934, Version 8.0, 05 JUL 2017) and that is considerably in progress;

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(b) that is under considerable construction or that is constructed.

“extreme storm storage” - means a storm storage allowance determined in accordance with the criteria in the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published by the administering authority.

“flare pit” means containment area where any hydrocarbon that is discovered in an over-pressured reservoir during a drilling operation is diverted to, and combusted. The flare pit is only used during the drilling and work over process on a petroleum well.

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

“foreseeable future” is the period used for assessing the total risk of an event occurring. Permanent structures and ecological sustainability should be expected to still exist at the end of a 150 year foreseeable future with an acceptable risk of failure before that time.

“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 containing hazardous waste, waste rock dumps, voids, or ore stockpiles and buildings as well as other structures whose ownership can be transferred and which have a residual beneficial use for the next owner of the operational land or the background land owner.

“hazard category” means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in *Manual for Assessment Hazard Categories and Hydraulic Performance of Dams*.

“hazardous waste” means any substance, whether liquid, solid or gaseous, derived by or resulting from, the processing of minerals that tends to destroy life or impair or endanger health.

“holder” means:

- (a) where this document is an environmental authority, any
- (b) person who is the holder of, or is acting under, that
- (c) environmental authority; or
- (d) where this document is a development approval, any person who is the registered operator for that development approval.

“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 (ESR/2016/1933).

“hydrogeological unit” is any soil or rock unit or zone that by virtue of its hydraulic properties has a distinct influence on the storage or movement of groundwater.

“infrastructure” means water storage dams, levees, roads and tracks, buildings and other structures built for the purpose of the mining activity.

“interpretation bore” means a monitoring bore located outside of any potential influence or impact by the mining activity, that is used for comparative and interpretative purposes and represents natural background quality and levels similar to the hydrogeological units of the compliance bores.

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

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

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

“land” in the ‘land schedule’ of this document means land excluding waters and the atmosphere, that is, the term has a different meaning from the term as defined in the Environmental Protection Act 1994. For the purposes of the Acts Interpretation Act 1954, it is expressly noted that the term ‘land’ in this environmental authority relates to physical land and not to interests in land.

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

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

“land use” term to describe the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

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

“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 (ESR/2016/1933).

“mandatory reporting level or MRL” means a warning and reporting level determined in accordance with the criteria in the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published by the administering authority.

“manual” means the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published by the administering authority, as amended from time to time.

“mandatory reporting level” means the volume below the spillway crest, equivalent to the lower of the AEP, 72 hour storm or the AEP wave allowance (AEP is the annual exceedance probability).

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

“mine affected water”:

- (a) means the following types of water:
 - (i) pit water, tailings dam water, processing plant water
 - (ii) water contaminated by a mining activity which would have been an environmentally relevant activity under Schedule 2 of the Environmental Protection Regulation 2008 if it had not formed part of the mining activity
 - (iii) rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion

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and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage such runoff, provided that this water has not been mixed with pit water, tailings dam water, processing plant water or workshop water

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

(v) groundwater from the mine's dewatering activities

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

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

(i) land that has been rehabilitated to a stable landform and either capped or revegetated in accordance with

the acceptance criteria set out in the environmental authority but only still awaiting maintenance and monitoring of the rehabilitation over a specified period of time to demonstrate rehabilitation success, or

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

a. areas that are been capped and have monitoring data demonstrating hazardous material adequately contained with the site

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

(iii) both.

"minimise" is to reduce to the smallest possible amount or degree.

"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) pea;

(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

(k) rock mined in block or slab form for building or monumental purposes

(l) but does not include-

(m) living matter

(n) petroleum within the meaning of the Petroleum Act 1923

(o) 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 and

(p) water.

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“modification or modifying” (see definition of ‘construction’)

“monitoring bore” means a groundwater bore that provides access to groundwater for measuring its quality and level; and allows groundwater samples to be withdrawn for laboratory analysis.

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

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

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

“noxious” means harmful or injurious to health or physical wellbeing, other than trivial harm.

“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);
- (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.

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

“permanent watercourse diversion” is as defined in Definitions, within the [Guideline: Works that interfere with water in a watercourse for a resource activity— watercourse diversions authorised under the Water Act 2000](#) or subsequent versions

“pre-existing watercourse” is the section of watercourse from which the flow of water will be diverted as a result of the construction and operation of a watercourse diversion.

“protected area” means - a protected area under the Nature Conservation Act 1992 or:

- (a) a marine park under the Marine Parks Act 2004 or
- (b) a World Heritage Area

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

“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 structure, 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 (ESR/2016/1933);
- (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;

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

“regulated structure” means any structure in the significant or high consequence category as assessed using the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published by the administering authority. A regulated structure does not include:

- a fabricated or manufactured tank or container, designed and constructed to an Australian Standard that deals with strength and structural integrity of that tank or container;
- a sump or earthen pit used to store residual drilling material and drilling fluid only for the duration of drilling and well completion activities;
- a flare pit.

“rehabilitation” 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.

“revegetation” is the re-establishment of vegetation¹ of a species and density of cover similar to surrounding undisturbed areas or the landform that existed before mining activities on soil surfaces associated with the construction or rehabilitation of a watercourse diversion.

“RL” means reduced level, relative to mean sea level as distinct from depths to water.

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

“residual drilling material” means waste drilling materials including muds and cuttings or cement returns from well holes and which have been left behind after the drilling fluids are pumped out.

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

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

“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) a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises or
- (b) a motel, hotel or hostel or
- (c) an educational institution or
- (d) a medical centre or hospital or
- (e) a protected area under the Nature Conservation Act 1992, the Marine Parks Act 1992 or a World Heritage Area or
- (f) a public park or gardens.

Note: The definition of ‘sensitive place’ and ‘commercial place’ is based on Schedule 1 of EPP Noise. That is, a sensitive place is inside or outside on a dwelling, library and educational institution, childcare or kindergarten, school or playground, hospital, surgery or other medical institution, commercial and retail activity, protected area or an area identified under a conservation plan under Nature Conservation Act 1992 as a critical habitat or an area of major interest, marine park under Marine Parks Act 2004, park or garden that is outside of the mining lease and open to the public for the use other than for sport or organised entertainment. A commercial place is inside or outside a commercial or retail activity.

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) is not a sensitive place for that mine or= mining project, 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 holders of the environmental authority for the mining project, or a related company. Accommodation for mine employees or contractors is a sensitive place if the land is held by a mining company or related company, and if occupation is restricted to the employees, contractors and their families for the particular mine or mines which are held by the same company or a related company.

For example, a township (occupied by the mine employees, contractors and their families for multiple mines that are held by different companies) would be a sensitive place, even if part or all of the township is constructed on land owned by one or more of the companies.

“significant disturbance” - includes land

- (a) if it is contaminated land or
- (b) it has been disturbed and human intervention is needed to rehabilitate it to a state required under the relevant environmental authority or
- (c) if the environmental authority does not require the land to be rehabilitated to a particular state - to its state immediately before the disturbance.

Some examples of disturbed land include:

- areas where soil has been compacted, removed, covered, exposed or stockpiled
- areas where vegetation has been removed or destroyed to an extent where the land has been made susceptible to erosion; (vegetation and topsoil)

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- areas where land use suitability or capability has been diminished
- areas within a watercourse, waterway, wetland or lake where mining activities occur
- areas submerged by tailings or hazardous contaminant storage and dam walls in all cases
- areas under temporary infrastructure. Temporary infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be removed after mining activities have ceased or
- areas where land has been contaminated and a suitability statement has not been issued

However, the following areas are not included:

- areas off lease (e.g. roads or tracks which provide access to the mining lease)
- areas previously significantly disturbed which have achieved the rehabilitation outcomes
- by agreement with the Department of Environment and Resource Management, areas previously significantly disturbed which have not achieved the rehabilitation objective(s) due to circumstances beyond the control of the mine operator (such as climatic conditions)
- areas under permanent infrastructure. Permanent infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be left by agreement with the landowner. The agreement to leave permanent infrastructure must be recorded in the Landowner Agreement and lodged with the Department of Environment and Resource Management
- disturbances that pre-existed the grant of the tenure unless those areas are disturbed during the term of the tenure.

“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” means geotechnical stability of the rehabilitated landform where instability related to the excessive settlement and subsidence caused by consolidation / settlement of the wastes deposited, and sliding / slumping instability has ceased.

“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:

- for regulated dams, an RPEQ who is a civil engineer with the required qualifications in dam safety and dam design
- 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.

“temporary watercourse diversion” s as defined in Definitions, within the [Guideline: Works that interfere with water in a watercourse for a resource activity— watercourse diversions authorised under the Water Act 2000](#) or subsequent versions.

“the Act” means the *Environmental Protection Act 1994*.

Environmental authority EPML00876713 Blair Athol Coal Mine

“tolerable limits” means that a range of values could be accepted to achieve an overall environmental management objective (e.g. a range of settlement of a tailing capping could still meet the objective of draining the cap quickly, preventing pondage and limiting infiltration and percolation).

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

“void” means any constructed, open excavation in the ground.

“watercourse” has the same meaning given in the Water Act 2000.

“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, nontidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater.

“water year” means the 12-month period from 1 July to 30 June.

“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.

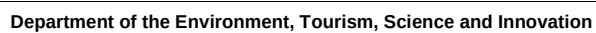
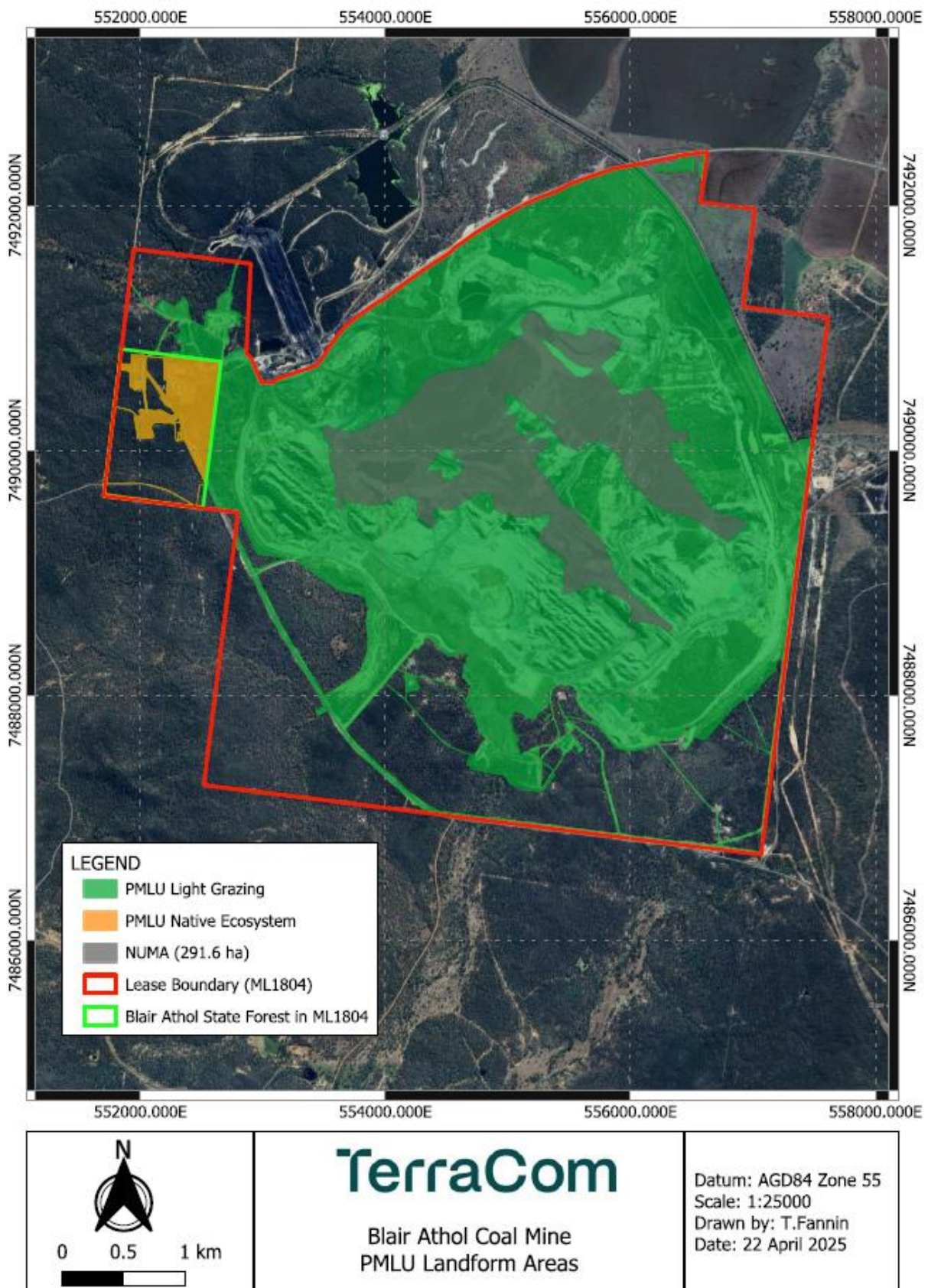


Figure 2 – Blair Athol Mine PMLU Landform Areas



END OF ENVIRONMENTAL AUTHORITY

Residual Void Management Plan

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1 PURPOSE

The purpose of the void management plan is to guide strategy for the long-term management of the final void at the Blair Athol Coal Mine (BACM) in accordance with Environmental Authority (EA) EPML00876713 issued 11 June 2025

2 SCOPE

The scope of the void management plan is to identify options for final use(s) of the void following completion of open cut mining at BACM, including minimisation of the final void volume, potential environmental impacts associated with the final void and strategies to minimise potential impacts and identify success criteria and monitoring requirements as per the conditions as set out in the EA EPML00876713.

3 PROCEDURE

The procedure is to review relevant site information and regulatory guidelines and assign management plan procedures that align with these components.

4 ACCOUNTABILITIES

Role	Accountabilities
NOTE	Only use this table if there is a role that is not mentioned in the S55 Mgt Structure e.g. Shotfirer, Document Controller

5 DOCUMENT INFORMATION

5.1 Definitions

Term	Definition
BACM	Blair Athol Coal Mine
EA	Environmental Authority
EP Act	Environmental Protection Act
RVMP	Residual Void Management Plan
NUMA	Non-use management area
PMLU	Post-mining land-use
PAF	Potential acid-forming
NAF	Non-acid forming

Term	Definition
TSF	Tailings storage facility
AMD	Acid mine drainage
TDS	Total dissolved solids
EC	Electrical conductivity
pH	Potential of hydrogen
ha	Hectares
Ca	Calcium
Mg	Magnesium
Na	Sodium
K	Potassium
Cl	Chloride
HCO ₃	Carbonate
SO ₄	Sulphate
mAHD	Metres above height datum
ha	Hectares
L/m	Litre per minute
MI	Mega litres
%	Percent

5.2 Related Documents

Reference	Title
SGME 2025	Blair Athol Progressive Rehabilitation and Closure Plan
EPML00876713	Environmental Authority

5.3 Reference Material

Reference	Title
BMT-WBM (2012)	BAC Final Landform Water Study. Report to Rio Tinto Coal Australia, November 2012.
(DEHP) (2018)	Environmental Authority EPML00876713 – Blair Athol Coal Mine, January 11, 2018.
JBT Consulting, (2012)	Blair Athol Mine Closure Groundwater Investigation, September 2012.
Queensland Government (1994)	Environmental Protection Act.
Rio Tinto (2006).	Geotechnical Characteristics, Blair Athol Coal Project.
Rio Tinto (2010).	Blair Athol Coal Project Mine Closure Plan, December 2010.
Rio Tinto (2012).	Blair Athol Mine. Ramp 1 South West Contingency 4 (R1SWC4). Geotechnical Review, 20 February 2012.
Rio Tinto (2016).	Blair Athol Acid & Metalliferous Drainage Management. HSEQ MS – Guideline. BAM-10-GUI-EV-0029_1, 21 July 2016.
TerraCom (2018).	Disposal Plan. Overburden, Interburden, Spoil, Coal Washery Coarse Rejects and Tailings. Blair Athol Mine, 21 May 2018.
URS (2006)	Assessment of water and sediment quality of Stockpile Dam and Environment Dam for EPA Hazardous Dam Classification. Letter report from URS to Blair Athol Coal Mine, Document No. 311006, 31 October 2006.

Reference	Title
WSP (2018),	Rehabilitation Management Plan Blair Athol Coal Mine Draft. June 2018.

5.4 Document Version and History

Only the history of the current version is recorded below. For prior version histories, please contact the site Document Controller.

Version	Date	Change Details
A	15/06/2018	Draft (WSP Pty Limited)
B	28/06/2018	Final (WSP Pty Limited)
C	04/09/2025	Revision (SGME Pty Limited)

6 INTRODUCTION

This Blair Athol Coal Mine (Blair Athol) Residual Void Management Plan (RVMP) has been prepared for TerraCom Ltd (TerraCom), to guide strategy for the long-term management of the final void at the Blair Athol Coal Mine (BACM) in accordance with Environmental Authority (EA) EPML00876713 issued 11 June 2025, as presented in Appendix A.

TerraCom acquired Blair Athol Coal Mine through its wholly owned subsidiary Orion Mining Limited in May 2017, following grant of Title Transfer from the Queensland

The acquisition of the Blair Athol Coal Mine brings the following benefits:

- progressive rehabilitation of one of Queensland's oldest coal mines
- resumption of coal mining, and local and export sales from the Blair Athol Coal mine, providing local, state and federal economies with increased economic activity, employment, royalties and taxation
- forecast positive cash flow through a low overhead structure and operational efficiencies.

In accordance with the EA, this RVMP includes specific details for ongoing management and monitoring of mine voids, with the intention of preventing any serious environmental harm to land, surface waters or groundwater across the mine site.

6.1 Purpose and scope

The purpose of this RVMP is to identify options for final use(s) of the void following completion of open cut mining at BACM, including minimisation of the final void volume, potential environmental impacts associated with the final void and strategies to minimise potential impacts and identify success criteria and monitoring requirements as per the conditions as set out in the EA EPML00876713 (Appendix B).

7 LEGISLATIVE REQUIREMENTS

7.1 Legislative context

The Queensland *Environmental Protection Act 1994* (EP Act) is the key legislation for environmental management and protection in Queensland. The EP Act establishes a general environmental duty and a duty to notify environmental harm that applies to all persons and corporations.

The EP Act requires that all areas disturbed within the relevant mining tenure must be rehabilitated to a post-mining land use (PMLU) or managed as a non-use management area (NUMA). NUMAs are only considered appropriate where justified under section 126D(2) of the EP Act.

7.2 Blair Athol Coal Mine Environmental Authority

Blair Athol Coal Mine currently operates under EA EPML00876713, which was issued 11 June 2025 by DETSI, under Section 258 of the EP Act.

This RVMP has been developed to provide a strategy and framework for residual void management and has been developed to meet the legislative requirements under the EA EPML00876713. The EA conditions that have informed the content of this plan include:

F13 Residual void outcome

Residual voids must not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself and subject to any other condition within this environmental authority. F14 Residual void design

Residual voids must comply with the design criteria specified in Table F1 – Rehabilitation Requirements and as detailed in the Residual Void Management Plan described in condition F16 (Refer Table 1).

Table 1: Table F1 – NUMA rehabilitation requirements

Post mining land use	Mine domain	Goal	Objective	Indicator	Acceptance criteria
NUMA	Final void	Safe for humans and wildlife, stable and non-polluting	Construct landforms that do not pose unacceptable hazards to humans, stock and wildlife	Highwall Criteria	(a) Maximum slope of 30% when measured from highwall toe to crest. (b) Buttressing at a minimum offset of 30m at the toe section of the highwall. (c) Fencing and warning signage posted at 50m intervals above the final void (d) Must be safe, stable and non-polluting.
				Low Wall Criteria	(a) Maximum slope of 15% slope. (b) Must be safe, stable, non-polluting.
			Demonstrate geotechnical stability Not exhibiting excessive erosion	Erosion	No gully erosion
			Maintain regional surface and groundwater quality	Maximum predicted water level (mAHD)	284.1
				Void maximum surface area	(a) Maximum NUMA extent no greater than 291.6 ha projected surface area. (b) Must be safe, stable and non-polluting

Post mining land use	Mine domain	Goal	Objective	Indicator	Acceptance criteria
			Provide flood immunity.	Flood immunity	Upgrades of Eastern and Western Diversion Drains (EDD and WDD) and levees must provide flood immunity to NUMA up to PMF flood. There must be no ingress.

F15 Residual Void Management Plan

A Residual Void Management Plan developed by an appropriately qualified person must be updated and submitted to the administering authority for approval by 30 June 2018. The Residual Void Management Plan must be reviewed and updated by 30 June every 2 years and made available to the administering authority on request.

F16 At a minimum the Residual Void Management Plan must include:

- a) options available for minimising final void area and volume;
- b) design objectives for rehabilitation of final voids;
- c) void hydrology, addressing the long-term water balance in the voids, connections to groundwater resources and water quality parameters in the long term;
- d) pit wall stability, considering the effects of long-term erosion and weathering of the pit wall and the effects of significant hydrological events;
- e) options available for minimising risk of flood interaction for all flood events up to and including the Probable Maximum Flood level;
- f) void capability to support native flora and fauna; and
- g) void rehabilitation success criteria and final void areas and volumes to meet the outcomes defined in the Rehabilitation Management Plan described in Condition F9.

8 EXISTING ENVIRONMENT

The BACM is located in Central Queensland, approximately 20 km north-west of the town of Clermont (Appendix A - Figure 1).

8.1 Surrounding features and land use

BACM is located in a landscape of gently sloping country derived from sedimentary rocks intersected by volcanic intrusions generally to the north of the mine. Large areas of the surrounding countryside have been cleared for low-intensity grazing and broad acre field cropping with only small remnant areas of native woodland vegetation remaining mostly on upper slopes and along watercourses.

The land covered by the mining lease is situated on the eastern flank of the Drummond Range, which forms the watershed of the Fitzroy and Burdekin River systems. Adjoining the mining lease to the north-east are dryland farming areas on fertile basalt derived soils. The remainder of the surrounding land use is forested or partially cleared grazing land.

8.2 Climate

This climatic description of the region in which the project site is located has been compiled using data from the Bureau of Meteorology (BOM) weather station at Clermont Post Office (Station No. 035019) from 1870 to February 2018. Clermont experiences a sub-humid climate with hot, wet summers and cold, dry winters.

Long term climate statistics are shown in Table 2. Annual average rainfall for Clermont is 665.6 mm, with the dry season peaking between July and September, and the wet season peaking from December through to March.

The coldest mean daily temperatures occur in July, with a mean minimum of 6.7°C and a mean maximum of 23.1°C. The hottest months occur in December (mean minimum of 20.8°C and a mean maximum of 34.8°C) and January (mean minimum of 21.6°C and a mean maximum of 34.3°C), with January also the highest rainfall month (average rainfall 117.0 mm). The mean daily evaporation, as measured by the Class A evaporation pan, is 5.7 mm/day (2,082 mm/yr).

Evaporation generally exceeds rainfall by approximately 3:1; annual humidity is generally between 38-63 percent and winds are predominately from the south-east (Rio Tinto 2010).

Table 2: Long term climate statistics BOM Clermont

Month	Temperature (°C)		Rainfall (mm)	
	Mean Maximum	Mean Minimum	Mean	Highest Monthly
Jan	34.3	21.6	117.0	516.0
Feb	33.0	21.1	114.4	428.0
Mar	32.0	19.4	74.6	403.4
Apr	29.5	15.7	38.4	274.2

Month	Temperature (°C)		Rainfall (mm)	
	Mean Maximum	Mean Minimum	Mean	Highest Monthly
May	26.1	11.4	34.1	234.4
Jun	23.1	8.1	33.5	307.2
Jul	23.1	6.7	25.3	192.5
Aug	25.3	8.3	18.7	171.2
Sep	28.8	12.1	20.1	184.9
Oct	31.9	16.3	35.2	165.2
Nov	33.9	19.0	57.0	263.9
Dec	34.8	20.8	91.5	670.7
Annual			665.6	1295.4

Rainfall records are also available for Blair Athol from 1913 to 2010, which reported a slightly lower average annual rainfall of 623.7 mm.

8.3 Background water quality

The catchment area upstream of BACM comprises a number of ephemeral streams; Breaker, Bath and Washpool Creeks. Infrequent rainfall events result in sporadic flows preceded by long dry periods. Upstream catchments vary between timbered hills (Breaker Creek, Washpool Creek, Washpool Creek West) to broad acre cropping (Bath Creek, Washpool Creek East), with variable surface water quality associated with each land use.

Rio Tinto (2010) sourced background water quality from two creeks within the local area considered representative of the catchments upstream of BACM, Sandy Creek (timbered hills) and Wolfgang Creek (grazing and cropping land). The regional background water quality was monitored during flows by the Queensland Government between 1962 and 2001. The water quality data is summarised in Table 3.

Table 3: Water quality monitoring data for local creeks (1962-2001)

Parameter	Sandy Creek			Wolfgang Creek		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Suspended solids (mg/L)	2	1760	222	20	220	87
pH	6.1	8.4	7.6	7.8	8.9	8.35

Parameter	Sandy Creek			Wolfgang Creek		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Total dissolved salts (mg/L)	45.4	771	286	243	1367	927.6
Electrical conductivity (µS/cm)	61	1176	440	335	2630	1622
Total sulfate (mg/L)	1.5	175	31	5	64	24

The results generally reflect higher salinities in the cleared farming land.

8.4 Geology and geochemistry

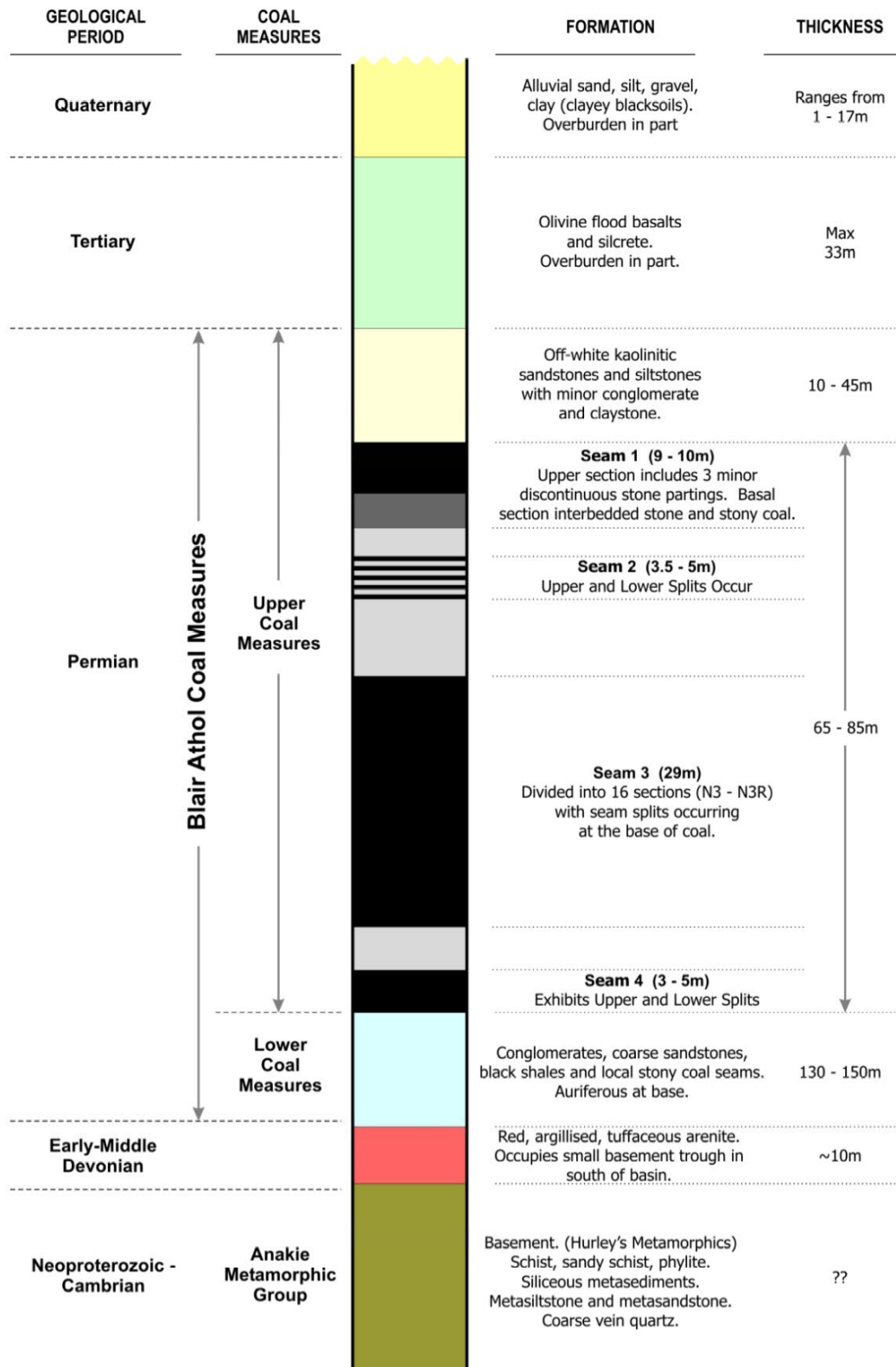
The Blair Athol Mine is in the Blair Athol Basin, an isolated Permian aged basin near the western edge of the northern Bowen Basin, on the northern extension of the Dennison Trough.

The Permian coal basins in the Blair Athol Basin contain Lower Permian Blair Athol Coal Measures, which overlie the Proterozoic/ Cambrian Anakie Metamorphic Group (tightly folded mica, quartz-mica and quartz-chlorite schist, with phyllite, slate and quartzite). The Permian sequence comprises a lower basal conglomerate, which is a quartzose and lithic pebble to cobble conglomerate, thought to be of glacial origin. The basal conglomerate is overlain by the Permian coal-bearing sequence, which includes laminated sandstone and siltstone, coal seams, carbonaceous siltstone and mudstone, and minor conglomerate (refer stratigraphic section, Figure 1).

During the Tertiary (Late Eocene to Middle Oligocene), basalt filled the area from east to west, with initial deposition focused on a deep paleochannel to the east of Clermont. The basalt is derived from nearby volcanoes, the remnants of which are still visible today as andesitic plugs including Mt Oscar and Wolfgang Peak. The basalt encountered in the north and north east of the site represents the marginal extent of basalt, with the basalt thickening to the north and north-east of the site.

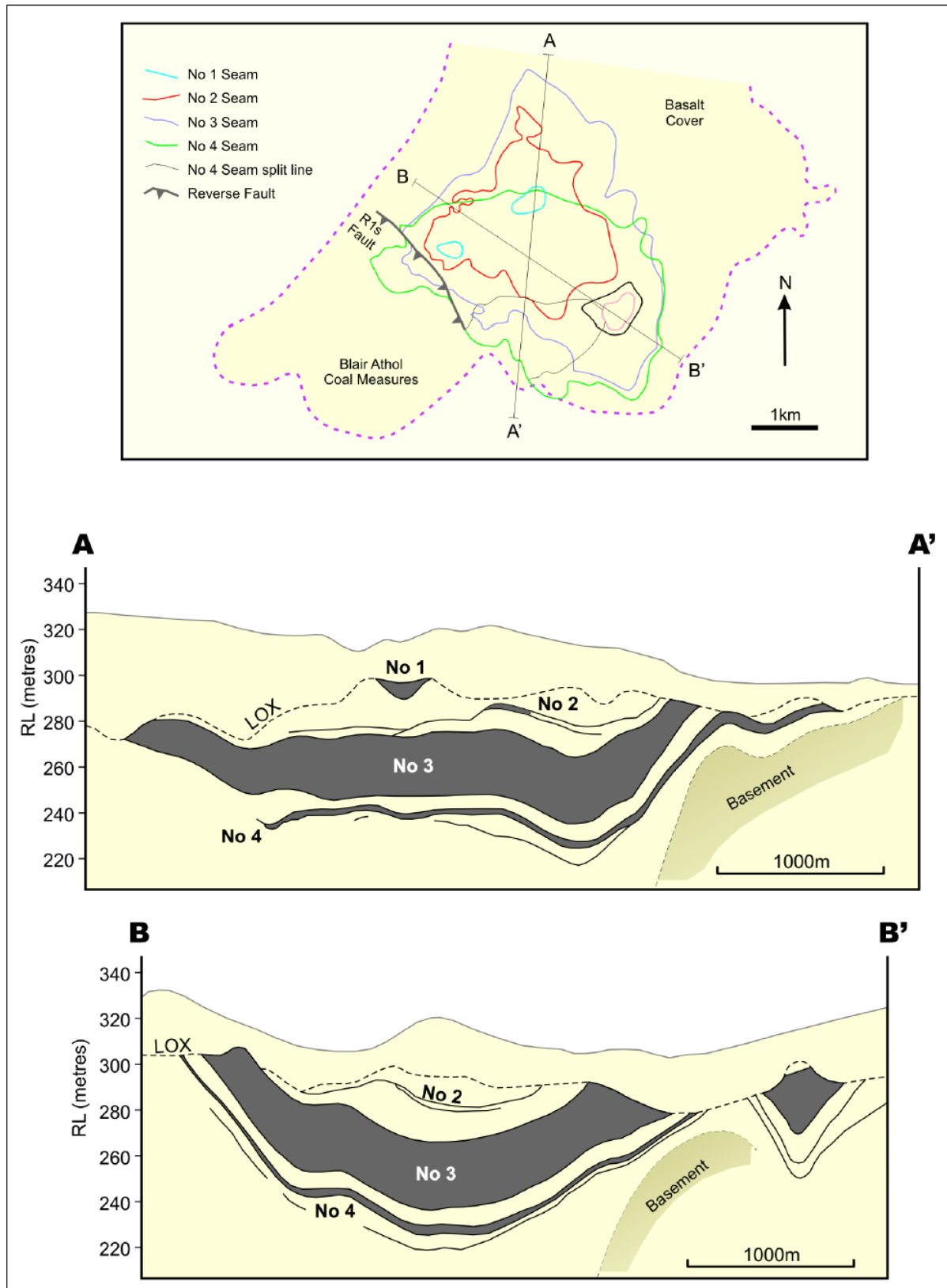
The stratigraphic sequence in the Blair Athol Basin comprises five lithological units (RTCA 2011). These are shown as a stratigraphic section in Figure 1.

Schematic cross sections through the basin, showing the general basin geometry and the coal measures sequence, are shown on Figure 2.



Source: Rio Tinto 2010

Figure 1: BACM mine area stratigraphy



Source: Rio Tinto 2010a

Figure 2: Schematic cross sections showing the coal sequence and seams

Extensive geochemical waste characterisation was undertaken by Rio Tinto during site operations (Rio Tinto 2016). Sulfides were identified in several coal units and the following specific waste types were calculated to be potentially acid forming (PAF):

- ▮ Seam 3 roof coal
- ▮ Seam 4 interburden coal interface (roof and floor)
- ▮ Coal washery coarse rejects
- ▮ Coal washery fine tailings

The overburden spoil and interburden were identified to be non-acid forming (NAF) due to an absence of sulphide in these units.

The highest acid mine drainage (AMD) risk on the site was considered to be the tailings storage facility (TSF) in Ramp 2, as the concentration of sulphide-containing coal tailings and rejects in this area increases the potential for AMD formation, although in 2010 no acidic run-off had been detected. The pit faces, spoil piles and coal stockpiles were also considered areas with the potential for AMD generation; however, the risk of AMD-related environmental impacts from these areas was regarded as low.

The benign overburden and interburden contains sodic sandstone units, which may pose salinity and sodicity issues, leading to saline drainage and erosion risk through dispersive spoil. Spontaneous combustion of remnant coal disposed of as mineral waste also present a risk at BACM.

8.5 Hydrology

Prior to mining, three main creeks and their tributaries crossed the BACM site, Bath Creek, Washpool Creek and Breaker Creek. These watercourses have been diverted around the mine site to prevent flooding of the mining areas and rail infrastructure, and to harvest water for use at the mine. Figure 2 (Appendix A) shows the hydrology of the site. Site hydrology has remained unchanged since the study undertaken by BMT WBM in 2012, and that the diversions proposed in the Rio Tinto Mine Closure Plan (Rio Tinto 2010) have not yet been constructed.

The total catchment area of the mine and upstream catchment is approximately 65 km² (including the areas within and outside the mining leases). At present, runoff water from undisturbed catchments north, west and east of the mine is diverted around the site via diversions to the Environmental Dam. There are currently four primary creek diversions on BACM:

- ▮ Rail Loop Diversion (Breaker Creek Diversion): located north of the rail loop and is a diversion for Breaker Creek North. This diversion protects the rail loop infrastructure and diverts Breaker Creek North into Washpool Creek West for improved water harvesting for the West Dam.
- ▮ Eastern Diversion Drain: transfers overflow from West Dam around the north of the mining area and collects clean water entering the site from the north (Washpool Creek), which is diverted around the mining area by the Eastern Diversion where Bath Creek joins the diversion. The diversion diverts flows around the Ramp 5 mining areas, and into the Environmental Dam before running off lease via the original Bath Creek channel, if the Environmental Dam fills and spills.
- ▮ Western Diversion Drain: diverts Breaker Creek around the Ramp 1 South mining area and into Bath Creek.

As of 2010, the Environmental Dam could hold approximately 600 ML of water and had a surface area of 56.9 ha. The dam wall was designed to contain 900 ML; however, it will start to spill once water reaches the spillways, i.e. 600ML. The Environmental Dam spillway was the former licensed discharge point from the mining operation.

Mining of Seam No. 4 coal resources in the South Pit (Figure 1) will require a new section of diversion to be constructed. It is proposed to alter the Eastern Diversion Drain to direct the surface water flow into Bath Creek East (Figure 2 – Appendix A).

With the diversions in place, the mining area forms an internally draining “sink”. Several voids on site are currently partially filled with water and serve to capture and contain mine water and localised runoff from areas disturbed by mining, including the TSF and industrial area.

There is no current authorised discharge point from BACM and release is only allowed during periods of natural flow with water quality that meets Table C2 in the EA.

8.6 Hydrogeology

The hydrogeology section has been derived from information contained in JBT (2012).

8.6.1 Groundwater resources

The following geological units are considered distinct hydrostratigraphic units in the vicinity of the BACM (JBT 2012):

- τ Basement Rocks
- τ Permian Sediments
- τ Tertiary Basalts
- τ Tertiary / Quaternary Alluvium
- τ Tailings and Spoil

The Tertiary Basalts are the only unit in the area with sufficient yield and size to be considered an aquifer. Descriptions of each hydrostratigraphic unit follow.

8.6.1.1 Basement rocks

Proterozoic-Cambrian metamorphics occur at surface or close to surface at a number of locations in the Clermont area, including the western and southern portions of the Blair Athol Mining Lease. A number of regional groundwater monitoring bores are screened within basement metamorphics at shallow depth. In these bores, the weathered metamorphics show a response to rainfall recharge that is similar to other watertable bores. However, the bore yields within the metamorphics are low and the unit is not regarded as an aquifer. The Proterozoic-Cambrian metamorphics are regarded as the hydraulic basement to other groundwater units in the region (JBT 2012).

Water level response in regional basement monitoring bores indicates that the basement rocks, especially where they occur at surface, are recharged via direct rainfall infiltration (JBT 2012). However, the storage of the rocks is low relative to other groundwater units in the area, so much rainfall in basement outcrop areas will report as runoff to surface drainage systems.

8.6.1.2 Permian sediments

Groundwater has been encountered in all coal seams during exploration drilling, but groundwater occurrence is more pervasive in Seams 3 and 4. The coal seams are water-bearing units but are not considered aquifers as the yields are too low and too short-lived (JBT 2012). The coal seams have not been observed to provide significant rates of seepage to the open pits during mining, and generally the seepage rates encountered were insufficient to provide a reliable water supply to the mining operation (JBT 2012).

The Blair Athol Basin is a relatively isolated groundwater system, at least in the sense of groundwater within the coal seams. Recharge mechanisms are unknown, however based on recharge mechanisms observed at other Bowen Basin coal mines it is speculated that recharge to the coal seams occurs in marginal areas of the basin where the coal seams subcrop, or via downward drainage from overlying groundwater units (JBT 2012).

There is no natural outlet for water in the coal seams (refer schematic cross sections, Figure 2), so groundwater movement within the coal seams could be expected to be minimal.

8.6.1.3 Tertiary basalts

The Tertiary Basalt aquifer is the most significant regional aquifer in the Clermont area as it is the main aquifer from which landholders in the region draw stock and domestic water supplies. The basalt is known to comprise a number of distinct flows, though these have not been mapped in a regional sense (JBT 2012).

Regionally, groundwater in the basalt has been observed to occur within discrete, isolated fractures, so that pumping from one fracture system can have little or no impact on water levels within adjacent fracture systems (JBT 2012). Basalt is encountered in the northern and eastern areas of the site, where basalt flows have infilled depressions in the pre-Tertiary land surface.

Seepage water from the basalt aquifer to the pits in the vicinity of Ramp 3 and Ramp 4 is understood to have provided reasonable supplies of non-potable water to the operation over the course of many years (JBT 2012). However, the average rate of seepage is unknown.

The basalt aquifer is the uppermost aquifer in the groundwater system, and receives recharge directly from rainfall. Regionally, the water level in the basalt aquifer rose in many bores after a succession of above average wet seasons from 2007/2008 to 2011 (JBT 2012).

Groundwater flow direction within the basalt aquifer is topographically controlled, with movement of water from topographically higher regions to topographically lower regions. Based on surface drainage, it is judged that the aquifer to the north of the site (within the Bath Creek catchment) will flow toward the mine, and that further north groundwater within the basalt aquifer will flow towards the north-east to either the Gowrie Creek or Miclere Creek catchments (JBT 2012).

8.6.1.4 Tertiary/Quaternary alluvium

Unconsolidated alluvial deposits occur along Bath Creek and Washpool Creek, which drain through the lease area from the north and north-east (Figure 2 – Appendix A). The creeks are ephemeral and groundwater occurrence within the alluvium is sporadic and related to rainfall recharge events when the streams briefly flow.

Following the 2010/2011 wet season rainfall the alluvium in the Ramp 1 mining area became sufficiently saturated that engineering measures were required to control the rate of groundwater inflow to the mining operation (JBT 2012). Therefore, potential exists for the alluvium to provide groundwater seepage to the final void particularly following above-average wet season rainfall, with the rate of seepage dependent on the degree of saturation of the alluvium, as well as the degree to which alluvial channels are hydraulically connected to the final void.

Groundwater recharge to the alluvium is via direct rainfall infiltration, with groundwater movement in the direction of surface drainage.

8.6.1.5 Tailings and spoil

The following section is taken from JBT (2012), in discussion of URS (2006) (which was not reviewed for this report):

The TSF is currently an artificial source of locally perched groundwater. The tailings are deposited as a slurry (about 40 - 60% solids). Seepage modelling undertaken by URS (2006) indicatively suggests (due to limited data) that most seepage from the TSF will be through the TSF embankments in the early and middle stages of construction and that seepage rates through the embankments will be minimal in the latter stages and moving into closure.

The long-term prediction from the URS (2006) report is that most seepage (latter stages and post-closure) will be through the floor of the TSF into the underlying spoil, and thence into the sandstone/conglomerate Permian sediments. The flux (i.e. the rate of water movement) through the floor of the TSF is expected to decrease post-closure as the tailings dewater and the TSF cap reduces rainfall recharge (URS, 2006).

As mentioned above, the fate of the basal conglomerate/sandstone aquifer on and immediately outside the site is difficult to predict.

The elevation of the TSF is below the base of the basalt aquifer, and so does not influence the quality or elevation of groundwater within the basalt aquifer. This is expected to remain the case in the long term well after closure.

The spoil comprises overburden and interburden that has been removed to access the coal seams, and progressively back-filled into pits as the coal is removed. The hydraulic properties of the spoil will therefore be dependent on the properties of the parent material, dumping method, degree to which the spoil has been consolidated by traffic, and degree to which the spoil has settled and consolidated over time.

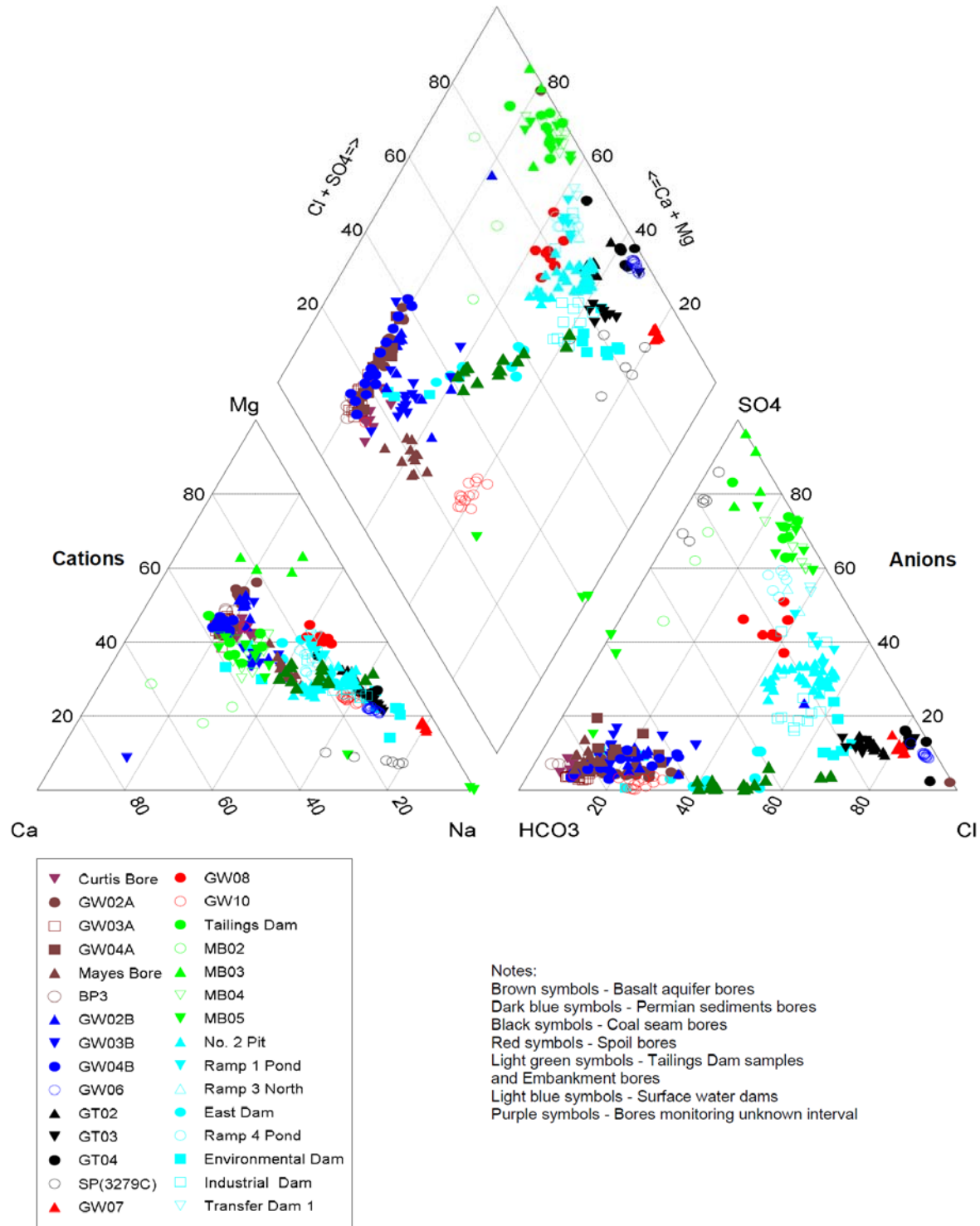
Recharge to the tailings and spoil is via direct rainfall recharge, and in the north of the lease area the spoil may receive recharge via lateral flow from the basalt aquifer and minor inflow from the Permian sediments and alluvials (JBT 2012). Groundwater flow direction will be dependent on the degree to which a mounded water table develops in the spoil, and on the shape of the final landform relative to surrounding natural material.

8.6.2 Groundwater quality

Groundwater total dissolved solids (TDS) values reported in JBT (2012) ranged from 0 to 101,000 mg/L, indicating the variable groundwater chemistries in the area. The higher TDS values were associated with the TSF and mine spoil and are not representative of background groundwater quality. The mean TDS reported was 2,252 mg/L, while the median was 619 mg/L. Background water quality for the basalt aquifer (average of four samples collected in 2009 from Curtis Bore on Blair Athol Station) indicated concentrations of TDS at 405 mg/L, chloride at 20 mg/L, sodium at 40 mg/L, sulfate at 11.5 mg/L and a pH of 7.8 (Rio Tinto 2010).

Major-ion groundwater chemistry was presented in JBT (2012) based on BACM monitoring data collected from bores screened in the different hydrostratigraphic units at the site, including within placed mining spoil and the TSF embankment. The major ion analyses for each water source was plotted on a Piper diagram (Figure 3) to determine the water type in each hydrostratigraphic unit, as well as for surface water storages (discussed in Section 11). A piper diagram is a graphical

representation of the chemistry of a water sample which shows the relative concentrations of major ions (Ca^{2+} , Mg^{2+} , Na^+ , K^+ , Cl^- , $\text{HCO}_3^- + \text{CO}_3^{2-}$ and SO_4^{2-}). Piper diagrams are used to define water types and can be used to identify groundwater processes such as precipitation or solution, mixing and ion exchange.



Source: JBT 2012

Figure 3: Piper diagram – Blair Athol groundwater and surface water major ion chemistry

The major ion chemistry at site is summarised as:

- † Basalt aquifer – basalt water samples are chemically characterised as Mg-Ca-HCO₃ type water, with the major cation composition related to the weathering products of basalt minerals (e.g. Na, Ca, Mg, K silicates). The bicarbonate is derived from interaction of recharge water with atmospheric CO₂ and plant root zone.
- † Permian conglomerate – two distinct water types are present. Where Permian conglomerates are overlain by basalt groundwater is chemically classified as Mg-Ca-Na-HCO₃ type water. Together with groundwater level (higher water levels observed in basalt bores), water quality data indicates a potential for downward leakage of water from the basalt aquifer to the underlying Permian sediments. In areas where basalt is absent, groundwater is chemically classified as Na-Cl type.
- † Spoil – Water from bores screening the spoil show varying water types from Na-Cl (GW07) to Na-Mg-SO₄-Cl (GW08) and Na-Mg-HCO₃ (GW10).
- † Tailings Storage Facility – water samples are mixed cation (Ca, Mg and Na)-SO₄ type.

When plotted on the piper diagram, samples for the basalt aquifer, as well as the Permian sediments underlying basalt, display a dominance of calcium and magnesium over chloride and sulphate. All other sites are more dominated by a combination of chloride + sulphate, and less dominated by calcium + magnesium.

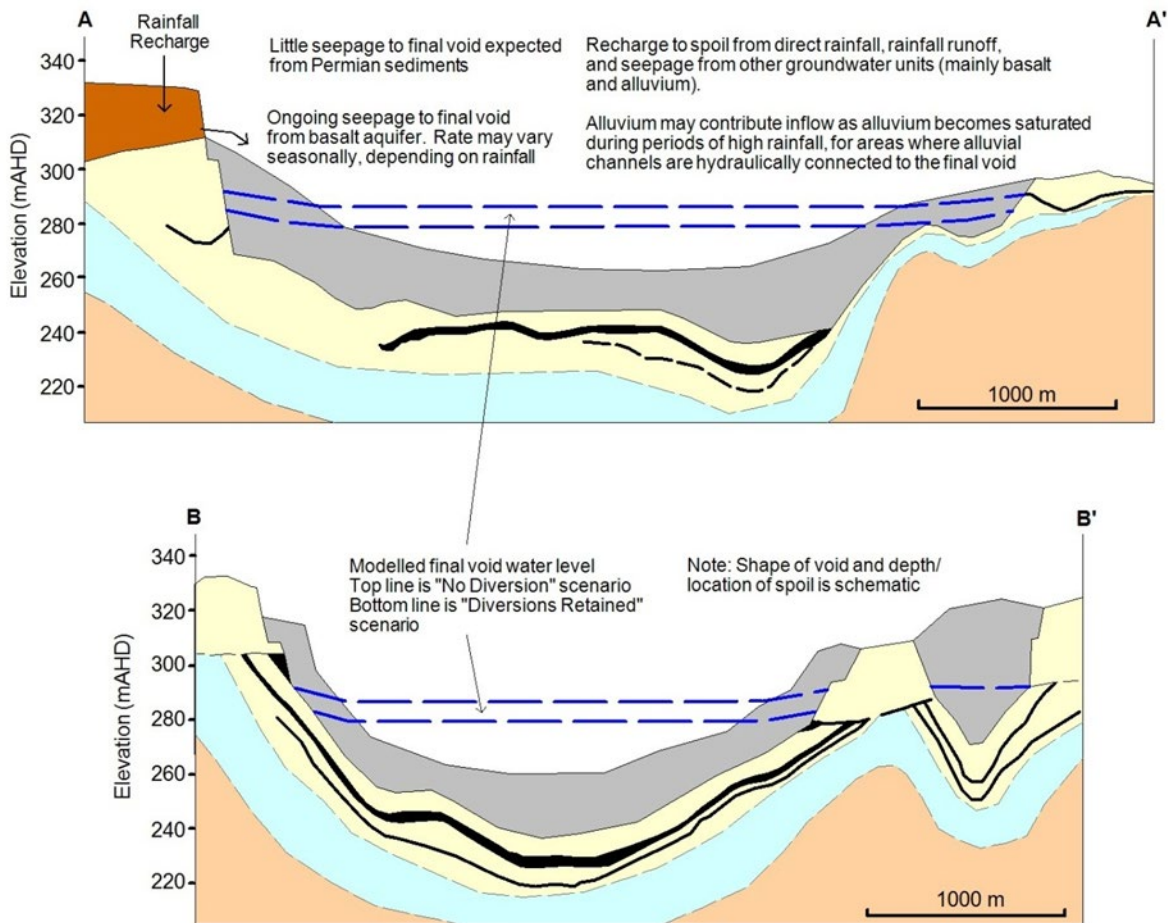
Groundwater quality appears to influence surface water geochemistry on site, with the early major ion chemistry of surface waters dominated by the geological environments within which the dams were developed. The major ion chemistry of surface waters then evolves over time to a mixed water type.

The beneficial use for groundwater in the Clermont region is stock watering. Groundwater within the Tertiary basalt aquifer is, in some instances, suitable for potable use based on TDS criteria alone; however, a number of other parameters (including pH, sodium, chloride, sulphate, arsenic, iron, cadmium, manganese and zinc) may make groundwater in the area unsuitable for potable consumption without treatment to a potable standard.

8.6.3 Groundwater inflow to final void

JBT (2012) presented estimates of the potential long-term post-closure yields of the groundwater units at BACM based on their conceptual groundwater model of the BACM at the end of the Rio Tinto mine plan (Figure 4). Changes to this mine plan have occurred since purchase of the site by TerraCom; however, it is considered that the general parameters used by JBT and the conclusions of their report remain valid as the changes to the hydrogeological conceptual model in the updated mine plan are minimal. It is recommended that the groundwater conceptual model be reviewed and a numerical groundwater model developed for BACM to provide certainty to the inflow volumes used in the final void water balance.

The potential inflow rates used in the JBT report (2012) were based on anecdotal information from site and professional judgement. Historical inflow rates to the mine were not quantified, and no groundwater modelling has been undertaken.



Source: JBT 2012

Figure 4: Post-closure hydrogeological model

Rates of groundwater inflow to the final void are likely to be highly dependent on climatic variation, as follows (JBT 2012):

- ⌚ During periods of higher than average rainfall the water level in the basalt, alluvium, and spoil can be expected to rise, and the rate of inflow to the final void from these groundwater units will increase. It is noted that the more transmissive units of the coal measures (the coal seams) have been largely removed by mining. Therefore, it is judged that the Permian coal measures will not provide significant rates of inflow to the pit void; and
- ⌚ During periods of lower than average rainfall the water level in groundwater units at site can be expected to decrease and the rate of inflow to the final void to decrease over time.

The indicative inflow rates to the final void for each hydrostratigraphic unit were predicted to be (JBT 2012):

- ⌚ Permian coal measures: 0 L/s
- ⌚ Permian basal conglomerate: 0-2 L/s
- ⌚ Tertiary Basalt: 1-5 L/s
- ⌚ Spoil: 1-5 L/s
- ⌚ Tertiary/Quaternary Alluvium: 1-2 L/s

Based on these indicative inflow rates, the total groundwater contribution to the final void is predicted to be in the order of 3-5 L/s, though the actual rate will be dependent on factors such as seasonal rainfall, the overall shape and dimensions of the final landform, the hydraulic characteristics of groundwater units (such as spoil) that occur adjacent to or within the final void and the depth / extent of the residual pit lake.

Groundwater levels in the surrounding hydrostratigraphic units were reviewed by JBT (2012), and it was concluded that groundwater levels for the majority of water-bearing units at site are currently higher than the predicted maximum water level in the final landform (pit lake) (refer Section 11.1). Therefore, it is predicted that the final landform pit lake will act as a groundwater sink, (i.e. groundwater flow will be towards the residual void), which will limit the potential for off-site discharge of water from the final void via groundwater. The fact that the Permian sediments at BACM form a basin both geologically and hydrogeologically reinforces this conclusion.

9 LAND USE OPTIONS – RESIDUAL VOID

9.1 Land use options

TerraCom has revised the final land use objectives of each closure domain to be primarily biodiversity outcome focussed. The residual voids are expected to be classed as non-use management areas (NUMA) with the targeted objective of promoting biodiversity through the development of native, self-sustaining vegetation.

Water balance modelling suggests a pit lake(s) will be present in the residual void (Section 11). The water quality of the pit lake(s) is likely to be the limiting factor regarding use of any water bodies present in the residual void. The resulting pit lake(s) is likely to exhibit poor water quality over time and is unlikely to be suitable for use as a recreational area or for stock watering (BMT WBM 2012). The final salinity of the pit lake(s) is also likely to be too high to support freshwater fish species.

The presence of a pit lake with poor water quality in the residual void appears unavoidable and will be classed as non-use management areas; therefore, the land use management strategy is to minimise the area of the residual void and the pit lake where practicable.

9.2 Residual void area minimisation

A key factor towards meeting the final land use objective, promoting biodiversity, is to reduce the footprint of the existing residual pit lake and the footprint that will be created due to future mining. This will maximise spoil for revegetation in the areas of the void that will not be regularly inundated by the pit lake.

The recommencement of mining at BACM provides the opportunity to reduce the number and size of residual voids through a planned spoils and waste placement program which is aligned with the closure plan. The overburden, interburden, spoil, coal washery coarse rejects and tailings disposal plan (TerraCom 2018) details the strategies to be utilised by TerraCom to manage PAF material and waste/residual coal susceptible to spontaneous combustion. Specific strategies designed to minimise the residual void and pit lake are discussed below.

Compliance with EA condition F14 will be possible through this plan by the disposal of coal washery wastes and spoil with exchangeable sodium percentage (ESP) >30% into the void and by covering this waste with a minimum of one metre of benign material (i.e. with ESP <15%) prior to rehabilitation commencing.

It is unknown whether sufficient spoil will be generated by ongoing mining by TerraCom to substantially fill the remnant voids as the mining plan has not been finalised and the final spoil volumes are not available to undertake this calculation. Should excess mining spoil be available, sequential backfilling of the final pit with this spoil will be conducted to minimise the size of the final pit. However, due to the coal measures geometry, namely their shallow dip and basinal nature, it is unlikely that the amount of spoil generated by mining will be sufficient to completely backfill of all mining voids. As a consequence, the focus for rehabilitation of the final void will be the creation of a safe and stable landform post-closure (Section 11.2). Therefore, the strategy is to fill as much of the void as possible whilst developing pit walls with appropriate factors of safety.

10 HYDROLOGY AND WATER QUALITY

The following hydrological constraints are proposed for BACM at closure:

- † Surface water diversions will remain in place to provide adequate water flows downstream of the site. Modelling has been conducted on scenarios with and without diversions, and the conclusions were that retaining the diversions resulted in the better environmental outcome (BMT WBM 2012; Section 11);
- † Internal drainage of the final mining areas will be directed into residual voids, with current voids backfilled and re-sculptured where possible; and
- † Existing dams will be rehabilitated into wetlands with no connection to the residual void.

10.1 Final void water levels

Water balance modelling by BMT WBM (2012) was undertaken using the then existing Rio Tinto final mine plan. Post-closure water levels for a period of fifty years were modelled for two scenarios; with the current stream diversions remaining in place post-closure, and with the diversions removed allowing the upstream catchments to enter the residual void post-closure. Under both scenarios the water level does not approach the crest height of the lake (assumed at 300 mAHD from the digital elevation model of the site) at any stage during the 50 year simulation, indicating that the mine void is unlikely to fill and overflow into the downstream environment during typical climatic conditions (BMT WBM 2012). The maximum water levels reached during the 'with diversions' scenario were approximately 280 mAHD, whereas the 'no diversions' scenario reached approximately 285 mAHD. This signifies that allowing the upstream catchment to flow into the residual void will have a relatively minimal effect on the residual pit lake water levels.

Although TerraCom has changed aspects of the final mine plan since purchasing the site, it is considered that the changes to the hydrology of the site are minimal and that the findings of the BMT WMB report (2012) remain valid. It is recommended that the final void water balance is remodelled using the updated mining plans to reduce uncertainty associated with residual void water volumes and quality. As recommended in Section 9.6.3, numerical groundwater modelling should also be undertaken using the updated mining plans to provide certainty to the groundwater inflow volumes to be adopted in the final void water balance.

10.1.1 Flood events

The water balance modelling by BMT WBM (2012) indicated that the residual void was unlikely to overtop during typical climatic conditions. However, it was considered possible that overflow may occur during extremely large rainfall events. Whilst likely to be a highly infrequent event, the likely poor water quality of the residual pit lake (see below) makes overtopping of the residual void undesirable. Engineering options such as using mine spoil to construct berms to increase the overtop height of the residual void are to be investigated as part of the mine closure process.

The water balance modelling conducted by BMT WBM (2012) used monthly means to generate climate inputs for the modelling based on a 50-year period of historical climate data. It is recommended that probabilistic water balance modelling, using a Monte Carlo approach, be undertaken to model a wide range of synthetic climate sequences. This will generate greater certainty of potential pit lake heights during extreme rainfall events, informing management and engineering options to minimise the risk of flood overtopping events. It is also recommended that the revised water balance modelling be extended for a longer simulation period (say 500 years) to confirm that the final void reaches an equilibrium water level over time. It is also recommended to estimate the probable maximum precipitation depth for the

final void catchment using ARR2016 methods to check if the simulated freeboard in the final void can cater for this event.

10.2 Final void water quality

BMT WBM (2012) conducted hydrodynamic modelling of the final pit void at BACM to model the salinity, temperature and density of the pit lake after closure. The modelling was conducted assuming both “with diversions” and “no diversions” scenarios.

The pit lake was found to likely become a self-contained system, with inflows from the upstream catchment and groundwater infiltration, and with evaporative flux as the only loss of volume. Results of modelling showed the system to become hyper-saline over time, as dissolved solids accumulate within the void, with salinities as high as 15,000 mg/L (Rio Tinto 2010), which has implications for long-term water quality at the site. A more saline water-body is likely to develop persistent haloclines and become stratified for periods up to several years, which has implications for long-term water quality at the site.

A closed, stratified system may also result in other undesirable water quality outcomes, such as algal blooms or potential toxic concentrations of pollutants as they accumulate over time. A coupled hydrodynamic and water quality model with the ability to simulate the interactions of phytoplankton, nutrients, oxygen and potentially toxic pollutants such as heavy metals, updated with the TerraCom mining plan, may be required to better understand the long-term residual void water quality if the site is to be open to the public, or if numerical groundwater modelling indicates possible interaction between the residual pit lake and groundwater.

An advantage of a closed system such as this, is that the downstream environment may be relatively unaffected by the closure of the mine, as all flows are contained within the void and do not flow downstream. This assumes that the existing creek diversions are kept in place, which will provide ephemeral flows to the downstream environment. If the diversions are removed, then these flows will likely be contained within the void, removing the flows from regions downstream.

Groundwater investigations (JBT 2012) concluded that the residual void is likely to act as a sink, with no significant groundwater outflow from the site. Therefore, the modelled poor water quality of the residual pit lake is considered unlikely to impact downgradient groundwater users or groundwater dependent ecosystems in the long-term. Numerical groundwater modelling as recommended in Section 9.6.3 should be conducted to confirm that the residual void is a sink and that there will not be any interaction between the residual pit lake and groundwater.

11 GEOTECHNICAL STABILITY OF THE VOID

11.1 EA requirements

In regards to the final landform, the EA states:

F4 - Rehabilitation landform criteria

All areas disturbed by mining activities must be rehabilitated in a manner that ensures it is:

- a) safe for humans and wildlife;
- b) stable;
- c) able to sustain vegetation; and
- d) non-polluting.

“stable” means geotechnical stability of the rehabilitated landform where instability related to the excessive settlement and subsidence caused by consolidation / settlement of the wastes deposited, and sliding / slumping instability has ceased.

In addition, the EA requirement F6 states *Rehabilitated landform slope angles are not to exceed 15 percent, with the exception of Ramp 3 cut through competent rock.* The Rio Tinto Mine Closure Plan (Rio Tinto 2010) proposed that areas cut from competent rock will be constructed to geotechnical specification (max 30%) to ensure long term safety where a maximum slope of 15% is not achievable.” TerraCom intends to retain these design specifications to achieve a safe and stable landscape on closure.

A final geotechnical stability analysis of the BACM has not been conducted. It is recommended that this be done with respect to TerraCom’s mining plans to confirm that the stability of the proposed final landform meets EA requirements.

11.2 Mining spoil

Geotechnical studies at BACM have identified several failures in the low wall spoil piles. These failures are attributed mainly to the spoil material having a very low strength and a high clay content (Rio Tinto 2012). Failure within the spoil piles typically occurred when the spoil pile:

- ⌚ Slopes were greater than 35%
- ⌚ Foundation dips at a relatively high angle of between 5 - 10° into the pit
- ⌚ Comprised poor quality very low strength, fine grained material with low plasticity.

Failure of the spoil often occurred following rainfall events. The occurrence of past failures in the mining spoil at BACM reinforces the necessity for final slope, encompassing the spoil pile, to meet the 15% angle criteria.

The minimisation of slope lengths will be important to prevent erosion of rehabilitated landforms. Specific drainage designs such as large grassed drainage swales or conventional rock lined and graded drainage channels are options to control rainfall runoff in the areas of rehabilitated spoil. Ultimately, the creation of a well-vegetated final landform that promotes infiltration and evapotranspiration is the best method to control erosion on rehabilitated mine spoil.

11.3 Highwalls

Based on observations and geotechnical assessment and analyses at BACM during operations (Rio Tinto 2006) geotechnical hazards or failures are typically associated with movement along geological discontinuities such as joints and faults and weak bedding parallel features. This movement results in isolated rock falls or larger block falls. Failure predominantly occurred within the Permian white sandstone, the coal seams and Tertiary basalt.

The weak bedding parallel features such as shears or layers of soft clay are generally associated with the coal seams especially with the roof and floor of Seam 3 and Seam 4. Translational sliding along the weak seams has occurred previously in the highwall as mining progresses up dip.

Isolated rock or block falls typically occur when Tertiary basalt overlies the Permian white sandstone.

The Permian white sandstone in the lower part of the highwall is usually weathered and is regarded as extremely weak (has a very low strength). On exposure, the condition of the sandstone rapidly deteriorates and after a few days localised rockfalls can occur. The poor performance of the white sandstones compared to other sandstones at BACM is thought to be related to either blasting impacts, deep weathering or leaching effects from the overlying basalts.

To ensure geotechnical stability of the still exposed highwalls and end walls at the closure at BACM, a flattening of the existing pit slope angles is required. The maximum allowed angle in competent rock is 30% as per EA conditions. To achieve this, at mine cessation, the highwall treatment strategies discussed in the Australian Coal Association Research Program (ACARP) Rehabilitation of Highwalls Report (ACARP 2006) should be implemented. Closure options could comprise:

- τ Cast blast the Tertiary basalt and Permian white sandstone highwall into the pit and regrade the blast material and slopes to 30% or less if possible.
- τ Regrade the backfilled spoil to a 15% slope on the low wall.

Although the laying back of the highwalls and end walls may increase the void catchment over a steeper configuration; the improved safety provided by the flatter slope angle is considered more important than creating a slightly larger final residual void.

Rock units considered susceptible to erosion, such as the highly weathered white sandstone, are to be covered in rock mulch where possible to ensure erosion does not compromise the safety and stability of the final landform. The final goal for the residual void landform that is not inundated by the pit lake is a self-sustaining vegetated stable landform that will persist in the long-term.

12 VOID CAPABILITY TO SUPPORT FLORA AND FAUNA

The capability of the residual void to support flora and fauna is dependent on the application and success of the management strategies outlined in Section 10.2 to minimise the residual void area and residual pit lake.

12.1 Rehabilitated landform

Intensive treatment such as backfilling will yield a similar environment to the rehabilitated spoil areas. Revegetation domain goals and action plans detailed in the Rehabilitation Management Plan (WSP 2018) describe revegetation methods and actions to promote biodiversity in the residual void by the seeding of reworked spoil with a selected mix of native species. Successful revegetation will provide food and shelter to encourage colonisation of the rehabilitated areas by native fauna.

The landform design is intended to achieve a safe and stable landscape on closure (Section 8). The EA requirement F6 states *Rehabilitated landform slope angles are not to exceed 15 percent, with the exception of Ramp 3 cut through competent rock*. The Rio Tinto Mine Closure Plan (Rio Tinto 2010) proposed that areas cut from competent rock will be constructed to geotechnical specification (max 30%) to ensure long term safety where a maximum slope of 15% is not achievable.” intends to retain these design specifications.

The flattening of steep highwalls/end walls to a slope of less than 30% greatly reduces the risk of native fauna coming to harm from falling from the pit walls. Where possible, the slopes in the vicinity of the pit lake will be flattened to prevent fauna from falling into the pit lake and allowing escape from the water body should any animals enter the water.

12.2 Residual pit lake

The ability of the residual pit lake to support significant life will depend on whether there is permanent water stored in the void and the water quality of the void water. Modelling undertaken by BMT WBM (2012) suggests that a pit lake will be present in the residual void and that the water quality is likely to become hypersaline with time (Section 11.2). In addition, thermoclines and haloclines are likely to develop, limiting oxygen levels in deeper sections of the lake and potentially leading to algal blooms.

The modelling suggested that removal of the current creek diversions allowing flow from the upstream catchments into the residual void would not make a significant difference to the pit lake water qualities. Therefore, retainment of the diversions was recommended to retain beneficial water flows to Bath Creek downstream of the mine. The impact on downstream surface water systems as a result of interception of surface flows by the final void was identified as a potentially significant social impact (Rio Tinto 2010).

13 FINAL RESIDUAL VOID REHABILITATION PERFORMANCE AND SUCCESS CRITERIA

13.1 Rehabilitated spoil

The success criteria and monitoring requirements for the rehabilitated spoil in the residual void are the same as the requirements for BACM as a whole and are detailed in the Rehabilitation Management Plan (WSP 2018). The EA stipulates performance criteria for the following:

- τ Slope >15% and unstable
- τ Slope <15%
- τ Gully erosion
- τ Mature vegetation
- τ Vegetation diversity
- τ Groundcover cover

Reference sites for each natural land system domain need to be established prior to assessing existing and future rehabilitation. Once reference sites have been established, ongoing progressive rehabilitation will need to be assessed in accordance with the performance criteria derived from the reference sites. The results of the reference site data will need to be analysed to determine performance criteria for the corresponding rehabilitation land system domains.

13.2 Residual highwalls and end walls

Performance criteria for highwalls and end walls are designated in Table F1 of the EA (Table 1).

13.3 Residual pit lake

The only specific performance criteria relating to the residual void in the EA is *Condition F13– Residual Void Outcome: Residual voids must not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself and subject to any other condition within this environmental authority.*

Performance criteria have been developed with regard to *Condition F13* and the Rio Tinto Mine Closure Plan (2010) (Table 4).

Table 4: Performance criteria for successful rehabilitation of residual pit lake

Rehabilitation objective	Success criteria	Monitoring
Final pit water quality will not impact negatively on the surrounding environment	No overflows of pit lake into external water systems	Quarterly water level monitoring until relinquishment. If the water levels are found to be inconsistent with modelling predictions, the measured data will be used to re-calibrate the final void water model.

Rehabilitation objective	Success criteria	Monitoring
	Water quality to meet expected (modelled) conditions	Quarterly water quality monitoring until relinquishment of the final void to ensure that it is consistent with the results of final void modelling. Monitoring will consist of physical and chemical measurements. (including pH, EC, TDS, dissolved oxygen, major cations and anions, and trace elements (metals and nutrients)). If the water quality is found to be inconsistent with modelling predictions, the measured data will be used to re-calibrate the final void water model.
	No impact on surrounding groundwater from the residual pit lake	Quarterly monitoring of groundwater chemistry and levels in surrounding sentinel monitoring bores. Monitoring of groundwater levels, pH, EC, TDS, major cations and anions and trace elements (metals and nutrients). Monitoring of water levels at Curtis Windmill Bore to detect any potential groundwater level impacts.

13.4 Review and corrective actions

Review and update of the monitoring and rehabilitation programs will be undertaken to ensure that:

- ⌚ The RVMP incorporates significant changes to the long-term mine plan resulting in material impacts to the projected final landform
- ⌚ The program can be altered if new technologies and/or strategies are developed by industry, government or academia
- ⌚ The rehabilitation program and monitoring is being conducted as per the RVMP and the EA
- ⌚ Rehabilitation performance is trending towards final completion criteria and the required rehabilitation schedule is being met by management
- ⌚ Adequate and suitable stockpiles of rock mulch, topsoil and seed banks are available for the rehabilitation; and
- ⌚ Records of rehabilitation (spoil backfilling, topsoil placement, etc) are being kept and are current.

13.5 Recommendations

The following actions are recommended to further inform future RVMPs.

- † Review of the existing groundwater conceptual model and development of a numerical groundwater model for BACM to provide certainty to the inflow volumes used in the final void water balance;
- † Remodelling of the final void water balance using the updated mining plans to reduce uncertainty associated with residual void water volumes and quality.
- † Probabilistic water balance modelling, using a Monte Carlo approach, be undertaken to model a wide range of synthetic climate sequences, including extension of the modelling for a longer simulation period (say 500 years) to confirm that the final void reaches an equilibrium water level over time
- † Estimation of the probable maximum precipitation depth for the final void catchment using ARR2016 methods to check if the simulated freeboard in the final void can cater for this event.
- † If numerical groundwater modelling indicates possible interaction between the residual pit lake and groundwater, development of a coupled hydrodynamic and water quality model with the ability to simulate the interactions of phytoplankton, nutrients, oxygen and potentially toxic pollutants such as heavy metals, updated with the TerraCom mining plan.
- † A final geotechnical stability analysis of the BACM, including a geotechnical assessment and certification on closure.
- † Monitoring as per EA.

14 REFERENCES

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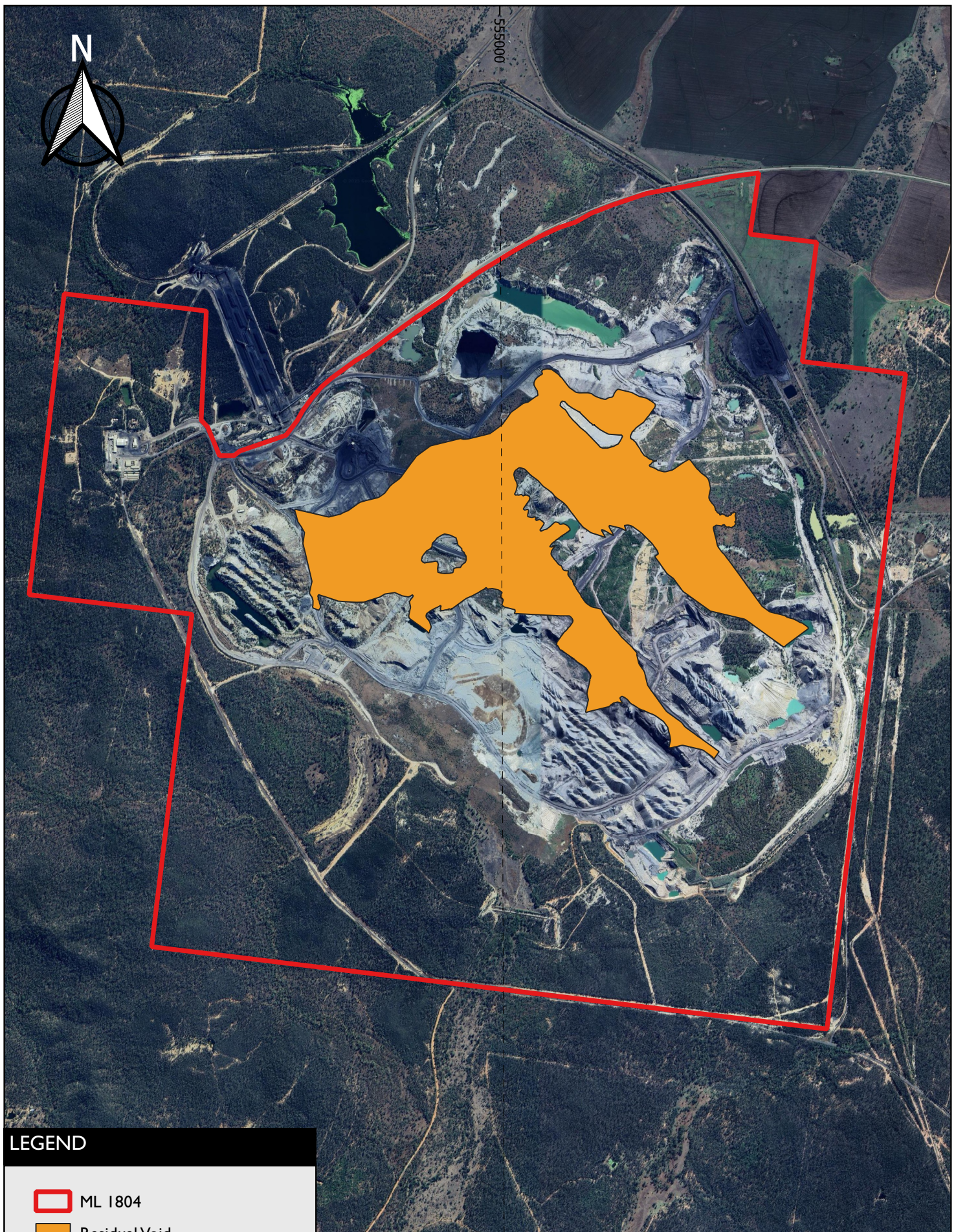
WSP (2018), Rehabilitation Management Plan Blair Athol Coal Mine Draft. June 2018.

Blair Athol Coal Mine – Environmental Management System

TerraCom

APPENDIX A – FIGURES





LEGEND

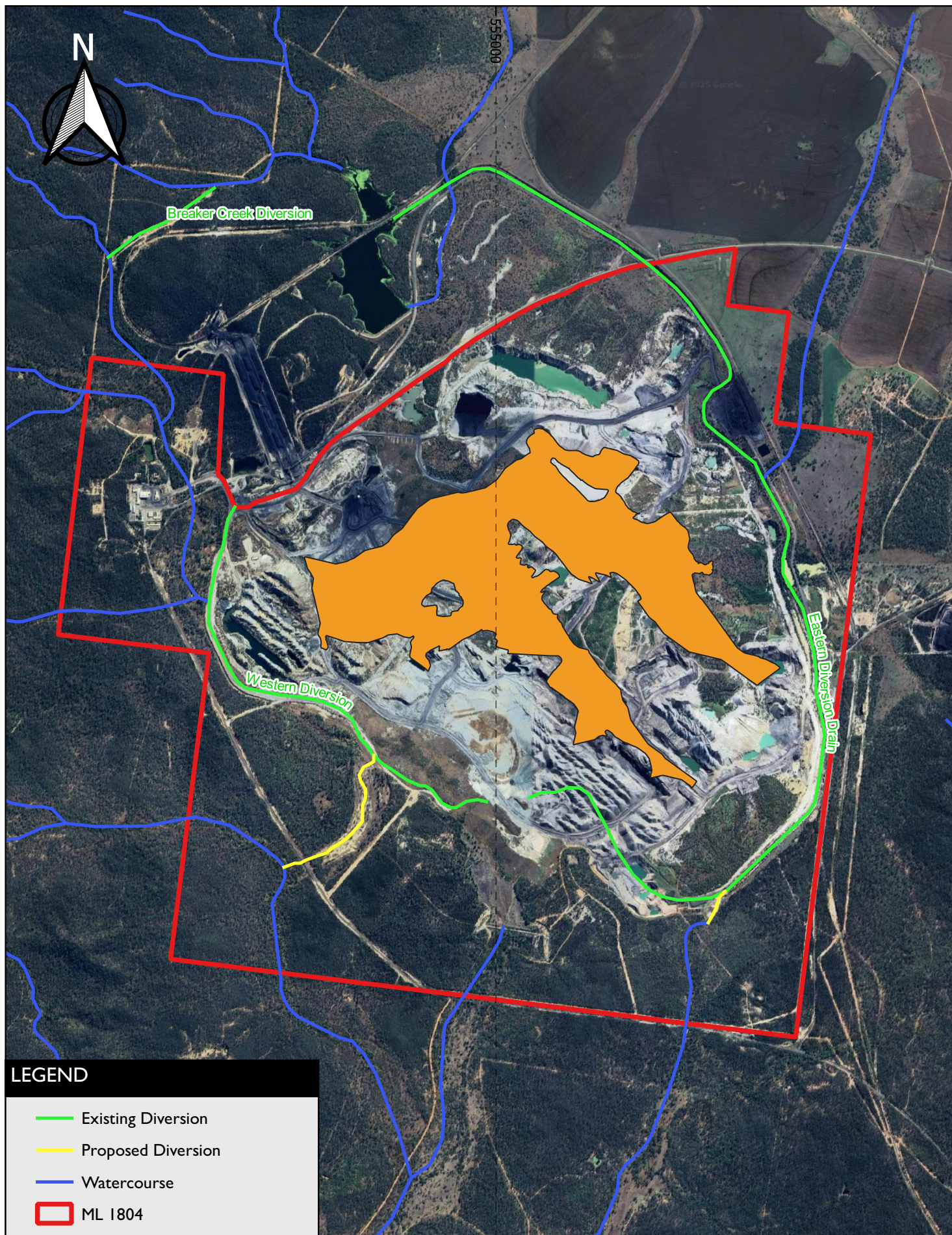
- ML 1804
- Residual Void

Scale 1 : 25 000

0 0.5 1 km



Client TerraCom Limited		Project Residual Void Management Plan	
Design:	SGME Pty Limited 4.09.2025	Title	Figure
Scale:	1 : 25,000	Final Void Extent	I
CRS:	GDA2020		



LEGEND

- Existing Diversion
- Proposed Diversion
- Watercourse
- ML 1804
- Final Void

Scale 1 : 25 000

0 0.5 1 km



Client TerraCom Limited		Project Residual Void Management Plan	
Design: SGME Pty Limited 4.09.2025 Scale: 1 : 25,000 CRS: GDA2020		Title Site Hydrology	Figure 2

Blair Athol Coal Mine – Environmental Management System

TerraCom

APPENDIX B – ENVIRONMENTAL AUTHORITY



Permit

Environmental Protection Act 1994

Environmental authority EPML00876713

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

Environmental authority number: EPML00876713

Environmental authority takes effect on 11 June 2025.

Environmental authority holder(s)

Name(s)	Registered address
Orion Mining Pty Ltd	Blair Athol Mine Access Road, Clermont QLD 4721

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
Ancillary 08 - Chemical Storage 1: Storing a total of 50t or more of chemicals of dangerous goods class 1 or class 2, division 2.3 under subsection (1)(a)	ML1804
Ancillary 31 - Mineral processing 2: Processing, in a year, the following quantities of mineral products, other than coke (b) more than 100,000t	ML1804
Ancillary 63 - Sewage Treatment 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (b-i) more than 100 but not more than 1500EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	ML1804
Schedule 3 13: Mining black coal	ML1804

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.



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

Mobile and temporary activities

If you operate a mobile and temporary environmentally relevant activity (ERA), other than regulated waste transport, you are required to maintain a work diary. You must:

- use the approved form for a work diary (ESR/2015/1696);
- keep the work diary records for 2 years after the last entry;
- inform the administering authority within 7 days of the work diary being lost or stolen;
- record the information required in the work diary for each location within 1 day of leaving the location.

Contaminated land

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

- the presence of, or happening of an event involving, a hazardous contaminant on the land that is causing, or is reasonably likely to cause, serious or material environmental harm (notice must be given within 24 hours); or
- if the land is contaminated land – a change in the condition of the land that is causing, or is reasonably likely to cause, serious or material environmental harm (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 land (notice must be given within 20 business days).

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.

The anniversary day of this environmental authority is the same day each year as the effective date. 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.

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

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information or operating without a valid environmental authority.



Signature

11 June 2025

Date

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

Enquiries:
Business Centre (Coal)
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EMERALD QLD 4720
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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).

Obligations under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

Matters of national environmental significance (MNES) are regulated under the Commonwealth EPBC Act rather than under state legislation. You may need to submit a referral if your project potentially impacts any matters protected under the EPBC Act. For more information on self-assessments, and referral and assessment processes please visit the Department of Climate Change, Energy, the Environment and Water webpage, <https://www.dcceew.gov.au/environment/epbc/advice>.

Obligations under the *Aboriginal Cultural Heritage Act 2003* and *Torres Strait Islander Cultural Heritage Act 2003* (the Cultural Heritage Acts)

The Cultural Heritage Acts require anyone who carries out a land-use activity to exercise a duty of care. This 'duty of care' means land users must take all reasonable and practicable measures to ensure their activity does not harm Aboriginal or Torres Strait Islander cultural heritage and applies to any activity where Aboriginal or Torres Strait Islander cultural heritage is located. For more information on your obligations under this legislation, please visit the Department of Women, Aboriginal and Torres Strait Islander Partnerships and Multiculturalism webpage at, <https://www.tatsipca.qld.gov.au/>.

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Conditions of environmental authority

The environmentally relevant activities conducted at the locations as described above may be conducted in accordance with the following site-specific conditions of approval. This environmental Authority consists of the following Schedules:

- Schedule A – General
- Schedule B – Air
- Schedule C – Water
- Schedule D – Acoustic
- Schedule E – Waste
- Schedule F – Land
- Schedule G – Regulated Structures
- Schedule H – Sewage Treatment
- Schedule I – Groundwater
- Definitions
- Figures

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Conditions of environmental authority

Schedule A: General	
Condition number	Condition
A1	Although this environmental authority authorises environmental harm to the extent stated in the conditions, all reasonable and practicable measures must be taken to prevent or minimise environmental harm caused by the activities.
A2	Maintenance of measures, plant and equipment All measures, plant and equipment necessary to comply with this authority must be: (a) installed in a proper and efficient condition; (b) maintained in a proper and efficient condition; (c) operated in a proper and efficient manner; and (d) properly calibrated.
A3	Monitoring The results and analysis of all monitoring and investigations required by this environmental authority must be: (a) kept for a period of at least five years; (b) be provided to the administering authority within a timeframe nominated by the administering authority; and (c) provided to the administering authority in the format requested.
A4	Any records kept or created in relation to this authority must be: (a) kept for a period of at least five years; and (b) provided to the administering authority on request.
A5	All monitoring and investigations required by this environmental authority must be undertaken by an appropriately qualified person.
A6	Upon request from the administering authority, copies of all records, plans and other documentation required by the conditions of this environmental authority must be made available and provided to the administering authority within: (a) ten (10) business days; or (b) an alternative timeframe agreed between the administering authority and the environmental authority holder.
A7	Risk management The holder of this environmental authority must develop and implement a risk management system for mining activities to the Standard for Risk Management (ISO31000:2009), or the latest edition of an Australian Standard for risk management, to the extent relevant to environmental management.
A8	Where a condition of this environmental authority requires compliance with a standard, policy or guideline published externally to this environmental authority and the standard is amended or changed subsequent to the issue of this environmental authority, the holder of this environmental authority must: (a) comply with the amended or changed standard, policy or guideline within two years of the amendment or change being made, unless a different period is specified in the amended standard or relevant legislation, or where the amendment or change relates specifically to regulated structures; and

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	(b) until compliance with the amended or changed standard, policy or guideline is achieved, continue to remain in compliance with the corresponding provision that was current immediately prior to the relevant amendment or change.
A9	Third-party Audits The environmental authority must: (a) ensure that an appropriately qualified third party conducts and documents an audit of compliance with all conditions of the environmental authority by 15 December 2018; and (b) ensure that further audits in accordance with condition A9(a) are conducted at intervals not exceeding once every two years from completion of initial audit.
A10	Notification of emergencies, incidents and exceptions The holder of this environmental authority must notify the administering authority by written notification within 24 hours , after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with, the conditions of this environmental authority.
A11	Within 10 business days following the initial notification of an emergency or incident, or receipt of monitoring results, whichever is the latter, further written advice must be provided to the administering authority, including the following: (a) results and interpretation of any samples taken and analysed; (b) outcomes of actions taken at the time to prevent or minimise unlawful environmental harm; and (c) proposed actions to prevent a recurrence of the emergency or incident.
A12	Complaints A record must be kept in a single location of all complaints received about the activities.
A13	The record required by condition A12 must include: (a) name, address and contact number for the complainant; (b) time and date of complaint; (c) investigations undertaken; (d) conclusions formed; (e) actions taken to resolve the complaint; (f) any abatement measures implemented; and (g) person responsible for resolving the complaint.
A14	The administering authority must be notified that a complaint has been made, within 48 hours of receiving the complaint.
A15	When requested by the administering authority, monitoring must be undertaken to investigate any complaint arising from the activity: (a) in the manner requested by the administering authority; and (b) within a reasonable timeframe nominated by or agreed to by the administering authority.
A16	Scope of activity This environmental authority authorises the mining of no more than 11 million tonnes of run of mine (ROM) coal per annum.
A17	The maximum area of disturbance that must not be exceeded in carrying out the mining activity is depicted in Figure 1 – Blair Athol Mine authorised disturbance footprint .

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Schedule B: Air	
Condition number	Condition
B1	Dust and particulate matter monitoring The environmental authority holder must ensure that the dust and particulate matter emissions generated by the mining activities do not cause exceedances of the following levels when measured at any sensitive or commercial place: (a) Dust deposition 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 Methods for sampling and analysis of ambient air-Determination of particulate matter-Deposited matter - Gravimetric method. (b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24-hour averaging time, when monitored in accordance with the most recent version of either: (i) Australian Standard AS3580.9.6 Methods for sampling and analysis of ambient air- Determination of suspended particulate matter-PM10 high volume sampler with size selective inlet - Gravimetric method; or (ii) Australian Standard AS3580.9.9 Methods for sampling and analysis of ambient air- Determination of suspended particulate matter-PM10 low volume sampler-Gravimetric method. (c) A concentration of particulate matter suspended in the atmosphere of 90 micrograms per cubic metre over a 1 year averaging time, when monitored in accordance with the most recent version of AS/NZS3580.9.3:2003 Methods for sampling and analysis of ambient air- Determination of suspended particulate matter-Total suspended particulate matter (TSP)-High volume sampler gravimetric method.
B2	Odour nuisance The release of noxious or offensive odour or any other noxious or offensive airborne contaminants resulting from the mining activities must not cause an environmental nuisance at any sensitive or commercial place.
B3	When requested by the administering authority, odour monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring.
B4	If the administering authority determines that condition B2 is not being met, then the environmental authority holder must: (a) address the complaint including the use of appropriate dispute resolution if required; and (b) immediately implement odour abatement measures so that emissions of odour from the activity do not result in further environmental nuisance.

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Schedule C: Surface Water	
Condition number	Condition
C1	Contaminant release Contaminants that will or have the potential to cause environmental harm must not be released directly or indirectly to any waters as a result of authorised activities, except as permitted under the conditions of this environmental authority.
C2	Unless otherwise permitted under the conditions of this environmental authority, the release of mine affected water to waters must only occur from the release points specified in Table C1 (Mine affected release points, Sources and Receiving Waters) and depicted in Figure X attached to this environmental authority.

Table C1 (Mine affected release points, sources and receiving waters) (1)

Release Point (RP)	Latitude (GDA2020)	Longitude (GDA2020)	Mine affected water source and location	Monitoring Point	Receiving waters description
Note: (1) There is no current authorised release point for Blair Athol Mine on ML1804.					

C3	The release of mine affected water to internal water management infrastructure installed and operated in accordance with a water management plan that complies with condition C24 is permitted.
C4	The release of mine affected water to waters in accordance with condition C2 must not exceed the release limits stated in Table C2 (Mine affected release limits) when measured at the monitoring points specified in Table C1 (Mine affected release points, sources and receiving waters) for each quality characteristic.

Table C2 (Mine affected release limits)

Quality Characteristic	Release limits	Monitoring frequency
Electrical conductivity (microsiemens per centimetre)	1000	Daily during release (the first sample must be taken within 2 hours of commencement of release)
pH (pH Unit)	6.5 (minimum), 9.0 (maximum)	Daily during release (the first sample must be taken within 2 hours of commencement of release)
Turbidity (NTU)	Current limit or limit derived from suspended solids limit and demonstrated correlation between turbidity to suspended solids historical monitoring data for dam water. To be provided to the administering authority following approval of a release point.	Daily during release (first sample within 2 hours of commencement of release)
Suspended Solids (mg/L)	1000	Daily during release (first sample within 2 hours of commencement of release)

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Sulfate (mg/L)	500	Daily during release (first sample within 2 hours of commencement of release)
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C5	The release of mine affected water to waters from the release points must be monitored at the locations specified in Table C1 (Mine affected release points, sources and receiving waters) for each quality characteristic and at the frequency specified in Table C2 (Mine affected release limits) and Table C3 (Release contaminant trigger investigation levels) .
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Table C3 (Release contaminant trigger investigation levels)

Quality Characteristic (1), (2)	Trigger Levels (micrograms per litre)	Comment on 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 SMD guideline	

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Molybdenum	34	For aquatic ecosystem protection, based on low reliability guideline	
Selenium	10	For aquatic ecosystem protection, based on LOR for ICPMS	
Silver	1		
Uranium	1		
Vanadium	10		
Ammonia	900	For aquatic ecosystem protection, based on SMD guideline	
Nitrate	1100	For aquatic ecosystem protection, based on ambient Qld WQ Guidelines (2006) for TN	
Petroleum hydrocarbons (C6-C9)	20		
Petroleum hydrocarbons (C10-C36)	100		
Fluoride (total)	2000	Protection of livestock and short term irrigation guideline	
Sodium	Limit to be determined based on receiving water reference data and achievable best practice sedimentation control and treatment. To be provided to the administering authority following approval of a release point.		

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 characteristics required to be monitored as per **Table C3 (Release contaminant trigger investigation levels)** can be reviewed once the results of **two years** monitoring data is available, or if sufficient data is available to adequately demonstrate negligible environmental risk, and it may be determined that a reduced monitoring frequency is appropriate or that certain quality characteristics can be removed from **Table C3 (Release contaminant trigger investigation levels)** by amendment.
- (3) SMD - slightly moderately disturbed level of protection, guideline refers ANZECC and ARMCANZ (2000).
- (4) LOR - typical reporting for method stated. ICPMS/CV FIMS – analytical method required to achieve LOR.

C6	If quality characteristics of the release exceed any of the trigger levels specified in Table C3 (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 C3 and; (1) where the trigger values are not exceeded then no action is to be taken. (2) where the downstream results exceed the trigger values specified Table C3 (Release contaminant trigger investigation levels) for any quality characteristic, compare the results of the downstream site to the data from background monitoring sites; (a) if the result is less than the background monitoring site data, then no action is to be taken. (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 within 90 days of receiving the result, outlining (i) details of the investigations carried out; and (ii) actions taken to prevent environmental harm.
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	Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with C6(2)(b)(ii) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.
C7	If an exceedance in accordance with condition C6(2)(b) is identified, the holder of the authority must notify the administering authority within 24 hours of receiving the result.
C8	Mine affected water release events The holder must ensure a stream flow gauging station/s is installed, operated and maintained to determine and record stream flows at the locations and flow recording frequency specified in Table C3 (Release contaminant trigger investigation levels) .
C9	Notwithstanding any other condition of this environmental authority, the release of mine affected water to waters in accordance with condition C2 must only take place during periods of natural flow in accordance with the receiving water flow criteria for discharge specified in Table C4 (Mine affected water release during flow events) for the release point(s) specified in Table C1 (Mine affected release points, sources and receiving waters) .

Table C4 (Mine affected water release during flow events)

Receiving water description	Release Point	Gauging station description	Latitude (GDA94)	Longitude (GDA94)	Minimum Flow in Receiving Water Required for a Release Event	Flow recording Frequency
Bath Creek	TBA	Gauging station 1	-22° 32' 16.8"	147° 32' 16.8"	3.6 cubic metres per second	Continuous (minimum daily)

C10	The release of mine affected water to waters in accordance with condition C2 must not exceed the Maximum Release Rate for each receiving water flow criterion for discharges specified in Table C4 (Mine affected water release during flow events) when measured at the monitoring points specified in Table C1 (Mine affected release points, sources and receiving waters) .
C11	The daily quantity of mine affected water released from each release point must be measured and recorded at the monitoring points in Table C1 (Mine affected release points, sources and receiving waters) .
C12	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.
C13	Notification of release event The authority holder must notify the administering authority as soon as practicable (no later than 6 hours of having commenced releasing mine affected water to the receiving environment). Notification must include the submission of written verification to the administering authority of the following information (a) release commencement date/time (b) expected release cessation date/time (c) release point/s (d) release volume (estimated) (e) receiving water/s including the natural flow rate (f) any details (including available data) regarding likely impacts on the receiving water(s).

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	Note: Notification to the administering authority must be via an email to WaTERS.
C14	The authority holder must notify the administering authority as soon as practicable (nominally within 24 hours after cessation of a release) of the cessation of a release notified under condition C13 and within 28 days provide the following information in writing: (a) release cessation date/time (b) natural flow volume in receiving water (c) volume of water released (d) details regarding the compliance of the release with the conditions of Department Interest: Water of this environmental authority (i.e. contamination limits, natural flow, discharge volume) (e) all in-situ water quality monitoring results (f) any other matters pertinent to the water release event.
C15	Notification of release event exceedance If the release limits defined in Table C2 (Mine affected release limits) are exceeded, the holder of the environmental authority must notify the administering authority within 24 hours of receiving the results.
C16	The authority holder must, within 28 days of a release that exceeds the conditions of this authority, provide a report to the administering authority detailing: (a) the reason for the release (b) the location of the release (c) all water quality monitoring results (d) any general observations (e) all calculations (f) any other matters pertinent to the water release event.
C17	Receiving Environment Monitoring and Contaminant Trigger Levels The quality of the receiving waters must be monitored at the locations specified in Table C8 (Receiving water upstream background sites and downstream monitoring points) for each quality characteristic and at the monitoring frequency stated in Table C7 (Receiving waters contaminant trigger levels).

Table C7 (Receiving waters contaminant trigger levels)

Quality Characteristic	Trigger Level	Monitoring Frequency
pH	6.5 - 8.0	Daily during the release
Electrical Conductivity (microsiemens per centimetre)	1000	
Suspended solids (mg/L)	1000	
Sulfate (mg/L)	250	

Table C8 (Receiving water upstream background sites and downstream monitoring points)

Monitoring point	Receiving Waters Location	Latitude	Longitude	Monitoring frequency
Upstream Background Monitoring Points				

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Monitoring Point 1	Washpool Creek, 10,700m upstream of GS1	-22° 40' 02.3"	147° 31' 52.7"	Daily during release
Monitoring Point 2	Back Creek, 6,600m upstream of GS 1	-22° 41' 17.5"	147° 33' 16"	Daily during release
Monitoring Point 3	Breaker Creek	-22° 41' 10.1"	147° 30' 40.7"	Daily during release
Downstream Monitoring Points				
Monitoring Point 4	Breaker Creek Diversion	-22° 42' 53"	147° 31' 17"	Daily during release
Monitoring Point 5	Bath Creek East	-22° 43' 27"	147° 32' 53"	Daily during release
Monitoring Point 6	Bath Creek Down Stream	-22° 44' 59"	147° 32' 13"	Daily during release
Note: The data from background monitoring points must not be used where they are affected by releases from other mines.				

C18	If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in Table C7 (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. (2) where the downstream results exceed the upstream results, complete an investigation in accordance with the ANZECC and ARMCANZ 2000 methodology, 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. [Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with C18(2)(ii) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.]
C19	All determinations of water quality monitoring must be performed by an appropriately qualified person.
C20	Receiving Environment Monitoring Program (REMP) The environmental authority holder must 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 the Bath Creek and connected or surrounding waterways within 12 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.
C21	A report outlining the findings of the REMP, including all monitoring results and

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	interpretations must be prepared annually. This must include an assessment of background reference water quality, the condition of downstream water quality compared with water quality objectives, and the suitability of current discharge limits to protect downstream environment values.
C22	Water reuse Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder or a third party (with the consent of the third party).
C23	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 the contaminants 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 with the conditions of this environmental authority (g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.
C24	Water Management Plan A Water Management Plan developed by an appropriately qualified person must be implemented for all stages of the mining activity.
C25	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 storm water.
C26	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 C25. (b) Water management infrastructure that is installed and operated, in accordance with a Water Management Plan that complies with condition C24, for the purpose of ensuring water does not become mine-affected water.

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Schedule D: Acoustic	
Condition number	Condition
D1	Noise limits The holder of this environmental authority must ensure that noise generated by the mining activities does not cause an environmental nuisance at any sensitive place or commercial place.
D2	When requested by the administering authority, noise monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive place, and the results must be notified within 14 business days to the administering authority following completion of monitoring.
D3	If monitoring indicates exceedance of the noise limits in Table D1 - Noise limits, then the environmental authority holder must: (a) address the complaint including the use of appropriate dispute resolution if required; or (b) immediately implement noise abatement measures so that noise from the activity does not result in further environmental nuisance.
D4	If monitoring indicates that noise from the mining activity is causing an environmental nuisance, then the environmental authority holder must: (a) address the complaint including the use of appropriate dispute resolution if required (b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance.
D5	Airblast overpressure nuisance The holder of this environmental authority must ensure that blasting does not cause the limits for peak particle velocity and air blast overpressure in Table D2 - Blasting noise limits to be exceeded at any sensitive place or commercial place.
D6	Monitoring and reporting Noise monitoring and recording must include the following descriptor characteristics and matters: (a) LAN,T (where N equals the statistical levels of 1, 10 and 90 and T = 15 mins) (b) background noise LA90 (c) the level and frequency of occurrence of impulsive or tonal noise and any adjustment and (d) penalties to statistical levels (e) atmospheric conditions including temperature, relative humidity and wind speed and directions (f) effects due to any extraneous factors such as traffic noise (g) location, date and time of monitoring (h) if the complaint concerns low frequency noise, Max LpLIN,T and one third octave band measurements in dB(LIN) for centre frequencies in the 10 - 200 Hz range.

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Table D1 (Noise limits)						
Sensitive place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	9am to 6pm	6pm to 10pm	10pm to 9am
LAeq, adj, 15 mins	CV = 50 AV = 5	CV = 45 AV = 5	CV = 40 AV = 0	CV = 45 AV = 5	CV = 40 AV = 5	CV = 35 AV = 0
LA1, adj, 15mins	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5
Commercial place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	7am to 6pm	6pm to 10pm	10pm to 7am
LAeq, adj, 15 mins	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5
Notes: (1) CV = Critical Value (2) AV = Adjustment Value (3) To calculate noise limits in Table D1: a. If $bg \leq (CV - AV)$: b. Noise limit = $bg + AV$ c. If $(CV - AV) / -$ LESS THAN $- / bg \leq CV$: d. Noise limit = CV If $bg / -$ GREATER THAN $- / CV$: e. Noise limit = $bg + 0$ (4) In the event that measured bg (LA90, adj, 15 mins) is less than 30 dB(A), then 30 dB(A) can be substituted for the measured background level (5) bg = background noise level (LA90, adj, 15 mins) measured over 3-5 days at the nearest sensitive receptor (6) If the project is unable to meet the noise limits as calculated above alternative limits may be calculated using the processes outlined in the "Planning for Noise Control" guideline.						

Table D2 (Blasting noise limits)		
Blasting noise limits	Sensitive or commercial place	
	7am to 6pm	6pm to 7am
Airblast overpressure	115 dB (Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 120 dB (Linear) Peak at any time	No blasting
Ground vibration peak particle velocity	5mm/second peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time	No blasting

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Schedule E: Waste	
Condition number	Condition
E1	All general and regulated waste must only be removed and transported from site by a person who has the authority to transport such wastes to a facility that is lawfully able to accept the waste under the <i>Environmental Protection Act 1994</i> .
E2	Storage of tyres Tyres stored awaiting disposal or transport for take-back and, recycling, or waste to- energy options, should be stockpiled in volumes less than 3 metres in height and 200 square metres in area and at least 10 metres from any other tyre storage area.
E3	All reasonable and practicable fire prevention measures must be implemented, including removal of grass and other materials within a ten (10) metre radius of the scrap tyre storage area.
E4	Disposal of tyres and conveyor belts Disposing of scrap tyres and conveyor belts resulting from the mining activities in spoil emplacements is acceptable, provided they are placed as deep in the spoil as reasonably practicable.
E5	Scrap tyres resulting from the mining activities disposed within the operational land must not impede saturated aquifers or compromise the stability of the consolidated landform.
E6	The location of tyre burial sites must be recorded.
E7	Burning Waste Unless otherwise permitted by the conditions of this environmental authority or with prior approval from the administering authority and in accordance with a relevant standard operating procedure, waste must not be burnt.
E8	The holder of this environmental authority may burn vegetation in accordance with the plan of operations, provided the activity does not cause environmental harm at any sensitive or commercial place.
E9	Mine waste and rejects management Waste products generated on or after the 30 August 2017 from the washing of coal must be disposed of within mining voids and covered with spoil to a depth of at least 5m.
E10	A Waste Rock, Spoil and Rejects Disposal Plan must be implemented and include, where relevant, at least: (a) effective characterisation of the waste rock, spoil and rejects to predict under the proposed placement and disposal strategy the quality of runoff and seepage generated concerning potentially environmentally significant effects including salinity, acidity, alkalinity and dissolved metals, metalloids and non-metallic inorganic substances; (b) a program of progressive sampling and characterisation to identify dispersive and non-dispersive spoil and the salinity, acid and alkali producing potential and metal concentrations of waste rock, spoil and rejects; (c) a materials balance and disposal plan demonstrating how potentially acid forming and acid forming waste rock, spoil and rejects will be selectively placed and/or encapsulated to minimise the potential generation of acid mine drainage; (d) where relevant, a sampling program to verify encapsulation and/or placement of potentially acid- forming and acid-forming waste rock, spoil and rejects; (e) how often the performance of the plan will be assessed; (f) the indicators or other criteria on which the performance of the plan will be assessed;

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	(g) a rehabilitation strategy; and (h) monitoring or rehabilitation, research and/or trials to verify the requirements and methods for decommissioning and final rehabilitation of the placed materials, including the prevention and management of acid mine drainage, erosion minimisation and establishment of vegetation cover.
E11	The Waste Rock, Spoil and Rejects Disposal Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years .
E12	Tailings dewatering cells must be designed and constructed to ensure that any runoff or seepage is contained within the mine water management system.

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Schedule F: Land	
Condition number	Condition
F1	Cover Material The topsoil requirements for rehabilitation of the mine and the availability of suitable topsoil on site must be detailed in a Rehabilitation Management Plan .
F2	Where a surrogate material (growth media) is proposed to be used for rehabilitation either in combination with, or instead of, topsoil, it must be demonstrated as being suitable for rehabilitation at the completion of rehabilitation trials.
F3	A description of the rehabilitation trials and monitoring results must be included in the Rehabilitation Management Plan .
F4	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 F1 - Rehabilitation Requirements and as detailed in the Rehabilitation Management Plan described in condition F10 . The final landform design is depicted in Figure 2 .

Table F1 (Rehabilitation Requirements)					
Post Mining Land Use	Mine domain	Goal	Objective	Indicator	Acceptance criteria
Grazing	All areas disturbed by mining activities	Safe for humans and wildlife	Safety hazards in rehabilitation are not significantly different to surrounding unmined land subject to the same land use	Hazard assessment	No significant difference
		Stable	Rehabilitation is geotechnically stable Rehabilitation is erosionally stable	Factor of safety	≥1.5
				Erosion	No gully erosion
				Slope gradient	Rehabilitated landform: <15%
					Ramp 3: <30%
				Groundcover	>50%
		Non-polluting	Rainfall runoff from rehabilitation achieves water quality objectives for receiving waters	pH EC Turbidity	Not significantly different to upstream values

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			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 light grazing	Land suitability assessment for light grazing	Land suitability class ≤ 3 or not different from pre-mining class if ≥ 4 . <i>LSA Framework for Open-Cut Coal Mine Rehabilitation 2018 (A rule-set for land suitability assessment beef cattle grazing on land rehabilitated after open-cut coal mine in the Bowen Basin Queensland)</i> unless otherwise agreed in writing between the administering authority and the environmental authority holder.
Native ecosystem	Areas disturbed by mining activities that are located on State Forest Land	Safe for humans and wildlife	Construct landforms that do not pose unacceptable hazards to humans, stock and wildlife.	Safety hazards in rehabilitation are not significantly different to surrounding unmined land subject to the same land use	Hazard assessment
		Stable	Demonstrate geotechnical stability.	Factor of safety	≥ 1.5
				Erosion	No gully erosion

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			Not exhibiting excessive erosion	Slope gradient	Rehabilitated landform: <15%
				Groundcover	>50%
		Able to sustain vegetation	Rehabilitation landform (including land cover and water) is suitable for providing native ecosystem	Vegetation assessment	A vegetation assessment is completed by an APQ using a methodology as outlined in the Queensland Mine Rehabilitation Commissioner technical paper 'Evaluating methods for assessing native ecosystem mine rehabilitation success' (March 2023).
			Achieve self-sustaining systems that doesn't require additional maintenance except that of surrounding areas (e.g., weed and fire control via grazing/pastoral management etc.).		>70% total cover across rehabilitation area, includes multilevel canopy, groundcover, and leaf litter. At least four native tree or shrub species across the rehabilitation area. Evidence of recruitment of native tree species over a representative climatic period.
		Non-polluting	Rainfall runoff from rehabilitation achieves 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

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Non-use Management Area (NUMA)	Final void	Safe for humans and wildlife, stable and non-polluting	Construct landforms that do not pose unacceptable hazards to humans, stock and wildlife	Highwall Criteria	(a) Maximum slope of 30% when measured from highwall toe to crest. (b) Buttressing at a minimum offset of 30m at the toe section of the highwall. (c) Fencing and warning signage posted at 50m intervals above the final void (d) Must be safe, stable and non-polluting.
				Low Wall Criteria	(a) Maximum slope of 15% slope. (b) Must be safe, stable, non-polluting.
			Demonstrate geotechnical stability Not exhibiting excessive erosion	Erosion	No gully erosion
			Maintain regional surface and groundwater quality	Maximum predicted water level (mAHD)	284.1
				Void maximum surface area	(a) Maximum NUMA extent no greater than 291.6 ha projected surface area. (b) Must be safe, stable and non-polluting
			Provide flood immunity.	Flood immunity	Upgrades of Eastern and Western Diversion Drains (EDD and WDD) and levees must provide flood

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					immunity to NUMA up to PMF flood. There must be no ingress.
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F5	Successfully rehabilitated land must have no active gully erosion. Erosion must be assessed by annual documented inspections. Gully dimensions must be quantitatively assessed for a minimum of two years both containing a minimum of two rainfall events of more than 25 millimetres in less than three hours.
F6	Rehabilitation activities Progressive rehabilitation of land disturbed by resource activities must be rehabilitated in accordance with Table F1 – Rehabilitation Requirements and must commence within 2 years of when areas become available within the operational land.
F7	The environmental authority holder must provide written notification to the administering authority that details how the progressive rehabilitation has been completed with each annual return.
F8	Rehabilitation Management Plan A Rehabilitation Management Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years .
F9	At a minimum, the Rehabilitation Management Plan must include: (a) map existing areas of rehabilitation including classification of stage (i.e. time since establishment) and quality; (b) a strategy for progressive rehabilitation; (c) detail the design objectives for rehabilitation of each domain to achieve rehabilitation success criteria and the identified post mining land uses; (d) specify spoil characteristics, soil analysis, soil separation for use on rehabilitation; (e) specify the topsoil requirements for the site and provide details of how topsoil will be managed for use in rehabilitation; (f) detail any topsoil deficit and how any deficit will be managed for successful rehabilitation, including, if applicable, the proposal of surrogate growth media; (g) detail rehabilitation methods applied to areas; (h) detail landform design including end of mine design; (i) detail how landform design will be consistent with surrounding topography; (j) identify and detail planned native vegetation rehabilitation areas and corridors; (k) identify at least a minimum of three (3) reference sites for use in rehabilitation monitoring; (l) describe rehabilitation indicators and how these will be monitored; (m) describe management actions to address unsuccessful rehabilitation or redesign; and (n) describe end of mine landform design planning and post mining land uses across the mine; and include a triple bottom line assessment (or a comparative alternative assessment method) of the proposed final landform design criteria and alternatives.
F10	Exchange Sodium Percentage Coal washery wastes and spoil with exchangeable sodium percentage (ESP) >30 percent must be covered with a minimum of one metre of benign material (i.e. with ESP <15 percent) prior to rehabilitation commencing.

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F11	Closure Management Plan A Closure Management Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years.
F12	At a minimum, the Closure Management Plan must include: (a) final landform design demonstrating rehabilitation requirements; (b) a schedule of rehabilitation that is integrated with the mine plan and identifies how rehabilitation will be completed progressively throughout the life of the mine; (c) the operation, monitoring and maintenance details of the following: (i) spontaneous combustion; (ii) wastewater collection and reticulation systems; (iii) wastewater treatment systems; (iv) groundwater quality monitoring network; (v) surface water quality; (vi) groundwater quality; (vii) seepage rates; (viii) erosion rates; (ix) integrity and stability of slopes, ramps and voids; and (x) the health and resilience of vegetation cover. (d) schematic representations of the proposed final landform including, landform type, slope, regional ecosystems, drainage designs and any post mining land or infrastructure use agreed with the landowner/holder and the administering authority; (e) details of the progressive rehabilitation program designed to demonstrate the trajectory of rehabilitated areas towards rehabilitation requirements; and (f) detail outlining potential residual risk with proposed strategies to reduce or manage these risks.
F13	Residual void outcome Residual voids must not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself and subject to any other condition within this environmental authority.
F14	Residual void design Residual voids must comply with the design criteria specified in Table F1 – Rehabilitation Requirements and as detailed in the Residual Void Management Plan described in condition F16.
F15	Residual Void Management Plan A Residual Void Management Plan developed by an appropriately qualified person must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years.
F16	At a minimum, the Residual Void Management Plan must include: (a) options available for minimising final void area and volume; (b) design objectives for rehabilitation of final voids; (c) void hydrology, addressing the long-term water balance in the voids, connections to groundwater resources and water quality parameters in the long term; (d) pit wall stability, considering the effects of long-term erosion and weathering of the pit wall and the effects of significant hydrological events; (e) options available for minimising risk of flood interaction for all flood events up to and including the Probable Maximum Flood level; (f) void capability to support native flora and fauna; and

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	(g) void rehabilitation success criteria and final void areas and volumes to meet the outcomes defined in the Rehabilitation Management Plan described in condition F9 .
F17	Acid rock drainage and leachate management Subject to the release limits defined in Table C2 - Mine affected release limits , all reasonable and practicable measures must be implemented to prevent hazardous leachate being directly or indirectly released or likely to be released as a result of the activity to any groundwater or watercourse.

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Schedule G: Regulated 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 Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) at the following times: (a) prior to the design and construction of the structure, if it is not an existing structure; or (b) prior to any change in its purpose or the nature of its stored contents.
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 Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).
G4	Design and construction of a regulated structure Conditions G5 to G9 inclusive do not apply to existing structures.
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 Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).
G6	Construction of a regulated structure is prohibited unless: (a) the holder has submitted a consequence category assessment report and certification to the administering authority; and (b) certification for the design, design plan and the associated operating procedures has been certified by a suitably qualified and experienced person in compliance with the relevant condition of this 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 Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) and must be recorded in the Register of Regulated Structures.
G8	Regulated structures must: (a) be designed and constructed in compliance with the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933); (b) be designed and constructed with due consideration given to ensuring that the design integrity would not be compromised on account of: (i) floodwaters from entering 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; and (c) 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:

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	(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	Notification of affected persons All affected persons must be provided with a copy of the emergency action plan in place for each regulated structure: (a) for existing structures that are regulated structures, within 10 business days of this condition taking effect; (b) prior to the operation of the new regulated structure; and (c) if the emergency action plan is amended, within 5 business days of it being amended.
G11	Operation of a regulated structure Operation of a regulated structure, except for an existing structure, is prohibited unless the holder has submitted to the administering authority in respect of regulated structure, all of the following: (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 the '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 authority relating to the construction of the regulated structure have been met; (f) the holder has entered the details required under this authority, into a Register of Regulated Structures; and (g) there is a current operational plan for the regulated structure.
G12	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 holder must submit to the administering authority within 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.
G13	Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in compliance with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.
G14	Mandatory reporting level Conditions G15 to G16 inclusive only apply to Regulated Structures which have not been certified as low consequence category for 'failure to contain - overtopping'.
G15	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.
G16	The holder must, as soon as practicable but within 48 hours of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.
G17	The holder must, immediately on becoming aware that the MRL has been reached, act to prevent the occurrence of any unauthorised discharge from the regulated dam.
G18	The holder must record any changes to the MRL in the Register of Regulated Structures.

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G19	The holder must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to 1 July of each year.
G20	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).
G21	The holder must, as soon as practicable but within 48 hours of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, notify the administering authority.
G22	The holder must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.
G23	Annual inspection report Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.
G24	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 a recommendations section, with any recommended actions to ensure the integrity of the regulated structure or a positive statement that no recommendations are required.
G25	The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).
G26	The holder must within 20 business days of receipt of the annual inspection report, provide to the administering authority: (a) The recommendations section of the annual inspection report; (b) If applicable, any actions being taken in response to those recommendations; and (c) If, following receipt of the recommendations and (if applicable) recommended actions, the administering authority requests a copy of the annual inspection report from the holder, provide this to the administering authority within 10 business days of receipt of the request.
G27	Transfer arrangements The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.
G28	Register of Regulated Structures A Register of Regulated Structures must be established and maintained by the holder for each regulated structure.
G29	The holder must provisionally enter the required information in the Register of Regulated Structures when a design plan for a regulated dam is submitted to the administering authority.
G30	The holder must make a final entry of the required information in the Register of Regulated Structures once compliance with conditions G11 and G12 has been achieved.
G31	The holder must ensure that the information contained in the Register of Regulated Structures is current and complete on any given day.
G32	All entries in the Register of Regulated Structures must be approved by the chief executive officer for the holder of this authority, or their delegate, as being accurate and correct.

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G33	The 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.
G34	Transitional arrangements All existing structures that have not been assessed in accordance with either the Manual or the former Manual for Assessing Hazard Categories and Hydraulic Performance of Dams must be assessed and certified in accordance with the Manual within 6 months of amendment of the authority adopting this schedule.
G35	All existing structures must subsequently comply with the timetable for any further assessments in accordance with the Manual specified in Table G1 (Transitional hydraulic performance requirements for existing structures) , depending on the consequence category for each existing structure assessed in the most recent previous certification for that structure.
G36	Table G1 (Transitional hydraulic performance 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.
G37	Certification of the transitional assessment required by G34 and G35 (as applicable) must be provided to the administering authority within 6 months of amendment of the authority adopting this schedule.

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Table G1 (Transitional hydraulic performance requirements for existing structures)

Transition period for existing structures to achieve the requirements of the Manual for Assessing Consequence Categories and Hydraulic Performance of Dams

Compliance with criteria	High consequence	Significant consequence	Low consequence
>90 percent 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 percent - ≤90 percent	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-≤70 percent	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 percent	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.
Regulated levee designed to prevent the ingress of clean flood water <100 percent compliant	Within 5 years unless otherwise agreed with the administering authority		

Note: Levees designed for the diversion of contaminated waters or protection of the structural integrity of a dam is not to be considered as part of this provision. These levees are considered a key design element of the relevant dam and transitional periods should as such align to that relevant compliance criteria and consequence category.

Schedule H: Sewage treatment	
Condition number	Condition
H1	All effluent released from the sewage treatment plant must be evaporated in an impervious pond.
H2	Dried sewage sludge must be buried within spoil emplacements, records of the disposal volumes and locations must be kept.
H3	The Sewage Treatment Management Plan must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years .

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Schedule I: Groundwater	
Condition number	Condition
I1	The holder of this environmental authority must not release contaminants to groundwater.
I2	A groundwater monitoring program to monitor water quality and standing water level in any aquifers likely to be impacted by mining activities must be implemented for all mining activities and reviewed and updated by 30 June every two (2) years .
I3	Groundwater monitoring Groundwater must be monitored: (a) at the locations and frequencies identified in Table I1 (Groundwater monitoring locations and frequency); and (b) for the quality characteristics specified in Table I2 (Groundwater quality trigger thresholds) and (c) for the standing water levels stated in Table I3 (Groundwater standing water level trigger thresholds).
I4	All groundwater sampling and monitoring methods must be in accordance with the latest version of the administering authority's ' <i>Monitoring and Sampling Manual 2018: Environmental Protection (Water) Policy 2009</i> ' unless otherwise approved by the administering authority.
I5	Groundwater quality Results of monitoring of groundwater quality from compliance bores identified in Table I1 (Groundwater monitoring locations and frequency) must not exceed any of the limits defined in Table I2 (Groundwater quality trigger thresholds) on more than three (3) consecutive monitoring occasions.
I9	Bore construction, maintenance and decommissioning The construction, maintenance and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimizes impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring.
I10	Transitional arrangements By 30 June 2026, the environmental authority holder must: (a) prepare a hydrogeological numerical groundwater model in accordance with the most recent version of the '<i>Australian Groundwater Modelling Guidelines</i>' (2012); and (b) submit a report to the administering authority proposing groundwater level trigger thresholds, derived from the results of the groundwater model, to populate Table I3 (Groundwater standing water level trigger thresholds).

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Table I1 (Groundwater monitoring locations and frequency)

Table I1 (Groundwater monitoring locations and frequency)					
Monitoring point	Location (GDA2020)		Hydrogeological Unit	Surface RL (mAHD)	Monitoring frequency
	Latitude	Longitude			
Reference bore-					
GW04B	-22.69090	147.55675	Permian conglomerate	314	Quarterly
Compliance bores					
BA Station (Mayes Bore)	-22.67855	147.55946	Tertiary Basalt	324	Quarterly
Curtis Windmill	-22.66615	147.56694	Tertiary Basalt	325	Quarterly
Notes:					
[1] Monitoring is not required where a bore has been removed as a direct result of the mining activity.					
[2] RL must be measured to the nearest 5cm from the top of the bore casing.					
[3] Reference sites must:					
(a) have a similar flow regime					
(b) be from the same bio-geographic and climatic region					
(c) have similar geology, soil types and topography					
(d) not be so close to the test sites that any disturbance at the test site also results in a change at the reference site.					

Table I2 (Groundwater quality trigger thresholds)

Parameter	Units	Trigger value		Trigger type
		Curtis Windmill	BA Station	
EC	µS/cm	883	631	Bore specific
pH	pH units	6.5-8.5	6.5-8.5	WQO*
Sulfate	mg/L	19	24	Bore specific
Metals (dissolved)				
Aluminium	mg/L	0.055	0.055	ANZG
Arsenic	mg/L	0.013	0.027	ANZG and bore specific
Boron	mg/L	0.94	0.94	ANZG
Cadmium	mg/L	0.0002	0.0002	ANZG
Chromium	mg/L	0.001	0.001	ANZG
Copper	mg/L	0.005	0.004	Bore specific

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Lead	mg/L	0.0034	0.0034	ANZG
Manganese	mg/L	1.9	1.9	ANZG
Mercury	mg/L	0.00006	0.00006	ANZG
Molybdenum	mg/L	0.034	0.034	ANZG
Nickel	mg/L	0.012	0.011	Bore specific and ANZG
Silver	mg/L	0.0005	0.0005	ANZG
Vanadium	mg/L	0.006	0.006	ANZG
Zinc	mg/L	0.021	0.009	Bore specific
Iron	mg/L	<i>Iron is monitored for interpretation purposes</i>		
Major ions	mg/L	<i>Calcium, Magnesium, Potassium, Sodium, Chloride, Bicarbonate and Carbonate are monitored for interpretation purposes</i>		

Table I3 (Groundwater standing water level trigger thresholds)

Monitoring location	Hydrogeological Unit	Baseline water level (mAHD)	Standing water level trigger threshold (mAHD)
BA Station (Mayes Bore)	Tertiary Basalt	TBD	TBD
Curtis Windmill	Tertiary Basalt	TBD	TBD
GW04B	Permian Conglomerate	TBD	TBD

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Definitions

Key terms and/or phrases used in this document are defined in this section. 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.

“20th percentile flow” means the 20th percentile of all daily flow measurements (or estimations) of daily flow over a 10 year period for a particular site. The 20th percentile calculation should only include days where flow has been measured (or estimated), i.e. not dry weather days.

“acid mine drainage” means drainage that is characterised by low pH, elevated metal concentrations, high sulfate concentrations and high salinity.

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

“administering authority” means the Department of Environment and Heritage Protection or its successor.

“affected person” is someone whose drinking water can potentially be impacted as a result of discharges from a dam or their life or property can be put at risk due to dwellings or workplaces being in the path of a dam break flood.

“airblast overpressure” means energy transmitted from the blast site

within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave, above ambient pressure is the peak airblast overpressure measured in decibels linear (dBL).

“ambient (or total) noise” at a place, means the level of noise at the place from all sources (near and far), measured as the Leq for an appropriate time interval.

“annual exceedance probability or AEP” 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;

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- (e) for conformance with the 'as constructed' drawings;
- (f) for the adequacy of the available storage in each regulated dam, based on an actual observation or observations taken after 31 May each year but prior to 1 November of that year, of accumulated sediment, state of the containment barrier and the level of liquids in the dam (or network of linked containment systems);
- (g) for evidence of conformance with the current operational plan.

"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;
- (b) and any land used for those operations.

"authority" means an environmental authority or a development approval.

"background" with reference to the water schedule means the average of samples taken prior to the commencement of mining from the same waterway that the current sample has been taken.

"blasting" means the use of explosive materials to fracture:

- (a) rock, coal and other minerals for later recovery or
- (b) structural components or other items to facilitate removal from a site or for reuse.

"certified" with respect to watercourse diversions, means assessed and approved by a suitably qualified and experienced person. In relation to 'as constructed' drawings and specifications, the certification must be by the suitably qualified person who supervised the construction of the watercourse diversion, or re-establishment of the watercourse.

"certification" means assessment and approval must be undertaken by a suitably qualified and experienced person in relation to any assessment or documentation required by this Manual, 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'.

"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

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- (b) a dangerous good under the Australian Code for the Transport of Dangerous Goods by Road and Rail approved by the Australian Transport Council, or
- (c) a lead hazardous substance within the meaning of the Workplace Health and Safety Regulation 1997, 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) 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
 - (v) a substance used for, or intended for use for mineral processing or treatment of metal, pulp and paper, textile, timber, water or wastewater, or
 - (vi) manufacture of plastic or synthetic rubber.

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

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

“compliance bore” refers to a groundwater monitoring bore which is the subject of compliance requirements for groundwater quality and/or level.

“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.

“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 (ESR/2016/1933).

“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 (ESR/2016/1933) 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.

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“designer” for the purposes of a regulated dam, means the certifier of the design plan for the regulated dam.

“development approval” means a development approval under the Planning Act 2016 (or under the repealed Sustainable Planning Act 2009 or Integrated Planning Act 1997) in relation to a matter that involves an environmentally relevant activity under the Environmental Protection Act 1994.

“disturbance” of land includes:

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

“EC” means electrical conductivity.

“effluent” means treated waste water released from sewage treatment plants.

“environmental offset” has the meaning in section 7 of the Environmental Offsets Act 2014.

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

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

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

“equilibrium” means a state where ‘balance’ is achieved despite changing variables.

“existing structure” means a structure that prior to 30 August 2017 meets any or both of the following, a structure:

- (a) with a design that is in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1934, Version 8.0, 05 JUL 2017) and that is considerably in progress;

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(b) that is under considerable construction or that is constructed.

“extreme storm storage” - means a storm storage allowance determined in accordance with the criteria in the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published by the administering authority.

“flare pit” means containment area where any hydrocarbon that is discovered in an over-pressured reservoir during a drilling operation is diverted to, and combusted. The flare pit is only used during the drilling and work over process on a petroleum well.

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

“foreseeable future” is the period used for assessing the total risk of an event occurring. Permanent structures and ecological sustainability should be expected to still exist at the end of a 150 year foreseeable future with an acceptable risk of failure before that time.

“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 containing hazardous waste, waste rock dumps, voids, or ore stockpiles and buildings as well as other structures whose ownership can be transferred and which have a residual beneficial use for the next owner of the operational land or the background land owner.

“hazard category” means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in *Manual for Assessment Hazard Categories and Hydraulic Performance of Dams*.

“hazardous waste” means any substance, whether liquid, solid or gaseous, derived by or resulting from, the processing of minerals that tends to destroy life or impair or endanger health.

“holder” means:

- (a) where this document is an environmental authority, any
- (b) person who is the holder of, or is acting under, that
- (c) environmental authority; or
- (d) where this document is a development approval, any person who is the registered operator for that development approval.

“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 (ESR/2016/1933).

“hydrogeological unit” is any soil or rock unit or zone that by virtue of its hydraulic properties has a distinct influence on the storage or movement of groundwater.

“infrastructure” means water storage dams, levees, roads and tracks, buildings and other structures built for the purpose of the mining activity.

“interpretation bore” means a monitoring bore located outside of any potential influence or impact by the mining activity, that is used for comparative and interpretative purposes and represents natural background quality and levels similar to the hydrogeological units of the compliance bores.

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

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

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

“land” in the ‘land schedule’ of this document means land excluding waters and the atmosphere, that is, the term has a different meaning from the term as defined in the Environmental Protection Act 1994. For the purposes of the Acts Interpretation Act 1954, it is expressly noted that the term ‘land’ in this environmental authority relates to physical land and not to interests in land.

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

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

“land use” term to describe the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

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

“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 (ESR/2016/1933).

“mandatory reporting level or MRL” means a warning and reporting level determined in accordance with the criteria in the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published by the administering authority.

“manual” means the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published by the administering authority, as amended from time to time.

“mandatory reporting level” means the volume below the spillway crest, equivalent to the lower of the AEP, 72 hour storm or the AEP wave allowance (AEP is the annual exceedance probability).

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

“mine affected water”:

- (a) means the following types of water:
 - (i) pit water, tailings dam water, processing plant water
 - (ii) water contaminated by a mining activity which would have been an environmentally relevant activity under Schedule 2 of the Environmental Protection Regulation 2008 if it had not formed part of the mining activity
 - (iii) rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion

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and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage such runoff, provided that this water has not been mixed with pit water, tailings dam water, processing plant water or workshop water

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

(v) groundwater from the mine's dewatering activities

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

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

(i) land that has been rehabilitated to a stable landform and either capped or revegetated in accordance with

the acceptance criteria set out in the environmental authority but only still awaiting maintenance and monitoring of the rehabilitation over a specified period of time to demonstrate rehabilitation success, or

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

a. areas that are been capped and have monitoring data demonstrating hazardous material adequately contained with the site

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

(iii) both.

"minimise" is to reduce to the smallest possible amount or degree.

"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) pea;

(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

(k) rock mined in block or slab form for building or monumental purposes

(l) but does not include-

(m) living matter

(n) petroleum within the meaning of the Petroleum Act 1923

(o) 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 and

(p) water.

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“modification or modifying” (see definition of ‘construction’)

“monitoring bore” means a groundwater bore that provides access to groundwater for measuring its quality and level; and allows groundwater samples to be withdrawn for laboratory analysis.

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

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

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

“noxious” means harmful or injurious to health or physical wellbeing, other than trivial harm.

“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);
- (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.

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

“permanent watercourse diversion” is as defined in Definitions, within the [Guideline: Works that interfere with water in a watercourse for a resource activity— watercourse diversions authorised under the Water Act 2000](#) or subsequent versions

“pre-existing watercourse” is the section of watercourse from which the flow of water will be diverted as a result of the construction and operation of a watercourse diversion.

“protected area” means - a protected area under the Nature Conservation Act 1992 or:

- (a) a marine park under the Marine Parks Act 2004 or
- (b) a World Heritage Area

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

“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 structure, 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 (ESR/2016/1933);
- (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;

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

“regulated structure” means any structure in the significant or high consequence category as assessed using the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) published by the administering authority. A regulated structure does not include:

- a fabricated or manufactured tank or container, designed and constructed to an Australian Standard that deals with strength and structural integrity of that tank or container;
- a sump or earthen pit used to store residual drilling material and drilling fluid only for the duration of drilling and well completion activities;
- a flare pit.

“rehabilitation” 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.

“revegetation” is the re-establishment of vegetation¹ of a species and density of cover similar to surrounding undisturbed areas or the landform that existed before mining activities on soil surfaces associated with the construction or rehabilitation of a watercourse diversion.

“RL” means reduced level, relative to mean sea level as distinct from depths to water.

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

“residual drilling material” means waste drilling materials including muds and cuttings or cement returns from well holes and which have been left behind after the drilling fluids are pumped out.

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

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

“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) a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises or
- (b) a motel, hotel or hostel or
- (c) an educational institution or
- (d) a medical centre or hospital or
- (e) a protected area under the Nature Conservation Act 1992, the Marine Parks Act 1992 or a World Heritage Area or
- (f) a public park or gardens.

Note: The definition of ‘sensitive place’ and ‘commercial place’ is based on Schedule 1 of EPP Noise. That is, a sensitive place is inside or outside on a dwelling, library and educational institution, childcare or kindergarten, school or playground, hospital, surgery or other medical institution, commercial and retail activity, protected area or an area identified under a conservation plan under Nature Conservation Act 1992 as a critical habitat or an area of major interest, marine park under Marine Parks Act 2004, park or garden that is outside of the mining lease and open to the public for the use other than for sport or organised entertainment. A commercial place is inside or outside a commercial or retail activity.

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) is not a sensitive place for that mine or= mining project, 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 holders of the environmental authority for the mining project, or a related company. Accommodation for mine employees or contractors is a sensitive place if the land is held by a mining company or related company, and if occupation is restricted to the employees, contractors and their families for the particular mine or mines which are held by the same company or a related company.

For example, a township (occupied by the mine employees, contractors and their families for multiple mines that are held by different companies) would be a sensitive place, even if part or all of the township is constructed on land owned by one or more of the companies.

“significant disturbance” - includes land

- (a) if it is contaminated land or
- (b) it has been disturbed and human intervention is needed to rehabilitate it to a state required under the relevant environmental authority or
- (c) if the environmental authority does not require the land to be rehabilitated to a particular state - to its state immediately before the disturbance.

Some examples of disturbed land include:

- areas where soil has been compacted, removed, covered, exposed or stockpiled
- areas where vegetation has been removed or destroyed to an extent where the land has been made susceptible to erosion; (vegetation and topsoil)

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- areas where land use suitability or capability has been diminished
- areas within a watercourse, waterway, wetland or lake where mining activities occur
- areas submerged by tailings or hazardous contaminant storage and dam walls in all cases
- areas under temporary infrastructure. Temporary infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be removed after mining activities have ceased or
- areas where land has been contaminated and a suitability statement has not been issued

However, the following areas are not included:

- areas off lease (e.g. roads or tracks which provide access to the mining lease)
- areas previously significantly disturbed which have achieved the rehabilitation outcomes
- by agreement with the Department of Environment and Resource Management, areas previously significantly disturbed which have not achieved the rehabilitation objective(s) due to circumstances beyond the control of the mine operator (such as climatic conditions)
- areas under permanent infrastructure. Permanent infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be left by agreement with the landowner. The agreement to leave permanent infrastructure must be recorded in the Landowner Agreement and lodged with the Department of Environment and Resource Management
- disturbances that pre-existed the grant of the tenure unless those areas are disturbed during the term of the tenure.

“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” means geotechnical stability of the rehabilitated landform where instability related to the excessive settlement and subsidence caused by consolidation / settlement of the wastes deposited, and sliding / slumping instability has ceased.

“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:

- for regulated dams, an RPEQ who is a civil engineer with the required qualifications in dam safety and dam design
- 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.

“temporary watercourse diversion” s as defined in Definitions, within the [Guideline: Works that interfere with water in a watercourse for a resource activity— watercourse diversions authorised under the Water Act 2000](#) or subsequent versions.

“the Act” means the *Environmental Protection Act 1994*.

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“tolerable limits” means that a range of values could be accepted to achieve an overall environmental management objective (e.g. a range of settlement of a tailing capping could still meet the objective of draining the cap quickly, preventing pondage and limiting infiltration and percolation).

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

“void” means any constructed, open excavation in the ground.

“watercourse” has the same meaning given in the Water Act 2000.

“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, nontidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater.

“water year” means the 12-month period from 1 July to 30 June.

“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.

Figure 1 – Blair Athol Mine authorised disturbance footprint

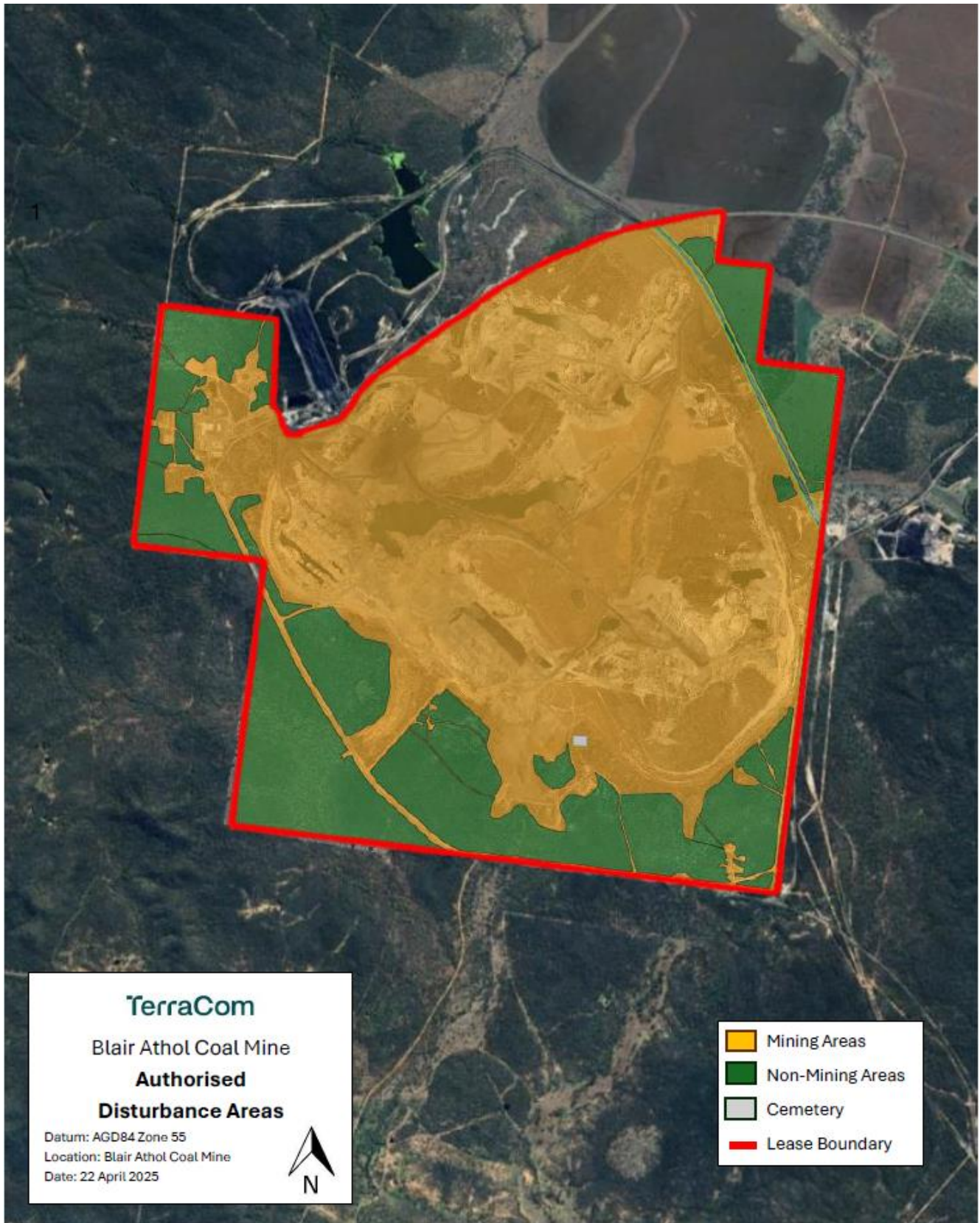
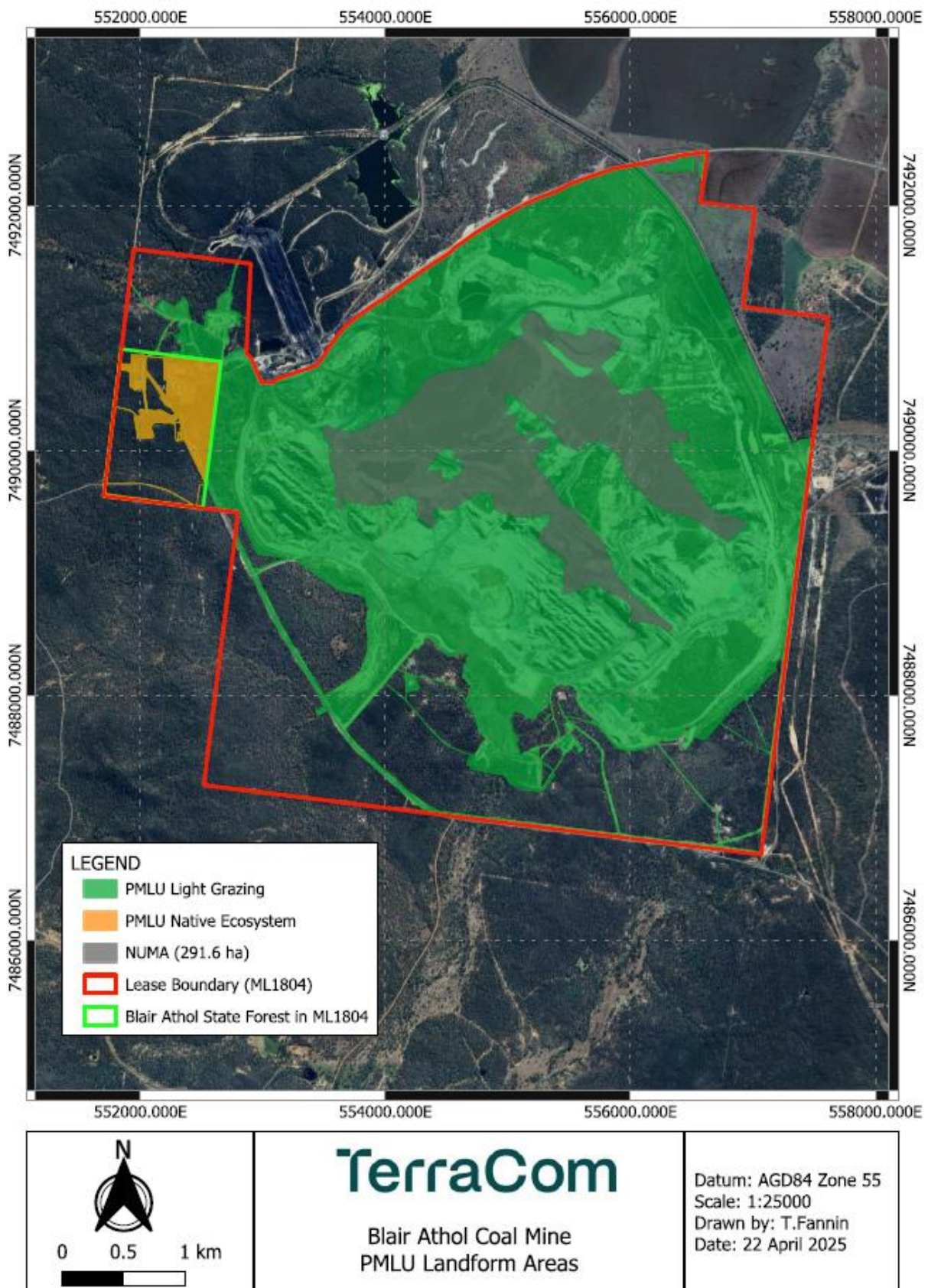


Figure 2 – Blair Athol Mine PMLU Landform Areas



END OF ENVIRONMENTAL AUTHORITY

Blair Athol Coal Mine – Environmental Management System

TerraCom

APPENDIX C – JBT 2012 GROUNDWATER INVESTIGATION



RIO TINTO COAL AUSTRALIA

BLAIR ATHOL MINE

**BLAIR ATHOL MINE CLOSURE
GROUNDWATER INVESTIGATION**



December 2012

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Appendix C	Comparison of Site Water Quality to Australian Guidelines

1.0 INTRODUCTION

Rio Tinto Coal Australia (RTCA) operates the Blair Athol Mine (BA), which is located in central Queensland, approximately 20 km north-west of the town of Clermont (Figure 1-1).

RTCA are planning for closure of BA and are currently undertaking a number of mine closure studies. RTCA have commissioned JBT Consulting (JBT) to undertake groundwater studies to support the closure of BA.

The scope of work for undertaking the assessment is outlined in Section 2.

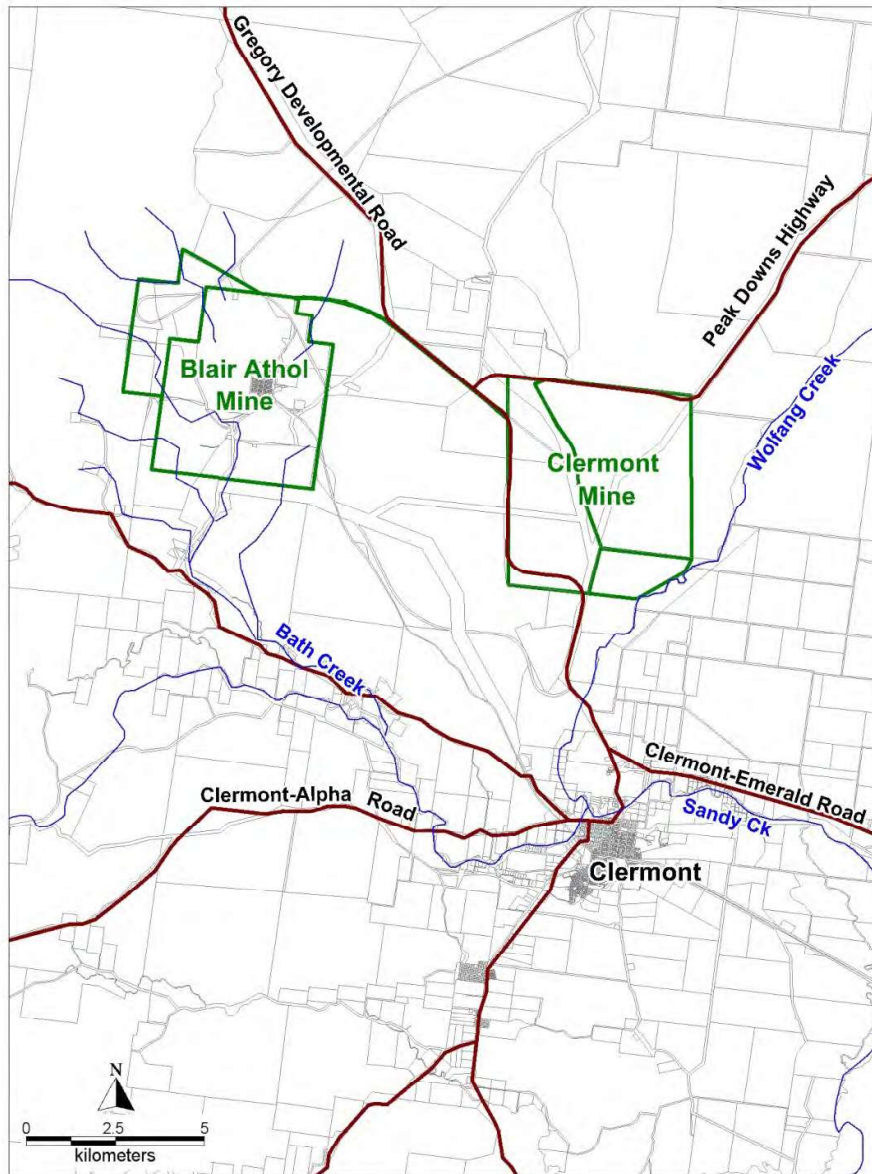


Figure 1-14-4: Site Location

2.0 SCOPE OF WORK

The scope of work for this groundwater study includes:

- Review groundwater data for the BA site, including previous reports, groundwater level data, surface water and groundwater quality data;
- Prepare an updated conceptual groundwater model for the site;
- Undertake a gap analysis with respect to the suitability of existing groundwater monitoring installations and monitoring/ sampling program for mine closure and post-closure;
- Make recommendations as appropriate for mine closure and post-closure groundwater monitoring/sampling, or other investigations if required; and,
- Prepare a report providing:
 - Detail of data available and reviewed for the study;
 - Presentation and discussion of groundwater level data
 - Presentation and discussion of water quality data from surface water and groundwater sources
 - An updated conceptual groundwater model for the site (pre-mining, during mining, and post-closure)
 - Data gap analysis; and,
 - Conclusions and Recommendations

3.0 HISTORY OF MINING

The Blair Athol Mine has been operating at large scale since 1984; prior to 1984 there was a history of small scale open cut and underground mining operations dating back to the 1890's.

There are four mining and rehabilitation areas at site, which are shown on Figure 3-1 and include:

- Ramp 1 (comprising Ramp 1 South Lower and Ramp 1 South East);
- Ramp 3 (comprising Ramp 3 North and Ramp 3 South);
- Ramp 4 (comprising Ramp 4 West and Ramp 4 East); and,
- Ramp 5 (comprising Ramp 5 North).

Since 1984 mining has focussed on Seam 3, which is up to 30 m thick, and the thinner (up to 5 m thick) Seam 4.

Mining has occurred at a typical production rate of 9-10 Mta (million tonnes per annum), with a maximum capacity of 12 Mta, and a recent production rate (for mining of Seam 4 reserves in the Ramp 1 area) of approximately 3.5 Mta.

Mining has been undertaken on site using the strip mining method, utilising a dragline for overburden removal, and truck and shovel operations for mining of coal and interburden. Mining areas have been progressively backfilled with spoil material (overburden and interburden material) leaving a final void at each mined-out area.

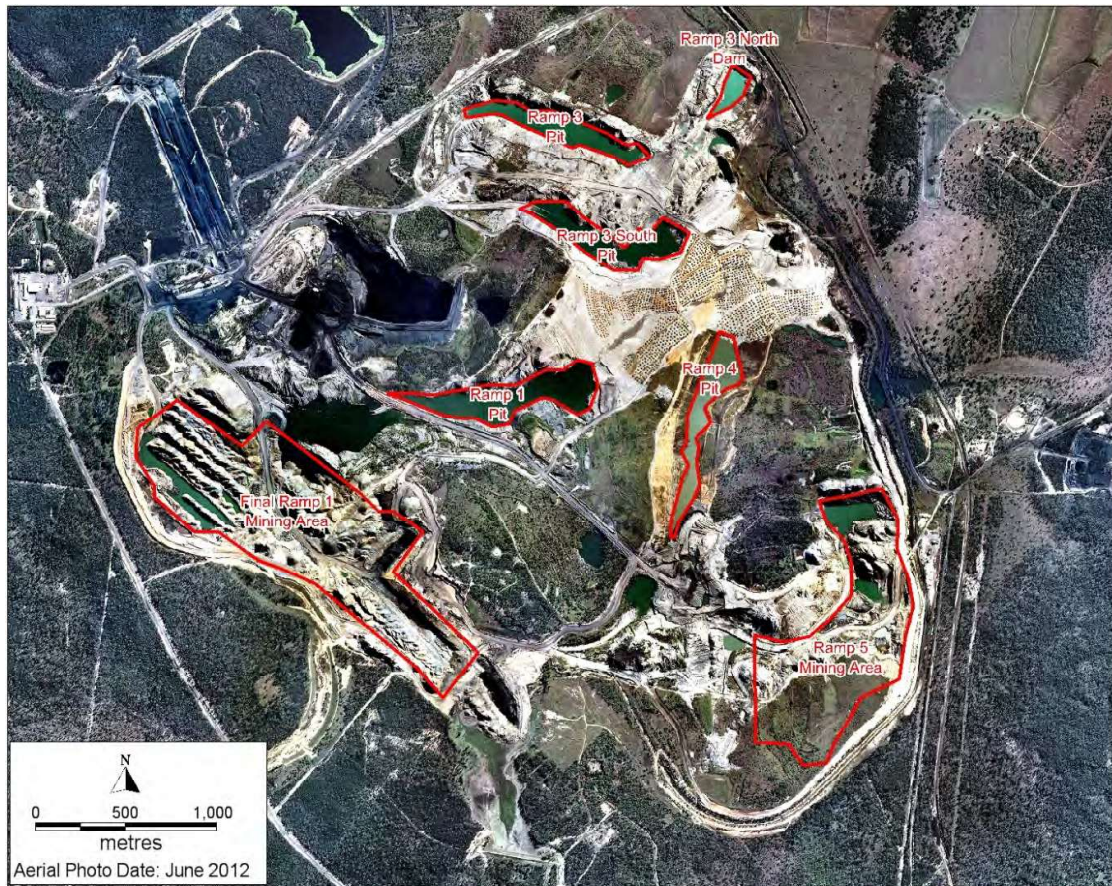


Figure 3-13-4: Blair Athol Mining Areas

4.0 AVAILABLE DATA

4.1 Existing Reports

Reports made available for review include:

- [BMT-WBM \(2012\) BAC Final Landform Water Study. Report to Rio Tinto by BMT WBM, November 2012](#)

Summary: The report presents a summary of water modelling of the pit lake within the final landform, and contains predictions of pit lake water level and salinity for two options: one where existing diversions around the operation are maintained, and another where the existing diversions are removed.

- Matrix+ (2007) *Groundwater Monitoring Bore Installation*. Report to Rio Tinto Coal Australia Blair Athol Coal Mine by Matrix + Consulting, July 2007.

Summary: The report contains a brief overview of regional and site hydrogeology, followed by a description of the drilling and installation of a number of groundwater monitoring bores and geotechnical monitoring bores (GW-series and GT-series bores). Information in the report includes bore locations, construction information (summary table and bore construction logs), and recommendations that:

- Monthly water level monitoring be undertaken at each groundwater and geotechnical bore; and,

- Quarterly water quality sampling be undertaken from each groundwater and geotechnical bore.
- RTCA (2011) *The Coal Resources and Coal Reserves of the Blair Athol Mine – 2010*. Report prepared to support 2010 year end statements by Rio Tinto Coal Australia (RTCA), February 2011.

Summary: The report provides detail of:

- Regional geology (structure and stratigraphy);
 - Local geology (structure, stratigraphy, description of coal seams, location of alluvium, influence of igneous activity at site (basalt flows and intrusive dykes);
 - Coal exploration status;
 - Current status of the geological database, geological model, and coal quality model;
 - Geotechnical characteristics of the site;
 - The status of coal resources;
 - Overview of the mining method, mining equipment, coal handling and processing, and site infrastructure;
 - Mine design (layout and constraints); and,
 - Economic information, including economic ranking, reserves statement, and stakeholder signoff.
- Terranus (2009) *Groundwater Review – Blair Athol Coal Mine*. Report to Blair Athol Coal Mine by Terranus Earth Sciences, May 2009.

Summary: The report was prepared to provide a summary of the understanding of groundwater conditions at site, in response to the findings of an internal RTCA environmental audit that the current understanding of groundwater conditions could be improved upon. The report includes:

- A summary of available reports and data;
- Description of the geological environment
- Description of the groundwater environment
- Summary of groundwater bores at site
- Review of data integrity (bore construction standards and monitoring data)
- Review of groundwater chemistry data
- Presentation of a conceptual hydrogeological model for the site;
- Data gap analysis, including statements as to the adequacy of:
 - Data coverage (bore distribution)
 - Data capture (water level and water quality data)
 - Data quality
 - Data assessment
- Review of available site data in comparison to Rio Tinto environmental standards; and,
- Recommended corrective actions, with recommendations that:
 - Water quality samples be collected from water bores every 4 months, but preferably quarterly;

- Water quality and water level data be collected from key storage dams on site;
 - EDMS (site environmental database) be updated to improve water quality reporting (this recommendation was mainly related to recording of sample QA/QC documentation);
 - Two new monitoring bores be installed, with one adjacent to the wash plant and one to the north of the TSF; and,
 - A detailed groundwater assessment be undertaken, including generation of hydrogeological cross sections through the site.
- Water Solutions (1999) *Report to RTCA Clermont Mine/ Blair Athol Coal on Permanent Waterworks Options Overview Investigations*. Water Solutions Document No. WS990292.
Summary: The report presents a review and hydrologic assessment of a number of options for controlling surface water runoff and diversion of surface water flow around the mined area as part of mine closure operations.
 - Water Solutions (2012) *Report to RTCA Clermont Mine/ Blair Athol Coal on OPSIM Water Management Metered Data Review*. Water Solutions Document No. WS120175 (Draft) 3 May 2012.
Summary: The report presents an update of the OPSIM model (site water balance model) for the Blair Athol and Clermont Mine sites. The report includes a summary of surface water storage volumes, catchment areas, site water demands, water inputs (rainfall, groundwater, other), and transfer of water between the two mine sites.
 - URS (2006) Assessment of water and sediment quality of Stockpile Dam and Environment Dam for EPA Hazardous Dam Classification. Letter report from URS to Blair Athol Coal Mine, Document No. 311006, 31 October 2006.
Summary: The report presents an assessment of water and sediment from the Environmental Dam, Stockpile Dam, and West Dam, in comparison to EPA acceptance criteria for hazardous dams.
 - A number of other reports prepared for the nearby RTCA Clermont Mine, which provide information on the regional groundwater system, groundwater levels, and groundwater chemistry in the Clermont region. The reports include information on groundwater occurrence within the Clermont Mining lease boundary. The reports do not make reference to Blair Athol Mine, but are useful for placing the regional groundwater system into context. Relevant reports include:
 - JBT (2009) *Regional Groundwater Model Update*. Report by JBT Consulting to Rio Tinto Coal Australia, Clermont Mine Project. JBT report No. JBT01-001-008, June 2009
 - JBT (2012) Clermont Mine – 5th Annual Aquifer Performance Review - 2011/2012 Water Year. Report by JBT Consulting to Rio Tinto Coal Australia, Clermont Mine. JBT report No. JBT01-001-061, August 2012.

4.2 Bore Construction Records

Details of site monitoring bores, including bore name, location, elevation, depth, screened interval, formation monitored, operational status, were available from:

- A summary spreadsheet provided by BAC;
- Bore construction records contained in Matrix+ (2007);
- Additional bore location and elevation (GPS) data provided by 4T consultants.

A summary of bore data is provided in Table 8-1.

4.3 Groundwater Level Data

Groundwater Level data available in Excel spreadsheet format included:

- Data downloaded from the site EDMS database covering the period March 2008 to August 2011;
- Data provided by 4T Consultants (site environmental sampling consultants) that included groundwater level data collected by them between May 2011 and August 2012; and,
- Additional water level data from Curtis Bore between January 2007 and May 2009, provided by BA site personnel

4.4 Water Chemistry

Water chemistry data was provided in Excel spreadsheet format, and included:

- Data downloaded from the site EDMS database covering the period March 2008 to August 2011;
- Data provided by 4T Consultants that included water quality data collected by them between May 2011 and August 2012; and,
- Water quality data from monitoring of site surface water storage facilities between May 1985 and July 2012.

4.5 Other Data

Other data provided for review/ report preparation includes:

- A geo-registered aerial photograph of the site, current to June 2012; and,
- Data generated from the site geological model, including:
 - Cross sections through the mining area; and,
 - A dxf file showing the mined-out area at end of mining.

5.0 CLIMATIC DATA

5.1 Clermont Climatograph

This climatic description of the region in which the project site is located has been compiled using data from the Bureau of Meteorology (BOM) weather station at Clermont Post Office (Station No. 035019) from August 2012.

Figure 5-1 presents a climatograph for the region. Annual average rainfall for Clermont is 666.7 mm, with the dry season peaking between July and September, and the wet season peaking from December through to March.

The coldest mean daily temperatures occur in July, with a mean minimum of 6.7°C and a mean maximum of 23°C. The hottest months occur in December (mean minimum of 20.8°C and a mean maximum of 34.9°C) and January (mean minimum of 21.6°C and a mean maximum of 34.3°C), with January also the highest rainfall month (average rainfall 117.9 mm).

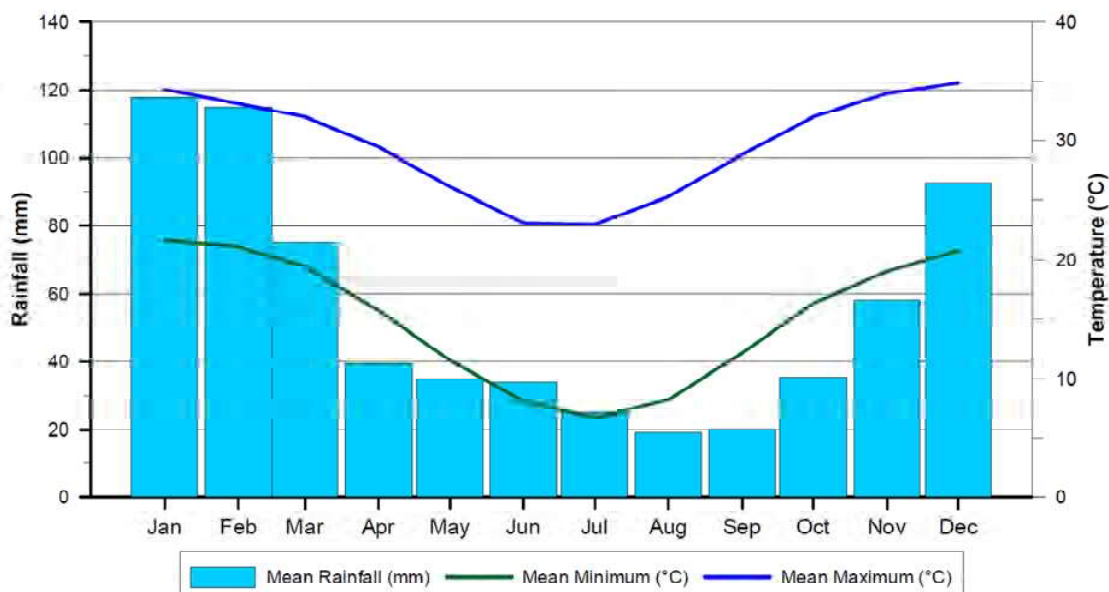


Figure 5-15-1: Climatograph for Clermont (BOM Station No. 035019 – Clermont Post Office)

5.2 Rainfall Analysis

Monthly rainfall for the period January 2002 to June 2012 is shown in Figure 5-2 (data recorded from the Bureau of Meteorology (BOM) Clermont Post Office weather station no. 035019).



Figure 5-25-2: Clermont Monthly Rainfall and Residual Mass Curve

Table 5-1 shows monthly data for the Clermont Post Office weather station for each water year from 2007/2008 to 2011/2012. The long-term average data shown in Table 5-1 is for the full period of record from the Clermont Post Office weather station (1871 to present).

The wet season total (November to March) for each year is also shown on Table 5-1. The following observations are made with respect to rainfall data:

- The 2007/2008 wet season was one of the wettest on record. A total of 799.4 mm of rainfall was recorded between November 2007 and March 2008, out of a total of 894.4 mm for the entire 2007/2008 water year. The 2007/2008 wet season rainfall had a significant effect on groundwater levels in the Clermont region (JBT 2012). This effect is observed in the water level record for Curtis bore (landholder bore used for water level monitoring – discussed further in Section 8.2);
- The 2008/2009 wet season was slightly below average, however the following three wet seasons were all above average;
- The 2010/2011 year was also significant in terms of groundwater recharge. The wet season (November to March) rainfall of 695.2 mm was above average, but most significantly the wet season started early, with an additional 175.8 mm of rainfall recorded in September (compared to a September average of 19.3 mm). This meant that the above average wet season rainfall occurred when the ground was already saturated, providing enhanced conditions for groundwater recharge; and
- The 2011/2012 wet season was also above average, due mainly to high rainfall recorded during January and March 2012.

Figure 5-2 also shows the Rainfall Residual Mass (RRM) curve for the period of data between January 2002 and December 2011.

The RRM is calculated by subtracting the long-term average monthly rainfall from the actual monthly rainfall, to provide a monthly “departure” from average conditions. If the monthly rainfall is above average the resulting rainfall departure number is positive, whereas if rainfall is below average, the number is negative. The monthly rainfall departures are summed cumulatively to provide the RRM. A number of below-average rainfall months will result in a falling RRM curve, while a number of above average rainfall months will result in a rising RRM curve. The RRM curve is used extensively in groundwater investigations due to the strong correlation in many locations between the RRM and groundwater level trends, especially for shallow aquifers. This relationship is discussed further in Section 8.2.

The overall trend from early 2002 to mid-2007 has been a reducing RRM curve, followed by a rising RRM curve from mid-2007 to present. The 2007/2008 wet season is especially significant in that it marked a reversal from a trend for static or reducing groundwater levels, to a trend towards rising groundwater levels following wet season rainfall. In the Clermont region this trend has been especially evident in the basalt aquifer and other shallow aquifers including alluvium, Permian sediments where they occur close to surface, and areas of bedrock outcrop (JBT, 2012).

Table 5-1: Clermont Rainfall (Clermont Post Office)

Rainfall (mm)	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2007-2008	0	13	29.6	24.4	188.4	60	254.2	256.4	40.4	0	12.8	15.2	894.4
					Total Nov to Mar - 799.4 mm								
2008-2009	73.4	0	26.4	12.2	60.4	150.8	82.1	134.8	0	57.2	17	9.6	623.9
					Total Nov to Mar - 428.6 mm								
2009-2010	0	0	0.4	24.2	36.8	45	148.2	231.8	47.6	63.4	12.4	6.6	616.4
					Total Nov to Mar - 509.4 mm								
2010-2011	18.5	43.4	175.8	25	225.6	192.6	111	20.6	145.4	79.6	26.8	22.7	1087.0
					Total Nov to Mar - 695.2								
2011-2012	9.5	10.9	0	63.8	34.2	99.4	165.8	77	193.2	49.4	51	32.4	786.6
					Total Nov to Mar - 569.6 mm								
Long-term average	24.8	19.1	20.2	35.5	58.1	92.5	117.5	115.1	74.2	39.1	34.8	34	663.5
					Total Nov to Mar - 457.4 mm								

* The table has been divided to provide a summary of rainfall over the wet season months (November to March).

6.0 GEOLOGY

6.1 Regional Geology

The Blair Athol Mine is located in the Blair Athol Basin, an isolated Permian basin near the western edge of the northern Bowen Basin, on the northern extension of the Dennison Trough.

The Denison Trough formed in the early Permian as an elongate depositional downwarp that developed as a half-graben (RTCA 2011). The Blair Athol Basin is an early Permian half graben lying unconformably on rocks of the Proterozoic to Cambrian Anakie Metamorphic Group (RTCA 2011).

The Permian coal basins in the Clermont area (including the Blair Athol Basin, which hosts the Blair Athol Mine, and the Wolfgang Basin which hosts the Clermont Coal – refer Figure 6-1) contain Lower Permian Blair Athol Coal Measures, which overly the Proterozoic/ Cambrian Anakie Metamorphic Group (tightly folded mica, quartz-mica and quartz-chlorite schist, with phyllite, slate and quartzite).

The Permian sequence comprises a lower basal conglomerate, which is a quartzose and lithic pebble to cobble conglomerate, thought to be of glacial origin¹. The basal conglomerate is overlain by the Permian coal-bearing sequence, which includes laminated sandstone and siltstone, coal seams, carbonaceous siltstone and mudstone, and minor conglomerate (refer stratigraphic section, Figure 6-4).

Vertical movement along faults has brought the basal conglomerates to the surface at various locations, so that the deposits occur at or near surface (with the overlying coal measures eroded away at these locations). This has occurred in the western area of the Clermont Mine, as well as in the vicinity of the Cement Hill and Black Ridge gold mines which are developed within Permian conglomerate (refer Figure 6-3).

The location of Permian coal basins within, and to the north and south of the lease area, can be seen in Figure 6-1, which shows the thickness of sediment within Permian basins in the Clermont area

¹ Herbert, H.K. (1989) Geology and Gold Potential, Black Ridge Area, Clermont Qld. Report to Southern Aurora Joint Venture, June 1989.

(including the Blair Athol Basin in which the BA Mine is developed, and the Wolfgang Basin in which the Clermont Mine is developed).

The top of Permian (pre-Tertiary) surface is shown in Figure 6-2. From this figure it can be seen that pre-Tertiary drainage in the northern part of the BA lease area was to the north-east and east, via a channel system incised into the pre-Tertiary surface. The area of Permian outcrop to the north of this valley (Figure 6-2) contains the host rocks for the Cement Hill and Black Ridge gold mines. The location of these mining areas is shown on Figure 6-3.

During the Tertiary (Late Eocene to Middle Oligocene) basalt filled the area from east to west, with initial deposition focused on a deep paleochannel that can be seen to the east of Figure 6-2. The basalt is derived from nearby volcanoes, the remnants of which are still visible today as andesitic plugs including Mt Oscar and Wolfgang Peak.

As deposition of basalt continued, the flows progressed further west and eventually infilled the pre-Tertiary channel that can be seen to the north of the BA and Clermont leases on Figure 6-2. The extent of basalt can be seen on the surface geology map shown as Figure 6-3.

Therefore the basalt encountered in the north and north east of the site (Figure 6-3) represents the marginal extent of basalt. Basalt thickens to the north and north-east of the site, with the greatest thickness (locally) within the pre-Tertiary channel shown on Figure 6-2. The basalt progressively thickens to the east of BA; at Clermont Mine the basalt maximum thickness of basalt is in the order of 70-80 m, and in the deepest part of the paleochannel (to the east of the extent shown on Figure 6-2) the basalt thickness exceeds 170 m (JBT 2009).

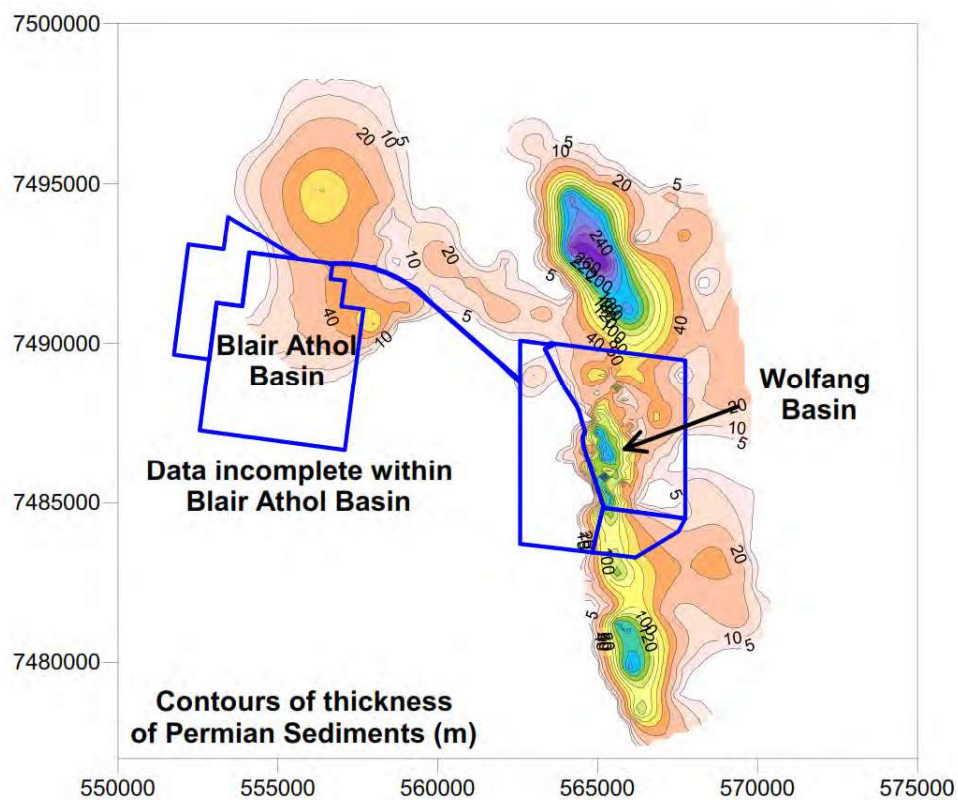


Figure 6-16-4: Location of Permian Basins in the Clermont Area

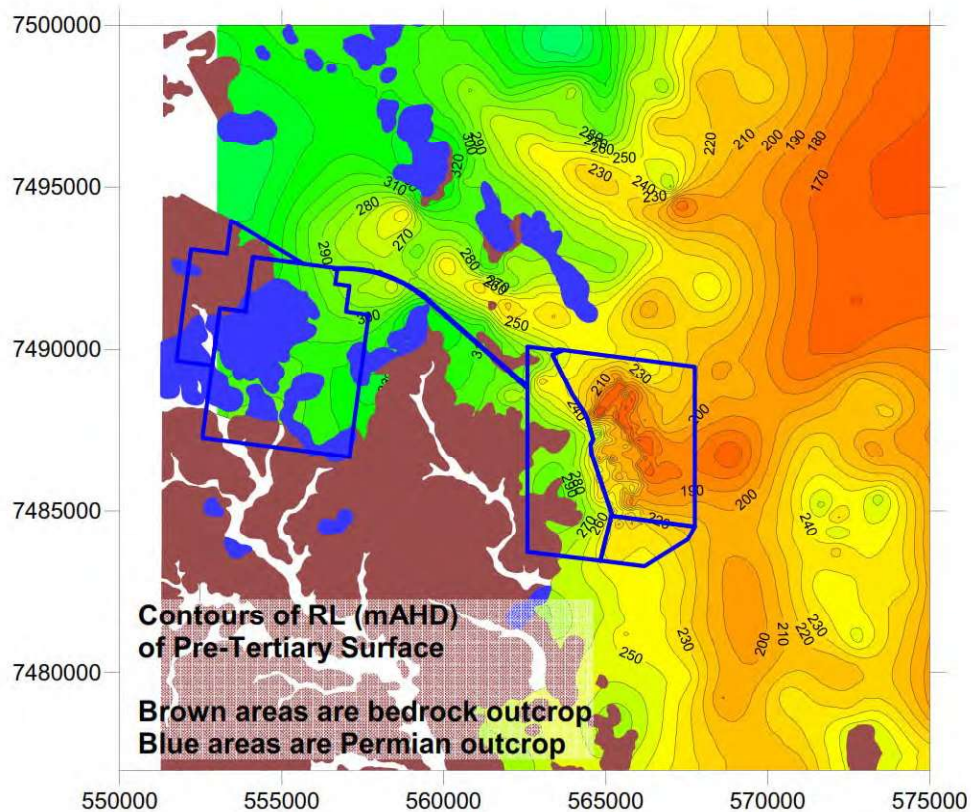


Figure 6-26-2: Pre-Tertiary Land Surface and Basement and Permian Outcrop Areas

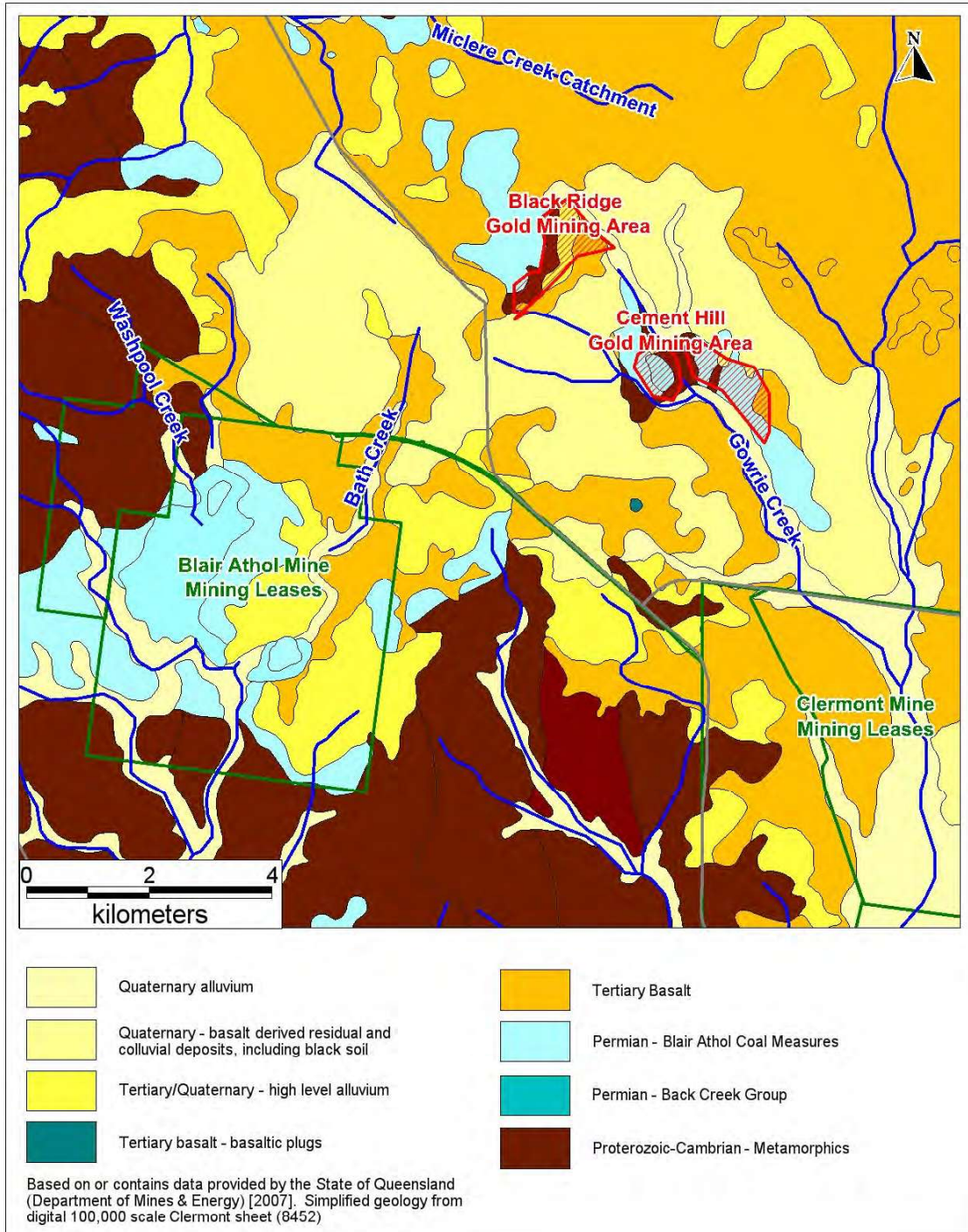


Figure 6-36-3: Surface Geology

6.2 Site Geology

The stratigraphic sequence in the Blair Athol Basin comprises five lithological units (RTCA 2011). These are, from stratigraphically lowest to highest:

- Proterozoic/ Cambrian Anakie Metamorphic Group, comprising schist, phyllite, metabasalt;
- Early to Middle Devonian arenites, occupying a small basement trough in the southern part of the basin;
- Permian-age Blair Athol Coal Measures, comprising:
 - The lower Coal Measures, which include basal conglomerate, sandstone, siltstone, and mudstone with an estimated maximum thickness of 130-150 m; and,
 - The upper Coal Measures, which include sandstone, siltstone, mudstone, conglomerate, as well as the four main coal seams of the basin (Seams 1, 2, 3, and 4)
- Tertiary basalt, which only occurs in the north and east of the lease area (Figure 6-3), with an average thickness within the lease area of 18-22 m; and,
- Tertiary and Quaternary (recent) alluvial deposits developed within the ephemeral streams that drain the site, including Bath Creek and Washpool Creek.

The stratigraphy outlined above is shown as a stratigraphic section in Figure 6-4.

Schematic sections through the basin, showing the general basin geometry and the relationship of the coal seams, are shown as Figure 6-5.

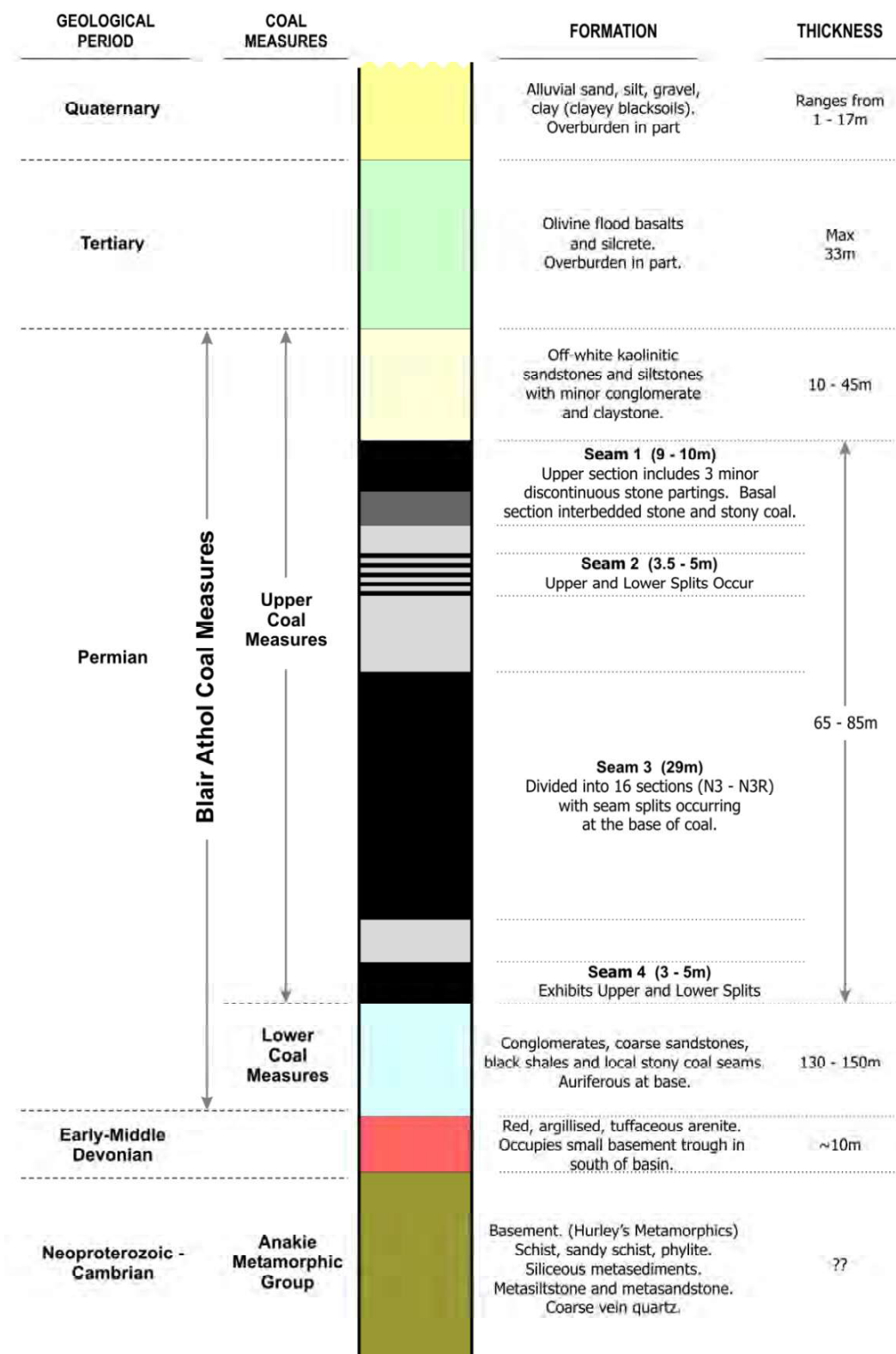


Figure 6-46-4: Mine Area Stratigraphy (Source: RTCA 2011)

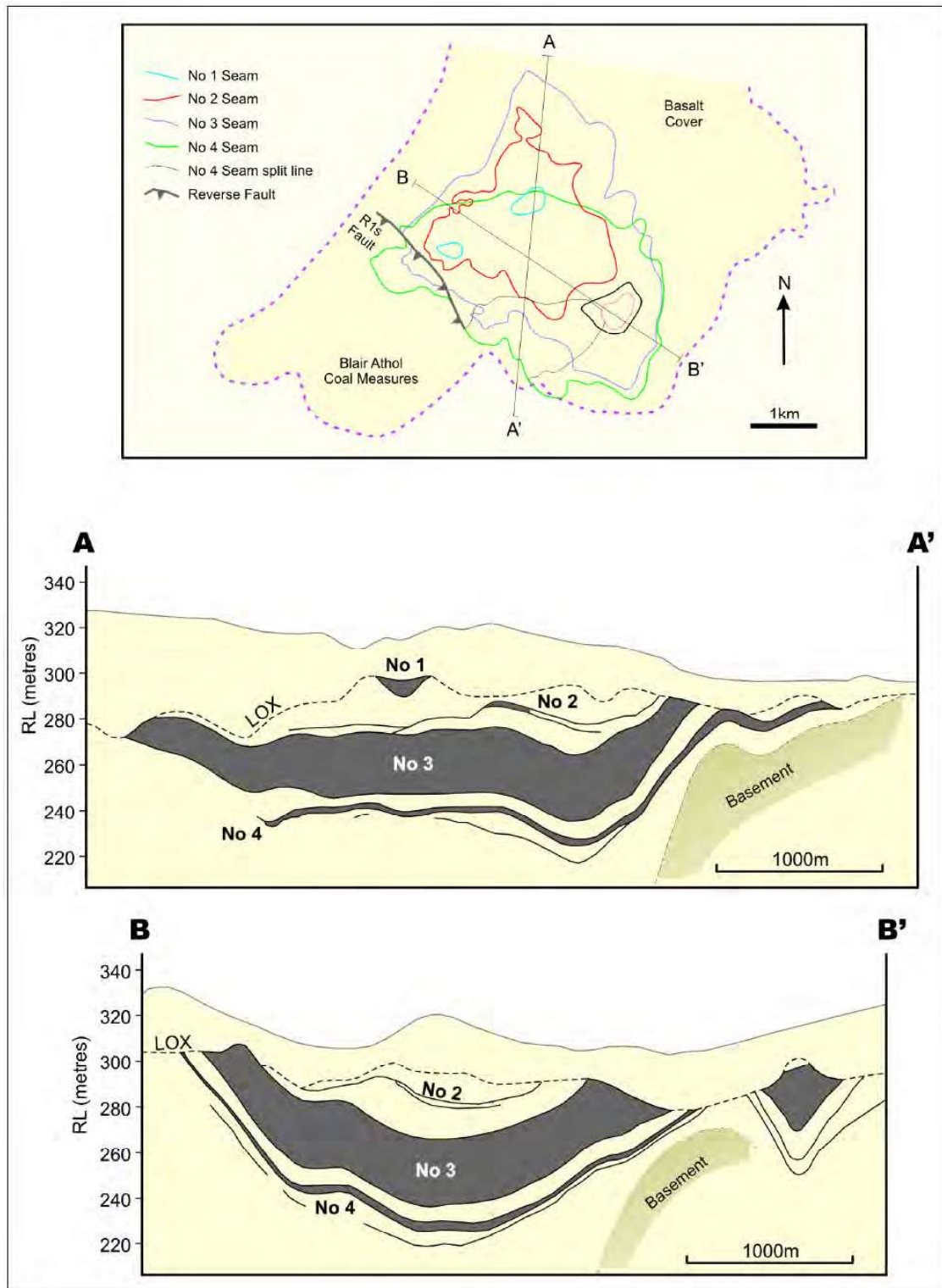


Figure 6-56-5: Schematic Cross Sections Showing Coal Seams (Source: RTCA 2011)

7.0 HYDROGEOLOGY

7.1 Introduction

Complex subsurface geology is generally simplified for groundwater studies by defining distinct hydrostratigraphic units. Hydrostratigraphic units comprise geological units grouped together on the basis of similar hydraulic properties, generally hydraulic conductivity (Fetter, 1994). Hydrostratigraphic units may incorporate a number of separate geological units if the hydraulic properties of those units are similar (e.g. a number of different rock types may be treated as one hydrostratigraphic unit if the rocks are similarly fractured, and store and transmit groundwater in the same way). In the Clermont area the distinct geological units are also distinct hydrostratigraphic units (JBT 2009), as discussed further below.

7.2 Description of Hydrostratigraphic Units

7.2.1 Basement Rocks

Proterozoic-Cambrian metamorphics occur at surface or close to surface at a number of locations in the Clermont area, including the western and southern portions of the Blair Athol Mining Lease, and to the east between the BA and Clermont Mining Lease areas (refer Figure 6-3).

A number of regional groundwater monitoring bores are screened within basement metamorphics at shallow depth (for a detailed discussion of regional water level data, refer JBT 2012). In these bores, the weathered metamorphics show a response to rainfall recharge that is similar to other watertable bores. However the bore yields within the metamorphics are low and the unit is not regarded as an aquifer. The Proterozoic-Cambrian metamorphics are regarded as the hydraulic basement to other groundwater units in the region (JBT 2009).

7.2.2 Permian Sediments

Groundwater has been encountered in all coal seams during exploration drilling, but groundwater occurrence is more pervasive in Seams 3 and 4 (Terranus 2009).

The coal seams are water-bearing units but are not aquifers as the yields are too low and too short-lived (generally hours, based on air-lift data (Terranus 2009)).

The coal seams have not been observed to provide significant rates of seepage to the open pits during mining, and generally the seepage rates encountered were insufficient to provide a reliable water supply to the mining operation (Terranus 2009).

7.2.3 Tertiary Basalt Aquifer

The Tertiary Basalt aquifer is the most significant regional aquifer in the Clermont area as it is the main aquifer from which landholders in the region draw stock and domestic water supplies. The basalt is known to comprise a number of distinct flows, though these have not been mapped in a regional sense.

Regionally, groundwater in the basalt has been observed to occur within discrete, isolated fractures, so that pumping from one fracture system can have little or no impact on water levels within adjacent fracture systems (JBT 2009).

Basalt is encountered in the northern and eastern areas of the site, where basalt flows have infilled depressions in the pre-Tertiary land surface (as described in Section 6.1).

Seepage water from the basalt aquifer to the pits in the vicinity of Ramp 3 and Ramp 4 is understood to have provided reasonable supplies of non-potable water to the operation over the course of many years (Terranus 2009). However, the average rate of seepage is unknown.

7.2.4 Tertiary/ Quaternary Alluvium

Unconsolidated alluvial deposits occur along Bath Creek and Washpool Creek, which drain through the lease area from the north and north-east (Figure 6-3). The creeks are ephemeral and groundwater occurrence within the alluvium is sporadic and related to rainfall recharge events when the streams briefly flow.

Following 2010/2011 wet season rainfall the alluvium in the Ramp 1 mining area became sufficiently saturated that engineering measures were required to control the rate of groundwater inflow to the mining operation. Therefore, potential exists for the alluvium to provide groundwater seepage to the final void particularly following above-average wet season rainfall, with the rate of seepage is dependent on the degree of saturation of the alluvium, as well as the degree to which alluvial channels are hydraulically connected to the final void.

7.2.5 Tailings and Spoil

The following section is taken from Terranus (2009), in discussion of URS (2008) (which was not reviewed for this report)

The TSF is currently an artificial source of locally perched groundwater. The tailings are deposited as a slurry (about 40 - 60% solids). Seepage modelling undertaken by URS (2008a) indicatively suggests (due to limited data) that most seepage from the TSF will be through the TSF embankments in the early and middle stages of construction and that seepage rates through the embankments will be minimal in the latter stages and moving into closure.

The long-term prediction from the URS (2008a) report is that most seepage (latter stages and post-closure) will be through the floor of the TSF into the underlying spoil, and thence into the sandstone/conglomerate aquifer. The flux (i.e. the rate of water movement) through the floor of the TSF is expected to decrease post-closure as the tailings dewater and the TSF cap reduces rainfall recharge (URS, 2008a).

As mentioned above, the fate of the basal conglomerate/sandstone aquifer on and immediately outside the site is difficult to predict.

The elevation of the TSF is below the base of the basalt aquifer, and so does not influence the quality or elevation of groundwater within the basalt aquifer. This is expected to remain the case in the long term well after closure.

The spoil comprises overburden and interburden that has been removed to access the coal seams, and progressively back-filled into pits as the coal is removed. The hydraulic properties of the spoil will therefore be dependent on the properties of the parent material, dumping method, degree to which the spoil has been consolidated by traffic, and degree to which the spoil has settled and consolidated over time.

The final landform should be shaped to control runoff and prevent ponding (i.e. to prevent conditions which could lead to enhanced recharge of the spoil).

7.3 Groundwater Recharge and Flow Direction

7.3.1 Basement Rocks

Water level response in regional basement monitoring bores indicates that the basement rocks, especially where they occur at surface, are recharged via direct rainfall infiltration. However, the storage of the rocks is low relative to other groundwater units in the area, so much rainfall in basement outcrop areas will report as runoff (i.e. rejected recharge) to surface drainage systems.

7.3.2 Permian Sediments

The Blair Athol Basin is a relatively isolated groundwater system, at least in the sense of groundwater within the coal seams. Recharge mechanisms are unknown, however based on recharge mechanisms observed at other Bowen Basin coal mines it is speculated that recharge to the coal seams occurs in marginal areas of the basin where the coal seams subcrop, or via downward drainage from overlying groundwater units.

There is no natural outlet for water in the coal seams (refer schematic cross sections, Figure 6-5), so groundwater movement within the coal seams could be expected to be minimal.

7.3.3 Tertiary Basalt Aquifer

The basalt aquifer is the uppermost aquifer in the groundwater system, and receives recharge directly from rainfall. Regionally, the water level in the basalt aquifer has risen in many bores due to a succession of above average wet seasons since 2007/2008. Therefore water levels in the basalt aquifer are currently elevated relative to historic levels.

Groundwater flow direction within the basalt aquifer is topographically controlled, with movement of water from topographically higher regions to topographically lower regions. Based on surface drainage evident from Figure 6-3, it is judged that the aquifer to the north of the site (within the Bath Creek catchment) will flow toward the mine, and that further north groundwater within the basalt aquifer will flow towards either the Gowrie Creek or Miclere Creek catchments..

7.3.4 Tertiary/ Quaternary Alluvium

Groundwater recharge to the alluvium is via direct rainfall infiltration, with groundwater movement in the direction of surface drainage.

7.3.5 Tailings and Spoil

Recharge to the tailings and spoil is via direct rainfall recharge, and in the north of the lease area the spoil may receive recharge via lateral flow from the basalt aquifer.

Groundwater flow direction will be dependent on the degree to which a mounded water table develops in the spoil, and on the shape of the final landform relative to surrounding natural material.

The degree of recharge and the water table height (and hence groundwater flow direction) is difficult to predict at this stage, though it is considered likely (based on surrounding topography) that flow direction will continue to be a reflection of topography, and that the ultimate flow direction will be to the south in the direction of Bath Creek drainage.

8.0 REVIEW OF MONITORING DATA

8.1 Groundwater Monitoring Bores

Groundwater monitoring is currently undertaken on 24 bores at 20 sites. Details of the monitoring bores are provided in Table 8-1, and the bore locations are shown on Figure 8-1. The information contained in Table 8-1 is based on information provided from site, as well as review of previous reports (Matrix+ (2007) and Terranus (2009)).

Table 8-1: Groundwater Monitoring Bore Summary Data

Bore Name	Easting (AGD84)	Northing (AGD84)	RL (mAHD)	Total Depth (m)	Casing Diameter (mm)	Screen From (mbgl)	Screen To (mbgl)	Lithology Monitored	Comment
BP3	556021	7492053	327					Tertiary Basalt	Located at same site as GW01
Curtis Bore	557350	7491750	325					Tertiary Basalt	Landholder bore on Blair Athol Station
GT01A	556584	7491258	318	54	50	36	39	Coal - Seam 3	Dry when drilled – bores no longer monitored. Site comprises two 50 mm standpipes within one borehole
GT01B	556584	7491258	318	54	50	44	46	Coal - Seam 4	
GT02	555631	7488834	318	24	50			Coal - Seam 4	
GT03	554768	7489108	318		50			Coal - Seam 4	
GT04	556584	7491258	314	72	50	41	44	Coal - Seam 4	
GW01B	556026	7492049	327	57	50	33	39	Permian Conglomerate	
GW02A	555293	7492702	329	60	50	21	27	Tertiary Basalt	
GW02B	555287	7492696	329	60.3	50	53	59	Permian Conglomerate	
GW03A	556581	7491265	318	17	50	11	14	Tertiary Basalt	
GW03B	556581	7491265	318	54.9	50	43	46	Permian Conglomerate	
GW04A	557071	7490417	314	16	50	11	14	Tertiary Basalt	
GW04B	557073	7490412	314	48	50	39	45	Permian Conglomerate	
GW05	557330	7489460	318	40.1	50	25	28	Permian Conglomerate	Dry when drilled – bore no longer monitored
GW06	553976	7491409	318	36	50	28	34	Permian Conglomerate	
GW07	554172	7490244	310		50			Spoil	
GW08	554834	7490684	307		50			Spoil	
GW10	555711	7489930	328	72	100			Spoil	
Mayes Bore	558120	7493142	324					Tertiary Basalt	Landholder bore on Blair Athol Station
MB02	554215	7490409	313		50	Screened for entire length of bore		TSF Embankment	Construction details for individual bores unknown, but bore depths are understood to be between 7.88 and 17.60 m (Terranus 2009).
MB03	554254	7490402	312		50			TSF Embankment	
MB04	554672	7490544	308		50			TSF Embankment	
MB05	554657	7490493	307		50			TSF Embankment	
SP(3279C)	555431	7488557	310	40	50	30?	?	Coal - Seam 4	Comprises 2 x 50 mm standpipes within one borehole. Upper piezo (20 m depth in sandstone) is dry

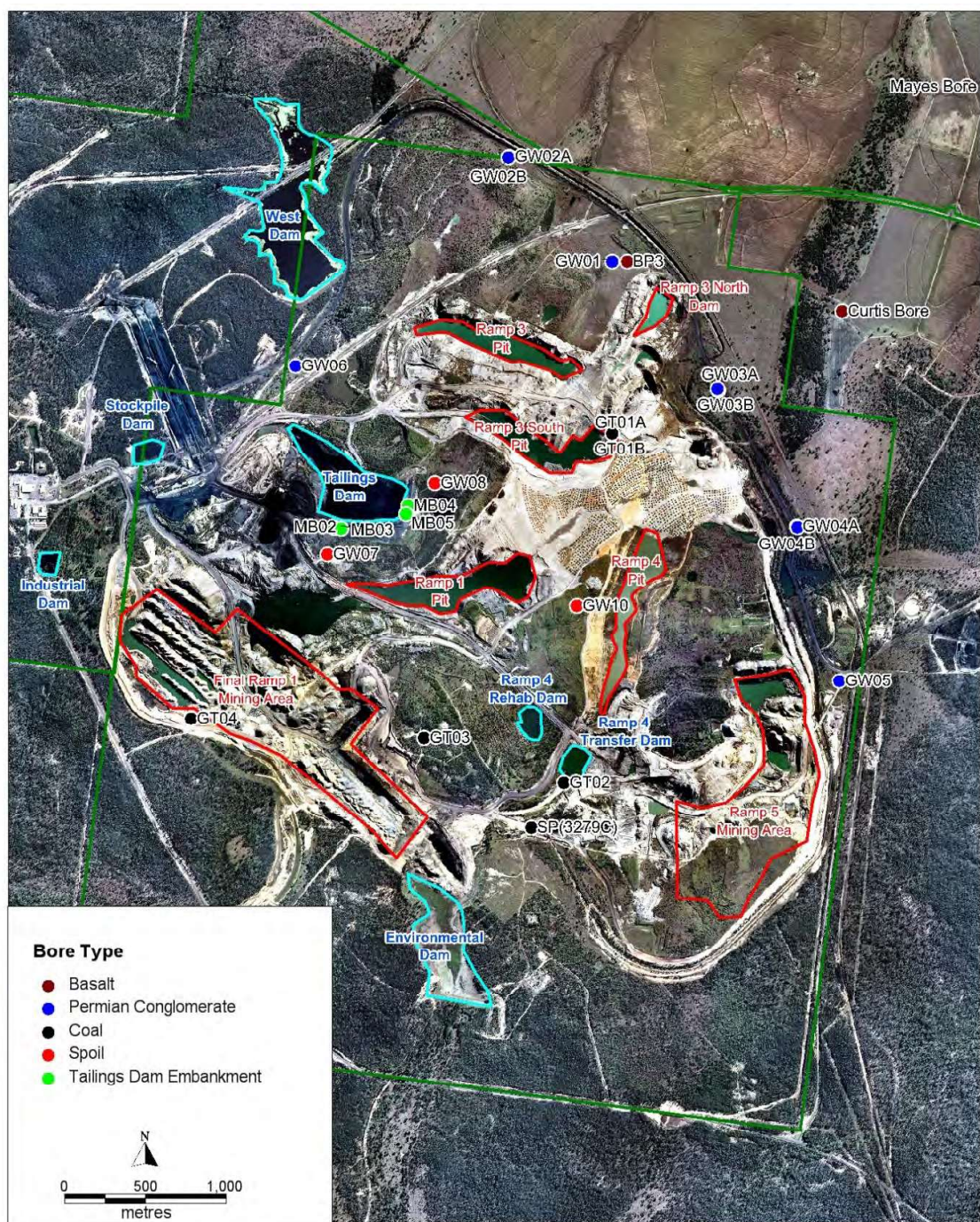


Figure 8-18-4: Location of Bores and Surface Water Dams

8.2 Groundwater Level Data

Groundwater level data (as water level below top of casing (TOC)) is shown in Appendix A. The data has been converted to reduced water level (relative to Australian Height Datum, AHD) with the resultant hydrographs shown as Figure 8-2. Observations from review of the hydrographs include:

Tertiary Basalt Aquifer

- Only one bore (Curtis Bore) has water level readings that date prior to January 2008 (prior to the 2007/2008 wet season). The impact of 2007/2008 wet season rainfall is evident at this site, where the water level rise in the bore matches the rise in the residual rainfall mass (RRM) curve. In response to 2007/2008 wet season rainfall the water level in the bore rose from 10.16 m below top of casing (mTOC) (November 2007) to 4.55 mTOC (March 2008). The water level has continued to rise in this bore, and in August 2012 the water level was above ground level (i.e. the bore is flowing).
- Other basalt bores display a relatively steady water level trend, with a slight overall rise in water level evident between March 2008 and August 2012 (refer also Appendix A).

Coal Seam

- Monitoring bores at site are screened in either Seam 3 or Seam 4 (lower coal seams) as the seams above (Seam 1 and Seam 2) tend to be dry when drilled;
- Bore GT01 is located adjacent to the Ramp 3 South pit (Figure 8-1). Both GT01A (Seam 3) and GT01B (Seam 4) are dry, indicating that water within the coal seams has drained to the pit at this location;
- The impact of mining on water levels in the coal seam can be seen from the hydrograph for bore GT03 (Seam 4). The bore is located adjacent to the Ramp 1 mining area, and the water level has reduced significantly at this site between May 2011 and May 2012 (7.38 m water level reduction) compared to a water level reduction of 0.11 m between March 2009 and May 2011. It is assumed that the water level reduction is related to mining in the adjacent Ramp 1 area.

Permian Conglomerate

- Water levels in bores monitoring the Permian conglomerate have tended to increase in response to rainfall recharge, i.e. water levels tend to conform to the overall trend of the RRM curve, which has displayed a rising trend since December 2007. Between May 2008 and May 2012 the water level has increased by 6.01 m in GW03B, 9.98 m in GW04B, and 1.36 m in GW06 (i.e. the greatest rate of water level increase has been in bores that are overlain by Tertiary basalt);
- At sites where the conglomerate is overlain by basalt (GW02B, GW03B, GW04B) the water level in the basalt aquifer is higher than the water level in the conglomerate, indicating a potential for the basalt aquifer to recharge the underlying Permian sediments. Recharge from the basalt aquifer to the underlying Permian sediments is noted from water quality data, as discussed in Section 8.3;
- At the site of GW04B the water level trend matches the trend displayed in adjacent basalt aquifer bore GW04A, though the rate of water level increase in GW04B is greater than observed in the basalt bore. The hydrographs have now almost converged (i.e. the hydrographs are almost reading the same water level) indicating a high degree of hydraulic connection, and a strong recharge potential, between the Tertiary basalt and the underlying Permian sediments.

Spoil

- Bores screened in spoil (GW08, GW10) show a rise in water level between July 2008 and August 2012 of between 8.06 m (GW10) and 12.32 m (GW08). This matches the overall rise in the RRM curve, indicating that groundwater levels within the spoil are directly impacted by rainfall recharge events.

Tailings Storage Facility (TSF)

- Bores screened within the TSF embankment (MB02, MB03, MB04, MB05) display relatively consistent water levels, suggesting that water levels in the bores are dominated by the water level within the TSF rather than by rainfall recharge (as is the case with bores in the surrounding spoil);
- Site sampling records indicate that all of the TSF bores are difficult to sample as the water level in all bores is just above the base of screens, and the water that is able to be bailed from the bores is generally turbid and often black in colour (reported as coal fines within the samples).

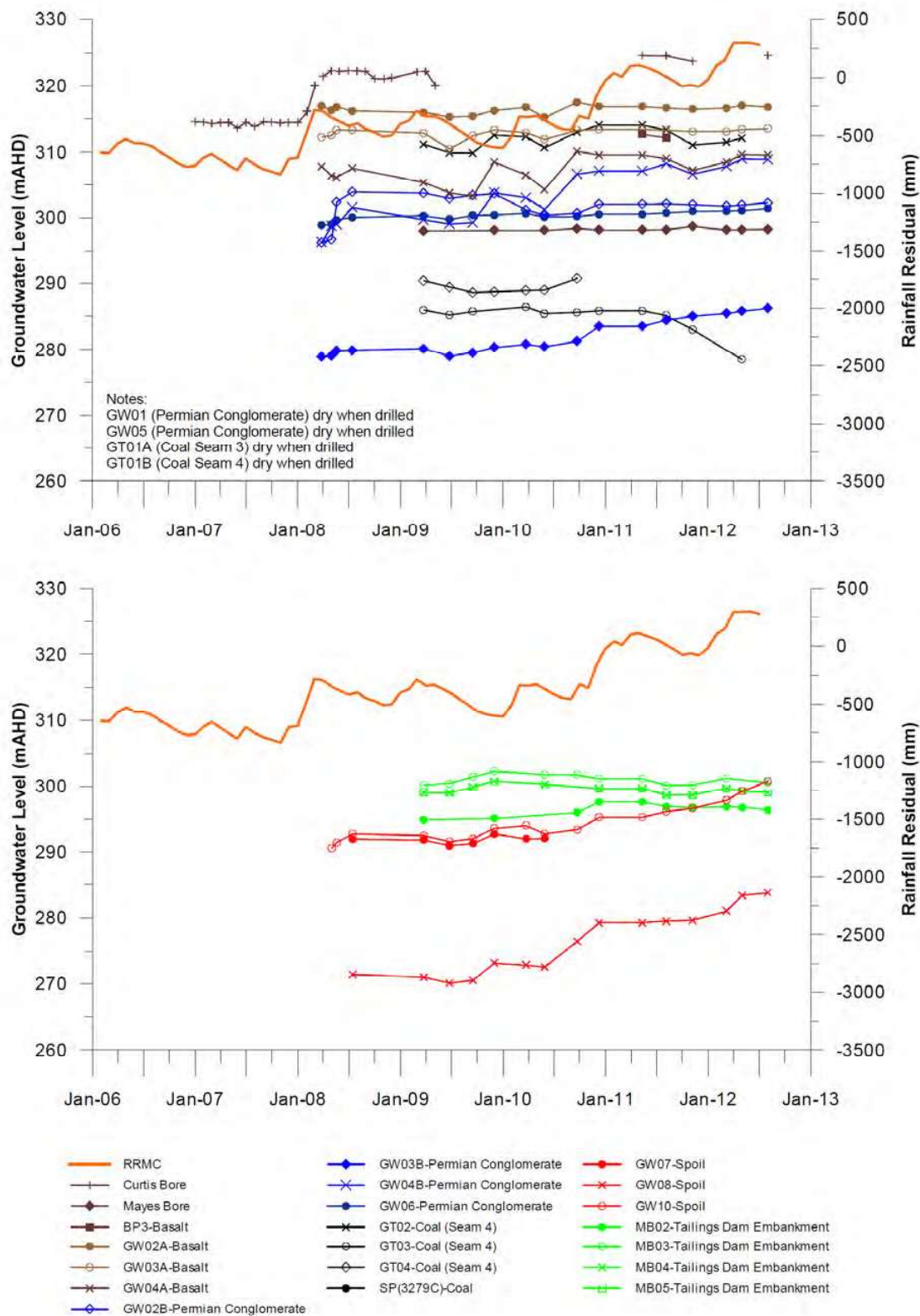


Figure 8-28-2: Groundwater Hydrographs

8.3 Water Chemistry

The following section presents an analysis of chemistry data from groundwater bores as well as site water storages.

Section 8.3.1 presents an analysis of major ion chemistry, which is used to differentiate water types at the site, and to describe the evolution of water at site from one water type to another (which is evident at a number of surface water storages).

Section 8.3.2 presents a comparison of historic and current site water quality data for major and minor ions, as well as for a number of metals/metalloids, against a range of Australian guidelines.

8.3.1 Major Ion Chemistry

8.3.1.1 Data Analysis

Major ion chemistry includes concentration data for cations (sodium (Na), potassium (K), magnesium (Mg), calcium (Ca)) and anions (chloride (Cl), carbonate (CO_3), bicarbonate (HCO_3), and sulphate (SO_4)). These data have been analysed to determine the water type at each groundwater bore location, as well as for surface water storages.

To undertake a water type analysis the relative concentration of each parameter (converted to milliequivalents per litre) is determined, so that the relative percentage of each anion adds up to 100%, and the relative percentage of each cation adds up to 100%.

Water type is then determined based on the dominant cation and anion in water samples from each site. For example, water classified as a sodium-chloride (Na-Cl) type water contains more than 50 percent of the total cation milliequivalents as sodium and more than 50 percent of the total anion milliequivalents as chloride. If no cation or anion is dominant (i.e. more than 50%) then the water is a mixed type and the most common cations and ions, in decreasing order of abundance, are used to describe the water type.

The water type for each site is presented in Table 8-2.

The major ion analyses for each water source has also been plotted on a Piper diagram (Figure 8-3). Piper diagrams are a useful visual indicator of the range of water types present in a particular area. Piper diagrams plot the percentage concentration of three cation types (i.e. the concentrations of Ca, Mg, and the sum of Na+K are expressed as a percentage, so that the sum of the cations is 100%) and three anion types (Cl, SO_4 , and the sum of CO_3 + HCO_3) on separate ternary diagrams. The data points for the top diamond plot are derived as the intersection point of lines drawn from the cation and anion plots.

Water that is dominated by Na and Cl ions will plot in the bottom right corner of the cation and anion plots, while water that is dominated by Ca and CO_3 + HCO_3 will plot in the bottom left corner of the cation/anion plots. As water from one source mixes with water from another source (e.g. with further distance along a groundwater flow line) this can be seen as the plot symbols for different dates move from one part of the graph to another.

Raw data used as the basis for the analysis presented in this section (i.e. major ion concentration converted from mg/L to meq/L, in preparation for plotting on a Piper diagram, and for performing water-type analysis) is presented in Appendix B.

Table 8-2: Water Type Analysis

Sample Point	Type	Water Source	Water Type
BP3	Groundwater bore	Tertiary Basalt	Mg-Ca-HCO ₃
Curtis Bore	Groundwater bore	Tertiary Basalt	Mg-HCO ₃
GW02A	Groundwater bore	Tertiary Basalt	Mg-Ca-HCO ₃
GW03A	Groundwater bore	Tertiary Basalt	Mg-Ca-HCO ₃
GW04A	Groundwater bore	Tertiary Basalt	Mg-Ca-HCO ₃
Mayes Bore	Groundwater bore	Tertiary Basalt	Na-Ca-HCO ₃
GW01	Groundwater bore	Permian Conglomerate	Mg-Ca-Na-HCO ₃
GW02B	Groundwater bore	Permian Conglomerate	Mg-Ca-Na-HCO ₃
GW03B	Groundwater bore	Permian Conglomerate	Mg-Ca-Na-HCO ₃
GW04B	Groundwater bore	Permian Conglomerate	Mg-Ca-HCO ₃
GW05	Groundwater bore	Permian Conglomerate	Dry
GW06	Groundwater bore	Permian Conglomerate	Na-Cl
GT02	Groundwater bore	Coal - Seam 4	Na-Cl
GT03	Groundwater bore	Coal - Seam 4	Na-Cl
GT04	Groundwater bore	Coal - Seam 4	Na-Cl
SP(3279C)	Groundwater bore	Coal - Seam 4	Na-SO ₄
GW07	Groundwater bore	Spoil	Na-Cl
GW08	Groundwater bore	Spoil	Na-Mg-SO ₄ -Cl
GW10	Groundwater bore	Spoil	Na-Mg-HCO ₃
MB02	Groundwater bore	TSF Embankment	Ca-Na-Mg-SO ₄
MB03	Groundwater bore	TSF Embankment	Mg-Na-SO ₄
MB04	Groundwater bore	TSF Embankment	Mg-Ca-Na-SO ₄
MB05	Groundwater bore	TSF Embankment	Mg-Ca-SO ₄
TSF	Surface Water		Mg-Ca-SO ₄
East Dam	Surface Water		Na-Mg-HCO ₃
West Dam	Surface Water		Na-Mg-Cl-HCO ₃ (1986-1994) Na-Ca-Mg-HCO ₃ (2011-2012)
Industrial Dam	Surface Water		Na-Cl (1995-1998) Na-Mg-Cl-SO ₄ (2011-2012)
No. 2 Pit	Surface Water		Na-Cl (1984-1989) Na-Mg-Cl-HCO ₃ -SO ₄ (1990-1992)
Ramp 1 Pond	Surface Water		Na-Mg-Cl-SO ₄
Ramp 3 North	Surface Water		Na-Mg-SO ₄ -Cl
Ramp 4 Pond	Surface Water		Na-Mg-SO ₄
Transfer Dam 1	Surface Water		Na-Mg-SO ₄
Environmental Dam	Surface Water		Na-Cl (1985-1993) Na-Mg-Cl-SO ₄ (2012)

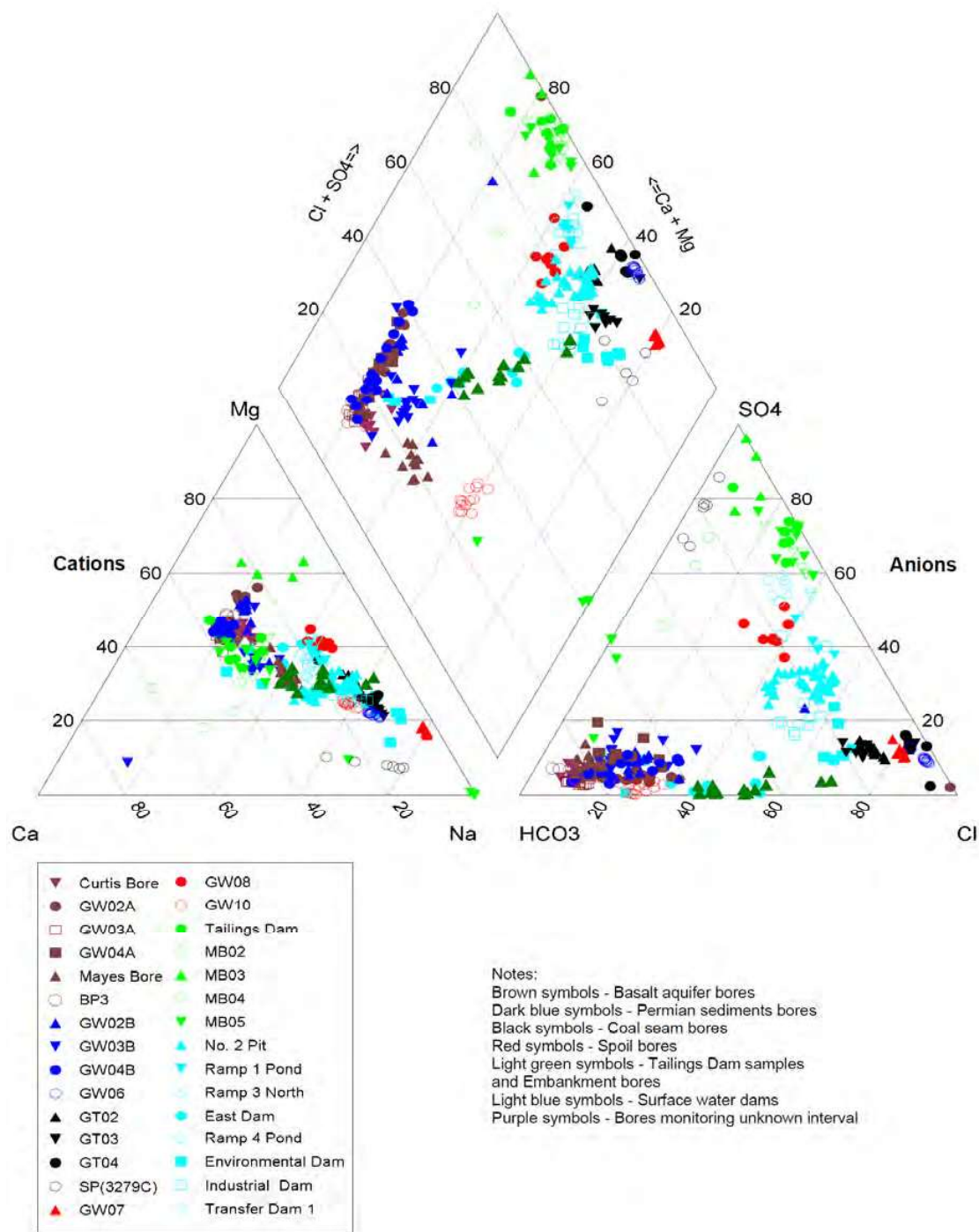


Figure 8-38-3: Piper Diagram – Blair Athol Surface Water and Groundwater Samples

8.3.1.2 Discussion

The following observations are made with respect to water type analysis and the Piper diagram:

Basalt Aquifer

- Basalt water samples are of magnesium-calcium-bicarbonate (Mg-Ca,HCO_3) type (Table 8-2). The cation mineralogy is interpreted to be related to the weathering products of basalt minerals, (e.g. Na, Ca, Mg, K silicates). The bicarbonate is interpreted to be present due to the interaction of recharge water with CO_2 from the atmosphere and the root zone of plants (H_2O and CO_2 combining to form carbonic acid (H_2CO_3), which dissociates to bicarbonate (HCO_3^-) and carbonate (CO_3)
- On the Piper diagram (Figure 8-3) the basalt water plots to the lower left of the anion plot, indicating that the samples are low in chloride and sulphate, and high in HCO_3 .
- The samples plot to the middle left of the cation plot, in a region that indicates a slight domination of magnesium (40-50 %) over sodium and calcium, which each comprise 20 – 30% of the equivalent weight.
- On the combined graph the plots cluster in the middle left corner of the plot, in a region that indicates high calcium + magnesium (60-80% of the equivalent weight) and low chloride + sulphate (between 10 and 40% of the equivalent weight).

Permian Conglomerate

- Water samples from bores screened in the Permian conglomerates are of two distinct water types, including:
 - Mg-Ca-Na,HCO_3 water in areas where the Permian conglomerates are overlain by basalt. At these sites (GW02B, GW03B, GW04B) the water level in the corresponding basalt bore (GW02A, GW03A, GW04A) is higher, indicating a potential for downward leakage of water from the basalt aquifer to the underlying Permian sediments; and,
 - Sodium-Chloride (Na-Cl) water, in areas where basalt is absent (e.g. GW06).
- On the Piper diagram (Figure 8-3) the groundwater samples from the Permian conglomerate bores plot in two distinct clusters:
 - For water samples from bores where the Permian conglomerate underlies the basalt (GW02B, GW03B, GW04B) the data points for the anions, cations, and combined plots are all in the same region as the basalt aquifer, indicating that the water in the Permian sediments at these locations is derived from downward leakage from the overlying basalt aquifer;
 - For water samples from the bore where the Permian conglomerates are not overlain by basalt (GW06) the data plots in a distinctly different area of each plot, i.e. towards the lower right of the cation plot (sodium dominated), to the lower right of the anion plot (chloride dominated) and in a region of the combined plot that indicates over 90% chloride + sodium, and less than 40% calcium + magnesium.

Spoil

- Water samples from bores that screen spoil show distinctly different chemical types, including Na-Cl (GW07), Na-Mg- SO_4 -Cl (GW08) and Na-Mg- HCO_3 (GW10)
- On the Piper diagram the samples plot relatively close together, though GW07 plots to the lower right of the plot, indicating the strong dominance of the sodium ion. However, the

samples plot in markedly different regions of the anion plots, with GW07 strongly dominated by chloride, GW08 dominated by sulphate, and GW10 dominated by bicarbonate.

- On the combined graph indicates high chloride and relatively low calcium + magnesium at GW07; low chloride + sulphate and 50-60% calcium + magnesium at GW08, and low chloride + sulphur (~30%) and moderate calcium + magnesium (~40%) at GW10.

Tailings Storage Facility

- Water quality in the area of the tailings storage facility (TSF), including TSF water samples as well as groundwater samples from embankment monitoring bores MB1, MB03, MB04, and MB05, are strongly sulphate dominated. The water samples have a relatively even mix of cations (calcium magnesium and sodium all ~30%) indicated by the clustering of sample points towards the middle of the cation plot.
- On the combined graph the cluster towards the top of the graph indicates a dominance of chloride + sulphate (more than 90% of cations, with sulphate accounting for ~70% and chloride 20%) and calcium + magnesium (60-80% of anions).

Surface Water Storages

- Surface water sources plot over a relatively wide area of each graph, indicating variability and mixing from different water sources. The following observations are made with respect to surface water major ion chemistry:
 - The early major ion chemistry appears to be dominated by the geological environment in which the dam is developed, as the initial major ion chemistry matches the groundwater chemistry. However, over time the major ion chemistry of the surface water bodies has evolved in all cases to a mixed water type. Examples include:
 - The industrial dam, where:
 - Early data (between May 1995 and February 1998) indicates a sodium-chloride (Na-Cl) water type. The industrial dam is located in an area where basalt does not exist, on an area of outcropping basement metamorphics and Permian sediments. Groundwater samples from the closest monitoring bore (GW06 – Permian conglomerate) are Na-Cl type water.

In terms of cations, sodium was dominant over magnesium, with calcium the least dominant cation. In terms of anions, chloride was dominant over bicarbonate, with sulphate the least dominant anion.
 - Later data (November 2011 to April 2012) indicates an evolution in water type from Na-Cl to Na-Mg,Cl-SO₄. In terms of cations, the percentage of magnesium has increased relative to sodium, with the percentage of calcium relatively unchanged. In terms of anions, the relative concentrations of both chloride and bicarbonate have decreased, and sulphate has increased.
 - The environmental dam, where:
 - Early data (between March 1985 and December 1993) indicates a sodium-chloride (Na-Cl) type water, with sodium dominant over magnesium, with calcium the least dominant anion. In terms of anions, chloride was dominant over bicarbonate, with sulphate a relatively minor ion (approximately 10% of the anion total – refer also Appendix B)

- Later data (January to April 2012) indicates an evolution in water type from Na-Cl to Ca-Mg-Cl-HCO₃. In terms of cations, the relative concentration of sodium has more than halved (from ~65% to ~30%), and the relative concentration of calcium has more than doubled (from ~12% to ~32%). In terms of anions, the relative concentration of chloride has reduced by approximately one-third (from ~60% to ~20%) and the concentration of bicarbonate has trebled (from ~25% to ~75%). The concentration of sulphate is relatively unchanged.
- West Dam, where:
 - Early data (January 1986 to November 1994) indicates a Na-Mg-Cl-HCO₃ type water. Unlike the dams mentioned above, the west dam is located in an area where the catchment includes basaltic rocks, so the early chemistry of the dam is similar to the groundwater chemistry of the basalt aquifer (as seen in bores such as GW02A, GW03A, and GW04A – refer
 - Later data (November 2011 to January 2012) indicates an evolution towards Na-Ca-Mg-HCO₃ water, with a relatively lower percentage of sodium, higher percentage of calcium, and a slight increase in the bicarbonate ion relative to chloride.

The chemistry of the west dam has altered only slightly compared to other dams at site. The current major ion chemistry is now similar to other storages on site, but the west dam started with similar chemistry, whereas other dams evolved to this chemistry type

8.3.1.3 Summary

The major ion chemistry at site is summarised as:

- Cation chemistry:
 - Water samples from the coal seam, the Permian conglomerate (in areas where basalt does not exist), and some spoil bores (e.g. GW07) is sodium dominated;
 - Cation chemistry for the basalt aquifer, and for the Permian conglomerate underlying basalt, is calcium-magnesium dominated; and,
 - A number of surface water (industrial dam, environmental dam) were initially sodium dominated, but evolved to calcium-magnesium dominated over time. West Dam, which is in a catchment containing basalt outcrop as well as bedrock outcrop, has consistently displayed a mixed water chemistry dominated by sodium, calcium, and magnesium cations.
- Anion chemistry is more diverse, with water samples from different sources tending to be dominated by either chloride, bicarbonate, or sulphate. This manifests as a clusters of data towards the three corners of the anion plot (for groundwater samples), with surface water samples reflecting a mixing of water types; and,
- When plotted together on the combined plot, samples for the basalt aquifer, as well as the Permian sediments underlying basalt, display a dominance of calcium and magnesium over chloride and sulphate. All other sites (surface water (except the TSF) and groundwater) are more dominated by a combination of chloride + sulphate, and less dominated by calcium + magnesium. Water samples from the TSF show a similar relative concentration of calcium + magnesium as basalt aquifer samples, but a much higher concentration of chloride + sulphate, reflecting a dominance of the sulphate ion in ash dam samples).

8.3.2 Comparison of Site Water Quality with Australian Guidelines

Available surface water and groundwater data has been compared to a number of environmental standards, including:

- Stock Watering Guidelines (ANZECC 2000)
- Freshwater Ecosystem Protection (value for slightly disturbed systems) (ANZECC 2000); and,
- Australian drinking water guidelines (ADWG 6, 2011)

Available groundwater data is included from the bores listed in Table 8-1.

Available surface water data is included from the following sample points:

- Transfer Dam 1
- Ramp 3 South
- Ramp 3 North
- Environmental Dam
- East Dam
- West Dam
- Industrial Dam
- Bath Creek – EPA Licence Point
- No 2 Pit
- No 1 Pit
- Ramp 4 Pond
- Ramp 1 Pond
- Tailings Storage Facility

Table 8-3: Comparison of Site Water Quality to Australian Guidelines

Parameter	No. of Samples	No. of Samples exceeding Guideline Limits ¹			
		Stock Watering ²	Freshwater Ecosystem ³	Drinking Water ⁴	
				Health	Aesthetic
pH – GW ⁵	243	n/a	n/a	n/a	25
pH – SW ⁶	340	n/a	n/a	n/a	2
TDS – GW	279	50	n/a	n/a	144
TDS – SW	340	2	n/a	n/a	258
Sodium (Na) – GW	281	n/a	n/a	n/a	56
Sodium (Na) – GW	281	n/a	n/a	n/a	2
Chloride (Cl) – GW	280	n/a	n/a	n/a	54
Chloride (Cl) – SW	454	n/a	n/a	n/a	26
Sulphate (SO ₄) – GW	279	n/a	n/a	68	53
Sulphate (SO ₄) – SW	483	n/a	n/a	59	44
Fluoride (F) – GW	71	0	n/a	0	n/a
Fluoride (F) – SW	154	0	n/a	0	n/a
Aluminium (Al) – GW	71	2	13	n/a	0
Aluminium (Al) – SW	154	0	12	n/a	0
Arsenic (As) – GW	71	0	5	8	n/a
Arsenic (As) – SW	62	0	0	0	n/a
Cadmium (Cd) – GW	71	0	6	3	n/a
Cadmium (Cd) – SW	62	0	1	1	n/a
Copper (Cu) – GW	71	0	31	0	0
Copper (Cu) – SW	62	0	8	0	0
Chromium (Cr) – GW	71	0	1	0	n/a
Chromium (Cr) – SW	39	0	0	0	n/a
Iron (Fe) – GW	71	n/a	n/a	n/a	21
Iron (Fe) – SW	139	n/a	n/a	n/a	12

Parameter	No. of Samples	No. of Samples exceeding Guideline Limits ¹			
		Stock Watering ²	Freshwater Ecosystem ³	Drinking Water ⁴	
				Health	Aesthetic
Mercury (Hg) – GW	71	0	0	0	n/a
Mercury (Hg) – SW	39	0	0	0	n/a
Manganese (Mn) – GW	71	n/a	2	16	30
Manganese (Mn) – SW	73	n/a	1	7	16
Molybdenum (Mo) – GW	71	0	(a)	0	n/a
Molybdenum (Mo) – SW	39	0	(a)	0	n/a
Lead (Pb) – GW	71	0	0	0	n/a
Lead (Pb) – SW	64	0	1	1	n/a
Antimony (Sb) – GW	71	n/a	n/a	0	n/a
Antimony (Sb) – SW	21	n/a	n/a	0	n/a
Zinc (Zn) – GW	71	0	62	(a)	2
Zinc (Zn) – SW	62	0	18	(a)	0

* Notes
1 - Exceedences for metals/metalloids are for dissolved metals. A comparison for both total and dissolved metals is included in Appendix C.
2 - ANZECC (2000) Livestock Watering Guideline Values
3 - ANZECC (2000) Freshwater ecosystem protection – guideline limits for *slightly to moderately disturbed systems*
4 - Australian Drinking Water Guidelines (ADWG 6, 2011)
5 - GW = Groundwater Samples
6 - SW = Surface Water Samples
n/a - No standard exists

Observations from review of data in Table 8-3 include:

Stock water guideline limits

- Groundwater samples do not exceed stock water quality guidelines, with the exception of TDS, where 50 out of 279 samples exceed 4,000 mg/L, and aluminium, where 2 out of 71 samples exceed guideline limits
- Surface water samples exceed stock water guideline limits for TDS, but only 2 out of 340 samples exceed 4,000 mg/L;

Freshwater ecosystem protection guideline limits (slightly to moderately disturbed systems)

- Groundwater samples exceed guideline limits for a number of parameters, including aluminium, arsenic, cadmium, copper, chromium, manganese, and zinc
- Surface water samples exceed guideline limits for aluminium, cadmium, manganese, lead, and zinc

Drinking water guideline limits

- Groundwater samples exceed guideline limits (health-based) for sulphate, arsenic, cadmium, manganese
- Groundwater samples exceed guideline limits (aesthetic-based criteria) for pH, TDS, sodium, chloride, sulphate, iron, manganese, and zinc
- Surface water samples exceed guideline limits (health-based) for sulphate, cadmium, manganese, and lead
- Surface water samples exceed guideline limits (aesthetic-based criteria) for pH, TDS, sodium, chloride, sulphate, iron, and manganese.

The results from site groundwater sampling are consistent with previous investigations have concluded that the beneficial use for groundwater in the Clermont region is stock watering. Groundwater within the Tertiary basalt aquifer is, in some instances, suitable for potable use based on TDS criteria alone, however a number of other parameters may make groundwater in the area unsuitable for potable consumption without treatment to a potable standard.

Parameters that occur above drinking water guideline levels in regional groundwater samples include (JBT 2012):

- antimony, arsenic, lead, manganese and molybdenum (health-based criteria); and,
- aluminium, iron, and manganese (aesthetic-based criteria).

9.0 FINAL VOID

9.1 Final Void (Pit Lake) Water Levels and Water Quality

A water balance study has been undertaken for prediction of the water level and salinity of the pit lake that will be developed within the final landform (BMT-WBM 2012). The report notes that the site has a large external catchment, but the majority of flows from the catchment are directed around the site by two perimeter diversions, which are likely to remain in place after mine closure.

Two water balance scenarios were modelled:

1. With the exiting diversions in place; and,
2. With the diversions removed.

The modelled water level in the final pit lake (final void) for both scenarios is shown in Figure 9-1. The maximum water level for each simulation (279.6 mAHD for the “diversions” scenarios and 286.8 mAHD for the “no diversions” scenario) has been plotted on the hydrographs showing current and historic groundwater levels (Figure 9-2).

With respect to the modelled water level of the final void relative to historic and current groundwater levels it is noted that:

- For the majority of aquifers the current groundwater level in site monitoring bores is above the predicted final void water level, for both water balance scenarios;
- The bores for which water levels are close to or below predicted final void water levels (Figure 9-2) are generally close to the existing pit voids (refer Figure 8-1 for bore locations), and therefore affected by mining operations (including GT03 (monitoring Seam 4) and GW08 (monitoring spoil adjacent to the tailings dam);
- One bore (GW03B) monitors water levels in the Permian sediments close to the eastern boundary of the site. Water levels in this bore have been rising since the 2010/2011 wet season in response to downward leakage from the overlying basalt aquifer. The current water level at this site is now close to the maximum modelled water level for the “no diversions” scenario. Therefore this bore is well placed to monitor for potential offsite discharge of water from the pit void, via the groundwater system. This site represents the only monitored location to the west, north, or east of the site at which groundwater levels are close to the predicted maximum water level in the final void (with the groundwater level at all other sites being higher than modelled pit lake water levels – refer Figure 9-2).

The results of final void modelling therefore predict that for both scenarios modelled, the pit lake is likely to act as a groundwater sink, limiting the potential for offsite movement of water from the pit lake via the groundwater system.

With respect to water quality, final void modelling predicts that the pit lake will become progressively more saline to a level that is significantly greater than the salinity of surrounding groundwater system.

Therefore, maintenance of the existing groundwater monitoring network, and extension of the network (discussed further below) is recommended to enable monitoring of the impact of the final

landform pit lake on groundwater. With respect to offsite movement of groundwater, it is judged that a useful indicator parameter of interaction between the pit lake and the groundwater system will be chloride. This is because:

- Final void modelling predicts that the salinity of the pit lake will be significantly higher than the salinity of surrounding groundwater, providing a contrast between the pit lake and the groundwater system; and,
- Chloride is a conservative parameter, i.e. it moves freely in the groundwater system at the rate of groundwater flow, and with little retardation along the flow-path.

Based on historic and current groundwater levels, and the results of final void water level monitoring, it is judged that the most likely pathway for offsite movement of impacted groundwater is in the area of current surface water discharge from site, i.e. the southern boundary and particularly down-gradient of the existing environmental dam. Therefore it is recommended that additional groundwater monitoring bores be placed down-gradient of the environmental dam, monitoring water levels and water quality in the alluvium, as well as the shallow bedrock at this location.

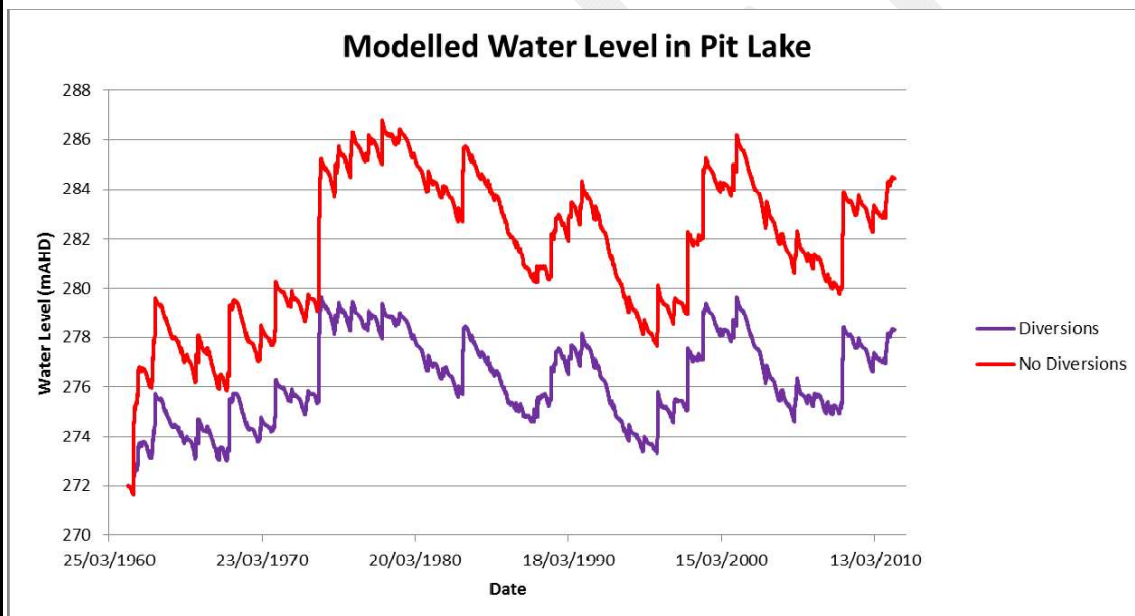


Figure 9-1: Modelled Water Level in Final Pit Lake (Source: BMT-WBM 2012)

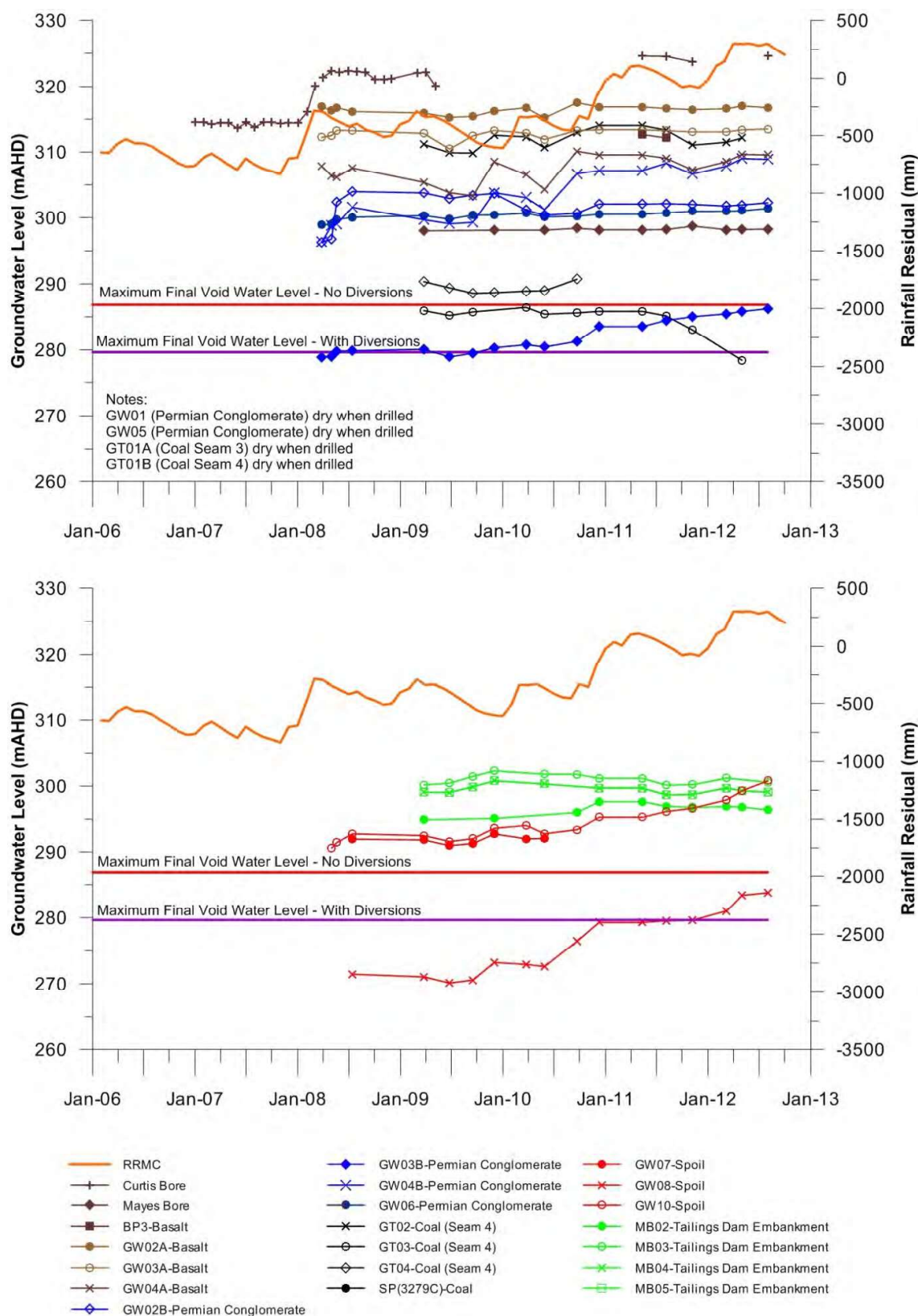


Figure 9-2: Modelled Final Void Water Levels Compared to Current Groundwater Levels

8.49.2 Potential Groundwater Inflow Rates to Final Void

The following section presents a summary of potential long-term yields of the groundwater units at the Blair Athol site. [The inflow rates presented in this section were used by BMT-WBM as input to final landform water study modelling \(BMT-WBM 2012\).](#)

Observations related to potential inflow rates to the final void from groundwater units at site are presented below in Table 9-1. The potential inflow rates are based on anecdotal information from site and professional judgement. Current inflow rates (i.e. to the operating mine) have not been quantified, and no groundwater modelling has been undertaken.

Rates of groundwater inflow to the final void are likely to be highly dependent on climatic variation, as follows:

- During periods of higher than average rainfall the water level in the basalt, alluvium, and spoil can be expected to rise, and the rate of inflow to the final void from these groundwater units will increase. It is noted that the more transmissive units of the coal measures (the coal seams) have been largely removed by mining. Therefore it is judged that the Permian coal measures will not provide significant rates of inflow to the pit void; and,
- During periods of lower than average rainfall the water level in groundwater units at site can be expected to decrease and the rate of inflow to the final void to decrease over time. In particular:
 - Within the basalt aquifer groundwater occurs within discrete fractures. Over time the rate of inflow from fractures connected to the final void could be expected to decrease, unless recharge (via rainfall) is maintained; and,
 - The alluvium tends to become saturated during high rainfall events (for example as occurred during the 2010/2011 wet season), however the volume of water contained within the alluvium will decrease over time as contained water is dissipated down-gradient.

Based on the indicative inflow rates presented in Table 9-1, the total groundwater contribution to the final void is predicted to be in the order of 3-5 L/s, though the actual rate will be dependent on factors such as seasonal rainfall, the overall shape of the final landform, and the hydraulic characteristics of groundwater units (such as spoil) that occur adjacent to or within the final void.

Table 9-1: Potential Groundwater Inflow Rates to Final Void

Unit	Predicted Inflow (L/s)	Comment
Permian coal measures	0	- The Permian coal measures are recharged in areas where the units subcrop (Figure 6-4), and via diffuse downward recharge. - The coal seams occur in an isolated basin, and the catchment area for recharge to the coal measures is small (refer Figure 6-4). - The permeability of the coal seams and interburden is low, therefore the capacity of the coal seam to transmit water is relatively low - Observations from site are that inflow rates from the coal seams during production were low - The coal seams (which are the most transmissive unit of the Permian coal measures) have been largely removed by mining. - Based on the above observations, it is concluded (for the purpose of pit void studies) that the inflow rate from the coal seams is nil
Permian conglomerate	0-2	- The Permian basal conglomerate generally only provides significant yields in areas where the unit has been remobilized. This is because the fine matrix material tends to be removed during remobilization, leaving behind the coarse clastic material which can form an aquifer (e.g. Tertiary gravels beneath Clermont Mine – refer JBT (2012). When the unit remains in-situ (i.e. in original position) the matrix remains, so that the permeability of the unit is dictated by the fine material of the matrix - At Blair Athol the basal conglomerate is saturated at depth. Where the unit exists close to surface it may contain water in areas where the unit receives recharge from direct rainfall, or via downward leakage where the unit underlies Tertiary basalt. - The Permian basal conglomerate does not form an extensive aquifer across the mine site, and the rate of inflow to the final void from this unit is expected to be low.
Tertiary basalt	1-5 (dependent on degree of rainfall recharge)	- Tertiary basalt exists only in the northern and north-eastern areas of the lease (Figure xx) - The basalt has been the main unit to contribute inflow to the pit voids during the life of the mine. Inflow rates are uncertain, but anecdotally it is believed that total flow rates are in the order of several litres per second - Inflow rates will be dependent on the position of the final void relative to the basalt aquifer.
Spoil	1-5 (dependant on spoil geometry relative to final void)	- The spoil will potentially become the most significant aquifer on site, however it is also noted that the extent of the spoil is limited, and the aerial extent (over which direct rainfall recharge will occur) is also limited; - Over time, it is judged that the spoil will be in continuous hydraulic connection with the pit lake, with the water level rising and falling in response to seasonal rainfall, as well as lake levels. - The greatest significance of the spoil aquifer to the final void is therefore likely to be geochemical, i.e. the extent to which rainfall recharge occurs through unsaturated spoil, and the extent to which the water level in the lake (and hence the spoil) rises and falls, will influence the chemistry of groundwater within the spoil, and hence within the pit lake. - The degree to which a water table develops in the spoil will be dependent on the shaping and cover of the final landform (i.e. whether rainfall recharge is enhanced or reduced) - The inflow rates to the final void will be dependent on factors such as: - The height of the water table in the spoil relative to the final void (and the hydraulic gradient available to drive groundwater flow); - The hydraulic properties of the spoil; and, - The geometry of the spoil relative to the final void
Alluvium	1-2 (dependent on degree of rainfall recharge)	- The alluvium tends to carry significant water only following periods of high rainfall, where the alluvium is directly recharged. - In periods of lower than average rainfall the groundwater level in the alluvium could be expected to continually decrease, with a corresponding decrease in inflow rate to the final void - The degree to which groundwater in alluvium could provide seepage to the pit void will be dependent on the degree of hydraulic connection between the pit void and alluvium. For example, if a significant thickness of alluvium is in hydraulic connection with the final void, and if a high rainfall period such as the 2010/2011 wet season re-occurs, the rate of groundwater inflow could be significantly in excess of the rate presented in the column to the left

9.010.0 CONCEPTUAL GROUNDWATER MODEL

Conceptual groundwater models are presented below for pre-mining, mining, and post-closure scenarios. Each scenario is discussed with reference to conceptual cross sections. The location of the sections, sub-crop area of each coal seam, and general extent of basalt cover, is shown schematically in Figure 10-1.

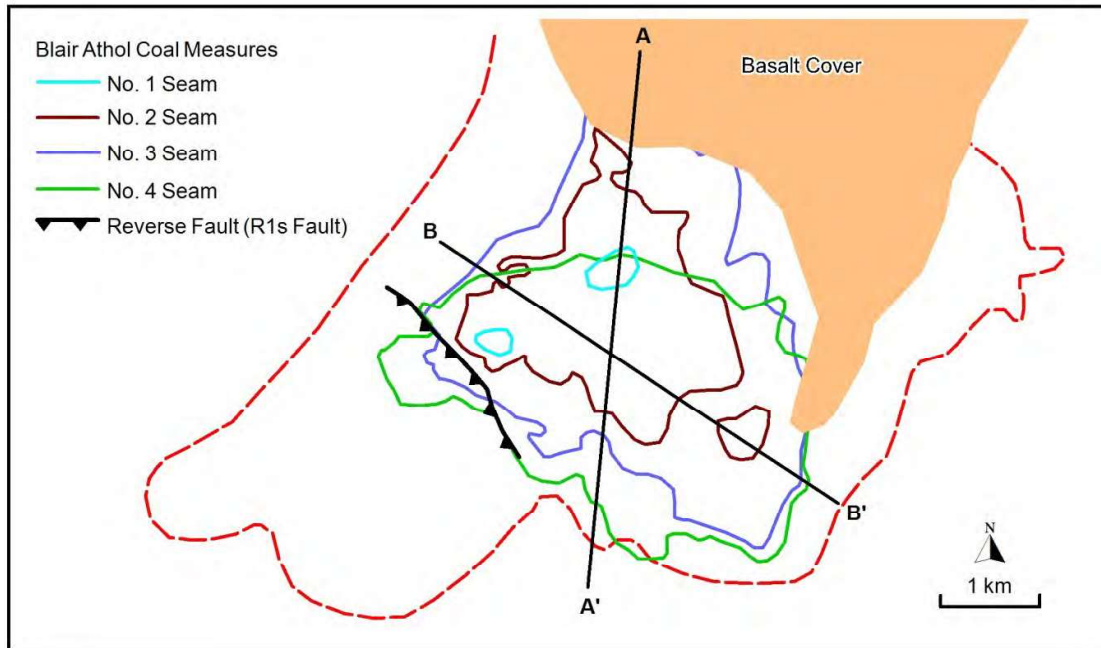


Figure 10-140-4: Location of Conceptual Sections (modified from RTCA 2011)

9.410.1 Pre-Mining Conceptual Groundwater Model

No groundwater data exists prior to commencement of mining, therefore the pre-mining conceptual model is based on observations from available monitoring data at site (water level and water quality), as well as observations from ongoing reviews by JBT of regional groundwater data for the Clermont Mine, and professional judgement. The pre-mining conceptual model (Figure 10-2) is summarised as:

- The basement metamorphics, Permian sediments, Tertiary basalt, and Quaternary alluvium all occur at surface in different areas of the Blair Athol Mining Lease (refer Figure 6-3);
- Groundwater occurs in all groundwater units at site, though available data relating to groundwater yields suggests that the units are not aquifers¹ (with the exception of the Tertiary Basalt) but rather water-bearing units, as the rate at which the units are capable of yielding water to a bore would not allow the units to be classified as aquifers. Exceptions may occur locally where faulting or fracturing has increased the secondary porosity of the unit;
- Pre-Tertiary (pre-basalt deposition) surface drainage was from the northern part of the lease area to the north-east and east, along a drainage channel incised into the Permian surface (Figure 6-2). During deposition the basalt flowed up the drainage channel and into the northern area of the lease. The basalt on site represents the marginal extent of the basalt flow, and the

¹ An aquifer is defined as "rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs". (Fetter, 1994)

basalt cover on site is therefore thin in areas where it occurs on lease, thickening to the north and north-east;

- Within the basalt aquifer groundwater occurs primarily within fractures that are generally poorly connected to adjacent fractures (i.e. pumping from one fracture system may have little impact on adjacent fracture systems). This has implications for potential long-term inflow rates from the basalt aquifer to the final void (refer Sections 10.1 and 10.2);
- The Blair Athol Basin is a relatively isolated groundwater system, and the coal seams drain towards the centre of the basin. The groundwater flow paths within the coal seams are relatively short as it can be observed from Figure 10-1 that the subcrop boundaries of the individual coal seams are only several kilometres apart (i.e. the distance from one side of the basin to the other);
- Recharge to the coal seams occurs in marginal areas of the basin where the coal seams subcrop (refer Figure 10-1 for coal seam subcrop areas), or via downward drainage from overlying groundwater units;
- Recharge to other groundwater units is via direct rainfall recharge, and groundwater flow direction is topographically controlled. A groundwater divide exists in the basalt aquifer to the north of the mine area, at the catchment boundary between the north-west draining Midlere Creek, the south-east draining Gowrie Creek, and Bath and Washpool Creeks, which drain in a southerly direction through the mining area (refer Figure 6-3);
- All creeks in the area are ephemeral, and groundwater exists within unconsolidated alluvial deposits following rainfall recharge events; and,
- Major ion chemistry/ water types are different in different regions of the site, reflecting the chemistry of the rock units that host the groundwater (i.e. Mg-Ca-HCO₃ in areas where basalt exists, Na-Cl in other areas).

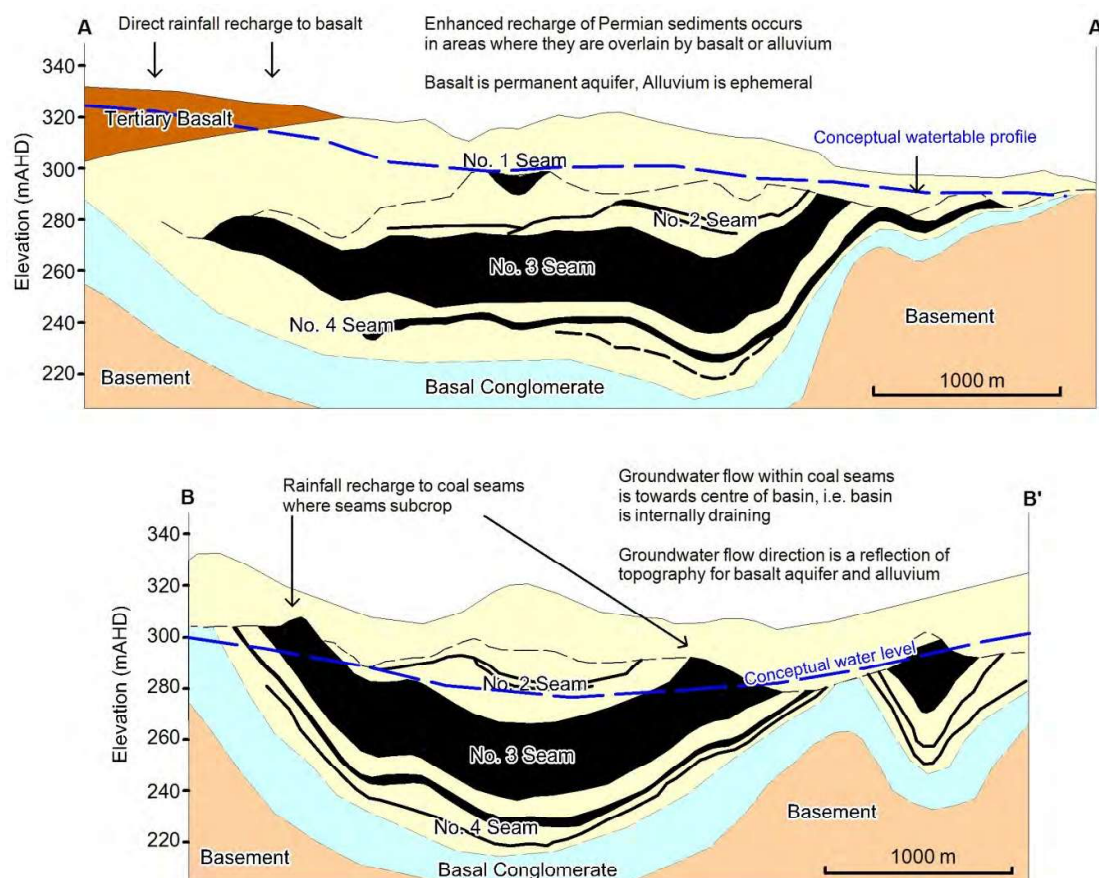


Figure 10-240-2: Pre-Mining Conceptual Groundwater Model (Modified from RTCA 2011)

9.210.2 During Mining Conceptual Groundwater Model

The conceptual model for groundwater conditions during mining is shown in Figure 10-3, and is summarised as:

- Excavation of the pit voids creates groundwater sinks, which locally dewater the coal seams;
- Flow toward the pit voids is also induced from the basalt aquifer, with seepage occurring from the base of basalt (predominantly at the contact between the basalt and underlying units);
- Inflow to the pits may also occur through Permian conglomerates, especially in areas where the unit underlies (and is recharged by) the basalt aquifer;
- A localised aquifer is created within the spoil which backfills the mined-out pit voids. The hydraulic properties of the spoil aquifer are likely to be highly variable, dependant on factors such as the permeability of the original material, the dumping pattern, degree of compaction due to traffic, and variability in the rate of compaction and settlement with time. One study of groundwater conditions within spoil aquifers across a number of mining regions in the United States² noted a 6-order of magnitude variability in the permeability of spoil;
- The spoil aquifer is directly recharged by rainfall, as evidenced by bore hydrographs which show a correlation between rainfall and water level rise in the spoil (Section 8.2);

² Rehman, B.R., Groenewold, G.H. & Morin, K.A. (1980) Hydraulic Properties of Coal and Related Materials, Northern Great Plains. Groundwater Vol 18, No. 6, November-December 1980.

- Water quality has evolved from a number of distinct types (Na-Cl in areas distant from the basalt aquifer, and Ca-Mg-HCO₃ within the basalt aquifer, as well as within units that underlie basalt) to mixed water types as mixing occurs between different groundwater units (Section 8.3.1).

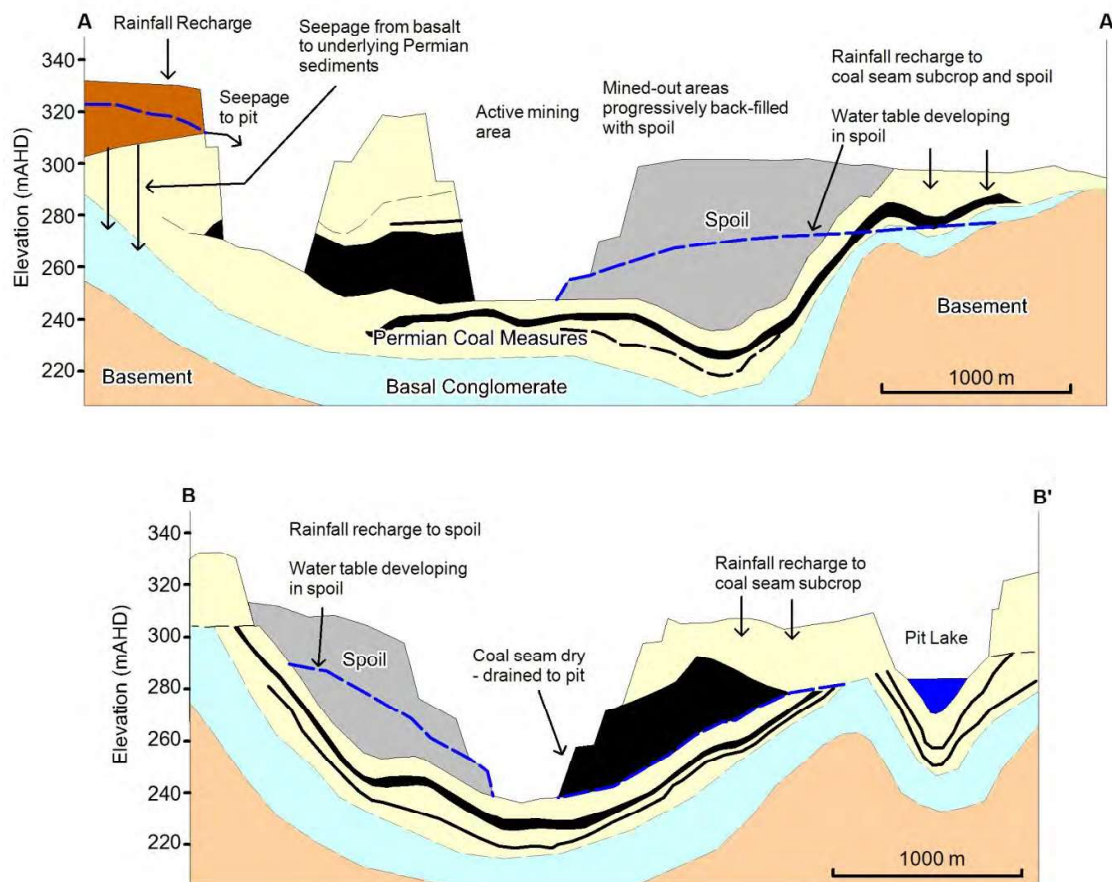


Figure 10-3: During-Mining Conceptual Groundwater Model

9.3.10.3 Post-Closure Conceptual Groundwater Model

Based on review of available geological, water level, and water quality data, the post closure conceptual groundwater model (Figure 10-4) is summarised as:

- A water table will develop within the spoil, with the water level in the spoil influenced by rainfall recharge;
- The spoil will potentially become the most significant aquifer on site, however it is also noted that the extent of the spoil is limited, and the aerial extent (over which direct rainfall recharge will occur) is also limited;
- Over time, it is judged that the spoil will be in continuous hydraulic connection with the pit lake, with the water level rising and falling in response to seasonal rainfall, as well as lake levels;
- The greatest significance of the spoil aquifer to the final void is therefore likely to be geochemical, i.e. the extent to which rainfall recharge occurs through unsaturated spoil, and the extent to which the water level in the lake (and hence the spoil) rises and falls, will influence the chemistry of groundwater within the spoil, and hence within the pit lake.
- The degree to which a water table develops in the spoil will be dependent on the shaping and cover of the final landform (i.e. whether rainfall recharge is enhanced or reduced);

- The inflow rates to the final void will therefore be dependent on:
 - The height of the water table in the spoil relative to the final void, and therefore the hydraulic gradient available to drive groundwater flow;
 - The hydraulic properties of the spoil; and,
 - The geometry of the spoil relative to the final void
- Groundwater quality within the spoil aquifer will be dependent on spoil chemistry and groundwater residence times. Based on analysis of existing water quality data, it is predicted that water at the site (surface water and groundwater) will evolve to a mixed water type (dominated by Mg, Ca, and Na cations, and SO₄ and HCO₃ anions);
- Water within the basalt aquifer occurs within discrete fracture systems. Ongoing seepage from the basalt aquifer towards pit voids can be expected in areas where water-bearing fractures have been exposed by mining. The individual fractures store a finite volume of water, so the seepage rates could be expected to decrease over time, with increases in seepage rates evident following periods of rainfall recharge. Wet season rainfall has generally been above average since the 2007/2008 wet season, therefore the water level in most aquifers in the region are currently higher than has historically been the case (i.e. since prior to 2007, refer JBT 2012). Therefore it could be expected that seepage rates to the pit voids from the basalt aquifer would reduce during sustained periods of below average rainfall as the finite volume of water within the fractures discharges to the pit voids without being replenished by rainfall recharge; and,
- Groundwater levels for the majority of aquifers at site are currently higher than the predicted maximum water level in the final landform (pit lake). Therefore, it is predicted that the final landform pit lake will act as a groundwater sink, which will limit the potential for off-site discharge of water from the final void.

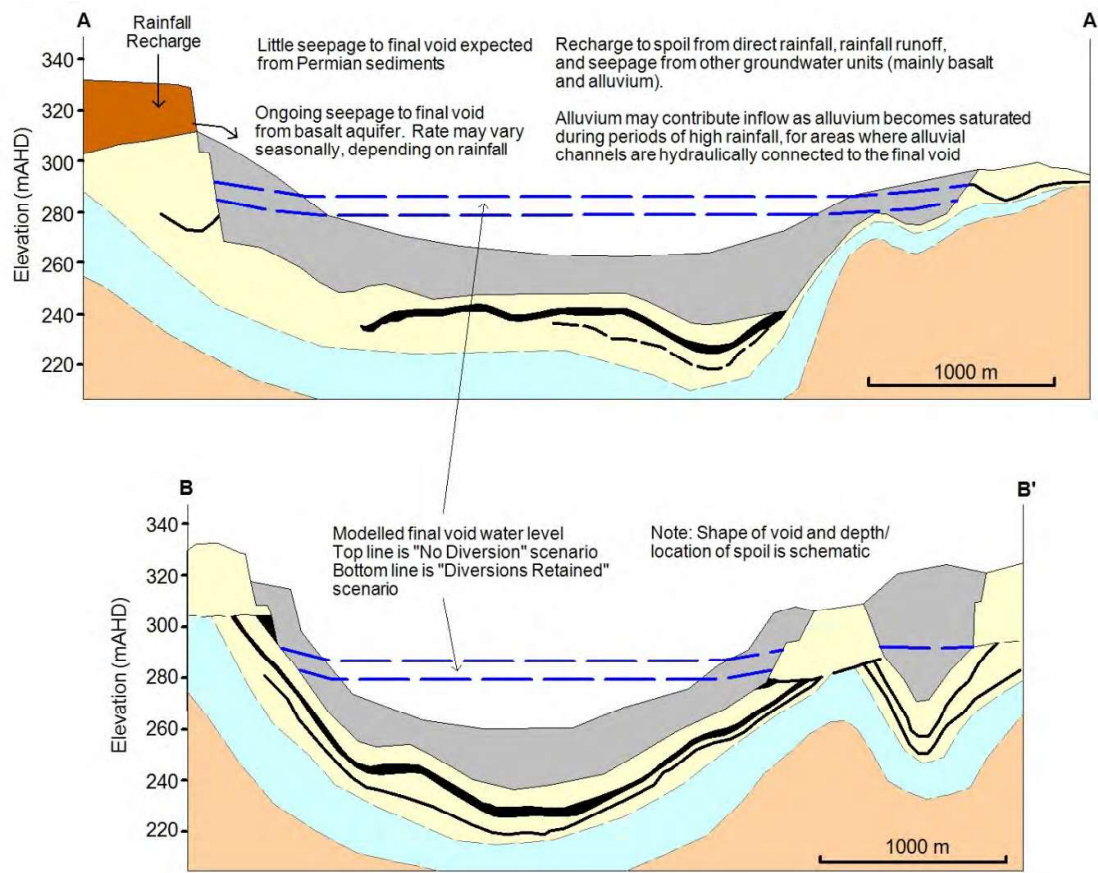


Figure 10-410-4: Post-Closure Conceptual Groundwater Model

10.011.0 CONCLUSIONS

10.111.1 Hydrostratigraphy

The stratigraphic sequence in the Blair Athol Basin comprises five lithological units; these are, from stratigraphically lowest to highest:

- Proterozoic/ Cambrian Anakie Metamorphic Group, comprising schist, phyllite, metabasalt;
- Early to Middle Devonian arenites, occupying a small basement trough in the southern part of the basin;
- Permian-age Blair Athol Coal Measures, comprising:
 - The lower Coal Measures, which include basal conglomerate, sandstone, siltstone, and mudstone; and,
 - The upper Coal Measures, which include sandstone, siltstone, mudstone, conglomerate, as well as the four main coal seams of the basin (Seams 1, 2, 3, and 4)
- Tertiary basalt, which only occurs in the north and east of the lease area (Figure 6-3); and,
- Tertiary and Quaternary (recent) alluvial deposits developed within the ephemeral streams that drain the site, including Bath Creek and Washpool Creek.

10.211.2 Groundwater Levels

Groundwater level data is summarised and analysed in Section 8.0. Observations from review of the hydrographs include:

Tertiary Basalt

- Only one bore (Curtis Bore) has water level readings that date prior to January 2008 (prior to the 2007/2008 wet season). The impact of 2007/2008 wet season rainfall is evident at this site, where the water level rise in the bore matches the rise in the residual rainfall mass (RRM) curve;
- Other basalt bores display a relatively steady water level trend, with a slight overall rise in water level evident between March 2008 and August 2012;

Coal Seam

- Monitoring bores at site are screened in either Seam 3 or Seam 4 (lower coal seams) as the seams above (Seam 1 and Seam 2) tend to be dry when drilled;
- Bore GT01 is located adjacent to the Ramp 3 South pit (Figure 8-1). Both GT01A (Seam 3) and GT01B (Seam 4) are dry, indicating that water within the coal seams has drained to the pit at this location;
- The impact of mining on water levels in the coal seam can be seen from the hydrograph for bore GT03 (Seam 4), the water level has reduced significantly at this site (7.38 m water level reduction) between May 2011 and May 2012.

Permian Conglomerate

- Water levels in bores monitoring the Permian conglomerate have tended to increase in response to rainfall recharge, i.e. water levels tend to conform to the overall trend of the RRM curve, which has displayed a rising trend since December 2007.
- Between May 2008 and May 2012 the water level has increased by 6.01 m in GW03B, 9.98 m in GW04B, and 1.36 m in GW06 (i.e. the greatest rate of water level increase has been in bores that are overlain by Tertiary basalt);
- At sites where the conglomerate is overlain by basalt (GW02B, GW03B, GW04B) the water level in the basalt aquifer is higher than the water level in the conglomerate, indicating a potential for the basalt aquifer to recharge the underlying Permian sediments.

Spoil

- Bores screened in spoil (GW08, GW10) show a rise in water level between July 2008 and August 2012 of between 8.06 m (GW10) and 12.32 m (GW08). This matches the overall rise in the RRM curve, indicating that groundwater levels within the spoil are directly impacted by rainfall recharge events.

Tailings Storage Facility (TSF)

- Bores screened within the TSF embankment (MB02, MB03, MB04, MB05) display relatively consistent water levels, suggesting that water levels in the bores are dominated by the water level within the TSF rather than by rainfall recharge (as is the case with bores in the surrounding spoil);

10.311.3 Water Chemistry

The major ion chemistry at site is summarised as:

- Water samples from the coal seam, the Permian conglomerate (in areas where basalt does not exist), and some spoil bores (e.g. GW07) is sodium dominated;
- Cation chemistry for the basalt aquifer, and for the Permian conglomerate underlying basalt, is calcium-magnesium dominated; and,
- A number of surface water (industrial dam, environmental dam) were initially sodium dominated, but evolved to calcium-magnesium dominated over time. West Dam, which is in a catchment containing basalt outcrop as well as bedrock outcrop, has consistently displayed a mixed water chemistry dominated by sodium, calcium, and magnesium cations.
- Anion chemistry is more diverse, with water samples from different sources tending to be dominated by either chloride, bicarbonate, or sulphate. However, over time the various water sources (including surface water and groundwater) that were previously chloride dominated have evolved towards being dominated by bicarbonate or sulphate anions.
- Therefore over time, the surface water and groundwater at site has evolved from distinct water types to a mixed water type, which is increasingly dominated by calcium, magnesium, bicarbonate, and sulphate.

Water quality across the site has also been compared to a number of Australian guidelines, with observations as follows:

- Stock water guideline limits (ANZECC 2000)
 - Groundwater samples do not exceed stock water quality guidelines, with the exception of TDS, where 50 out of 279 samples exceed 4,000 mg/L, and aluminium, where 2 out of 71 samples exceed guideline limits
 - Surface water samples exceed stock water guideline limits for TDS, but only 2 out of 340 samples exceed 4,000 mg/L;
- Freshwater ecosystem protection guideline limits (ANZECC 2000 - slightly to moderately disturbed systems)
 - Groundwater samples exceed guideline limits for a number of parameters, including aluminium, arsenic, cadmium, copper, chromium, manganese, and zinc
 - Surface water samples exceed guideline limits for aluminium, cadmium, manganese, lead, and zinc
- Drinking water guideline limits (ADWG 2011)
 - Groundwater samples exceed guideline limits (health-based) for sulphate, arsenic, cadmium, manganese
 - Groundwater samples exceed guideline limits (aesthetic-based criteria) for pH, TDS, sodium, chloride, sulphate, iron, manganese, and zinc
 - Surface water samples exceed guideline limits (health-based) for sulphate, cadmium, manganese, and lead
 - Surface water samples exceed guideline limits (aesthetic-based criteria) for pH, TDS, sodium, chloride, sulphate, iron, and manganese.

In summary, the results from site groundwater sampling are consistent with previous investigations have concluded that the beneficial use for groundwater in the Clermont region is stock watering. Groundwater within the Tertiary basalt aquifer is, in some instances, suitable for potable use based

on TDS criteria alone, however a number of other parameters may make groundwater in the area unsuitable for potable consumption without treatment to a potable standard.

11.4 Final Void

11.4.1 Final Void Water Levels and Water Quality

A summary of final void modelling undertaken by BMT-WBM (2012) with respect to groundwater implications, is presented in Section 9.1 and is summarised as follows:

- Comparison of final void modelling with current and historic groundwater levels indicates that, for the majority of cases, groundwater levels are higher than the water level in the final void. This suggests that the final landform pit lake will act as a groundwater sink, limiting the potential for off-site movement of water from the pit lake via the groundwater system;
- It is concluded that the existing groundwater monitoring network (north, east and west of the site) is sufficient to monitor for offsite impacts from the final void lake;
- The groundwater monitoring network should be supplemented with:
 - Monitoring bores around the pit lake, drilled to intersect the water table and to monitor for changes in water level and water quality; and,
 - Monitoring bores to the south of the site, in the area where offsite groundwater movement is most likely to occur (i.e. down-gradient of the existing environmental dam, with bores placed too monitor water level/ water quality in the alluvium as well as adjacent/ underlying units (shallow bedrock)).

11.4.2 Groundwater inflow to Final Void

The potential for groundwater to provide inflow to the final void is presented in Section 9-2 and Table 9-1, and is summarised as follows:

- Rates of groundwater inflow to the final void are likely to be highly dependent on climatic variation, as follows:
- During periods of higher than average rainfall the water level in the basalt, alluvium, and spoil can be expected to rise, and the rate of inflow to the final void from these groundwater units will increase. It is noted that the more transmissive units of the coal measures (the coal seams) have been largely removed by mining. Therefore it is judged that the Permian coal measures will not provide significant rates of inflow to the pit void; and,
- During periods of lower than average rainfall the water level in groundwater units at site can be expected to decrease and the rate of inflow to the final void to decrease over time. In particular:
 - Within the basalt aquifer groundwater occurs within discrete fractures. Over time the rate of inflow from fractures connected to the final void could be expected to decrease, unless recharge (via rainfall) is maintained; and,
 - The alluvium tends to become saturated during high rainfall events (for example as occurred during the 2010/2011 wet season), however the volume of water contained within the alluvium will decrease over time as contained water is dissipated down-gradient.
- Based on the indicative inflow rates presented in Table 9-1, the total groundwater contribution to the final void is predicted to be in the order of 3-5 L/s, though the actual rate will be dependent on factors such as seasonal rainfall, the overall shape of the final landform, and the hydraulic characteristics of groundwater units (such as spoil) that occur adjacent to or within the final void.

10.411.5 Conceptual Groundwater Model

Conceptual groundwater models for pre-mining, mining, and post-mining (closure) scenarios are presented in Section 10. The conceptual models are presented in summary form, so they will not be further summarised in this section.

11.012.0 RECOMMENDATIONS

Following review of groundwater conditions at site, as well as data from the existing groundwater monitoring network and results of final landform water study modelling, the final recommendations are made:

- Following development of the final landform, groundwater monitoring bores should be constructed around the perimeter of the lake (final number to be established once the landform is complete). Bores should be drilled to intersect the watertable, and monitored for change in water level and water quality;
- Additional groundwater monitoring bores should also be constructed at the southern end of the site (between the environmental dam and the southern boundary of the lease) to monitor for potential offsite movement of contaminants from site, particularly from the final landform pit lake;
- Following final design of the post-closure groundwater monitoring network, a plan and schedule for ongoing monitoring/sampling of water levels and water quality should be developed. Initial recommendations for monitoring include:
 - Monitoring of water levels within key bores (to be determined) via down-hole data loggers, with data loggers to be downloaded at a maximum interval of 3-monthly. For other sites water levels should be recorded manually at 3-monthly intervals. Following each data download the data should be reviewed for data integrity, and a report on groundwater levels and trends prepared on an annual basis;
 - Water quality should be monitored quarterly for a minimum of 2 years to establish a base-line data set for closure conditions, for a minimum of the following parameters:
 - Total Dissolved Solids
 - EC, pH (field)
 - Major Ions - sodium, calcium, magnesium, potassium, chloride, sulphate, alkalinity (hydroxide, carbonate, bicarbonate, total)
 - Fluoride
 - Total + dissolved metals, via ICPMS/FIMS (aluminium, arsenic, boron, cadmium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, vanadium, zinc)
 - It is recommended that water quality data be reviewed each quarter, and a report prepared on an annual basis to present and discuss results and trends. The frequency of data collection should be reviewed following 2 years of data collection, with recommendations then made as to the frequency of ongoing data collection.
- It is acknowledged that different monitoring/reporting conditions may be required by DEHP, therefore the post-closure groundwater monitoring plan will need to be reviewed and approved by DEHP.

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APPENDIX A
GROUNDWATER LEVEL DATA

APPENDIX A
WATER-TYPE ANALYSES

APPENDIX B
COMPARISON OF SITE WATER QUALITY
TO AUSTRALIAN GUIDELINES

**Blair Athol Coal Mine –
Environmental Management
System**

TerraCom

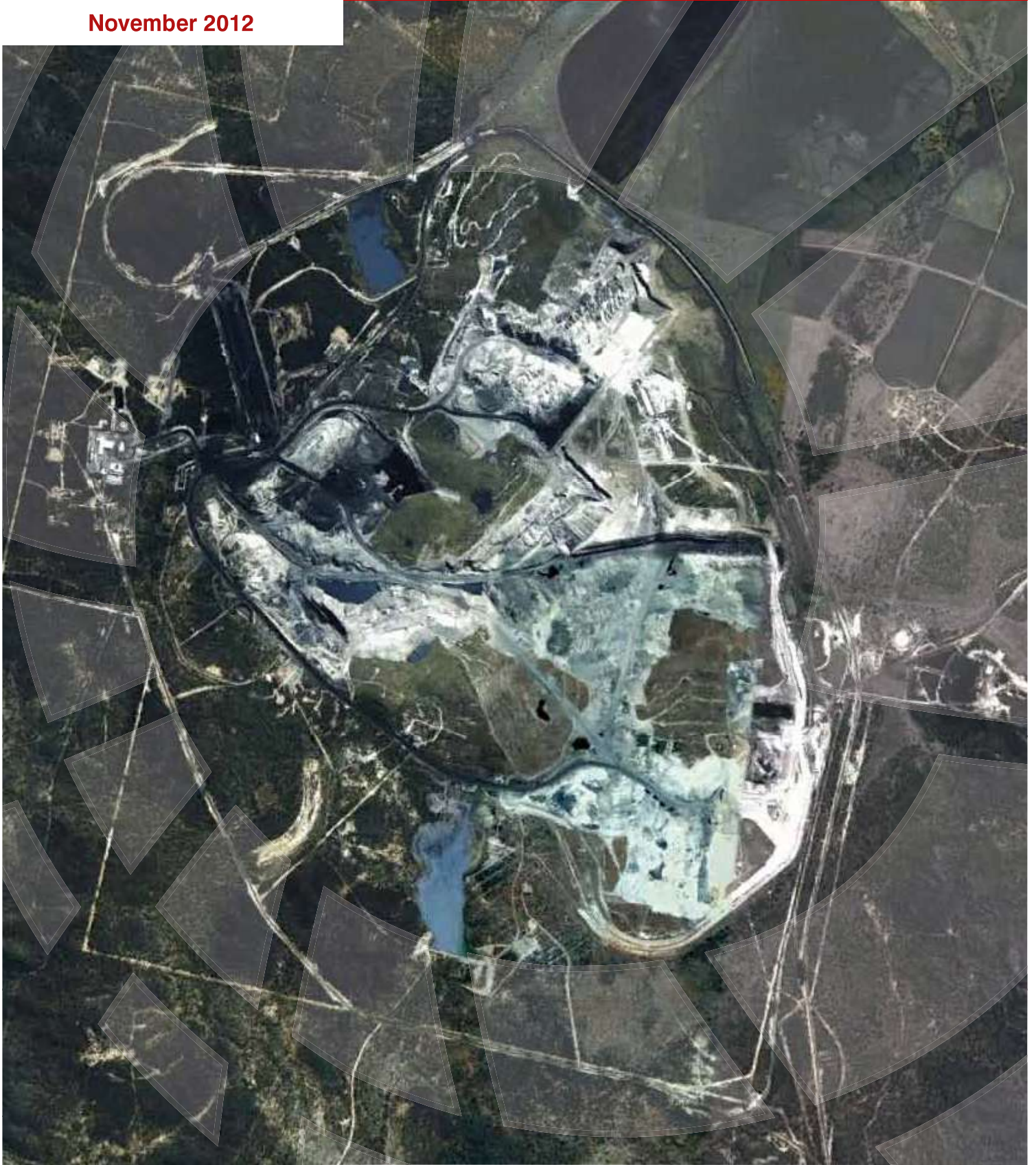
APPENDIX D – BMT WBM 2012 FINAL LANDFORM WATER STUDY



“Where will our knowledge take you?”

BAC Final Landform Water Study

November 2012



“

at a Glance

”

Objectives

Rio Tinto Coal Australia (RTCA) is undertaking closure planning for the mine site at Blair Athol, Central Queensland.

Upon closure of the mine site, the final landform will likely contain at least one final void with a series of waterbody depressions scattered throughout the site (hereafter referred to as the 'pit lake'). The site has a large external catchment, but the majority of flows from this external catchment are redirected around the site by two perimeter diversions, which are likely to remain in place after the mine is decommissioned.

BMT WBM has undertaken a preliminary assessment of the water balance of the pit lake under two scenarios: (i) with the existing diversions in place and (ii) with the diversions removed. Our assessment includes both water quantity and quality and has applied a combination of catchment and hydrodynamic models for the assessment – assessing how the final landform would function using 50 years of historical climate data (from 1961 to 2011).



Key Findings

- Under both scenarios, the water level within the pit lake is predicted to be much lower than its crest height during the 50 year simulated. The pit lake is subsequently highly unlikely to 'over-top' and discharge into downstream waterways, except during very large flood events.
- The pit lake is subsequently unlikely to have any impact on water quality within the downstream waterways through surface flows. There still exists the potential for impacts on the downstream environment through groundwater interactions, but the likelihood of this occurring is unknown.
- The pit lake is predicted to experience seasonal thermal stratification during summer under both scenarios, with lake 'turn-over' (mixing of surface and bottom layers) during winter. After approximately 25 years, the lake is predicted to become more saline with 'haloclines' developing (large differences in salt concentrations between the surface and bottom waters) and remaining in place for extended periods of time.
- Water quality within the pit lake is likely to be poor. Deep layers are likely to become anoxic (with very low oxygen levels), pollutants (e.g. heavy metals) will accumulate, and there may be algal blooms (and associated impacts, such as reduced oxygen levels).

Where to from here ?

The creek diversions around the site should remain in place and be maintained to ensure that flow from upstream catchment areas continues into downstream waterways.

Further work should be undertaken to determine whether water within the lake could flow to the downstream environment through groundwater interactions.

Further work should also be undertaken out to provide a more detailed understanding of future likely water quality of the lake – with a view to determining beneficial uses of the site (if any).

BAC Final Landform Water Study

Prepared For: Rio Tinto

Prepared By: BMT WBM Pty Ltd (Member of the BMT group of companies)

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Client :	Rio Tinto										
Client Contact:	Scott Diggles										
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Title :	BAC Final Landform Water Study
Author :	Rob Holmes
Synopsis :	preliminary assessment of the water balance of the final proposed landform for the Blair Athol mine

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Executive Summary



EXECUTIVE SUMMARY

Rio Tinto Coal Australia (RTCA) is undertaking closure planning for the mine site at Blair Athol, Central Queensland, and has commissioned BMT WBM to conduct a water study of the site's final landform. The Blair Athol sites has an upstream catchment of 64 km², but the majority of flows from the catchment are redirected around the site by two perimeter diversions, which are likely to remain in place after the mine is decommissioned. This study examined the hydrodynamics of the mine pit lake under two scenarios: (i) with the diversions in place and (ii) with the diversions removed.

The study comprises two components, a catchment model of the mine site and upstream catchment, and a hydrodynamic model of the mine pit lake.

The catchment model was created using Source Catchments, developed by the eWater CRC, which is widely used for studies of this nature. The model requires rainfall and potential evapotranspiration data, which were provided by the Bureau of Meteorology (BoM), while salinity data were derived from total dissolved solids (TDS) measurements taken from nearby creeks. Flows and salinities for both scenarios were simulated and the results provided for use as inputs to the hydrodynamic model. Flows under the 'no diversions' scenario were approximately 3.3 times those under the 'diversions' scenario over the course of the run (1961 to 2011).

The hydrodynamic model of the pit lake was created using DYRESM, developed by the Centre for Water Research at University of Western Australia. DYRESM is a one dimensional, laterally-averaged model, which requires meteorological data (sourced from BoM), surface inflows (the catchment model results) and groundwater inflows (provided by JBT Consulting) to run. The DYRESM structure was derived from a DEM (Digital Elevation Model) of the final landform, provided by RTCA. Using these inputs, the model was simulated for 50 years from 1961 to 2011.

The results of the hydrodynamic modelling indicate that, under both scenarios, the water level within the lake is not predicted to reach the lake crest height during the 50 year simulation. The model subsequently predicts that there would be zero flows from the lake to the downstream environment (during the 50-year historical climate period) and the only loss of water volume would be through evaporative flux. This makes the lake a closed system, with salinity that gradually increases over time as more dissolved solids are brought into the lake through catchment and groundwater inflows.

Initially, the system is predicted to experience seasonal thermal stratification under both scenarios. During summer, surface waters warm and become more buoyant, leading to the creation of a thermocline (a thin layer between surface and bottom layers over which a strong temperature gradient exists). The thermocline is then destroyed and the water column overturns during winter, as the surface waters cool and become more dense. After approximately 25 years of salt accumulation, however, the system is predicted to become more saline and haloclines are predicted to develop, which are strong salinity gradients between surface and bottom waters. The haloclines can be much more long-lived, with the water-body becoming strongly stratified for years at a time.

Long-term stratification of a lake can have negative implications for water quality, with deep layers becoming anoxic as they lack atmospheric oxygen exchange. The lack of flushing of the closed lake may also result in the accumulation of nutrients over time, which may results in algal blooms, further reducing oxygen levels within the lake. Pollutants such as heavy metals may also accumulate over time.

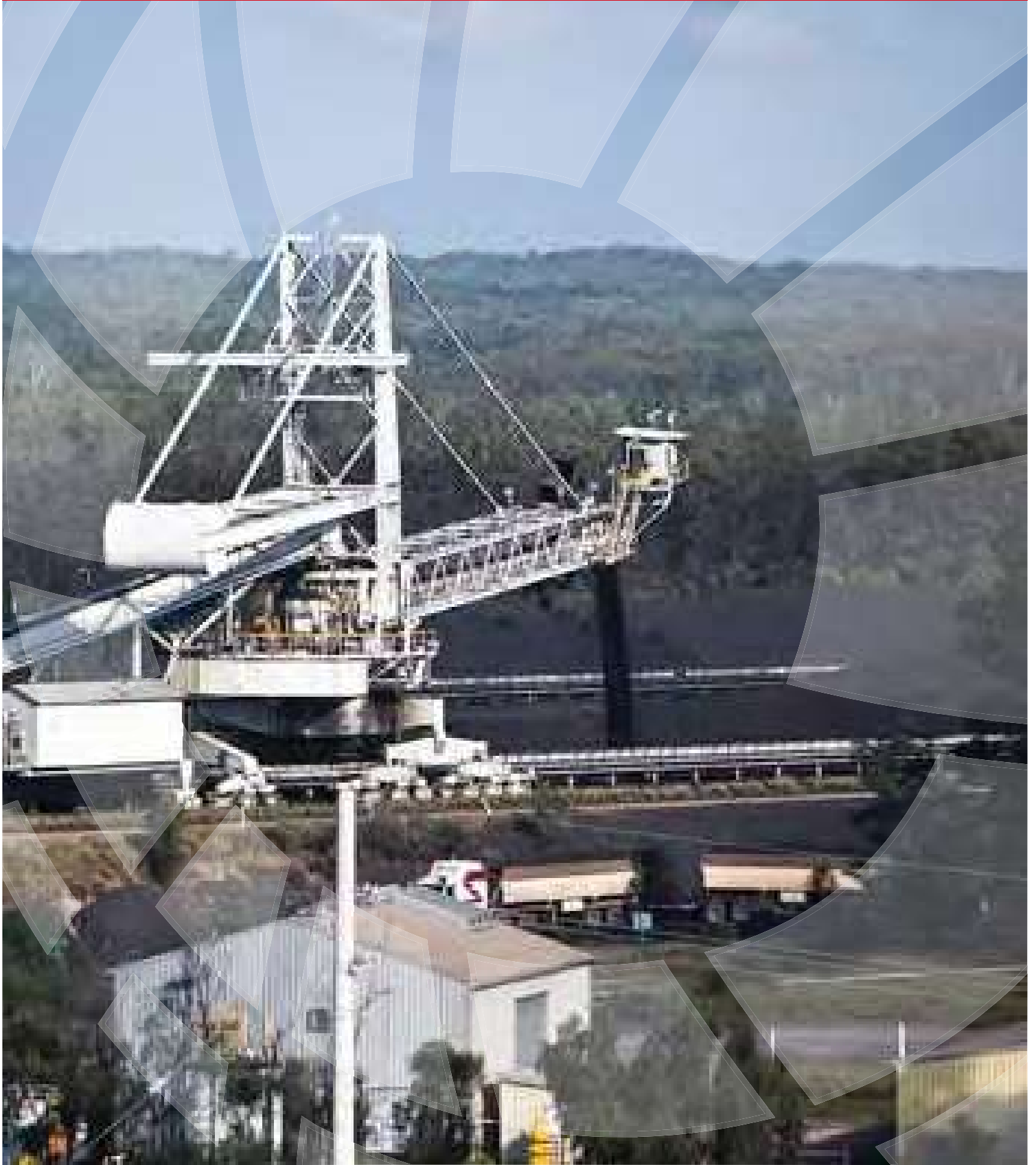
A benefit of the lack of flow from the lake to the downstream environment is that, if the water quality within the lake is poor (which appears likely), then the probability of negative effects on the downstream environment from the lake overflowing is low. This does not take into account groundwater interactions, however, which may provide a pathway for lake water to flow downstream of the mine site.

BMT WBM recommends that the creek diversions around the site remain in place and are maintained to ensure that flow from the upstream catchment during a rainfall event reaches the downstream environment. Removing the creek diversions would result in the majority of surface flow from the catchment entering the pit lake, and not flowing to the creeks downstream of the site. Such an outcome would likely have a negative effect on the downstream environment.

BMT WBM also recommends that a further groundwater study should be performed to determine if water quality within the lake is likely to affect the downstream environment through groundwater interactions.

Furthermore, BMT WBM recommends that additional work be carried out to determine the future likely water quality of the lake, with a view to determining beneficial uses of the site, if any.

1: Introduction



1 INTRODUCTION

Blair Athol Mine is located in the Bowen Basin in Central Queensland, 25 km north-west of the township of Clermont. Coal mining has been undertaken at the site since 1882 and the current mining operation supplies customers in Asia and Europe with up to 12 million tonnes of coal per annum. Rio Tinto Coal Australia (RTCA) manages the existing operation on behalf of a joint venture and is currently undertaking closure planning for the mine site. Upon closure of the mine site, the final landform will likely contain at least one final void with a series of water-body depressions scattered throughout the site. RTCA commissioned BMT WBM to conduct a modelling assessment of the long-term water balance of the final landform, which is described in this report.

The mining lease extends over approximately 1030 hectares and is located downstream of an external catchment (see Figure 1-1 and Figure 1-2). The external catchment upstream of the site comprises of number of ephemeral creeks that are known as Breaker, Bath and Washpool Creeks. Perimeter diversions (to divert these creeks around the site) have been necessary to enable mining of the Blair Athol coal measures. These diversions are expected to remain in place upon closure of the mine. Nevertheless, this study examined two scenarios for the upstream catchment: (i) with the diversions in place and (ii) with the diversions removed..



Title:

Site Layout

Figure:

1-1

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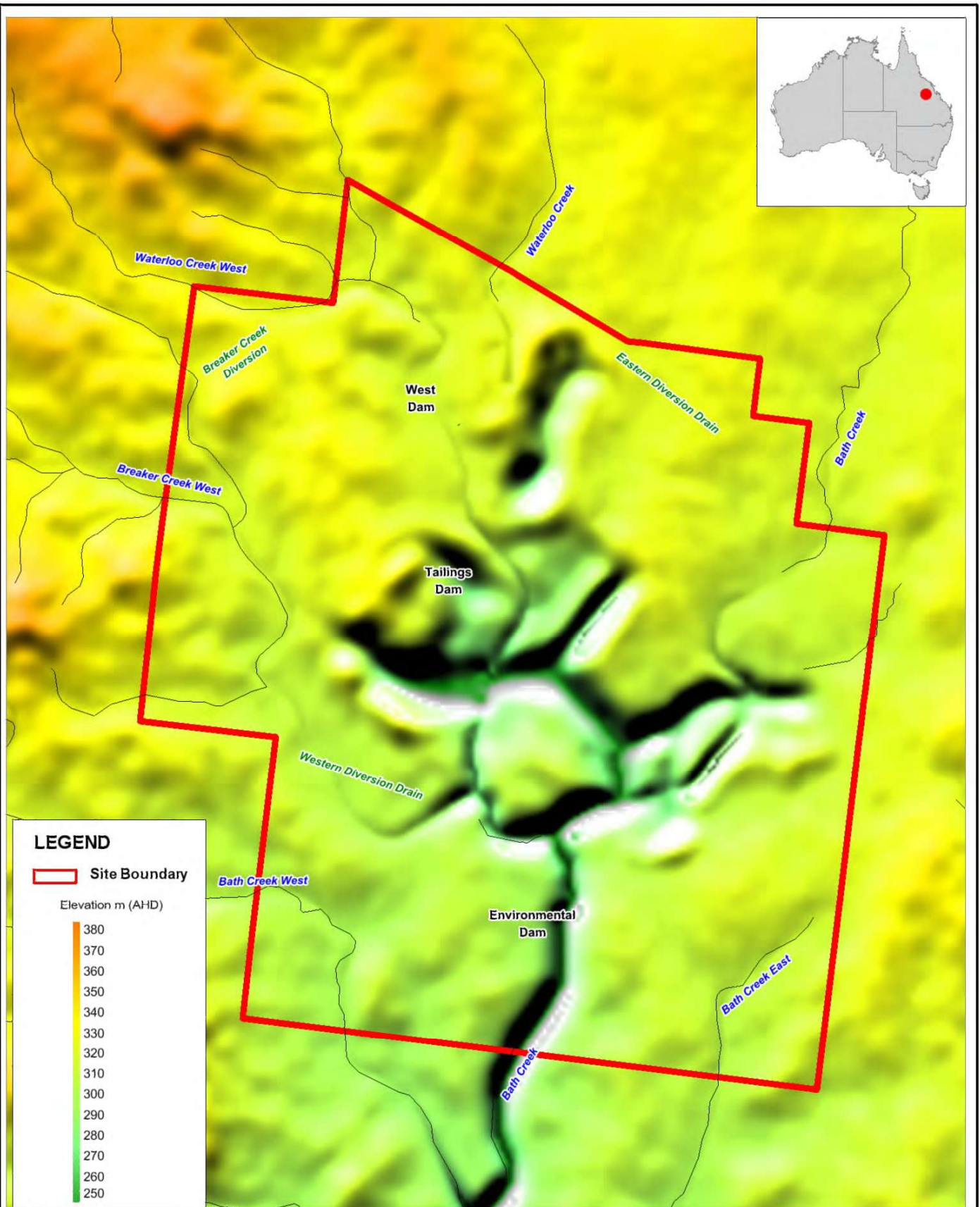
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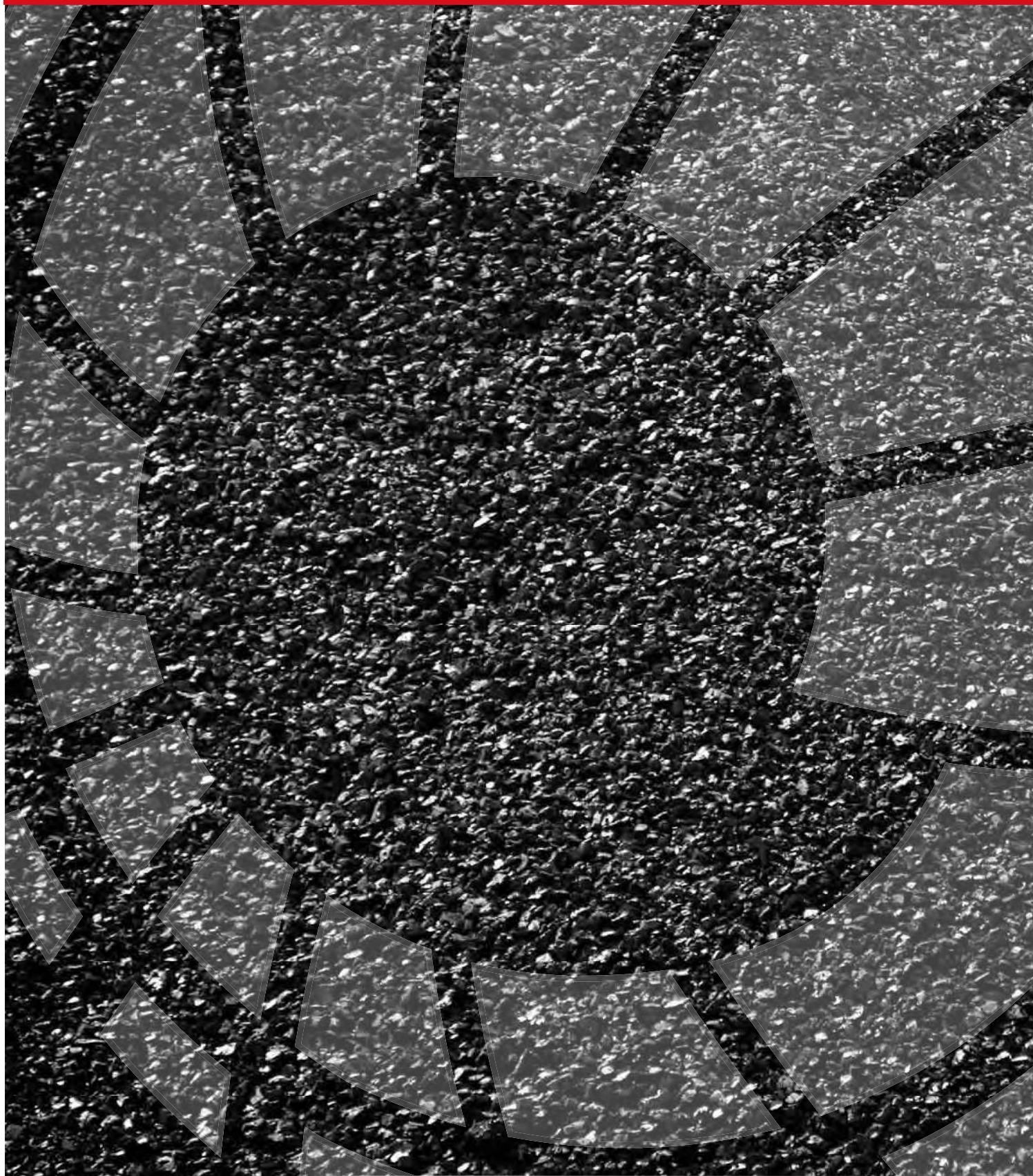


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2: Methodology



2 METHODOLOGY

BMT WBM applied a staged approach to the assessment, with catchment modelling of the surrounding area informing the surface flows to the water body within the final landform.

The catchment modelling was conducted using the Source Catchments software and is described in Section 2.1 below. The hydrodynamic water-body modelling was conducted using DYRESM (DYNamic REServoir Simulation Model) and is described in Section 2.2.

2.1 Catchment modelling

Catchment flows and runoff salinities were derived using a lumped hydrologic model that allowed for the simulation of current catchment characteristics and hydrological responses to rainfall. Source Catchments (Source) was the model used in this study to define flows and salinity draining from the catchments upstream of and within the final Blair Athol landform. The Source modelling framework was developed by the eWater CRC (eWater CRC 2010), a federally funded Cooperative Research Centre combining Australia's pre-eminent research organisations, State Government water regulators and industry practitioners. Details of the Source data requirements and model construction methodology are described in the following sub sections.

2.1.1 Source Catchments Model Setup

Construction of the Source catchment model required transforming the physical catchment information into a mathematical form used to convert rainfall to runoff and constituent loads for the hydrodynamic water balance modelling. The outcome was a numerical representation of the physical and chemical features that represented the land-based framework, hydrological processes and salinity load generation aspects of the catchment.

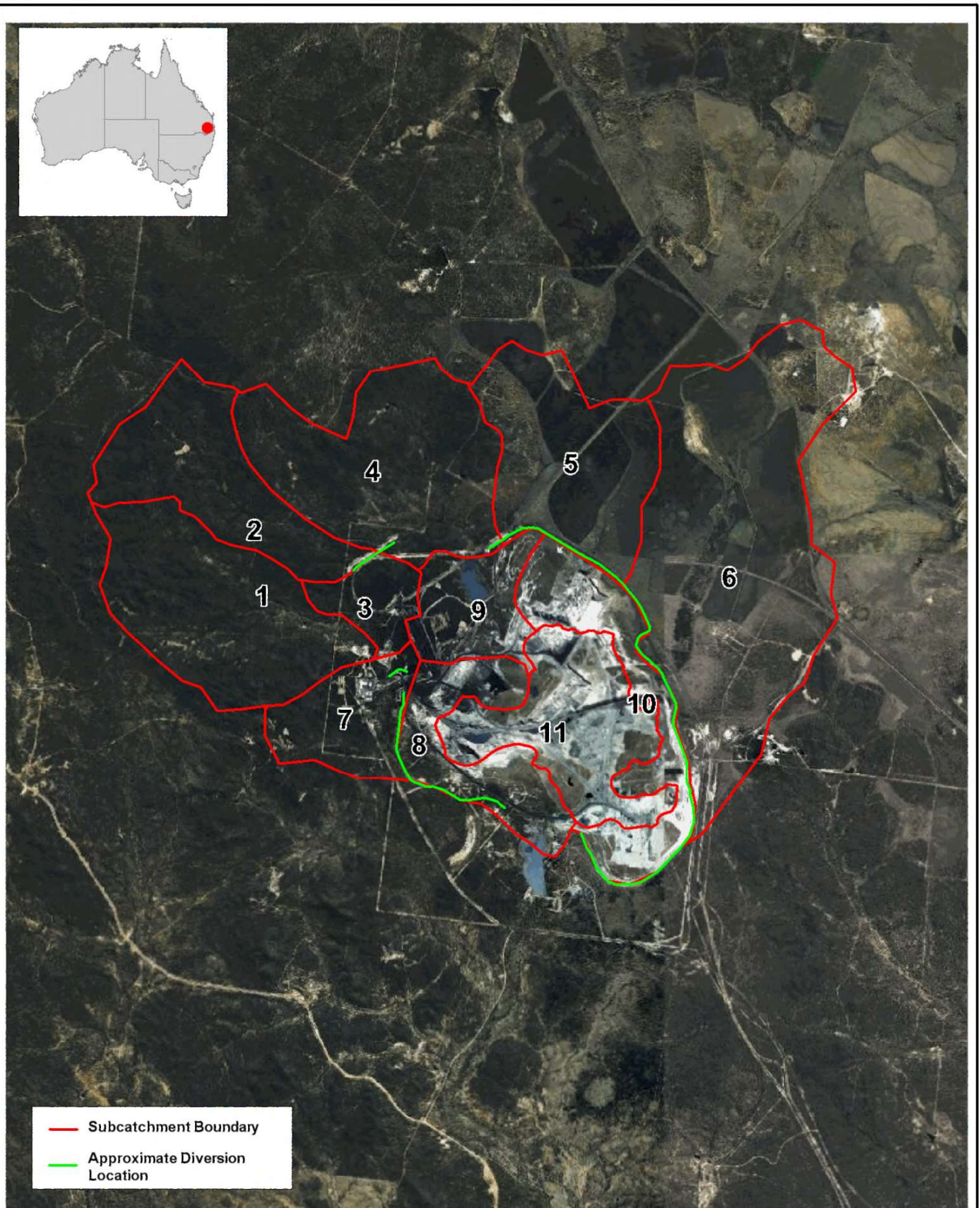
Constructing the catchment model required the following data inputs:

- Digital elevation model (DEM). The DEM was used to delineate catchment boundaries.
- Land use data. Land use data were used to characterise the hydrologic and salinity export modules because they are likely different for various land uses (e.g. forested and grazing).
- Climate data (daily rainfall and evapotranspiration). Climate data are the input data used in the water balance model to generate runoff through the various components of the hydrologic cycle.
- Stormwater salinity export rates for the aforementioned land use types. The Source Catchment modelling used salinity export rates to quantify only stormwater runoff.

These data and their sources as adopted for this model are discussed in the following sections.

2.1.1.1 Subcatchment Map

Subcatchment maps of the areas draining to the Blair Athol landform were developed from the final landform and existing 2005 Australia/New Zealand Land Information Council elevation data. Catchment delineation was performed for the areas draining to the flow diversion and the landform.



— Subcatchment Boundary
— Approximate Diversion Location

Title:
Blair Athol Subcatchments - With Existing Diversions

Figure:
2-1

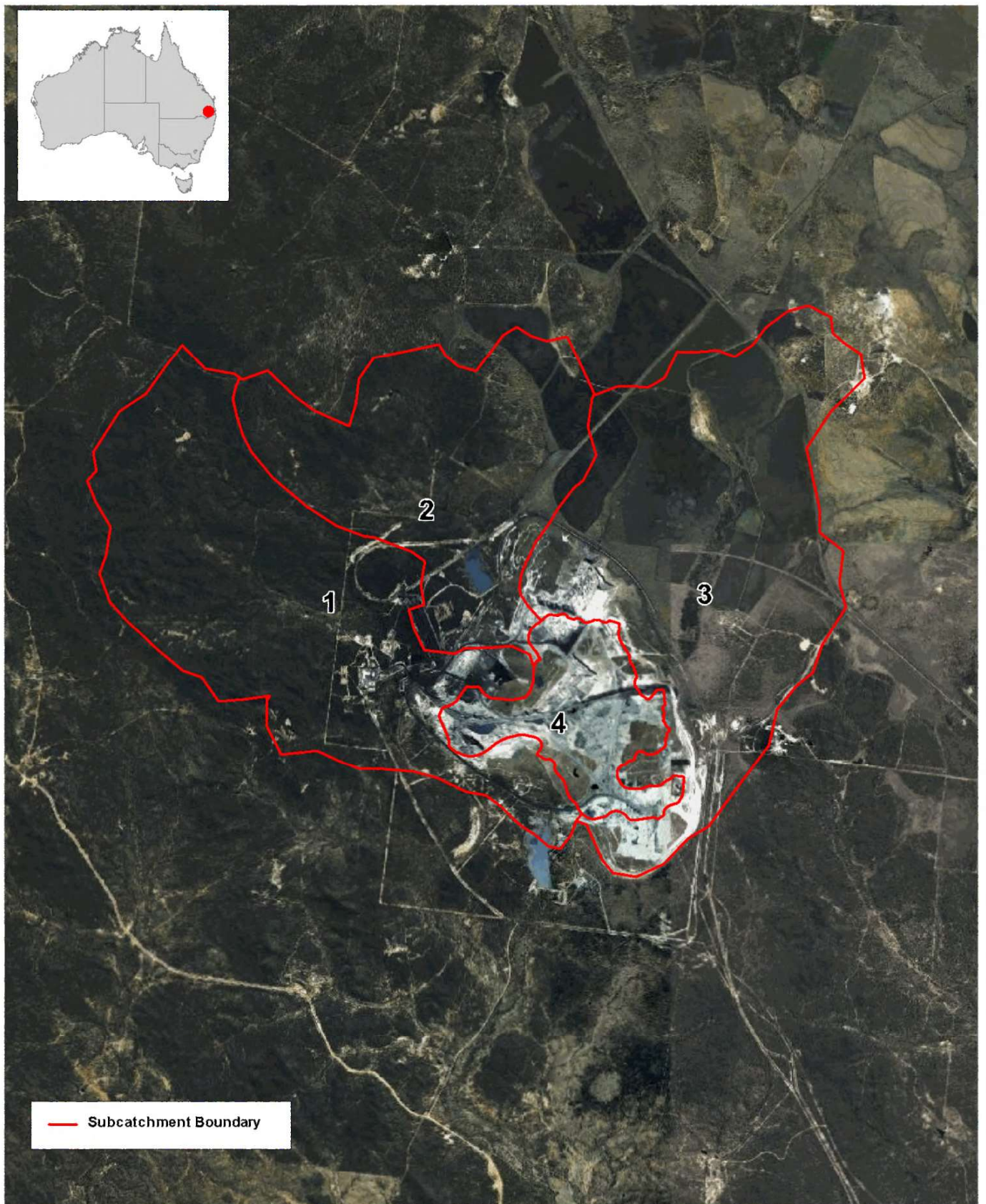
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Title:
**Blair Athol Subcatchments - With Existing
Diversions Removed**

Figure:
2-2

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shows the catchment boundaries for the scenario in which the diversions are maintained and shows the boundaries for the scenario in which existing diversions are removed. The total catchment area, including the Blair Athol Mine site landform is approximately 64 km².

2.1.1.2 Land Use

Each subcatchment was further divided into regions of similar hydrological characteristics based on typical land use designations. Land use data were taken from 1999 DERM land use data. These data were categorised into 6 broad functional units: dryland cropping, forested, grazing, water, mining & urban. Figure 2-4 shows the land use data for the contributing catchments. Table 2-1 shows the functional unit breakdown by subcatchment for the contributing catchments with and without diversions.

Table 2-1 Land Use Areas

	With Diversions		With No Diversions	
Land Use	Area (km ²)	% of Total	Area (km ²)	% of Total
Dryland Cropping	0.00	0%	10.03	17%
Forested	6.58	35%	24.09	41%
Grazing	3.88	20%	13.06	22%
Water	0.32	2%	0.32	1%
Mining	8.26	43%	10.72	18%
Urban	0	0%	0.23	0%
Total Area	19.0		58.5	

2.1.1.3 Climate – Rainfall and Evapotranspiration

Source requires daily rainfall and potential evapotranspiration (PET) data as an input to determine catchment runoff. These datasets were sourced from the Bureau of Meteorology (BoM). Rainfall data were sourced from 4 stations within the area (Blair Athol, Clermont, Hillside, and Araluen). Rainfall for each catchment was determined by using a modified natural neighbour/inverse distance weighting interpolation method.

Total annual rainfall for the Blair Athol rainfall gauge (Station 35010) is presented in Table 2-2. The mean annual rainfall is 635mm. It should be noted these annual rainfall totals represent a hydrologic year beginning on 1 July and ending 30 June. The hydrologic year is defined by the end year of that year. For example, the hydrologic year 1984 began 01/07/1983 and ended 30/06/1984.

PET data obtained were average monthly values and converted to mm/day. These data are presented in Table 2-2.

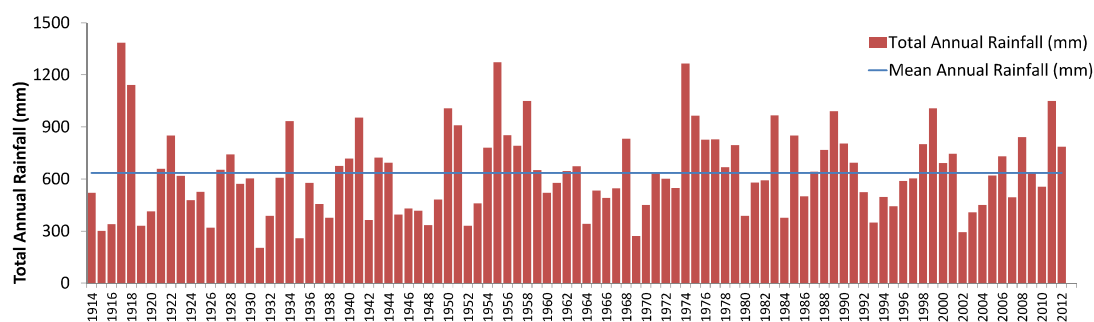
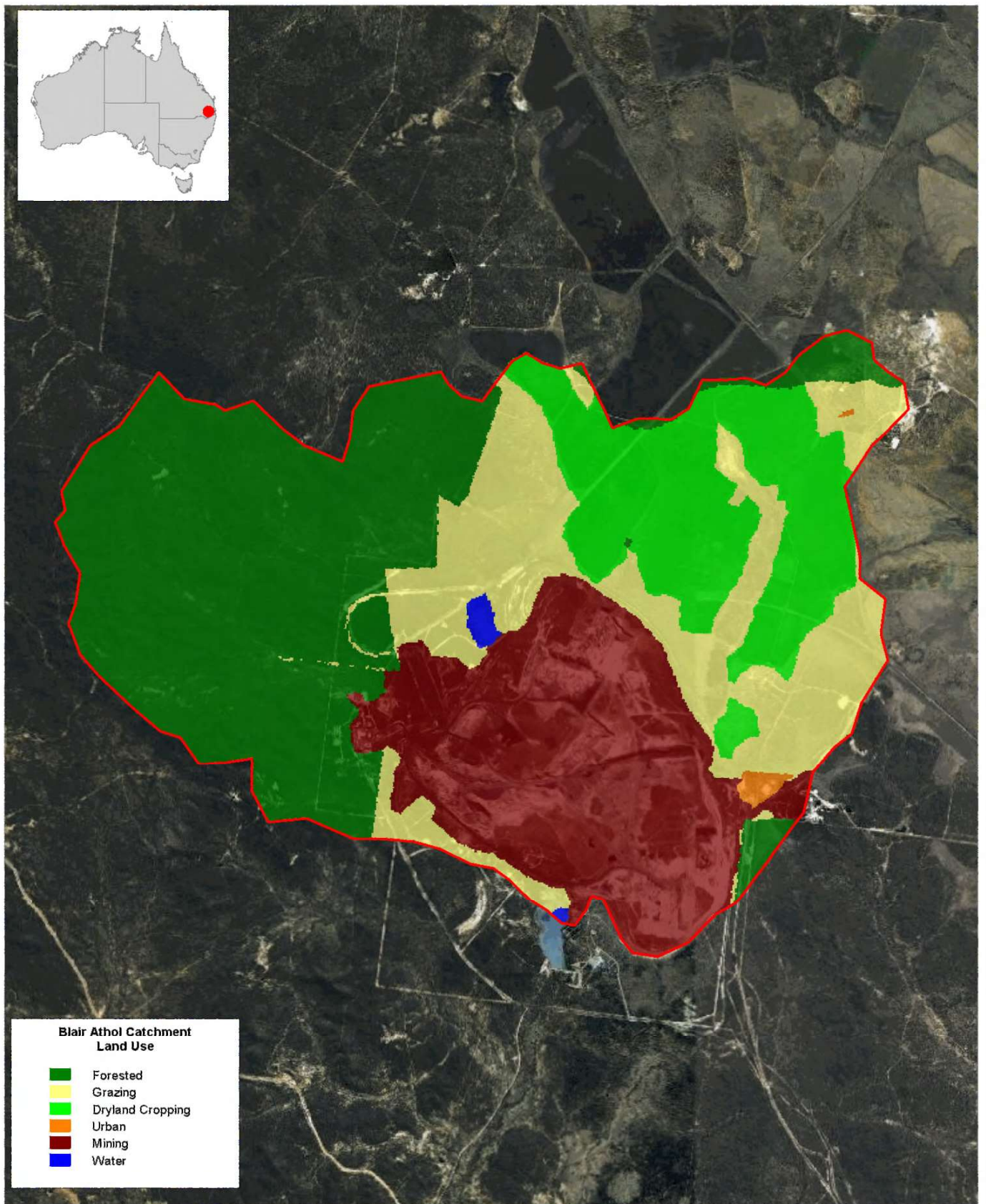


Figure 2-3 Total and Mean Annual Rainfall

Table 2-2 Daily PET Rates

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PET (mm/day)	2.81	2.86	3.13	2.27	2.81	1.73	2.52	2.26	2.17	2.23	1.97	0.87



**Blair Athol Catchment
Land Use**

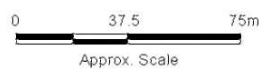
- Forested
- Grazing
- Dryland Cropping
- Urban
- Mining
- Water

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Land Usage for Sub-catchments

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2-4

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2.1.2 Source Catchments Hydrologic and Water Quality Parameterisation

2.1.2.1 Hydrologic Parameterisation

Ellis *et al* (2009) constructed and calibrated a catchment model of the entire Fitzroy basin using WaterCAST, the predecessor to Source. From this model, hydrologic parameters for characterising catchment runoff were taken. These parameters include storage characteristics and coefficients of proportionality that Source uses to convert the rainfall and PET data into surface water runoff. A summary of the hydrologic parameters used in the Source modelling is presented in Table 2-3.

Table 2-3 Source Hydrologic Parameterisation

Parameter	Dryland Agriculture	Forested	Grazing	Mining	Urban
Baseflow Coefficient	0.27	0.19	0.72	0.25	0.25
Impervious Threshold (mm)	1.5	1.5	1.5	1.5	1.5
Infiltration Coefficient	156	400	251	200	200
Infiltration shape	1.84	0.52	1.11	1.5	1.5
Interflow Coefficient	0.24	0.05	0.07	0.22	0.22
Pervious Fraction	1.00	1.00	1.00	1.00	1.00
Recharge Coefficient	0.11	0.1	0.07	0.11	0.11
Rainfall Interception Storage (mm)	3.01	4.31	3.08	2.93	2.93
Soil Moisture Storage (mm)	117	500	242	187	187

It should be noted that from the catchment modelling, only the components of the climate data that were directly converted to surface water runoff (storm events) were used to force the DYRESM model. Groundwater contributions to total runoff were not included because that was characterised by the groundwater report of JBT Consulting (JBT, 2012). The groundwater components in the Source modelling were important, however, in determining the surface water (storm event) flows.

2.1.2.2 Salinity

Salinity loads were estimated in the modelling using conductivity values observed in regional creeks reported in the Blair Athol Mine Receiving Environment Monitoring Programme (REMP; Rio Tinto 2011). The REMP examined regional water quality observed in two creeks in the region of the mine site, Sandy and Wolfgang Creeks.

Sandy Creek is characterised by forested and mountainous regions while Wolfgang Creek is predominantly grazing and clay cropping soils. The water quality in these creeks was assumed to characterise different land use categories within the Blair Athol catchment (Rio Tinto 2011)

Conductivity values, used as a surrogate for salinity, were different between the two catchments. These values are presented in Table 2-4 along with the land use categories they were applied to in the Source modelling.

Table 2-4 Conductivity Values for Regional Creeks

Catchment	Land Use	Conductivity ($\mu\text{S/cm}$)
Sandy Creek	Forested, Urban	440.3
Wolfgang Creek	Grazing, Cropping and Mining	1157.4
Catchment	Land Use	Conductivity ($\mu\text{S/cm}$)

2.2 DYRESM Hydrodynamic Modelling

DYRESM (<http://www.cwr.uwa.edu.au/software1/models1.php?mdid=2>) is a one-dimensional (laterally averaged) hydrodynamic model developed by the Centre for Water Research at the University of Western Australia. The software is often applied for predicting the vertical distribution of temperature, salinity and density in lakes and reservoirs, including mine pit lakes (Castendyk & Eary, 2009).

The key inputs required by DYRESM are as follows:

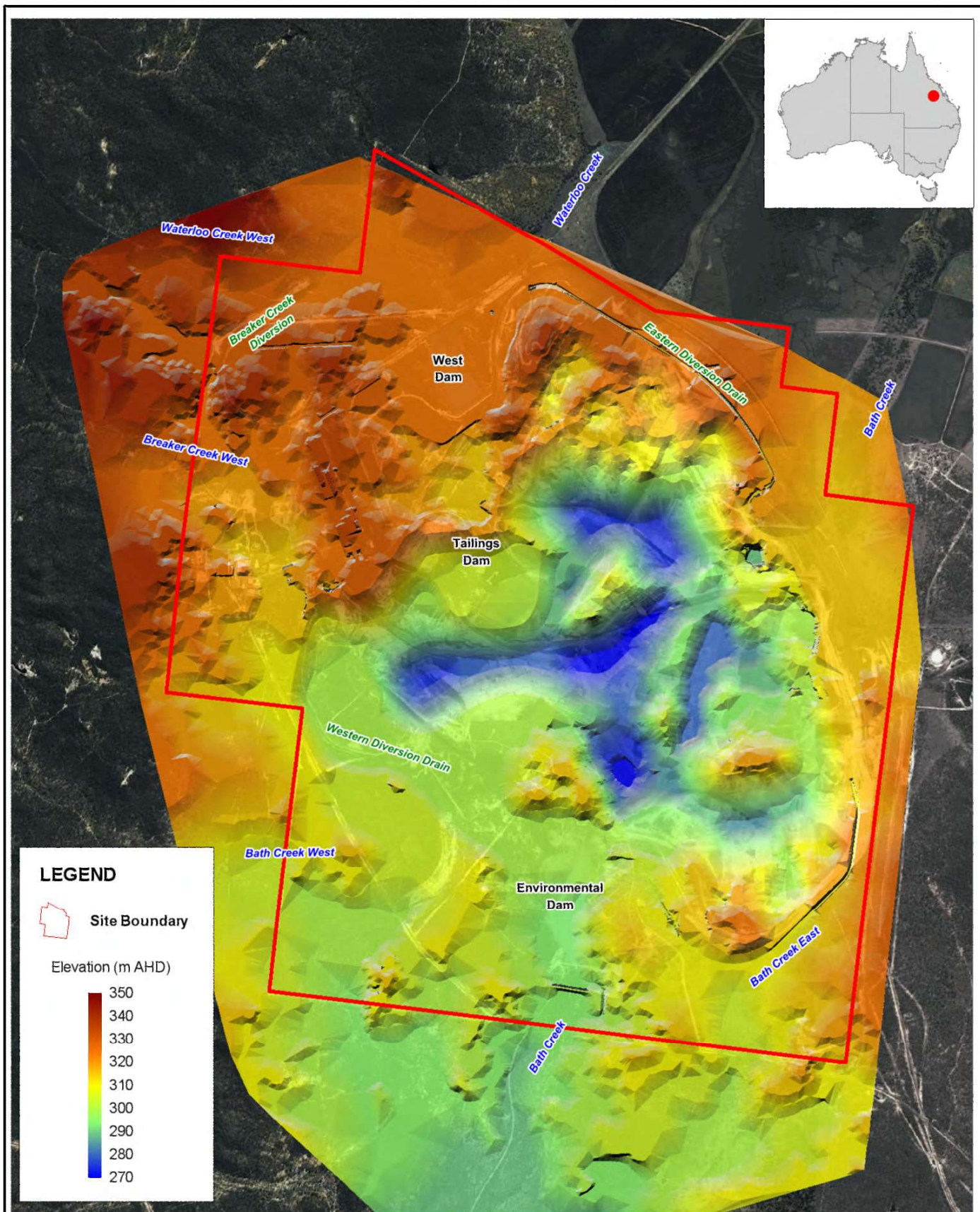
- Lake morphometry, comprising a hypsometric curve (area with height) of the water body;
- Catchment flows, including the salinity and temperature of the flows;
- Groundwater flows, including salinity and temperature; and
- Meteorological data.

More detailed descriptions are provided in the following sub-sections.

Using the above inputs, DYRESM was run for a period of 50 years from 1st July 1961 to 1st July 2011 under both the 'diversions' and 'no diversions' scenarios, with an initial depth of 2m, initial temperature of 25 °C and initial salinity of 5. In addition, a number of runs were completed to examine the sensitivity of the results to some of the assumptions made, including the magnitude of groundwater flow, groundwater salinity, the temperature of inflows and wind speed, which has a strong influence on evaporation. Results for the scenarios and sensitivity runs are presented in Section 3.

2.2.1 DYRESM Structure

A DEM (digital elevation model) of the final landform was provided by RTCA (Figure 2-5), which was discretised into 1m contours to derive an elevation vs area relationship (hypsometric curve). This relationship was used by DYRESM to create an aggregated, one-dimensional representation of the final landform, which is illustrated in Figure 2-6. The resulting pit void is 30 m deep with a crest height at 300 m AHD, and a total volume of $64 \times 10^6 \text{ m}^3$.



Title:

Digital Elevation Model of Proposed Final Landform

Figure:

2-5

Rev:

A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.



0 0.5 1km
Approx. Scale



Filepath : J:\drafting\B19180_I_GML Blair Athol BAD\DRGUW_006_121113_DEM_FinalLandform.wor

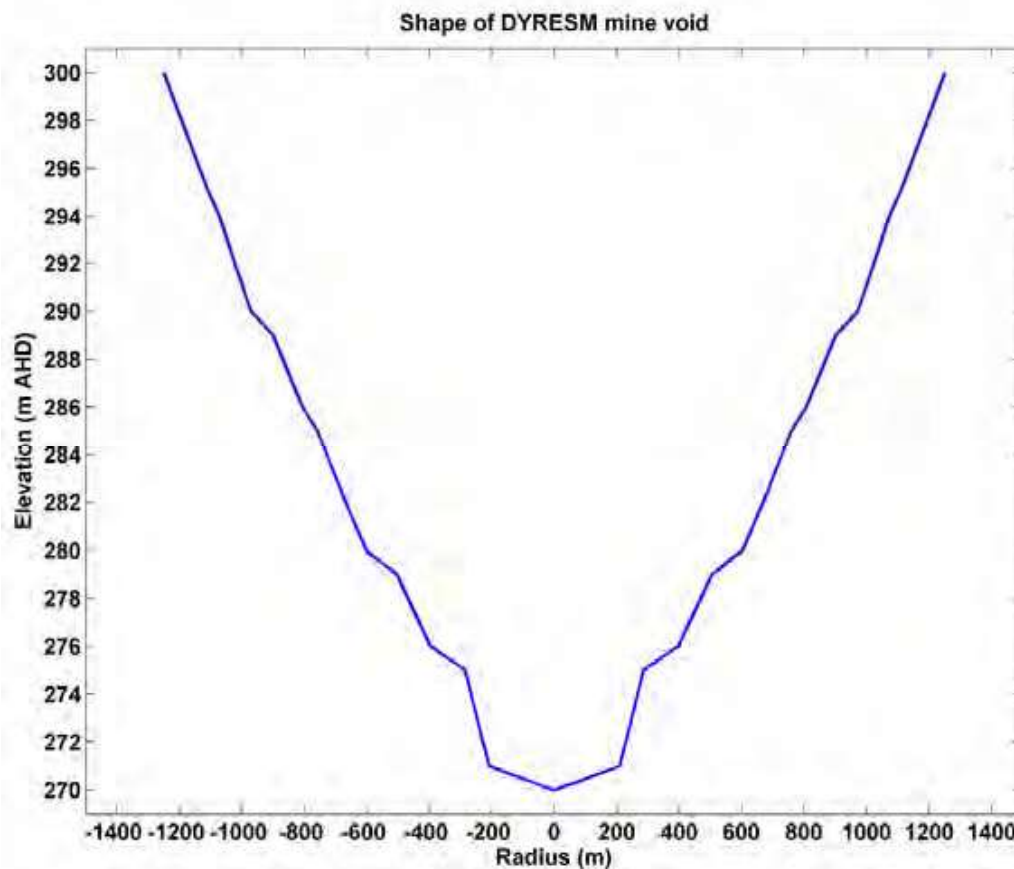


Figure 2-6 Profile of The Mine Void as Simulated By DYRESM

2.2.2 Meteorological Forcing

A number of variables are required by DYRESM, namely:

- Rainfall (m/day);
- Air temperature (°C);
- Wind speed (m/s);
- Solar radiation (W/m^2);
- Vapour pressure (hPa); and
- Cloud cover (decimal fraction).

These data were sourced from the BoM sampling site at Clermont Post Office, which is located approximately 25km from the mine site, and is the closest BoM site that samples each of the required variables. The exceptions are rainfall, which was taken from the interpolated rainfall map derived as input for the catchment model (Section 2.1.1.3), and solar radiation which was taken from a regional monthly climatology provided by BoM (Table 2-5). Vapour pressure was calculated from air temperature and relative humidity using the equation outlined in Tennessee Valley Authority (1972).

Table 2-5 Solar Radiation Climatology Used in DYRESM

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Solar Radiation (W/m²)	277.8	266.2	243.1	219.9	196.8	162.0	185.2	219.9	254.6	277.8	289.4	289.4

The Clermont PO dataset spanned the period 1/4/1881 to 31/7/2012 but not all the required variables were sampled over this period. After careful analysis of the dataset, it was determined that the period 1/1/1991 to 1/1/2011 provided the most suitable coverage for the required variables and therefore this period was used as meteorological forcing for the entire model run. The twenty year period was repeated to provide full coverage over the simulation for air temperature, wind speed and cloud cover (Figure 2-7). Relative humidity did not have sufficient coverage for an uninterrupted time series spanning this period, so a monthly climatology was derived from the available data instead (Table 2-6).

Table 2-6 Relative Humidity Climatology Used in DYRESM

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Relative Humidity (%)	55.7	59.5	54.1	53.4	53.2	55.1	50.6	46.9	42.7	43.0	47.4	49.8

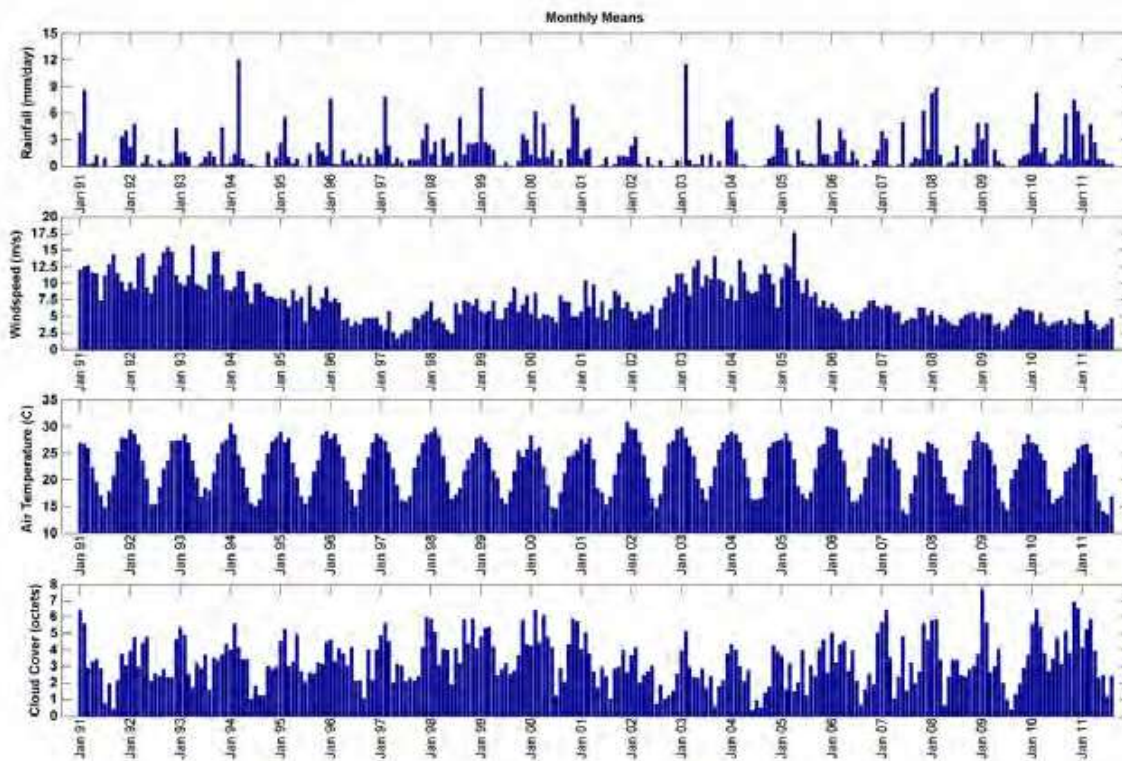


Figure 2-7 Monthly Means of Meteorological Data Used in DYRESM

2.2.3 Groundwater Inflows

Inputs from groundwater were provided by a report by JBT Consulting (JBT, 2012), which determined that the rate of groundwater flow to the final void would be approximately 3-5 L/s. Accordingly, a value of 4 L/s was adopted for the baseline model run, with sensitivity runs conducted to include values of 3 L/s and 5 L/s.

Salinity values were calculated from groundwater measurements of total dissolved solids (TDS) presented in the groundwater report. The mean TDS reported was 2.252 g/L, while the median was 0.6185 g/L, reflective of a wide range of measured values (0 – 101 g/L). A conversion factor of 0.65 was applied to convert TDS values to conductivity values, which was derived from the mean TDS and conductivity values measured as part of the REMP (Rio Tinto, 2011); salinity values were in turn calculated from conductivity using the UNESCO equations (UNESCO, 1983). A value of 1.0 was chosen as the baseline salinity for groundwater, with values of 0.5 and 2.0 applied as part of the sensitivity analysis. Groundwater inflows were assumed to have temperatures matching the surface flows, as no temperature data were included in the groundwater report.

2.2.4 Surface Inflows

Surface flows were taken from the catchment modelling outlined in Section 2.1, with the conductivity values provided by the catchment model converted to salinities using the UNESCO (1983) equation. In the absence of data, surface inflows were given temperatures equal to the ambient air temperature. To test the sensitivity of the model to this assumption, a range of temperatures were applied, the results of which are presented in Section 1.1.1.

3: Results



3 RESULTS

3.1 Catchment Results

The Source model output daily runoff flows and salinity loads to the Blair Athol mine for both the diverted and undiverted scenarios. These were used to force the DYRESM model. Summarised in this section are total annual runoff volumes and salinity loads for the years of record. Total dissolved solids (TDS) were used as a surrogate for conductivity/salinity loads because conductivity (measured in $\mu\text{S}/\text{cm}$) and salinity (measured in psu) cannot be summarised in terms of a load to the river. To derive TDS loads from conductivity, conductivity was multiplied by a conversion ratio of 0.65. This is based on the conductivity and total dissolved solids data presented in the REMP (Rio Tinto 2011).

Table 3-1 presents annual flow and TDS load statistics of the model data for the data shown in Figure 3-1 and Figure 3-2. It should be noted that the hydrologic year used to define these annual flows and loads is the same as that used to define annual rainfall.

Table 3-1 Flow and Total Dissolved Solids Load Statistics

Statistic	Annual Flows (ML/yr)		Annual TDS Loads (t/yr)	
	With Diversions	Without Diversions	With Diversions	Without Diversions
Minimum	28.8	88.0	19.7	58.8
25 th %-ile	184.5	587.0	129.8	407.1
50 th %-ile	449.3	1665.6	319.4	1184.2
75 th %-ile	985.1	3335.0	696.2	2342.5
Maximum	4034.2	12655.1	2904.6	9010.4
Mean	699.2	2317.9	496.0	1627.1

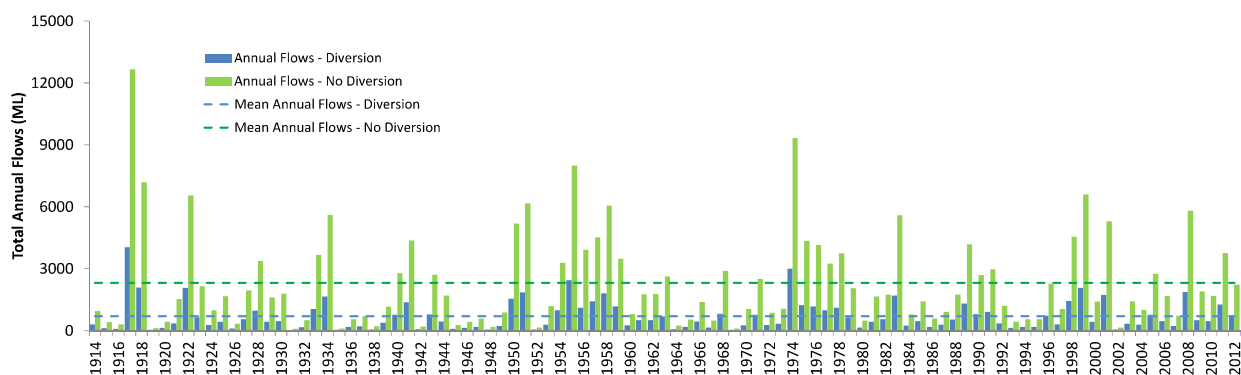


Figure 3-1 Total and Mean Annual Flow Volumes

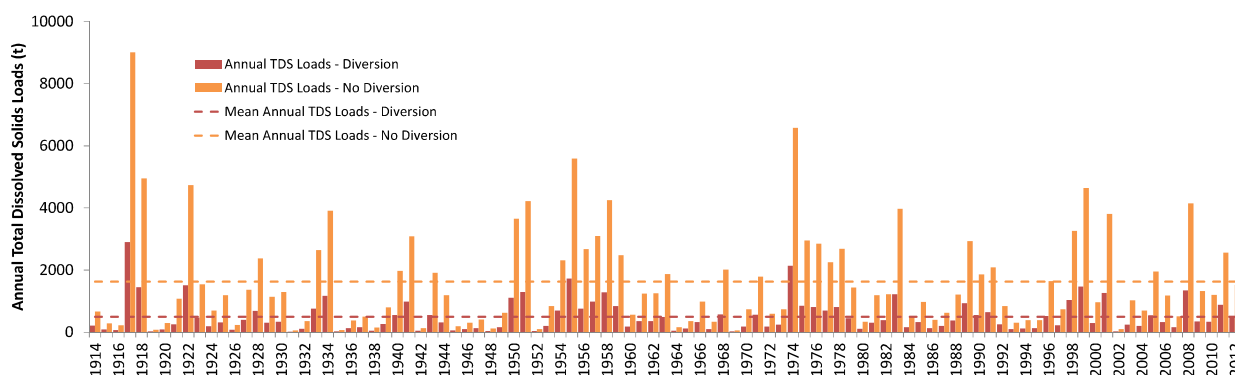


Figure 3-2 Total and Mean Annual Dissolved Solids Loads

The catchment area with the diversion is approximately 33% of the catchment area without the diversion (). This corresponds approximately to the contributions of flows and loads from the diversion and no diversion scenarios (Table 3-1). While the land use changes from the diverted scenario to the undiverted scenarios, the percentage of land use that is characterised as forested is largely the same (35% - diverted; 41% - not diverted), and it is the forested land use that demonstrates significantly different characteristics in terms of soil moisture storage capacity and infiltration coefficients compared to the other land uses (Table 2-3).

Figure 2-3, Figure 3-1 and Figure 3-2 demonstrate the rainfall conversion to runoff in the diversion scenario was very sensitive to the total rainfall, whereas this was not observed in the undiverted scenario. For the diverted scenario, the percentage of rainfall directly converted to runoff ranged from 0.6% in one of the driest year (1969) to 15.3% in the wettest year (1917). Contrastingly, for the undiverted scenario, the percentage for the same years was 5.0% for 1969 and 5.4% for 1917. This suggests that the land use composition of the two scenarios is significant. The percentage area of forested land for the undiverted scenario is only 7% greater than the diverted scenario, however, in both scenarios, the forested land comprises more than 33% of the total area of the catchment. The capacity of forested land to result in infiltration to groundwater and storage of moisture in the soil is much higher than for any of the other land uses

3.2 DYRESM Results

The results of both the 'diversions' and 'no diversions' scenarios, including temperature and salinity profiles and stratification analysis, are presented below. In addition, a summary of the sensitivity analysis conducted is included in Section 3.2.2, with more detailed results presented in Appendix A.

3.2.1 Scenario Results

The temperature and salinity profiles from the 'diversions' and 'no diversions' scenarios are presented in Figure 3-3 and Figure 3-4, respectively. As expected, the 'diversions' scenario results in a more saline and shallower pit lake than the 'no diversions' case.

Under both scenarios, however, the water level does not approach the crest height of the lake at any stage during the 50 year simulation, indicating that the mine void is unlikely to fill and overflow into the downstream environment during typical climatic conditions, although it is possible it may overflow during extremely large rainfall events.

This creates a closed water body, where any groundwater or catchment loads (e.g. salinity, TDS, pollutants) accumulate within the void, and resulting concentrations will steadily increase over time, as is illustrated by the salinity profiles in Figure 3-3 and Figure 3-4.

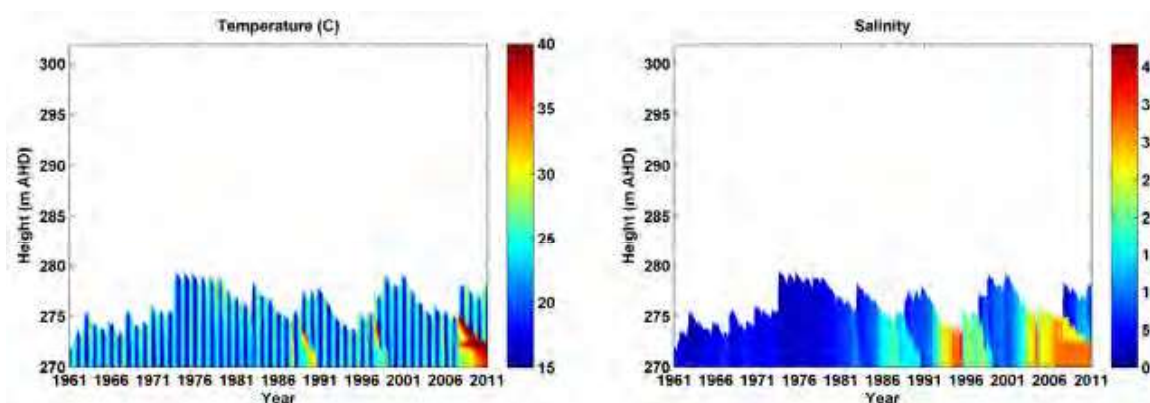


Figure 3-3 Temperature and Salinity Profiles Under The 'diversions' Scenario

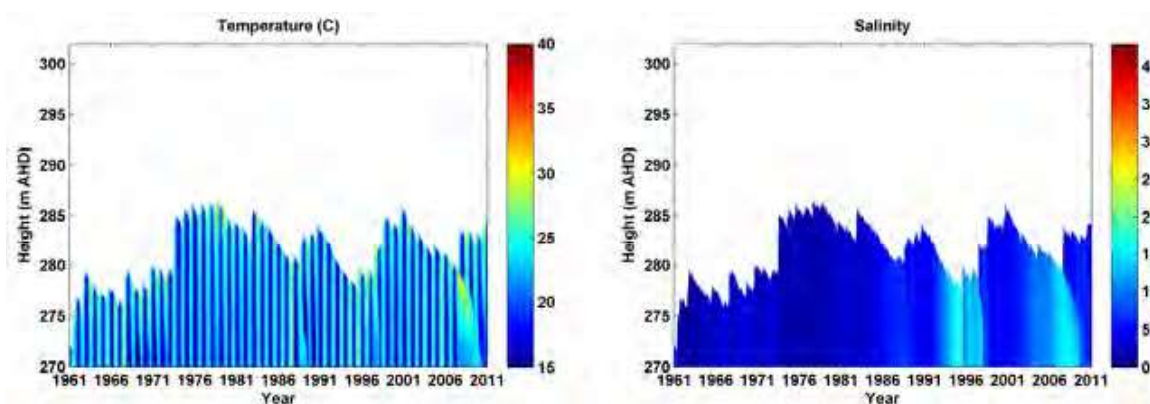


Figure 3-4 Temperature and Salinity Profiles Under the 'no diversions' Scenario

As the lake becomes increasingly saline, the hydrodynamic regime changes. Temperature profiles illustrate that, for the first 25 years of the run, the water body undergoes thermal stratification in the summer, followed by a cooling of the surface layer and an 'overturning' of the water column during winter (Figure 3-5). This dynamic is more pronounced in the 'no diversions' scenario due to the deeper water column allowing for a larger vertical density gradient (Figure 3-6). This seasonal stratification and destratification is expected behaviour for a pit lake of this type, and the temperature distribution is broadly in line with expectations. Later in the simulation, however, as the lake becomes more saline, salinity exerts more of an influence on the density profile and regular seasonal thermal stratification can be interrupted by the creation of haloclines.

Under the 'with diversions' scenario, several dry years in the mid to late 1980's result in a drop in water level and an increase in salinity to approximately 17 (Figure 3-7). Subsequently, a large rainfall event triggers a surface inflow which does not mix fully with the water body; and the freshwater inflow remains above the denser, more saline lake water, creating a halocline. The resulting strong vertical density gradient gradually weakens, but persists until it is finally destroyed in early 1991. Similar events occur in the late 1990's and from the mid 2000's until the end of the simulation. The model predicted that a temperature inversion would occur as the halocline develops (Figure 3-7), trapping

warm water below cooler surface water. While this type of inversion can occur given the competing effects of temperature and salinity on density, it is unlikely to persist for the length of time predicted here. The temperature inversion is probably an artefact of the numerical model in this case, although the development of a halocline has a high probability of occurring as the pit lake becomes more saline.

The 'without diversions' scenario does not exhibit the same frequency of halocline creation, but it does occur in the late 2000's. Under this scenario, the pit lake is still a closed system with no outflows, so it is likely that these events would also become more frequent over time, although over a longer timescale than the 'with diversions' scenario as it experiences a greater volume of freshwater inflow.

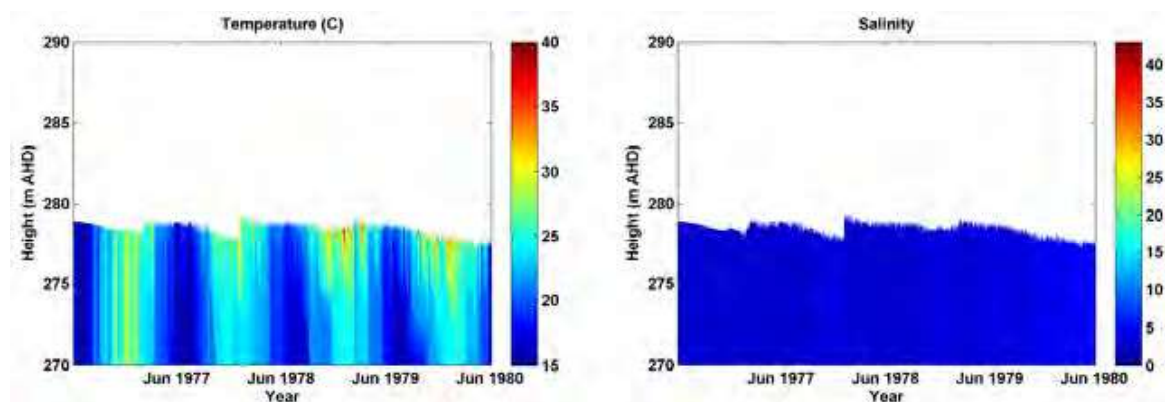


Figure 3-5 Thermal stratification under the 'with diversions' scenario

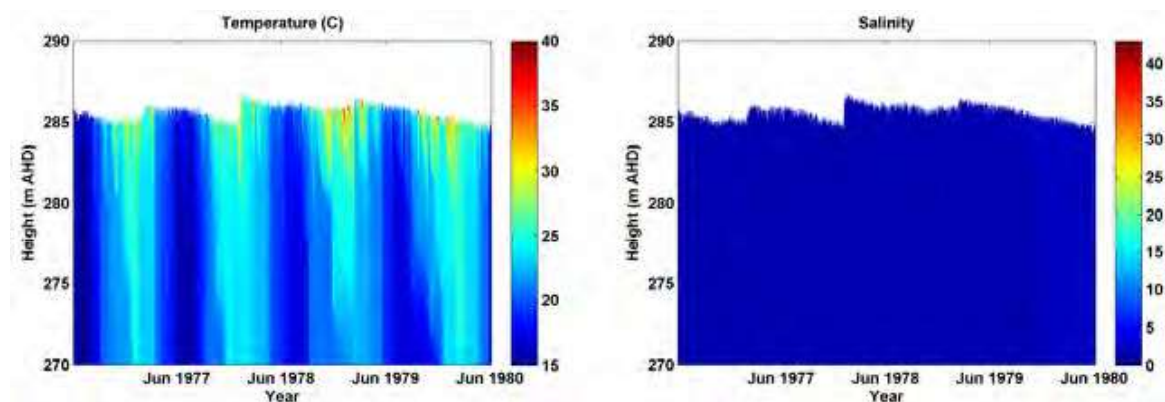


Figure 3-6 Thermal stratification under the 'without diversions' scenario

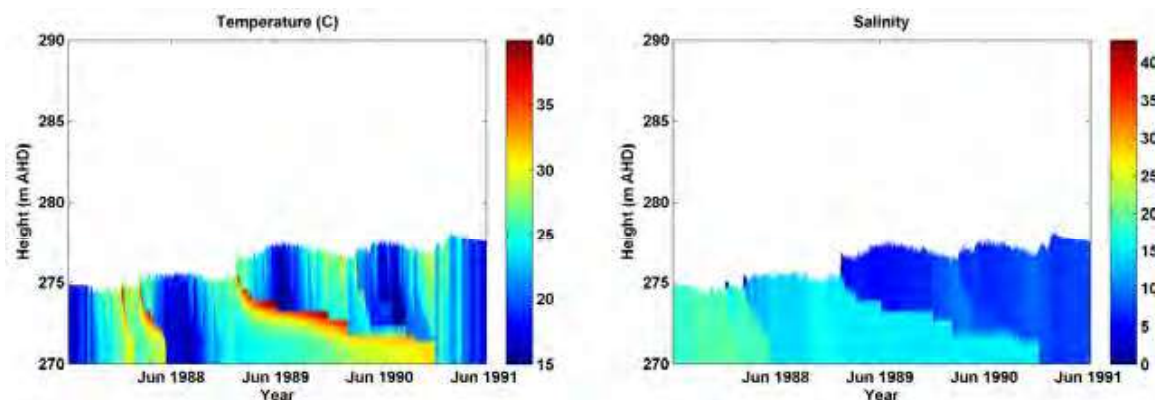


Figure 3-7 Development and destruction of a halocline under the 'diversions' scenario

3.2.2 Sensitivity Analysis

In addition to the two scenario simulations, a further nine runs were conducted to examine the sensitivity of the model to some of the assumed parameters. The nine runs included the following assumptions:

- Groundwater flow set to 3 L/s, the lower end of the provided estimate
- Groundwater flow set to 5 L/s, the upper end of the provided estimate
- Groundwater salinity set to 2.0, double the value used in the scenario runs
- Groundwater salinity set to 0.5; half the value used in the scenario runs
- Temperature of inflows set to 2 degrees below ambient temperature
- Temperature of inflows set to 4 degrees below ambient temperature
- Wind sensor height set to 5 m above lake crest
- Wind sensor height set to 15 m above lake crest
- Wind sensor height set to 20 m above lake crest.

Wind sensor height is an important parameter as it determines the wind stress experienced at the lake surface, with wind stress inversely proportional to sensor height. Evaporative flux is sensitive to wind stress, which is why a sensitivity analysis was conducted on this parameter. It was difficult to determine a reasonable value for this parameter, as the surface of the water body is likely to be sheltered by the pit walls and experience lower wind stress than that measured at the Clermont Post Office sampling site. Nevertheless, the wind sensor height was assumed to be 10 m above the lake crest for the scenario runs, which is the standard measurement height employed by BoM.

The summary results of the sensitivity analysis are as follows, with the associated plots included in Appendix A:

- Groundwater flow:
 - Varying the magnitude of the flow has a minimal impact on the dynamics of the water body. A groundwater flow of 5 L/s results in a higher water level than 3 L/s by a mean of 36 cm over the length of the run. The water body is less saline by a mean of 0.06, and cooler by a mean of 0.1 °C under the higher flow rate.

- Groundwater salinity:
 - Increased groundwater salinity results in a more saline water body, but the general dynamics of the system do not change substantially. Vertical density gradients are slightly stronger but turnover frequency is unaffected. A groundwater salinity of 2.0 results in the water body having mean salinity of 8.9 over the course of the run, while a groundwater salinity of 0.5 results in a fresher water body with mean salinity 5.9. Temperature is also slightly affected with the more saline run warmer by a mean of 0.2 °C.
- Temperature of inflows:
 - The model was relatively insensitive to the temperature of the surface and groundwater inflows. Reducing the temperatures by 4 °C resulted in a mean cooling of the water body of 0.05 °C, indicating that the temperature profile is primarily determined by surface dynamics rather than inflows. The lower inflow temperatures result in a slightly higher water level (2 cm) and salinity (0.6).
- Wind sensor height:
 - Varying the wind sensor height did not have as great an impact as expected. Lowering the wind sensor height from 20 m to 5 m resulted in higher evaporation rates, which resulted in a lower water level within the lake by a mean of 12 cm over the course of the run. Salinity increased by 0.2, while the water body cooled by 0.3 °C. Stratification within the water body was slightly affected, with a strong halocline developing in the mid 1990's during the 50 m sensor height run, which did not develop during the 35 m run. No other stratification features were substantially affected.

4: Conclusions and Recommendations



4 CONCLUSIONS AND RECOMMENDATIONS

The key findings of the modelling study are as follows:

- The lake is unlikely to overflow into the downstream environment, except during very large flood events. This is especially true under the 'with diversions' scenario;
- Groundwater and catchments loads, including pollutants, will accumulate in the pit lake;
- Salinity will steadily increase, leading to the development of persistent haloclines over time;
- The pit lake exhibits seasonal thermal stratification, except during periods where a strong halocline is present, which could result in isolation of the bottom water over extended periods; and
- As the salinity of the pit lake increases, haloclines are likely to become more frequent and have stronger density gradients.

The pit lake is likely to be a self-contained system, with inflows from the upstream catchment and groundwater infiltration, and with evaporative flux as the only loss of volume. If this is the case, the system will become hyper-saline over time, as dissolved solids accumulate within the void, which has implications for long-term water quality at the site. A more saline water-body is likely to develop persistent haloclines and become stratified for periods up to several years, which has implications for long-term water quality at the site.

A closed, stratified system may also result in other undesirable water quality outcomes, such as algal blooms or toxic concentrations of pollutants as they accumulate over time. Determining the likelihood of these outcomes is beyond the scope of this study, but could be examined using a coupled hydrodynamic and water quality model with the ability to simulate the interactions of phytoplankton, nutrients, oxygen and potentially toxic pollutants such as heavy metals. The water-quality module bundled with DYRESM (CAEDYM) is capable of simulating such processes and could be used for such a study, if required.

An advantage of a closed system such as this, is that the downstream environment may be relatively unaffected by the closure of the mine, as all flows are contained within the void and do not flow downstream. This assumes that the existing creek diversions are kept in place, which will provide ephemeral flows to the downstream environment. If the diversions are removed, then these flows will likely be contained within the void, removing the flows from regions downstream. Even if the lake does not overflow, the downstream environment may potentially be affected by groundwater interactions that could result in water within the pit lake affecting areas outside the mine site, although the likelihood of this occurring is unknown.

The key recommendations of this study are as follows:

- The existing creek diversions should be kept in place and maintained, to provide environmental flows to the downstream environment;
- A further groundwater study should be performed to determine if water quality within the lake is likely to affect the downstream environment through groundwater interactions; and
- The resulting pit lake is likely to exhibit poor water quality over time, and is unlikely to be suitable for use as a recreational area or for stock watering. If the site is to be opened to the public, then

a further study into the future water quality of the pit lake is recommended to evaluate possible risks to public health.

5: References



5 REFERENCES

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Appendices



APPENDIX A: SENSITIVITY ANALYSIS FIGURES

Groundwater Analysis

Figures relating to the variation in groundwater flow and salinity.

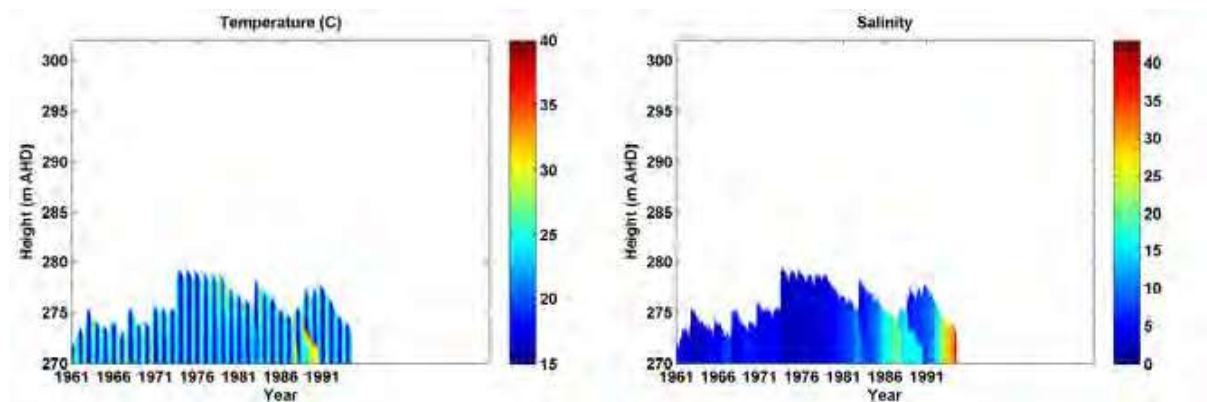


Figure A-1 Groundwater flow set to 3 L/s (the run did not complete as salinity exceeded 42)

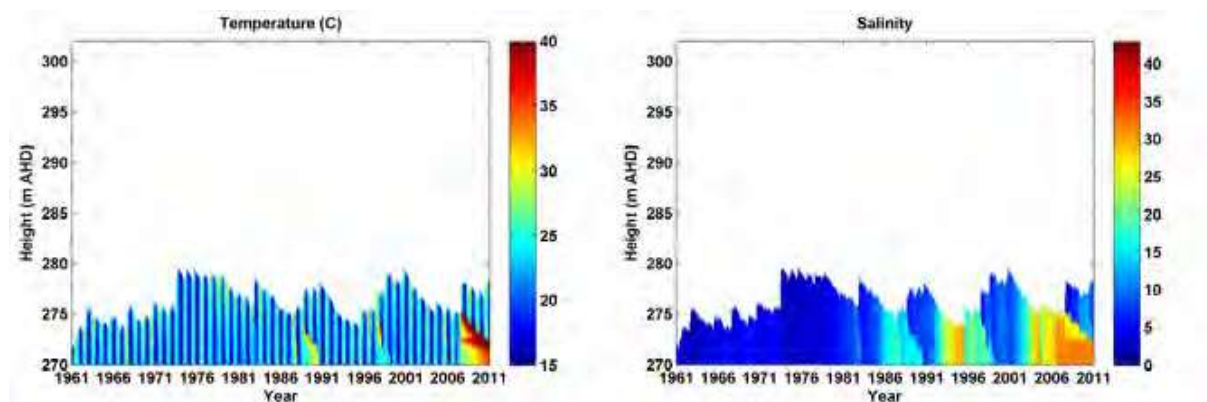


Figure A-2 Groundwater flow set to 5 L/s

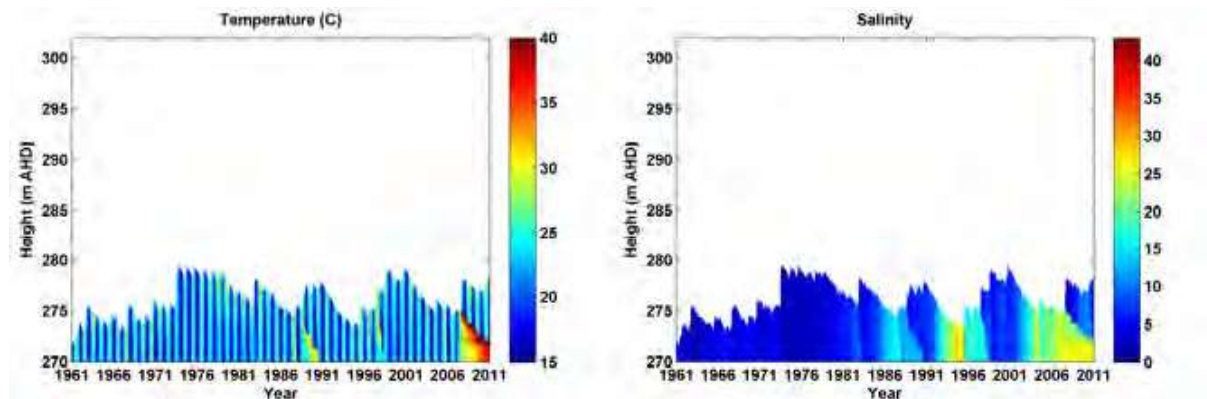


Figure A-3 Groundwater salinity set to 0.5

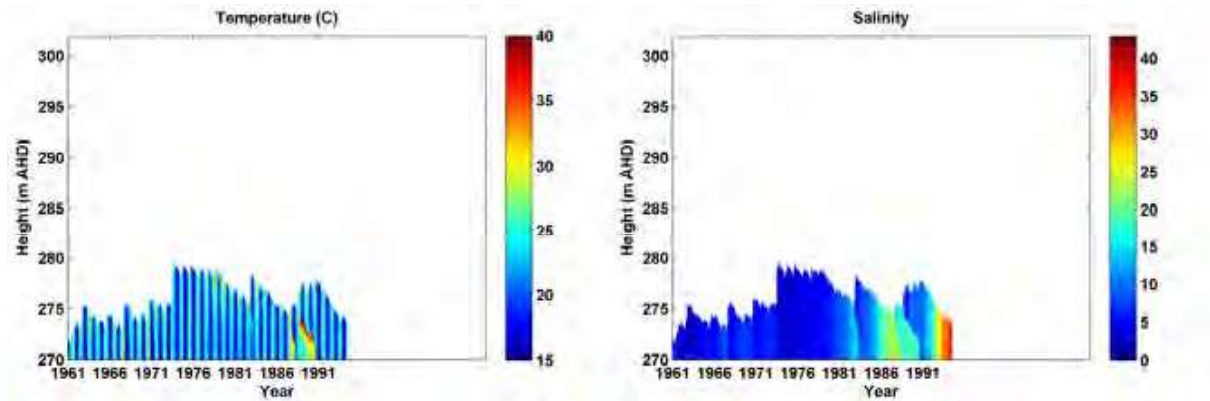


Figure A-4 Groundwater salinity set to 2.0 (the run did not complete as salinity exceeded 42)

Temperature Analysis

Figures relating to the variation in temperature of surface and groundwater inflows.

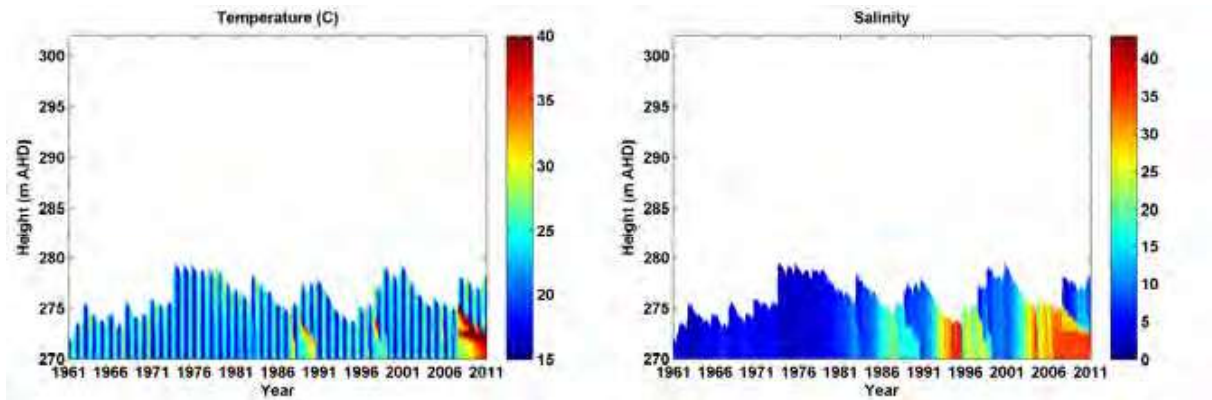


Figure A-5 Inflow temperatures set to 2 °C below ambient air temperature

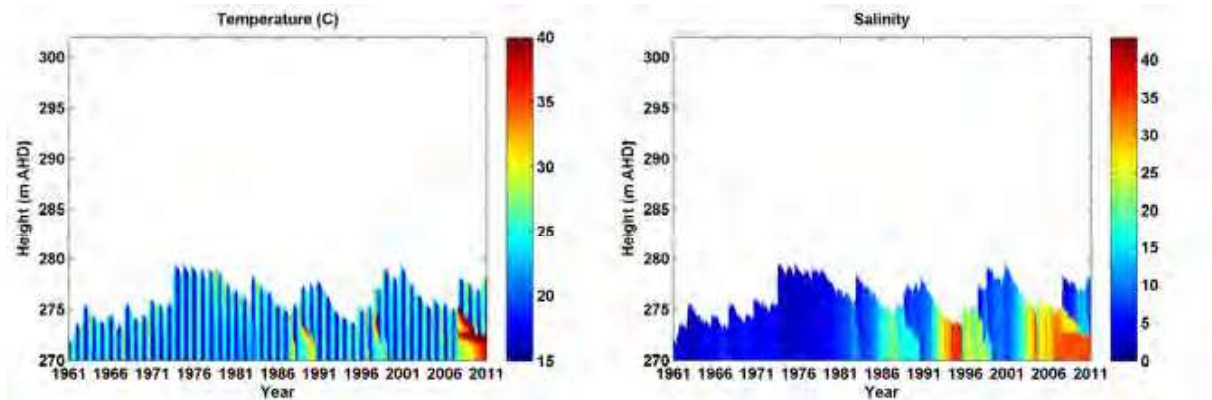


Figure A-6 Inflow temperatures set to 4 °C below ambient air temperature

Wind Sensor Height Analysis

Figures associated with variations in wind sensor height.

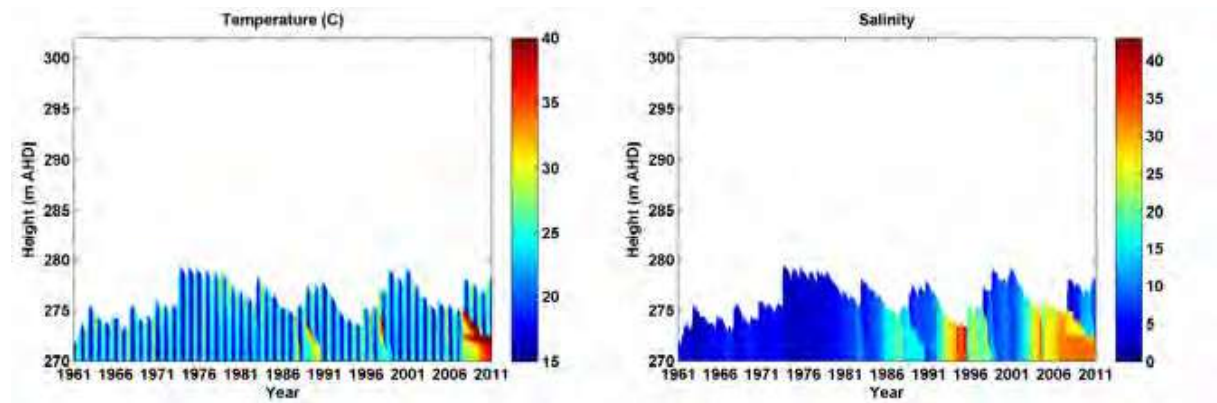


Figure A-7 Wind sensor height set to 5 m above lake crest

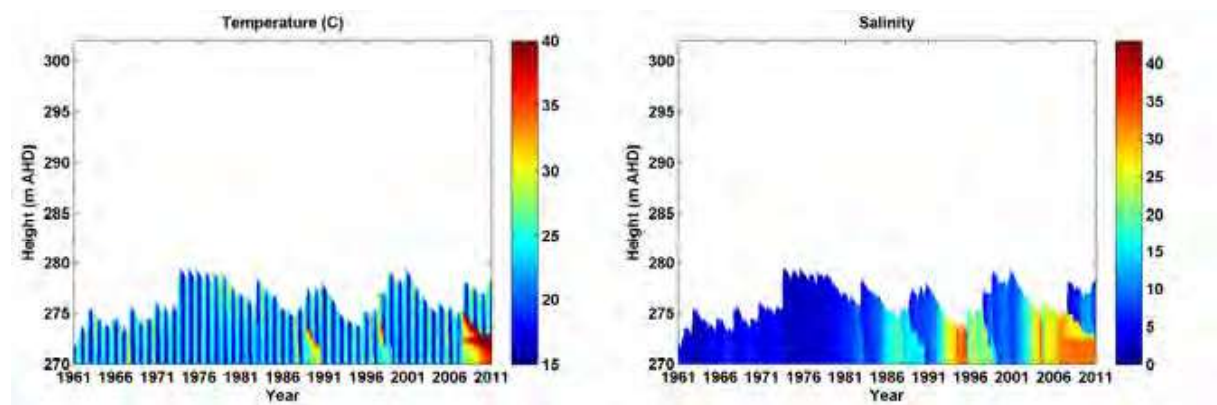


Figure A-8 Wind sensor height set to 15 m above lake crest

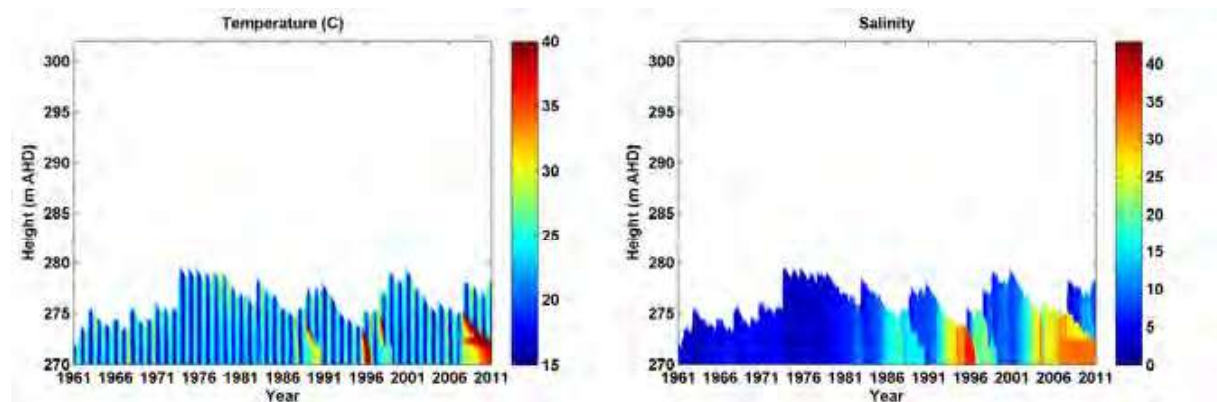


Figure A-9 Wind sensor height set to 20 m above lake crest



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Blair Athol Coal Mine – Environmental Management System

TerraCom

APPENDIX E – GEOTECHNICAL STUDIES



Blair Athol Mine

Ramp 1 South West Contingency 4 (R1SWC4)

Geotechnical Review

From	Alex Hossack – Acting Principal Geotechnical Engineer
Department	Resource Assessment
To	Rishi Verma – Manager Technical Services Stephen Ramage – Superintendent Short Term Mine Planning Rachel Arnold – Superintendent Geology Adam McDonald – Senior Mining Engineer Scheduling Vrotnesky Cediell – Senior Mining Engineer Andrew Rathbone – Mine Planner John Williams – Dragline Engineer Nathan Niaga – Geotechnical Engineer
CC	Sabine Stam – Senior Geotechnical Engineer Ken Preston – Manager Resource Assessment
Reference	NA
Date	20/02/12
Number of pages	11

Introduction

During mining of Strip 1 in Ramp 1 South West Contingency 3 (R1SWC3) at Blair Athol Mine (BA) on the 10/01/12, cracking was observed near the base of the lowwall approximately North East of where the dragline was operating. This cracking extended rapidly and sometime between the 10/01/12 and 11/01/12 a significant lowwall failure occurred.

Geotechnical modelling and subsequent back analysis of the R1SWC3 lowwall failure has determined that conditions leading to slope failure were a combination of:

- 1) Poor quality spoil material.
- 2) An aggressive lowwall design (lowwall height >60m in some places).
- 3) An increased phreatic surface due to a rainfall event that occurred on the 10/01/12.

Due to this failure, it has been requested by the Senior Mining Engineer of Clermont Region that a geotechnical review of the proposed lowwall design for R1SWC4 strip be completed in order to determine suitable mining recommendations and reduce the likelihood of further lowwall failures in this area.

This report forms part of a larger investigation which is composed of four elements:

- 1) Back analysis of the R1SWC3 lowwall failure.
- 2) Mining recommendations to reduce the likelihood of further lowwall instability during coaling operations.
- 3) Determine if recovery of the coal from underneath the toe of the lowwall failure is feasible and discuss mining recommendations.
- 4) Determine suitable lowwall design parameters for future strips.

This report will cover Part 4 while a separate report discussing the results of Parts 1 and 2 has already been issued.

Figure 1 below is a plan showing R1SWC3 and R1SWC4 while Figure 2 shows the BO5 cross section.

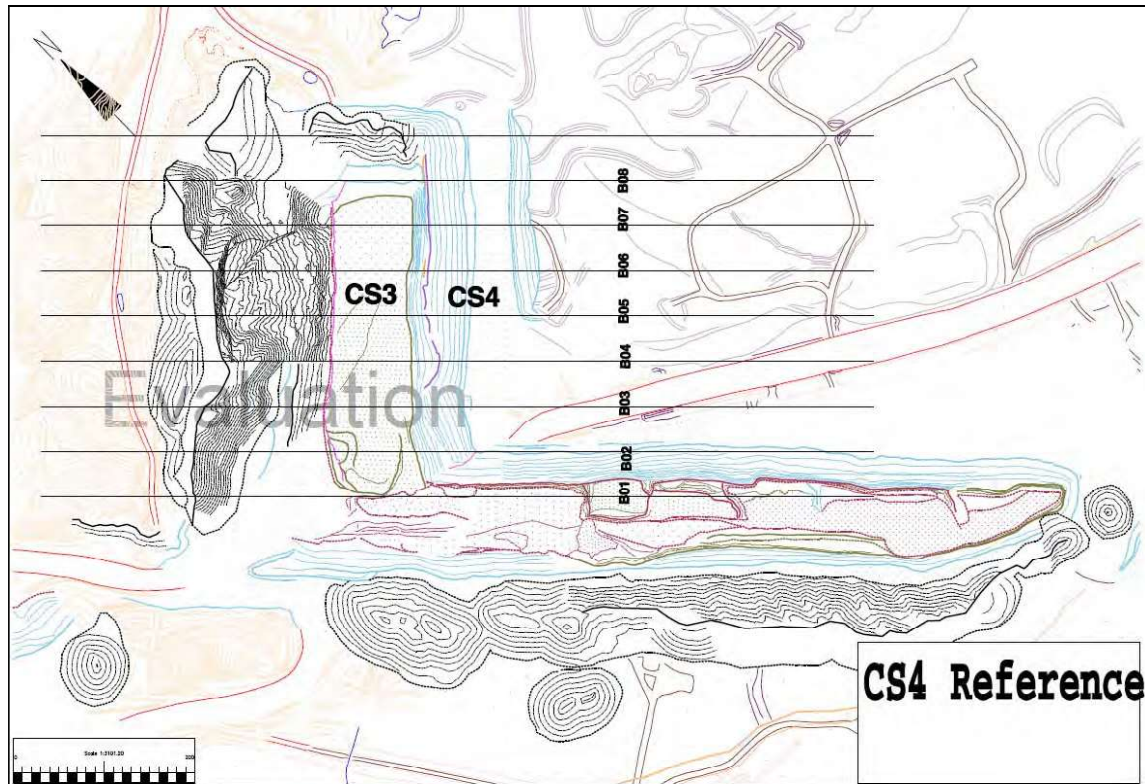


Figure 1 Plan of R1SWC3 and R1SWC4

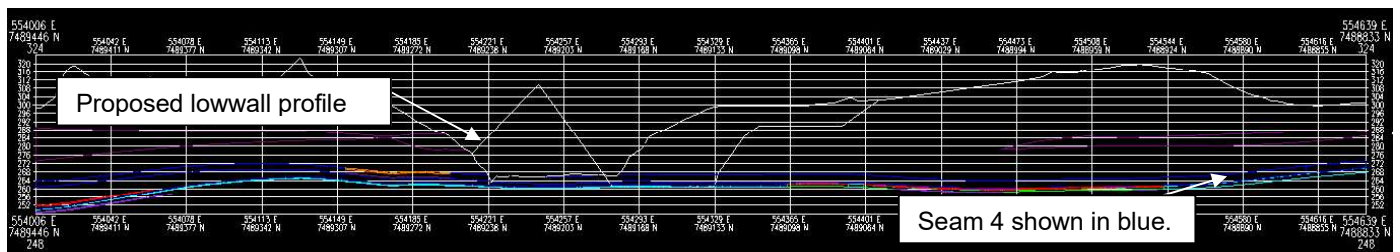


Figure 2 Cross Section BO5

R1SWC4 Conditions

The lowwall of R1SWC4 is likely to consist of weathered material. Groundwater is likely to percolate through the spoil and conditions are predicted to be similar to those experienced during mining of R1SWC3.

The base of the Lower Seam 4 is assumed to be composed of fresh Permian siltstone that is relatively hard. This assumption is aligned with observations made in R1SWC3 pit and R1SW Strip 1 pit. The floor dips towards the endwall of R1SWC4 and ranges between 0 and 2 degrees away from the lowwall.

The highwall is likely to be characterised by moderate to highly weathered sandstone. The highwall in R1SWC3 has performed relatively well and it is predicted that the proposed highwall design in R1SWC4 will perform similarly.

R1SWC4 Geotechnical Risk Assessment

A risk assessment checklist was completed for the proposed highwall and lowwall designs in R1SWC4. The following high risks were identified with the proposed highwall and lowwall designs in R1SWC4:

- The dragline bench width is <5m.
- The material type in the passive block of the lowwall is likely to be composed of fine grained, low plasticity material with some framework. Using the Simmons and McManus system this type of spoil can be defined as a category 2.
- A lowwall failure has occurred in the previous strip.

Moderate risks include:

- Overall lowwall slope height is between 50m and 60m in some places.
- Overall lowwall slope angle is between 35 and 40 degrees.
- The material type in the active block of the lowwall is likely to be composed of fine grained, low plasticity material with no to some framework. Using the Simmons and McManus system this type of spoil can be defined as a category 2.

Refer to Appendix 1 of this report for the complete geotechnical risk assessment checklists.

Lowwall Stability Assessment

A slope model was developed and assessed using the slope stability assessment software Galena looking at stability of the lowwall under the following conditions:

- Slope geometry was as presented in R1SWC4 design strings provided by BA Mine Planning personnel.
- Spoil types consistent with those assumed for R1SWC4, that being; category 2 unsaturated spoil on top of category 2 saturated spoil.
- Lowwall floor conditions consistent with fresh Permian sequences common in the area and as determined from observations in R1SWC3.
- A 'normal' phreatic surface condition as defined below:
 - Water level approximately 5m above the floor of the lowwall and tapering towards the toe of the lowwall.
- A large scale, bi-wedge failure mechanism.

The Sarma method as implemented in the Galena stability analysis code was used during the stability analysis as well as the shear strength parameters in Table 1. Material shear strengths were adopted based on the known or derived properties of the exposed geology observed in the excavation during the inspection conducted on the 18/01/12.

Table 1 Material Shear Strength Parameters

Material	C'(kPa)	ϕ' (°)	γ (kN/m ³)
Tertiary Material	52	30	20
Category 2 Spoil – Unsaturated	30	28	18
Category 2 Spoil – Saturated	15	23	20
Fresh Coal	30	35	15
Fresh Permian	100	45	22

Results of the assessment are presented in Table 2 and Appendix 2.

Table 2 Analysis of R1SW Failure

Description	Factor of Safety (FoS)
At the end of dragline pad removal.	1.23

The FoS in Table 2 above indicates that large scale, bi – wedge type failure is unlikely and that currently the proposed lowwall for R1SWC4 meets criteria specified in the Clermont Region SDMP relating to lowwall design.

Highwall Stability Assessment

Historically, instances of highwall instability at Blair Athol (and other Rio Tinto coal mines) are dominated by either:

- Failure within over-steepened weak material, namely spoil or weathered rock due to the rockmass strength being inadequate to support the proposed slope profile, or
- Defect driven kinematic failure of more competent rock due to the interaction and orientation of rock defects (joints, faults, shears and bedding) with respect to the wall angle and orientation. Adversely orientated defects can result in planar, toppling or wedge type failures.

Both of these mechanisms are assessed below using borehole data obtained from the original Ramp 1 design report written by the RTCA Principal Geotechnical Engineer at the time (Glen Guy).

Global Stability

Global slope stability, which involves whole slope failure, is more common in weaker low strength material. Weaker overburden is typically associated with the edge of a basin where weathering profiles are close to or intercept the coal seam. This is seen in R1 SWC3 strip and should be expected for the R1SWC4 strip where overburden comprises weathered and weak coal measure material. However, given R1SWC3 highwall performed relatively well during mining, showing no signs of large scale instability, it is predicted that the highwall of R1SWC4 will also perform relatively well.

Kinematic Analysis

A kinematic analysis was undertaken on defect data that was derived from downhole acoustic scanner results from four cored holes in the Ramp 1 area.

The defect data was plotted on equal area, lower hemisphere stereonet in an attempt to determine the likelihood of planar, toppling and wedge type failure from the in-situ sections of the highwall. Refer to Table 3 below for the orientations of major and minor defect sets:

Table 3 R1SWC4 Defect Orientations

Set No.	Mean Dip (°)	Mean Dip Direction (°)	Comments
Joint Set 1 (J1)	78	313	Major
Joint Set 2 (J2)	67	218	Minor
Joint Set 3 may be associated with J1 (J3)	83	133	Minor
Joint Set 3 (J3)	77	109	Minor
Joint Set 4 (J4)	77	265	Minor
Bedding	10	026	Major

Stereographs used for analysis are presented in Appendix 3 of this report. A 75 degree pre-split wall at the orientation indicated on the strip and block plans for R1SWC4 was used for the analysis.

Results indicate that:

- There is a low risk of planar sliding type failure.
- There is a low risk of toppling type failure.
- There is a low risk of wedge failure.

Buffer Blasting Techniques

A request has been made by the Superintendent Geology and the Senior Mining Engineer at Clermont Region Operations to assess the feasibility of using buffer blast techniques for R1SWC4 highwall excavation.

It has been predicted that the use of buffer blast techniques for the excavation of R1SWC4 highwall will improve productivity during the final dragline pass by reducing:

- Time taken to pull the coal edge.
- Amount of dozing time due to hard bands of material at the toe.
- Dragline downtime for maintenance.

From a geotechnical point of view; buffer blast techniques have been successfully used at other Rio Tinto coal mines such as Bengalla (BMC), Hunter Valley Operations (HVO) and Hail Creek (HCK) to reduce the likelihood of kinematic failure. Risks associated with a buffer shot wall include but are not limited to:

- Over steepening of faces during excavation creating/increasing the risk of rock roll.
- Formation of large tension cracks at the power trough boundary which may restrict access.
- Material at toe of blast not pulling adequately causing operational delays.

The risks detailed above have been managed successfully at HCK, HVO and BMC via normal operating processes and procedures.

Given the information above, it is recommended that buffer blast techniques be used in R1SWC4 and if successful these techniques should be implemented in future strips. Refer to Figures 3 and 4 below for two buffer blast wall designs that could be implemented.

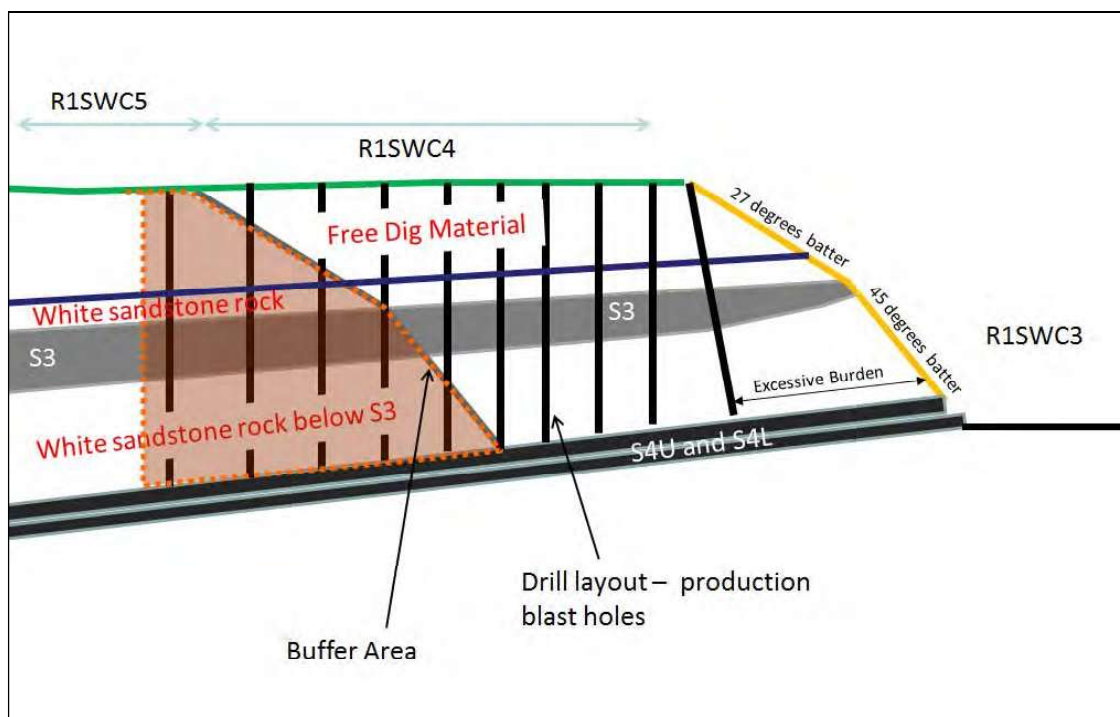


Figure 3 R1SWC4 Buffer Shot Highwall with 45° and 27° Batters

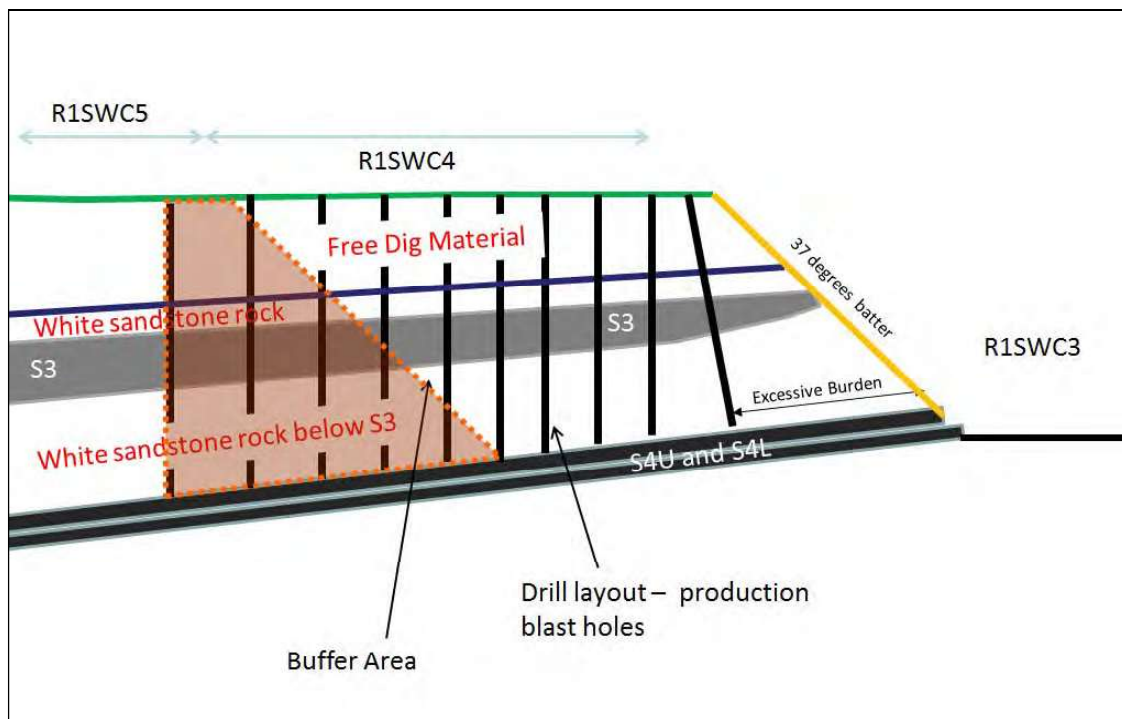


Figure 4 R1SWC4 Buffer Shot Highwall with 37° Batter

Conclusions

The following conclusions have been made:

- The proposed lowwall design in R1SWC4 has a dragline bench width <5m which increases the risk of rock roll to operators and equipment working in the strip.
- Slope stability analyses results indicate a low likelihood of large scale lowwall instability during mining of R1SWC4.
- Given R1SWC3 highwall performed relatively well during mining, it is predicted that the highwall of R1SWC4 will also perform relatively well as conditions are similar.
- Kinematic analyses results indicate:
 - There is a low risk of planar sliding type failure from the high wall of R1SWC4.
 - There is a low risk of toppling type failure from the high wall of R1SWC4.
 - There is a low risk of wedge failure occurring from the high wall of R1SW4.

Recommendations

It is recommended that:

- The lowwall in R1SWC4 should be designed with a remnant dragline pad at least 5m in width.
- Given the risks associated with buffer blast techniques have been managed successfully at other RTCA operations, it is recommended that this technique be used for R1SWC4 highwall and if successful should be implemented in future strips.

- The maximum allowable height of an unbenched buffer shot wall should not exceed 30m.
- Water should not be allowed to pool in the strip at any time, especially at the toe of the lowwall.
- Regular inspections should continue to occur by the Operations and Technical Services teams to ensure that the proposed design is being met, major assumptions are confirmed and possible deterioration of the lowwall or highwall does not go unnoticed, especially during and/or after rainfall events. Major assumptions to confirm include:
 - Presence or absence of weak layers at the base of coal seams.
 - Presence of groundwater with the lowwall and highwall.

If you have any further questions regarding this issue or would like clarification on any of the above don't hesitate to contact the undersigned:

Yours faithfully,

A handwritten signature in blue ink, appearing to read 'A. Hossack', is written over a light blue horizontal line.

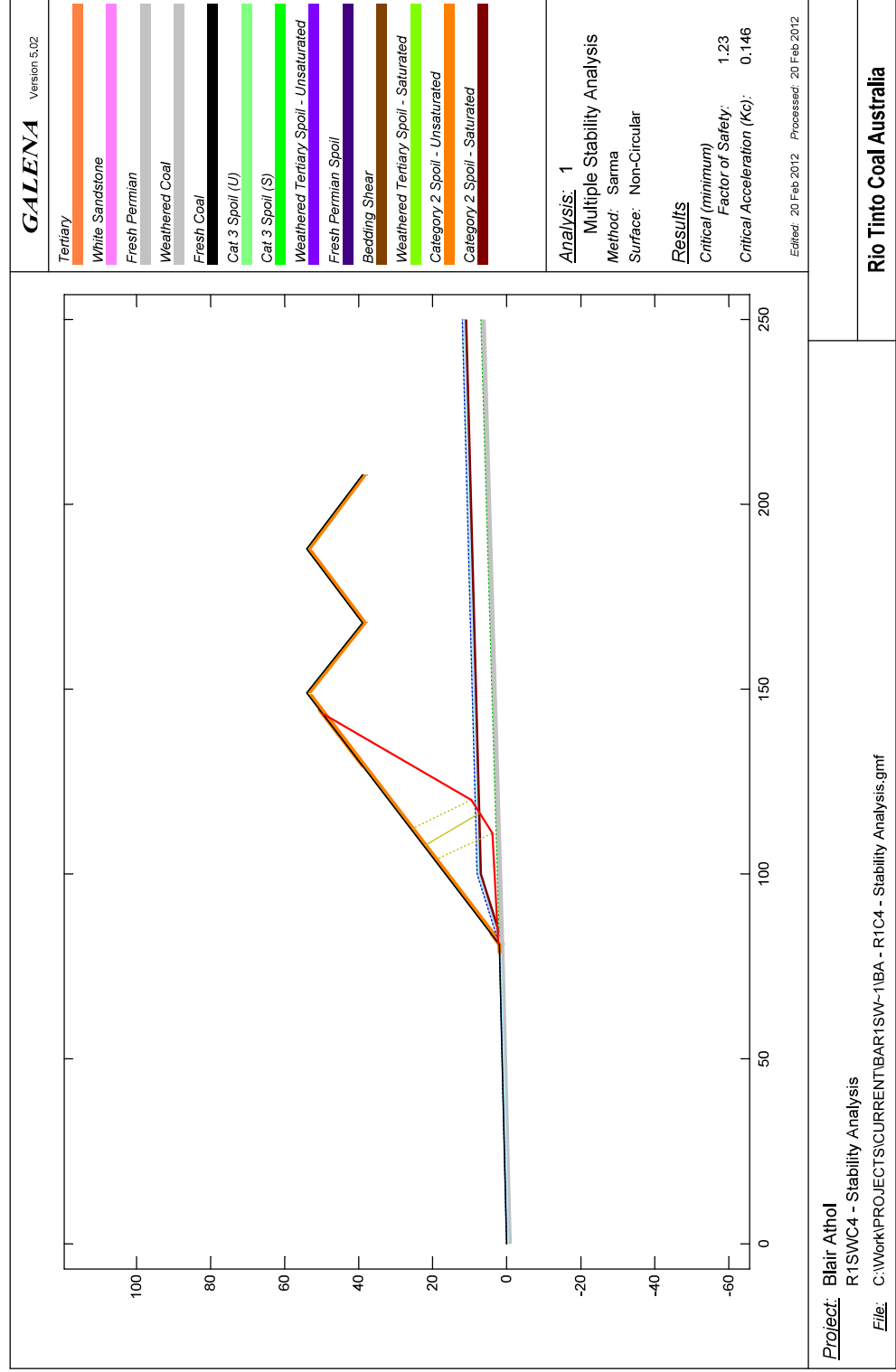
Alex Hossack (RPEQ 11165)
Acting Principal Geotechnical Engineer
Rio Tinto

Appendix 1 – Risk Assessment Checklists

BA MINE					
GEOTECHNICAL DESIGN CHECKLIST - LOWWALL					
Pit design:	R1SWC4				
ITEM	FACTORS	Low	Moderate	High	NA
Design Engineer to fill section below					
Final Low Wall Geometry	Floor Dip Beneath Proposed Spoil Profile	All ≤ 9 degrees	Majority $\leq 9^\circ$ with areas $>9^\circ < 50m$ wide	Areas $>50m$ wide $> 9^\circ$	
	Dragline Batter Height (after coal removal)	$< 50m$	50 - 60m	$> 60m$	
	Dragline Batter Angle	≤ 42 degrees	42 - 50 degrees	> 50 degrees	
	Bench Width (at pad level)	$> 10m$	5 - 10m	$< 5m$	
	Overall Slope Height	$< 50m$	50 - 60m	$> 60m$	
	Max. Overall Slope Angle (incl. bench/ramps)	< 35 degrees	35 - 40 degrees	> 40 degrees	
Engineer Comments	NA				
Geologist to fill from this point down					
Spoil Condition	Material Type: Passive Block (Base, Toe)	Cat 4 - Cat 3.5	Cat 3 - Cat 2.5	Cat 2 - Cat 1	
	Material Type: Active Block (Bulk, Crest)	Cat 4 - Cat 2.5	Cat 2 - Cat 1.5	Cat 1	
	Exposure Time Prior to Blasting	< 1 year	1 to 2 years	> 2 years	
Spoil Floor Conditions	Sub-floor materials (up to 3.0m)	Sandstone/Siltstone	Siltstone/Mudstone	Clays, shears or laminated strata	
	Floor surface condition	Strong	Moderate Slake	High Slake or Weak	
	Any Weak Material Disrupted (Blasted or Ripped)	N/A	Yes for majority of strip width	No or only for part of strip width	
	Condition of floor prior to overburden blasting	Clean over majority of strip or with minor mud/water	Dewatered and weak material pushed up against low wall	Water and mud present over much of the strip	
	Floor Exposure Time Prior to Overburden Blasting	< 1 year	1 to 2 years	> 2 years	
Groundwater & Pit Water	Wet zones or springs above floor (prev. strip)	NO	Yes ($< 2m$ high)	Yes ($> 2m$ high)	
	Water/mud on pit floor	NO	Minor ($< 1m$)	Yes ($> 1m$ deep)	
	Ponding time	N/A or < 2 months	2-6 months	> 6 months	
History	Failure Last Strip	No	Localised or ravelling	YES	
	Failure(s) Previous Strips	No	Localised or ravelling	YES	
Geologist Comments	NA				

BA MINE					
GEOTECHNICAL DESIGN CHECKLIST - HIGHWALL					
Pit design:		R1SWC4			
ITEM	FACTORS	RISK RATING			
		Low	Moderate	High	NA
Design Engineer to fill section below					
Hard Wall Geometry. (excavated high walls & end walls)	Maximum Batter Height after coal removal	≤ 45m	45 - 50m	> 50m	
	Maximum Batter Angle (Fresh Coal Measures)	≤ 75 degrees	75 - 80°	> 80 degrees	
	Inter Ramp Slope Angle if highwall is benched (Excl. Benches >20m)	≤ 55 degrees	55 - 60	> 60 degrees	
	Minimum Bench Width	≥ 25m	15 - 25m	< 15m	
	Overall slope angle (for multiple benches)	≤ 55 degrees	55 - 70	> 70 degrees	
Soft Wall Geometry. (soft walls, spoil, weathered rock walls & boxcut low walls)					
	Maximum Batter Height after coal removal	< 20m	20 - 30m	> 30m	
	Maximum Batter Angle	≤ 45 degrees	45 - 55 degrees	> 55 degrees	
	Overall slope angle (for multiple benches)	≤ 37 degrees	37 - 45 degrees	>45 degrees	
	Overall slope height (for multiple benches)	≤ 60m		> 60m	
Blasting					
	Face splitting/Buffer Shot technique	Presplit/Buffer Shot	Midsplit	None	
	Do blast lines intersect faults or defect zones?	NO	Yes but defect intercept slope at >30°	YES	
Engineer Comments					
Geologist to fill from this point down					
Groundwater /Surface Water	Seepage from Face	None/minor	Confined to coal seam	>20m high	
	Is run-off beyond crest controlled	Yes	Mostly with only minor run-off	No, ponding or stored water	
Rock Mass Defects & Structure					
	Pitwards-dipping bedding (strike length)	None	Yes but less than length of wall height	Yes greater than length of wall height	
	Does defect data indicate structures leading to the formation of wedges?	No or low likelihood	Yes, moderate likelihood	Yes, high likelihood	
	Does defect data indicate pitwards-dipping structure greater than 30 ° (planar failure)	No or low likelihood	Yes, moderate likelihood	Yes, high likelihood	
	Does defect data indicate pitwards-leaning joints (toppling failure)	No or low likelihood	Yes, moderate likelihood	Yes, high likelihood	
	Joint Set spacing	> 10m	2 - 10m	< 2m	
	Defect Continuity	< 5m	> 5m	Entire unbenched wall height	
History					
	Failure Last Strip	No, or <50m3	Don't know	Yes, >50m3	
	Failure(s) Previous Strips	No, or <50m3	Don't know	Yes, >50m3	

Appendix 2 – Stability Analysis Result



Appendix 3 – Kinematic Analyses Results

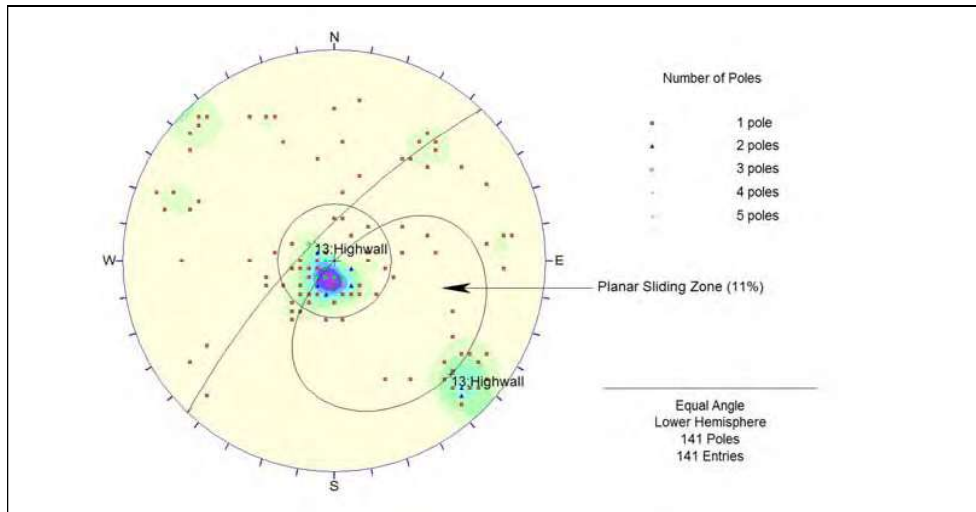


Figure 5 R1SWC4 Highwall - Sliding Type Failure Analysis

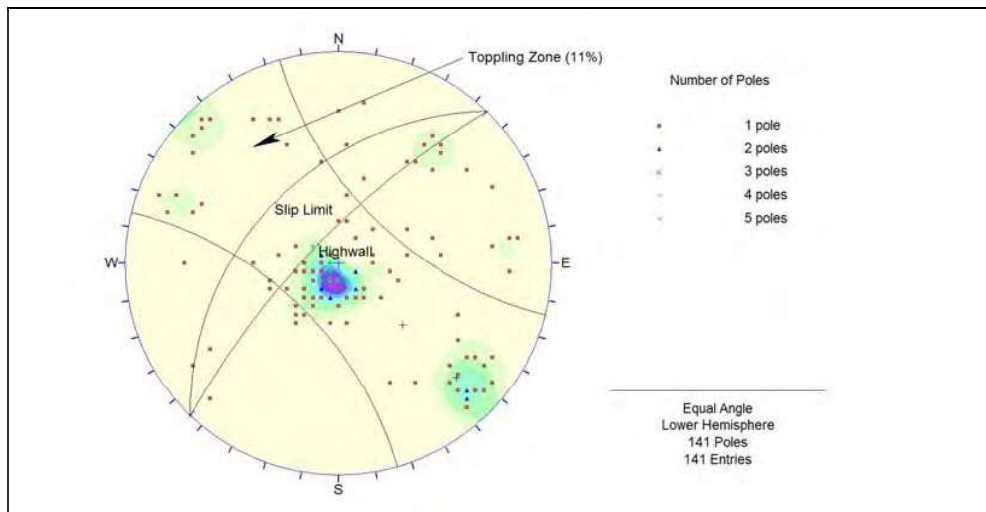


Figure 6 R1SWC4 Highwall - Toppling Type Failure Analysis

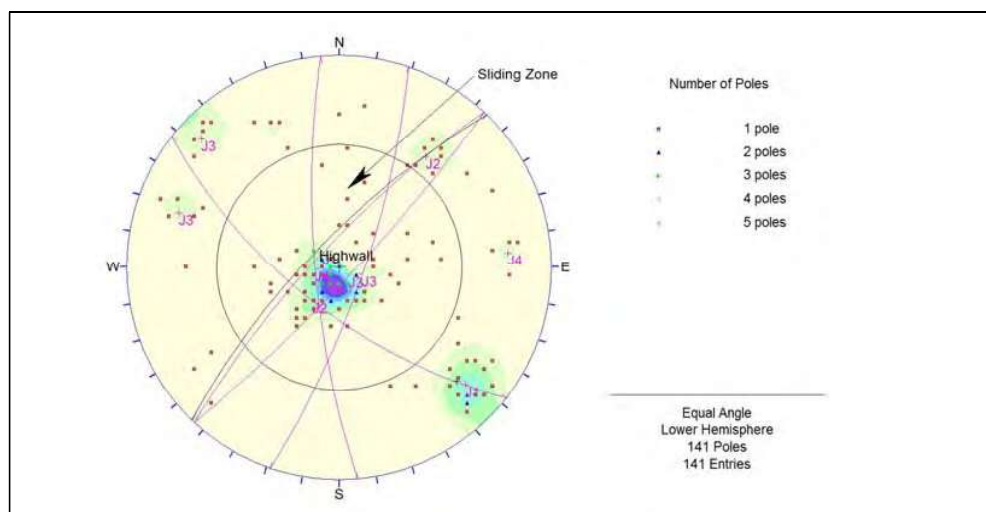


Figure 7 R1SWC4 Highwall - Wedge Type Failure Analysis

1.0 GEOTECHNICAL CHARACTERISTICS

Geotechnical hazards or failures at Blair Athol are generally related to discontinuities such as joints and faults; weak bedding parallel materials; and isolated rock or blockfalls. The rock types predominantly associated with these failures are the white sandstone, coal and basalt.

Design changes of the highwall and lowwalls have occurred over the last few years and specific criteria developed for each ramp. Local pit controls have also been introduced such as a golden rule of a 10 metre exclusion zone from any operating face, daily monitoring, and training of all site personnel in the mechanisms and hazards associated with the failures.

In 2003, a geotechnical assessment was completed by the site geotechnical consultant on selected drilling data for stability characteristics of the different rock types. Table 1 is a summary of these different rock type characteristics.

Table 1 - Stability characteristics of the different rock types

Material Type	Shear Strength		Unit Weight (kN/m3)
	Cohesion (kPa)	Friction (angle)	
Rock Materials			
Tertiary (in situ)	52	30	20
White Sandstone (where weathered)	6	32	20
Fresh Permian	100	45	22
Weathered Coal	0	30	15
Fresh Coal	30	35	15
Spoils			
Spoil (unsaturated) / Category 3-1Std Dev.	35	28	18
Spoil (saturated) / Category 3 - 1 Std Dev	10	22.5	20
Weathered Tertiary Spoil	20	25	18
Fresh Permian Spoil	50	30	18
Weak materials			
Weak or sheared bedding parallel materials	0	16	Not applicable

Jointing is evident in sections of the coal and overburden walls running approximately 10 – 15 degrees off the orientation of the wall and inclined at various angles from 75 degrees into the pit to around 85 degrees into the wall.

Weak bedding parallel materials are generally associated with the coal seams especially with the roof and floor of Seam 3 and Seam 4. With the progression of mining, the strips are advancing in an up dip direction for the highwalls causing a potential for translational sliding along these weak planes. The undercutting of bedding as part of the excavated lowwall development is also a part of this. The materials typically comprise of soft clayey or sheared bands.

Isolated rock or blockfalls are generally associated with the basalt overlying the white sandstone. Generally the upper pass of the highwall consists of basalt and the lower pass of white sandstone. In order to reduce the impact of failure from basalt with its columnar forming characteristics, buffer blasting has been employed.

The white sandstone is weathered and is regarded as extremely weak. It is involved in the majority of failures. Following a few days of exposure, the wall condition in the white sandstone deteriorates often leading to failure. The lower strength of the material compared to other sandstones at site is considered to be related to either blasting impacts, deep weathering or leaching effects from the overlying basalts.