HILLGROVE RESOURCES

Hillgrove Copper Pty Ltd

Kanmantoo Copper Mine

ML6345, ML6436

Program of Environment Protection and Rehabilitation (PEPR)

MAIN REPORT

Revision: 10

Date: March 2020

Hillgrove Copper Pty Ltd

Program for Environment Protection and Rehabilitation

ML6345 and ML6436
Kanmantoo Copper Mine

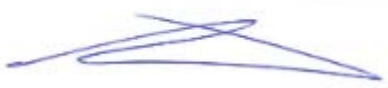
Tenements	ML6345 and ML6436
Commodity	Copper, gold, silver and garnet (although garnet will report to tailings)
Operation Name	Kanmantoo Copper Mine
Proponent	Hillgrove Copper Pty Ltd
Contact	Lachlan Wallace, General Manager Catherine Davis, Environment Manager

Declaration of Accuracy

The information contained in this PEPR is, to the best of my knowledge, a true and accurate representation of the mining and mining-related activities. Hillgrove Copper Pty Ltd have taken all reasonable steps to review the information contained herein to ensure the accuracy as at the date of submission.

The following steps have been undertaken to ensure the accuracy of the document:

- using suitably qualified specialists for all specialist studies throughout the life of the operation and previous MLP and PEPR documentation, on which this PEPR is based;
- external assistance to prepare the PEPR and review inputs;
- an internal process for review; and
- sign off by senior management.

Name	Position	Signature	Date
Lachlan Wallace	CEO		March 2020

Document Control

Report Status	Distributed to	Date	Authorised by
V1	Hillgrove and DMITRE	23 June 2014	T. Halliday
V2	Hillgrove and DSD	10 July 2014	T. Halliday
V3	Hillgrove and DSD	13 July 2015	E. Colley
V4	Hillgrove	30 November 2015	E. Colley
V5	Hillgrove	6 May 2016	T. Halliday
V6	DSD	7 October 2016	C. Davis
V7	DSD	31 July 2017	C. Davis
V8	Hillgrove	28 February 2019	C. Davis
V9	DEM	18 December 2019	C. Davis
V10	DEM	March 2020	C. Davis

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Glossary

AEP	Annual exceedance probability	LFA	Landscape Function analysis
AHD	Australian Height Datum	LGA	Local government area
ANCOLD	Australian National Committee on Large Dams	MARCR	Mining and Rehabilitation Compliance Report
ANFO	Ammonium nitrate fuel oil	MBO	Murray Bridge - Onkaparinga pipeline
ARD	Acid rock drainage	MCA	Minerals Council of Australia
ARI	Average recurrence interval	MDE	Maximum design earthquake
ASX	Australian Stock Exchange	ML	Mineral lease
DCMB	District Council of Mount Barker	MLP	Mining Lease Proposal
DEE	Commonwealth Department of the Environment and Energy	MNES	Matter of national environmental significance
DEM	South Australian Department for Energy and Mining	MSDS	Material safety data sheets
DEW	Department for Environment and Water	NAF	Non acid forming
DPTI	South Australian Department of Planning, Transport and Infrastructure	NAPP	Net acid production potential
DSD	Former South Australian Department of State Development	NVC	Native Vegetation Council
EHS	Environment health and safety	NVF	Native vegetation fund
EML	Extractive minerals lease	NVMP	Native vegetation management plan
EMP	Environmental management plan	OTD	Old tailings dam
EMS	Environmental management system	PAF	Potentially acid forming
EPA	South Australian Environment Protection Authority	PEPR	Program of Environment Protection and Rehabilitation
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999	PHES	Pumped hydro-electricity scheme
ESP	Exchangeable Sodium Percentage	PPV	Peak particle velocity
FoS	Factor of Safety	RC	Reverse circulation
GABS	Garnet andalusite biotite schist	RL	Reduced level
GHG	Greenhouse Gas(es)	ROM	Run of mine
GMMP	Groundwater Monitoring and Management Plan	RWS	Return Water Storage
GMO	Groundwater management objective	SA	South Australia
GNSS	Global Navigation Satellite System	SACOME	South Australian Chamber of Mines and Energy
GPS	Global Positioning System	SAG	Semi autogenous grinding

HDPE	High-density polyethylene	SEB	Significant environmental benefit
Hillgrove	Hillgrove Copper Pty Ltd	SMA	Seed management area
IMS	Integrated management system	SPA	Seed production area
ISQG	Interim sediment quality guidelines	TSF	Tailings Storage Facility
IWL	Integrated waste landform	TSS	Total suspended solids
KCCCC	Kanmantoo Callington Community Consultative Committee	TZVI	Theoretical zone of visual influence
Ksat	Hydraulic conductivity		

%	Percentage	m	Metres
°	Degrees	m^3	Cubic metres
µm	Micrometre	ML	Megalitres
dB	Decibel	Mm^3	Million cubic metres
GWh	Gigawatt hour	mm	Millimetres
ha	Hectare	Mt	Million tonne
kg	Kilogram	MW	Megawatts
kL	Kilolitres	tpa	Tonne per annum
KV	Kilovolt	tph	Tonne per hour
L	Litres		

1.0 Introduction

1.1 Kanmantoo Copper Mine

Hillgrove Copper Pty Ltd (Hillgrove) operates the Kanmantoo Copper Mine (hereafter referred to as 'the project'), located approximately 44 km southeast of Adelaide within the Mount Barker District Council area in South Australia (Figure 1-1).

The mine footprint and associated infrastructure are located within a 438 ha area, which is covered by Mineral Lease (ML) 6345 (436 ha) and ML6436 (2.1 ha) and is defined in this report as the ML area (Figure 1-2). Extractive Minerals Lease (EML) 6340 (Figure 1-2) covers a borrow pit associated with the operation and is covered in separate documentation.

The project has and is expected to continue to result in:

- Economic benefits, such as expenditure during construction, operations and closure, royalty payments and salaries.
- Social benefits, such as employment opportunities, training and education.
- Environmental benefits, such as rehabilitation of areas of disturbance from previous mining activities, the provision of a significant environmental benefit offset area for native vegetation and the use of recycled water from the Laratinga Effluent Treatment Facility as the primary water source during project operations.

1.2 Proponent Details

The proponent of the Kanmantoo Copper Mines is Hillgrove Copper Pty Ltd (Hillgrove), a fully owned subsidiary of Hillgrove Resources Limited. Hillgrove Resources Limited is an Australian resources company listed on the Australian Stock Exchange, which focuses on identifying opportunities that can be brought into production readily or have a clearly defined value-adding route within a clearly understood risk environment.

Table 1-1: Hillgrove contact details

Kanmantoo Copper Mine Éclair Mine Road Kanmantoo SA 5252 Telephone: + 61 8 8538 6800 Facsimile: + 61 8 8538 5255	General Manager – Kanmantoo Copper Mine Contact: Glenn Norris Environment Manager Contact: Catherine Davis

1.3 Kanmantoo Copper Mine History

The Kanmantoo Copper Mines is located in an area that has a long history of mineral exploration and mining. Mining at Kanmantoo began in 1846 and continued to 1874 when a collapse in world copper prices forced the mine to close. Intermittent prospecting continued in the area until the late 1960s when exploration by a joint venture between North Broken Hill Ltd and Broken Hill South Ltd led to the discovery of the main deposit at Kanmantoo.

In the early 1970s, Kanmantoo Mines Limited (a joint venture between North Broken Hill Ltd Broken Hill South Ltd, Electrolytic Zinc Co of Australia Ltd and Ravenrock Investments Ltd) commenced open pit mining over the workings of the earlier Kanmantoo mines. The mine operated for six years when, once again, low copper prices forced the operation to close. Remnant mining infrastructure from that time included an open pit, processing plant infrastructure (currently used as a fertiliser manufacturing facility at the adjacent Neutrog site) and a waste rock dump and tailings dam (Figure 1-3).

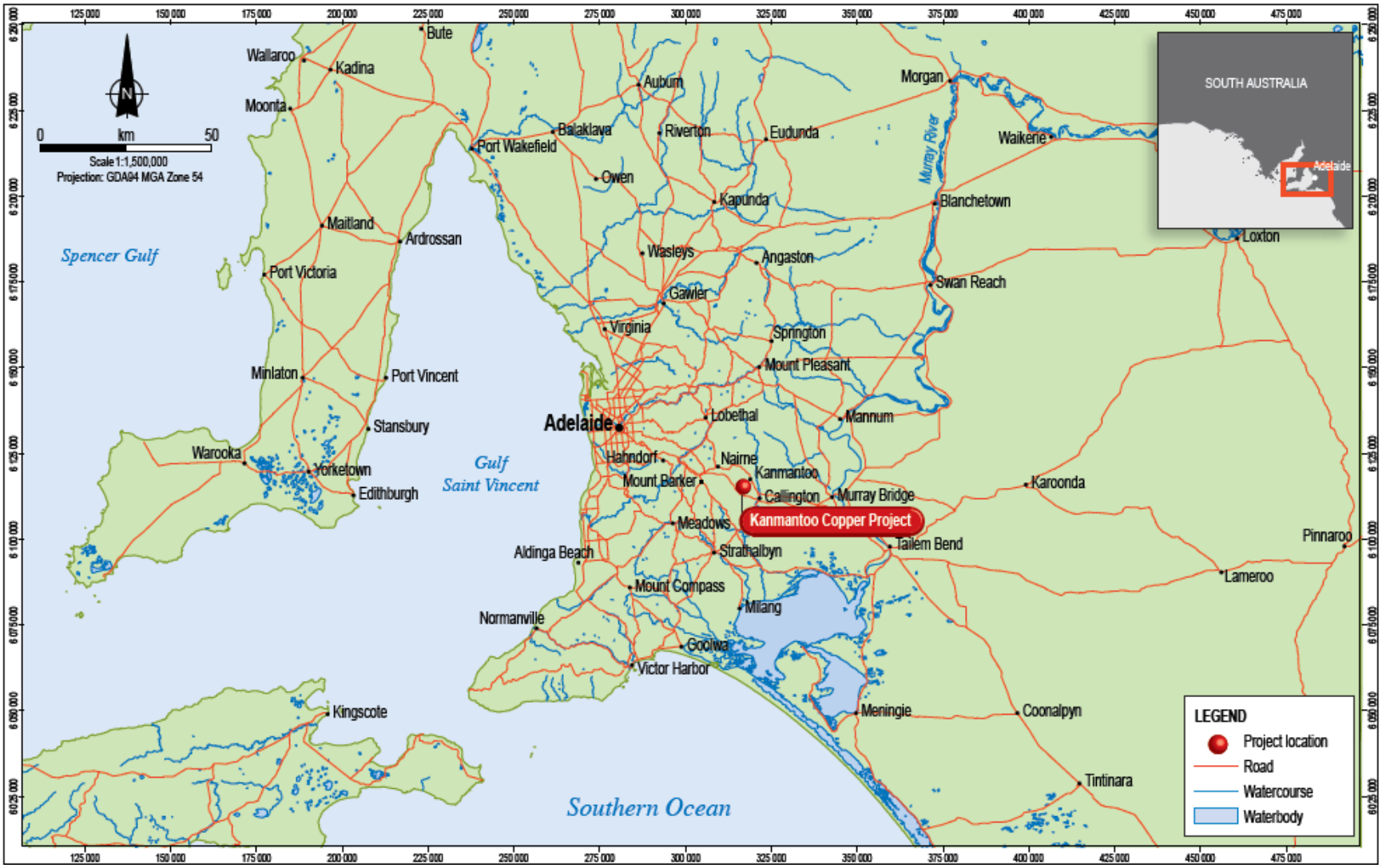


Figure 1-1– Project Location

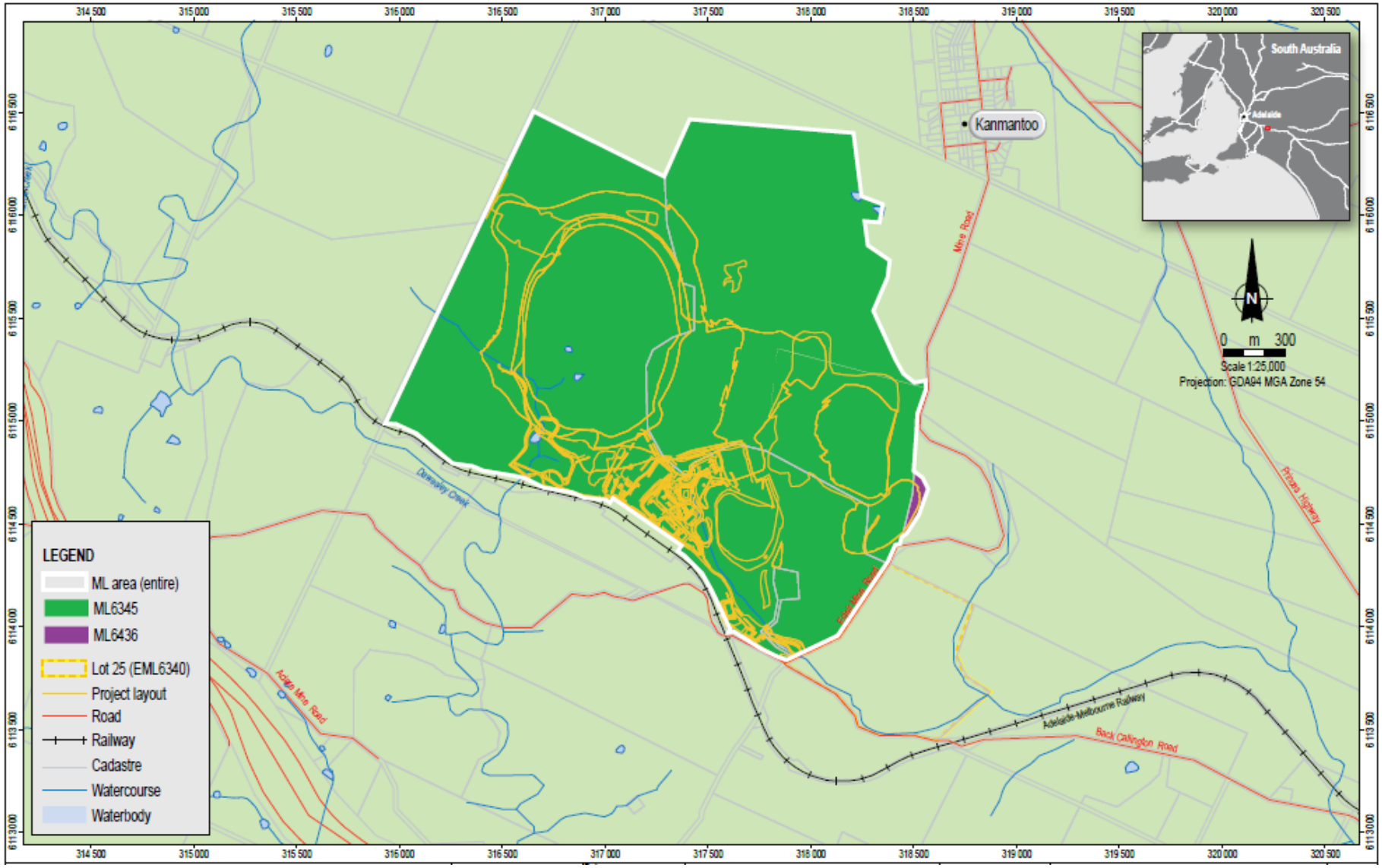


Figure 1-2 – ML area

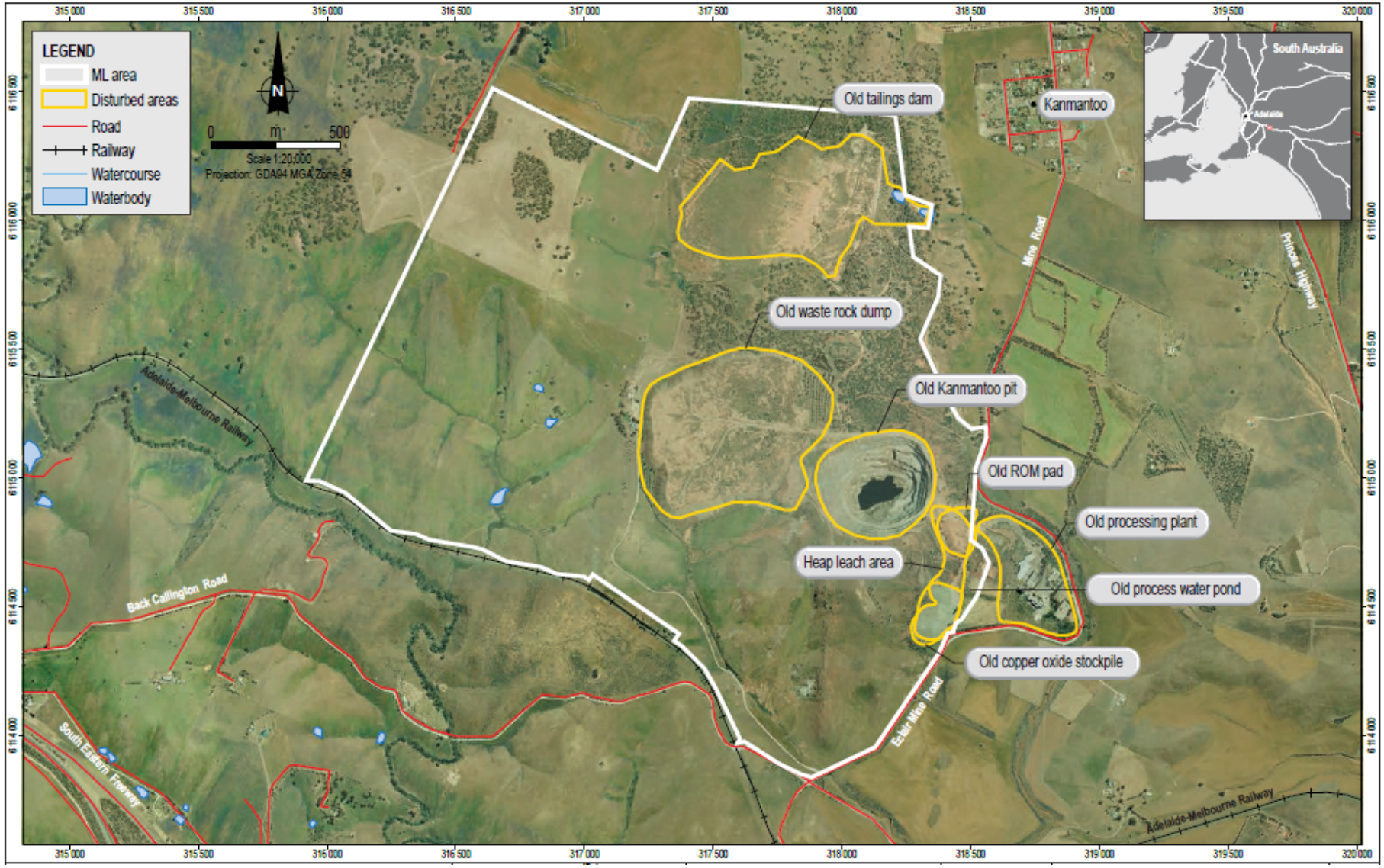


Figure 1-3 – Historic Hillgrove Mining Disturbance

In late 2003, Hillgrove began an exploration program in the Kanmantoo area and was granted a mineral lease (ML6324) for the Kanmantoo Copper Mines in October 2008. In September 2009, the mining lease was reissued and numbered ML6345 with mining commencing in 2011. An additional ML (ML6436) was granted in June 2014 to enable Hillgrove to extract additional ore at depth on ML6345 as part of its extended life of mine project.

Hillgrove mined the Kanmantoo deposit as an open pit operation until May 2019, at which time the economic open pit resource was exhausted. Processing of stockpiles has continued since this time.

1.4 Legislative Context and Existing Approvals

The Kanmantoo Copper Mine is regulated under a number of primary Acts and associated regulations, as identified in Table 1-2.

Other relevant legislation that applies to the project includes:

South Australian

- Aboriginal Heritage Act 1988.
- Controlled Substances Act 1984.
- Dangerous Substances Act 1979.
- Electricity Act 1996.
- Explosives Act 1936.
- Fire and Emergency Services Act 2005.
- Heritage Places Act 1993.
- Local Government Act 1934.
- Mines and Works Inspection Act 1920.
- National Parks and Wildlife Act 1972.
- Radiation Protection and Control Act 1982.
- Work Health and Safety Act 2012.

Commonwealth

- Aboriginal and Torres Strait Islander Heritage Protection Act 1984.
- Australian Heritage Council Act 2003.
- Australian Heritage Council (Consequential and Transitional Provisions) Act 2003.
- Environment and Heritage Legislation Amendment Act 2003 and 2006.

Table 1-2 – Primary legislation applicable to Kanmantoo Copper Mine

Legislation	Objective of Regulation	Kanmantoo Copper Mine Relevance
Mining Act 1971 (SA)	South Australia's principal legislation for the regulation of mining and is administered by the Department for Energy and Mining (DEM). Governing act for provision of tenements, approval of mining operations and ongoing compliance requirements.	The following documents have been submitted and approved under the Mining Act. • Mining Lease Proposal (MLP) submitted 2007 – ML6345 granted October 2008, reissued September 2009. • Additional MLP submitted April 2014, ML6436 granted April 2015. • October 2016 PEPR (to be superseded by this underground PEPR once approved) • Minor Change Notification – Change to Waste Rock Classification Criterion for ML6345 (submitted 6 December 2017, assessed as not resulting in any change to approved environmental outcomes or measurement criteria 7 December 2017). Incorporated into Section 3.7.1.1. • Minor Change Notification – Kavanagh Zone Underground Exploration Activities at ML6345 (submitted 27 September 2019, assessed as not resulting in any change to approved environmental outcomes or measurement criteria 11 October 2019). Incorporated into Section 3.0.
Natural Resources Management Act 2004 (SA)	Promotes sustainable and integrated management of the state's natural resources and provides for their protection and is administered by the Department for Environment and Water. Permits are required for the construction of water harvesting/extracting facilities such as wells and dams, and water licences are required along with any endorsed water allocation for water use from any prescribed water resource.	Water licence 115556 for catchment water collection and groundwater pumping (dewatering).

Legislation	Objective of Regulation	Kanmantoo Copper Mine Relevance
River Murray Act 2003 (SA)	Provides for the protection and enhancement of the River Murray and related areas and ecosystems. Kanmantoo Copper Mine is located in the Murray-Darling Basin hence this act applies.	Under Section 35 of the Mining Act, when considering an application for an ML in an area within the Murray-Darling Basin, the Minister for Mineral Resources Development must take into account the objectives of the *River Murray Act 2003* and the Objectives for a Healthy River Murray under that act. The MLP was referred to the Minister for the River Murray and their views obtained before DEM approved the ML.
Environment Protection Act 1993 (SA)	Provides for the protection of the environment and is administered by the Environment Protection Authority (EPA). The act defines the duties to environmental care in Part 4: 25 – General environmental duty states: A person must not undertake an activity that pollutes, or might pollute the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm. Under this act, mining and mineral processing is a prescribed activity and requires an environmental authorisation in the form of a works approval and/or licence from the EPA to proceed. This act also provides for the establishment of environment protection policies, several of which are relevant to the project.	Licence EPA 27762 for: • 2(9) Mineral Works • 7(7) Extractive industries Environmental Protection (Air Quality) Policy 2016 Environmental Protection (Noise) Policy 2007 Environmental Protection (Water Quality) Policy 2015

Legislation	Objective of Regulation	Kanmantoo Copper Mine Relevance
Development Act 1993 (SA)	Provides for the planning and regulation of developments, the use and management of land and buildings, the design and construction of buildings and the maintenance and conservation of land and buildings. Under Section 75 of the Development Act, all mining proposals within those areas of the state listed in Schedule 20 of the Development Regulations (which include the Mount Barker District Council and therefore apply to this project) require DEM to consider the advice of the Extractive Industries Committee (part of Development Assessment Commission).	Project was reviewed by the Extractive Industries Committee at MLP stage. Additionally, the site access road was assessed under the Development Act (Development Number 580/987/07 approved 10 March 2010). The water pipeline from the Laratinga waste treatment facility was assessed developed by the Council. Relevant provisions of the Mount Barker District Council Development Plan apply.
Native Vegetation Act 1991 (SA)	Administered by the Native Vegetation Council (NVC) and provides incentives and assistance to landowners in relation to the preservation and enhancement of native vegetation, and regulates the clearance of native vegetation. Operations authorised under the Mining Act are exempt from the act provided that clearance is undertaken in accordance with an approved management plan that DEM (as the delegated authority with respect to mining operations) is confident will provide either a significant environmental benefit (SEB) on the site or within the same region of the state, or a payment has been made to the NVC sufficient to achieve a SEB elsewhere in the state.	A native vegetation management plan (NVMP) in accordance with relevant guidance has been prepared as part of this PEPR (Appendix A).

Legislation	Objective of Regulation	Kanmantoo Copper Mine Relevance
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Cwth)	The Australian Government Department of the Environment and Energy (DEE) is responsible for administering the act which requires actions that are likely to have a significant impact on a matter of national environmental significance (MNES) to be assessed.	In June 2007, two ecological communities known to be present in the project area (Peppermint box, *Eucalyptus odorata*) grassy woodland of South Australia and iron-grass natural temperate grassland of South Australia) were listed as critically endangered under the EPBC Act. The controlling provisions of the EPBC Act are not retrospectively applied, however the new clearance associated with the life of mine extension required referral. The extension project was assessed as a controlled action under the Act and a number of approval conditions are associated with this, including demonstration of how remnant vegetation will be preserved and how a significant environmental benefit offset will be delivered. The 2014 Life of Mine Extension NVMP (Appendix to the Mine Closure NVMP (Appendix A) addresses the approval conditions and incorporates changes to earlier versions of the NVMP following public and regulatory input.

1.5 PEPR Objectives and Context

This Program for Environment Protection and Rehabilitation (PEPR) revision provides the information required to move the project from an open cut operation to an underground operation and into mine closure and completion. Specifically, this PEPR covers:

- Underground mining from the base of Giant Pit (also referred to as Giant Pit);
- Associated lifting of the tailings storage facility to contain the processing waste from processing the underground ore; and
- Mine closure and completion for the Project.

This PEPR has been prepared in accordance with the requirements of the South Australian *Mining Act 1971* to demonstrate that the outcomes ML6345 and ML6436 can be achieved.

The PEPR is based on the following documents and has been revised to reflect the mining lease conditions, refinements in project design and feedback received from stakeholders during the formal assessment processes and subsequent period. The PEPR content is consistent with the requirements of the Department for Energy and Mining (DEM) Minerals Regulatory Guidelines MG2b Guidelines (2018) for the preparation of a PEPR.

- Enesar Consulting Pty Ltd (2007) Kanmantoo Copper Project Mining Lease Proposal, prepared for Hillgrove Resources (resulted in granting of ML6345);
- Coffey Environments (2014) Kanmantoo Copper Mine Life of Mine Extension Mining Lease Proposal, prepared for Hillgrove Resources;
- Hillgrove Copper Pty Ltd (2016) Program for Environment Protection and Rehabilitation - Life of Mine.

2.0 Existing Environment

This chapter summarises the pre-existing environment of the ML area and provides any updated environmental data obtained since the 2016 PEPR. For further detail refer to Chapter 4 of the 2016 PEPR, Chapter 5 of the original MLP (Enesar, 2007) and Chapter 5 of the Life of Mine Extension MLP (Coffey, 2014).

The ML area is a brownfields site and is heavily influenced by the components of the pre-Hillgrove mining operations. The old pit has been mined out by the Giant Pit operations, the old waste rock dump has been covered by the integrated waste landform (IWL) and the old processing plant is used by Neutrog. The old tailings dam still remains and has not been modified by the current Hillgrove operations.

2.1 Sensitive Receptors

The southern extent of the Kanmantoo township and about nine individual occupied residents in the rural area are located within about 1 km of ML boundary and represent the closest sensitive receptors to the project (Figure 2-1). Also within this 1km zone is the Neutrog fertiliser factory, which is the closest neighbour to the site (approximately 130m) and is located adjacent to the eastern ML boundary on the old processing plant site.

There are no groundwater dependant ecosystems within the vicinity of the ML area. The nearest groundwater bore used by a third party is approximately 1.1km from the open pit crest.

2.2 Climate

The ML area and surrounds have a typical Mediterranean climate, characterised by low rainfall in the immediate area of Kanmantoo and Callington (annual average of around 424mm), and moderate to high daytime temperatures (Figure 2-2).

Evaporation exceeds rainfall for five months of the year, with an annual evaporation rate of approximately 1,450mm.

The prevailing winds in the summer months are generally from the south while winds in the winter months are largely from the west and sometimes northwest (Figure 2-3).

2.3 Ambient Air Quality, Odour and Noise Levels

Dust monitoring indicates that the mine is a source of dust generation in the local area with the majority of impact to the east of the ML and not in the direction of the two major towns. The Hillgrove air quality impact monitoring has also identified numerous other sources of local dust impacting local air quality, such as surrounding agricultural activities, the local quarry and the Neutrog fertiliser activities.

The Neutrog fertiliser factory, located east of MacFarlane Hill in the old processing plant site, is the main source of odour within the area. Hillgrove odour monitoring ceased after the initial surveys identified the only detectable source of odour to be Neutrog fertiliser production.

Hillgrove noise monitoring results indicate that after the initial construction phase, noise levels have remained compliant with criteria. The noise environment of the ML area and surrounds are typical of a rural area and country town (28 to 41dBA during the day and 26 to 30dBA during the night).

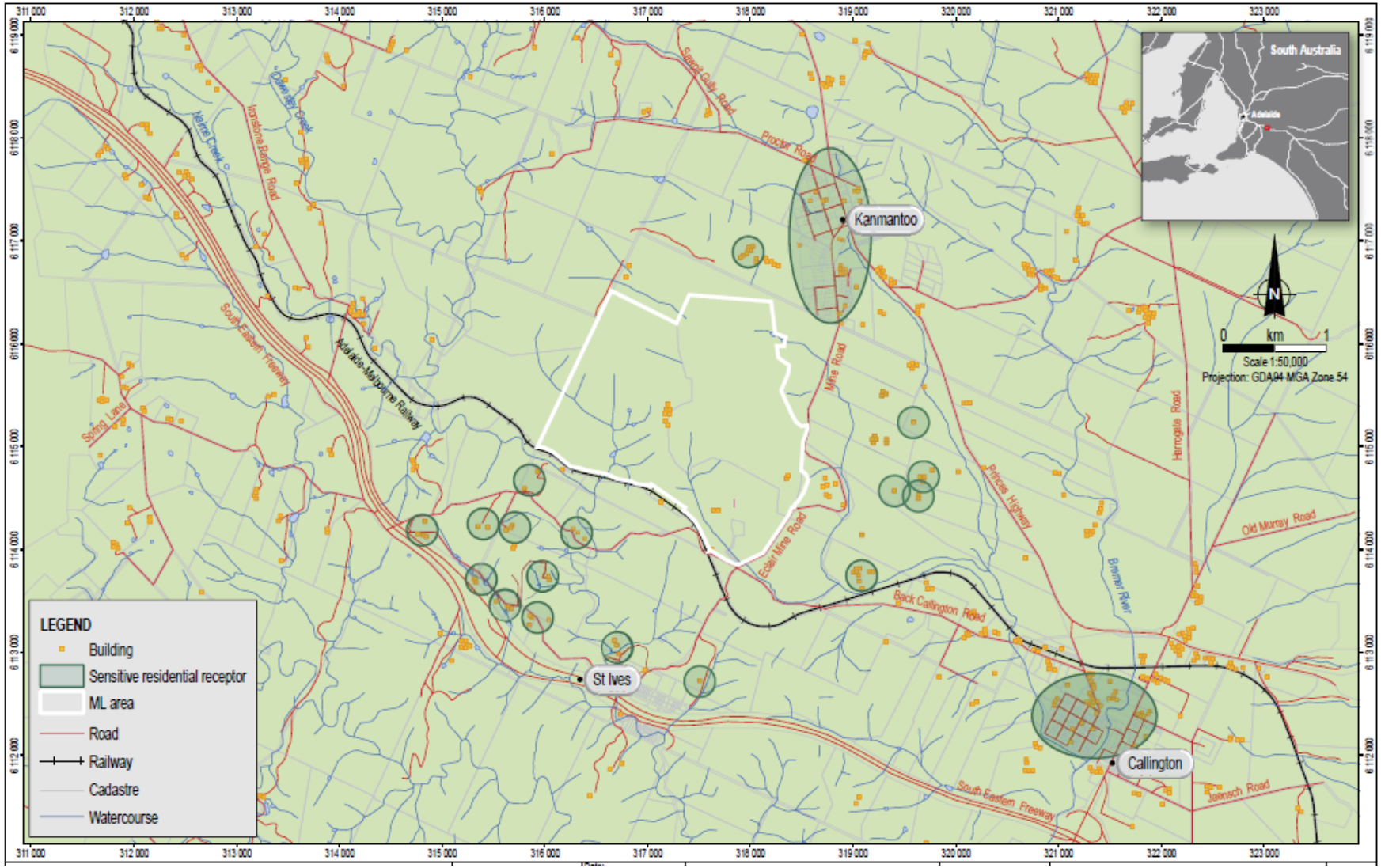


Figure 2-1 – Sensitive receptors

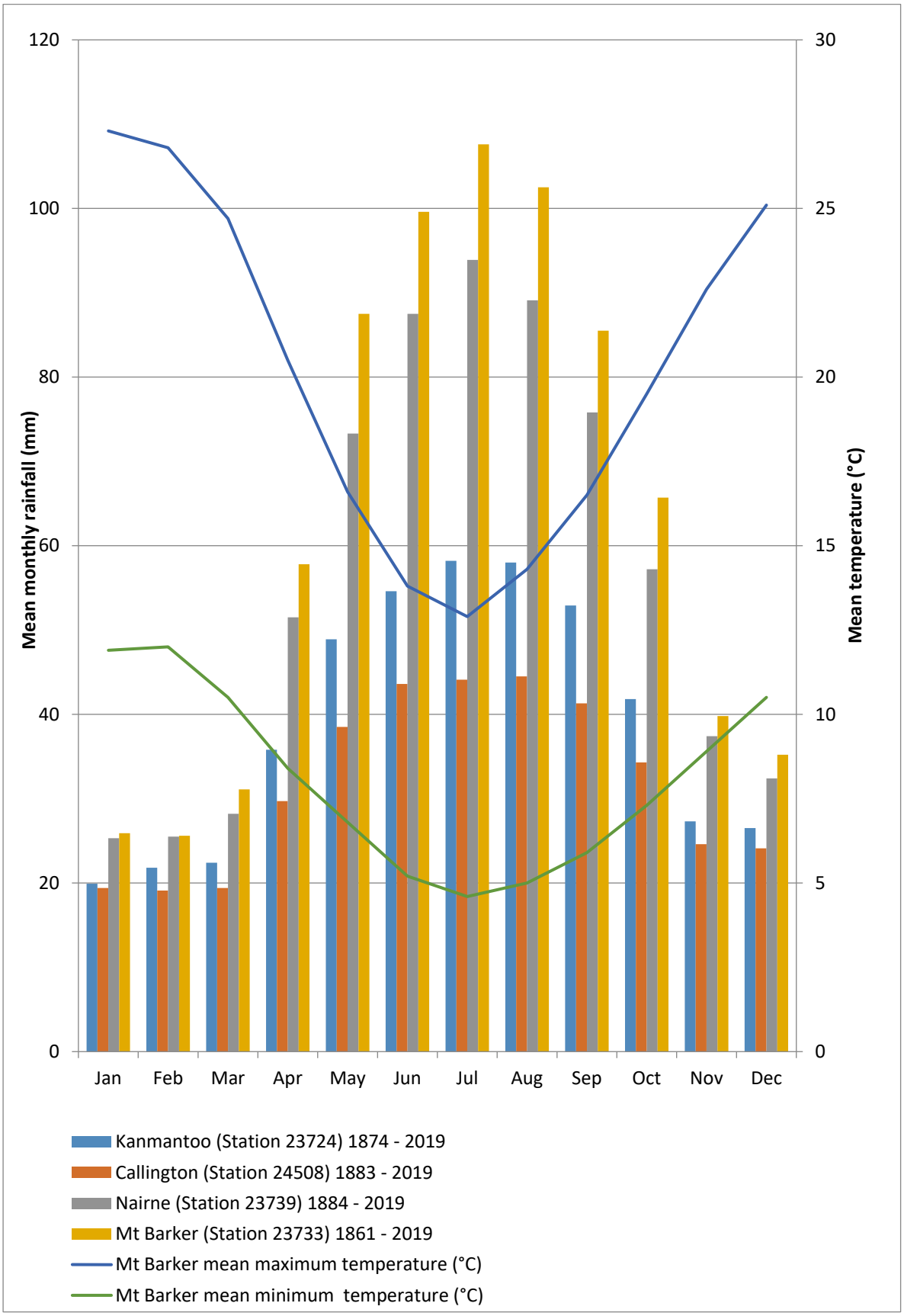


Figure 2-2 – Mean monthly rainfall and temperature

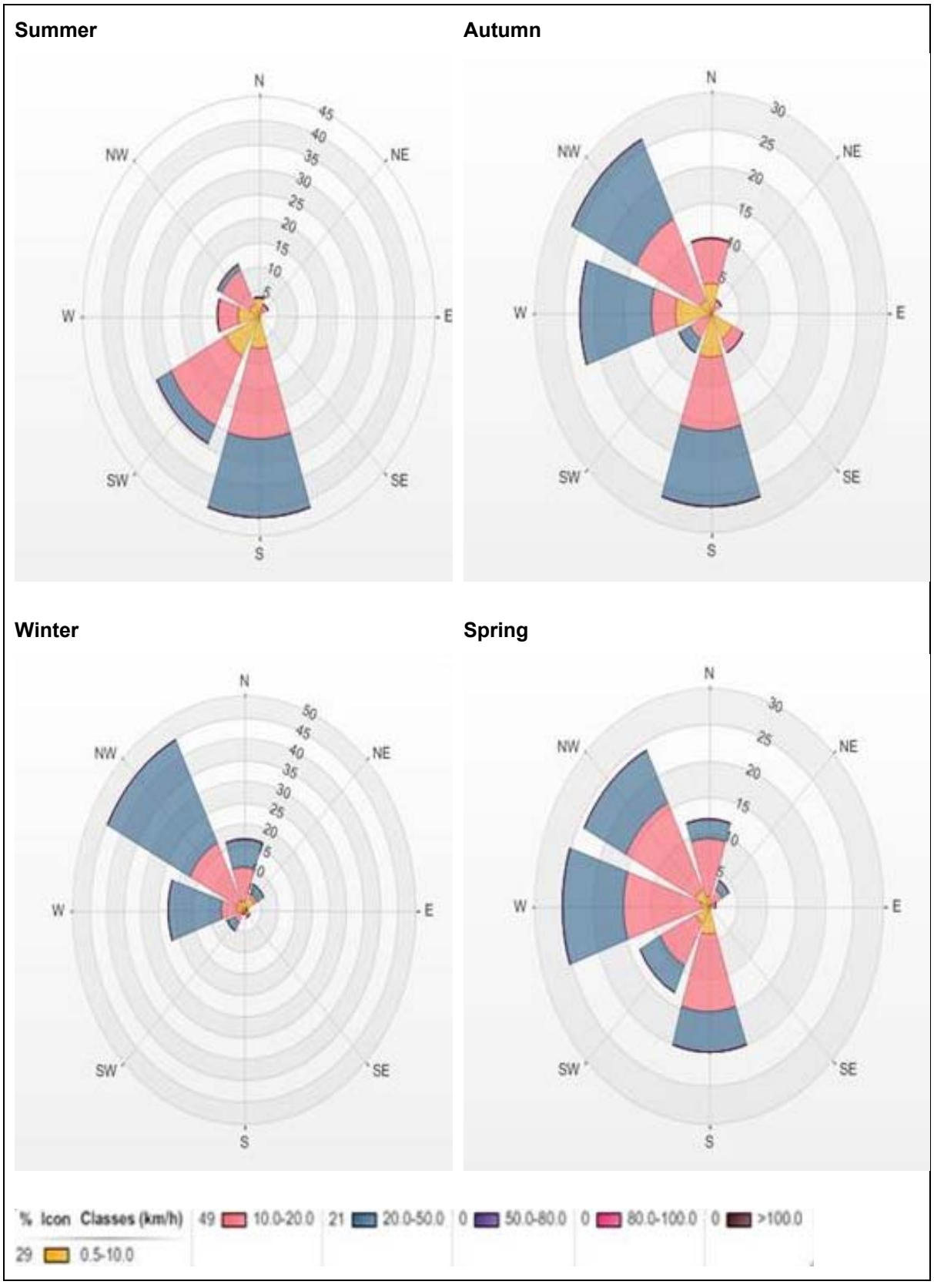


Figure 2-3 – Annual and seasonal wind roses (Carmen's Paddock air quality monitoring BAM 2018)

2.4 Topography, Landscape and Visual Amenity

2.4.1 Topography

The ML area is located on the eastern slopes of the Mount Lofty Ranges in the Bremer River catchment and the River Murray tributary zone. The area is dominated by northwest to southeast trending ridges, with surface elevations ranging from 150 to 260 m Australian Height Datum (AHD), which form several small sub-catchments and ephemeral creeks. The topography is characterised by undulating ridges with steep slopes punctuated by low-lying valleys and creek lines.

2.4.2 Landscape

The landscape is rural with a dominance of agricultural land and smaller areas of remnant native vegetation with some light industrial, road and rail activities. The long history of farming, grazing and previous mining operations in the region has resulted in the clearing of large areas of native vegetation for crops, pasture and planted vegetation. As a result, remnant native vegetation is generally restricted to areas that have not been used for agricultural activities, with the largest remnant located on the ML area.

2.4.3 Visual Amenity

JBS&G were contracted by Hillgrove to conduct a visual amenity assessment, including description of the current visual amenity. The full report is included as Appendix B. As part of this assessment, they defined the current visual amenity of the IWL, as the most dominant landform on the ML area.
The ML area comprises four main landscape units, as referenced by the following viewpoints:

- Petwood South (Ironstone Range Road): This landscape contains local ridges and vegetation that has grown along the northern edge of the mine, a transmission line and rail corridor are also present (Viewpoint (VP) 1, Figure 2-4).
- Callington North (Princess Highway): This landscape north of Callington contains vegetation that is associated with ridgelines (MacFarlane Hill) adjacent to Kanmantoo and includes several dwellings, a rail corridor and fence lines (VP 2, Figure 2-5).
- Dawesley South (Ironstone Range Road): This landscape is dominated by the undulating ridges associated with the northwestern sub-regional area. Fence lines and transmission lines are common in this area (VP 3, Figure 2-6).
- St Ives North (Back Callington Road): This landscape contains the old waste rock dump (to the west), while Adelaide Hills and the Mount Lofty Ranges dominate the distant landscape. Scattered dwellings are also present (VP 4, Figure 2-7).

The visual amenity of the ML area is dominated by remnants of previous mining operations, including the existing open pit and the IWL which incorporates the old and new waste rock dumps. These facilities can be viewed from the northwest, west, southwest and southeast; however, due to existing topography and landscape features (MacFarlane Hill), the degree of exposure varies. The old tailings dam from historic operations remains a feature in the north of the ML area however is not visually dominant from external viewpoints.

Figure 2-4 - VP 1 Photomontage Analysis: Petwood Road, Petwood, looking east (4/8/2019)

Figure 2-5 - VP 2 Photomontage Analysis: Old Princes Highway, Kanmantoo, looking west north west (4/8/2019)

Figure 2-6 -VP 3 Photomontage Analysis: Ironstone Range Road, Petwood, looking south east (4/8/2019)

Figure 2-7 - VP 4 Photomontage Analysis: Back Callington Road, Petwood, looking north east (4/8/2019)

2.5 Geology and Soils

The Kanmantoo copper-gold deposit is hosted within the metamorphosed Kanmantoo group sediments, which extend between the Mount Lofty Ranges and Kangaroo Island. The Kanmantoo group sediments comprise two stratigraphic subgroups named Keynes and Bollapurudda (which overlies Keynes). The Bollapurudda subgroup consists of conglomerates, massive greywacke beds, calcareous metasiltstones of the Talisker formation, interbedded muddy sands and siltstones of the Tapanappa formation and cross-bedded sandstones (Burtt, 2003). The copper-gold mineralisation at Kanmantoo is hosted within a 5km^2 zone of massive garnet andalusite biotite schist (GABS) ± staurolite schists and is characterised by chalcopyrite ± minor pyrite, pyrrhotite and magnetite.

Soils across ML6345 are predominantly shallow and stony with rocky outcrops formed on basement rocks, but in the northwestern edge of ML6345 the soils are deeper sands and loams. Topsoil depth ranges from 0.05 to 0.50 m.

The baseline soil assessment for ML6436 identified the soils on this lease were disturbed from previous mining and industrial activities.

Hillgrove have assayed for uranium and thorium in all their exploration drilling at Kanmantoo since 2015, including the mineralisation the subject of the underground targets. This data shows that the mineralisation and its host rocks are not radioactive. The assays show that the levels of uranium and thorium in the rocks at Kanmantoo do not exceed the background levels for non-radioactive sedimentary rocks.

2.6 Geohazards

The project is in a relatively stable geotechnical area. No landslides have been recorded within, or immediately adjacent to, the ML area. The closest landslide recorded by Geoscience Australia occurred 25.6km west of the ML area. Seismic activity in the surrounding region (15km radius) has been limited to micro-earthquakes (less than 2.0 Richter magnitude) and very minor earthquakes (2.0 to 2.9 Richter magnitude) not generally felt by people.

The underground workings will be located in in the GABS unit and the GDM1a geotechnical domain, which reflects a competent rock mass suitable for underground development requiring minimal rock support.

2.7 Surface Water

The ML area sits within the Eastern Mount Lofty Ranges Prescribed Water Resource Area, Bremer River surface water catchment area.

Drainage in the ML area is via clean water diversion drains or ephemeral streams only flowing after high rainfall events. The annual average flow rate of the ML area (based on a catchment area of 4.4km^2) is estimated to be 4.7L/s (Aquaterra, 2007a,b). Clean water (rainfall) drainage from the ML area reports eventually to the Bremer River, either via Dawesley Creek and Mount Barker Creek or via an unnamed ephemeral stream (Figure 2-8). The Bremer River has distinct annual high (winter and spring) and low (summer) flows, and runs south for about 40km through Hartley and Langhorne Creek before discharging to Lake Alexandrina. Given the low rainfall and high evaporation, there is limited surface water runoff, however when there is, all surface water run-off from disturbed areas associated with Hillgrove activities is captured.

Water quality of the Dawesley Creek upstream of the Dawesley Creek/Mount Barker Creek confluence shows signs of acid rock drainage (ARD) including elevated levels of acidity (median pH 5.4), sulphate (630 to 800mg/L) and some metals, where concentrations of aluminium, cadmium, cobalt, copper, manganese, nickel and zinc exceed the then ANZECC/ARMCANZ (2000) and/or EPA guidelines. The source of ARD has been attributed to the former Brukunga Mine, which is located approximately 10km

upstream of the ML area. The Mount Barker Creek does not show signs of ARD contamination and downstream of the confluence with the Dawesley Creek the water quality improves with a substantial decrease in metal concentrations and higher pH.

Water quality data for the Bremer River some 8 km downstream of the Dawesley Creek/Bremer River confluence shows median total metal concentrations are below the state water quality criteria with the exception of cadmium and copper, which are slightly elevated. However, nutrient levels are elevated, with median concentrations of oxidised nitrogen and total nitrogen exceeding ANZECC/ARMCANZ guidelines. The source of nutrients is likely to be runoff from grazing land (mainly fertilisers and animal wastes) and septic tank overflows.

Stream sediments contain high concentrations of some metals and largely reflect the geological mineralisation of the area. Most median metal concentrations in sediments collected from the Bremer catchment exceed average crustal abundances, however these are below the interim sediment quality guidelines (ISQG-High), with the exception of copper concentrations that ranged from 140 to 13,500 mg/kg, (where the latter value is 50 times the ISQG-High value). The area with the highest concentrations of heavy metals is the Dawesley/Mount Barker confluence, with cadmium ranging from <0.1 to 54 mg/kg (ISQG-High = 10), lead ranging from 2 to 42,400 mg/L (ISQG-High = 220) and zinc ranging from 16 to 5,850 mg/L (ISQG-High = 410). It is believed that, at this point, the more acidic waters of Dawesley Creek mix with the more alkaline waters of Mount Barker Creek and cause precipitation of dissolved metals.

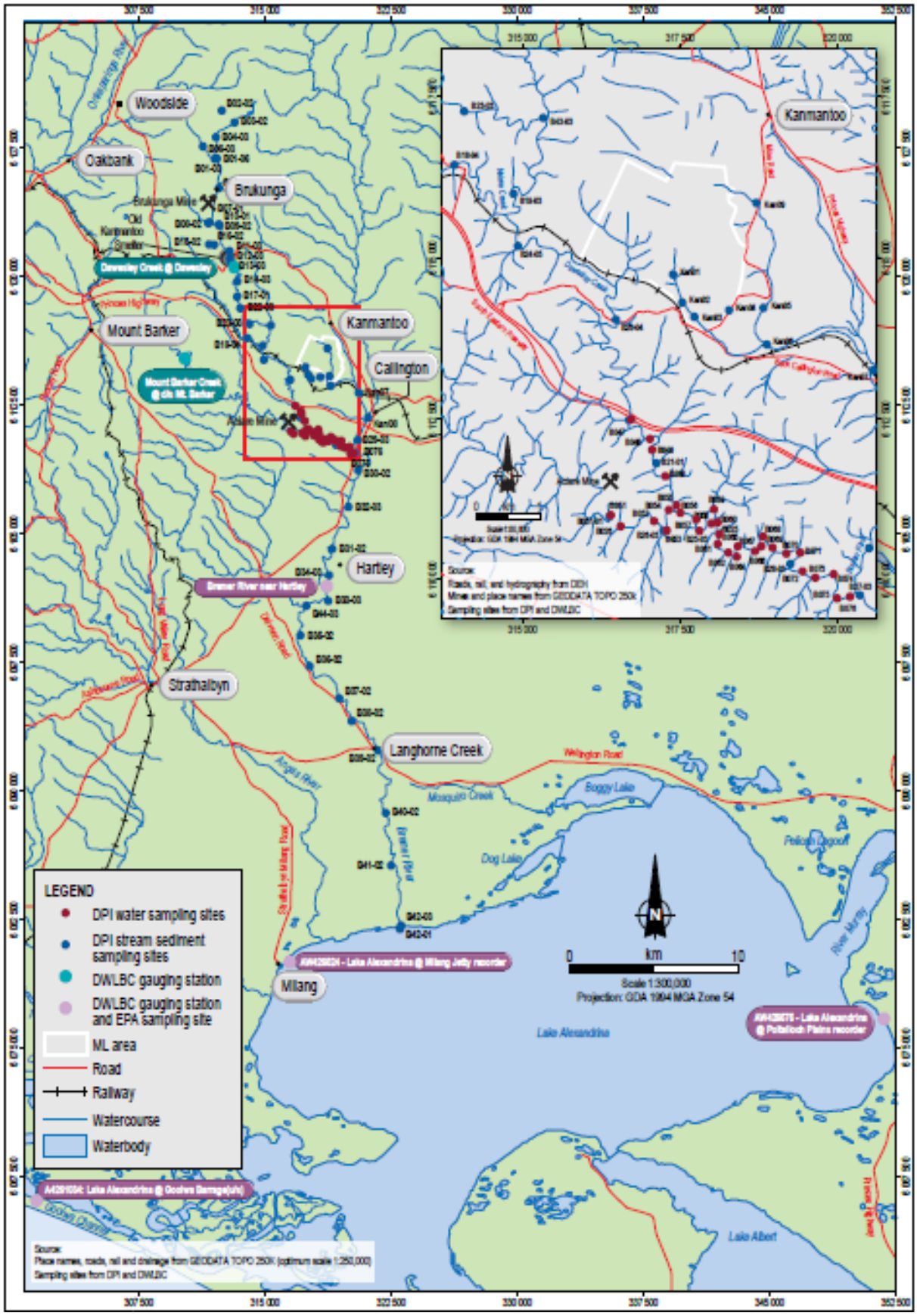


Figure 2-8 – Bremer River catchment water monitoring sites

2.8 Groundwater

The ML area lies within the Eastern Mount Lofty Ranges water management area, where groundwater is sourced from either fractured rock or sedimentary aquifers and is of varying quality and yield. The ML area is underlain by the Kanmantoo Group aquifer, a fractured rock aquifer that is generally tight and impermeable and yields only low-flow brackish groundwater.

On site, groundwater typically occurs within fracture zone intervals at relatively deep levels below the limit of any bedrock weathering with little or no groundwater occurring in the weathered and relatively thin bedrock zone or shallow sequence of alluvial / colluvial sediments present along drainage lines (JBS&G, 2018a). Due to the fractured nature of the bedrock, hydraulic conductivity is highly variable across the site and groundwater flow is likely to be extremely heterogenous, compartmentalised and predominantly fracture-driven (Mining One, 2019a).

Regional groundwater flow is in a generally east direction across the ML area and in a south to southeasterly direction in the southern portion of the site (consistent with undulating topography). Locally, since mining, the direction of groundwater flow in the northern section of the site is southeasterly and in the southern section of the site is dominated by flow towards the open pits, generally in a south south-easterly direction (Figure 2-9).

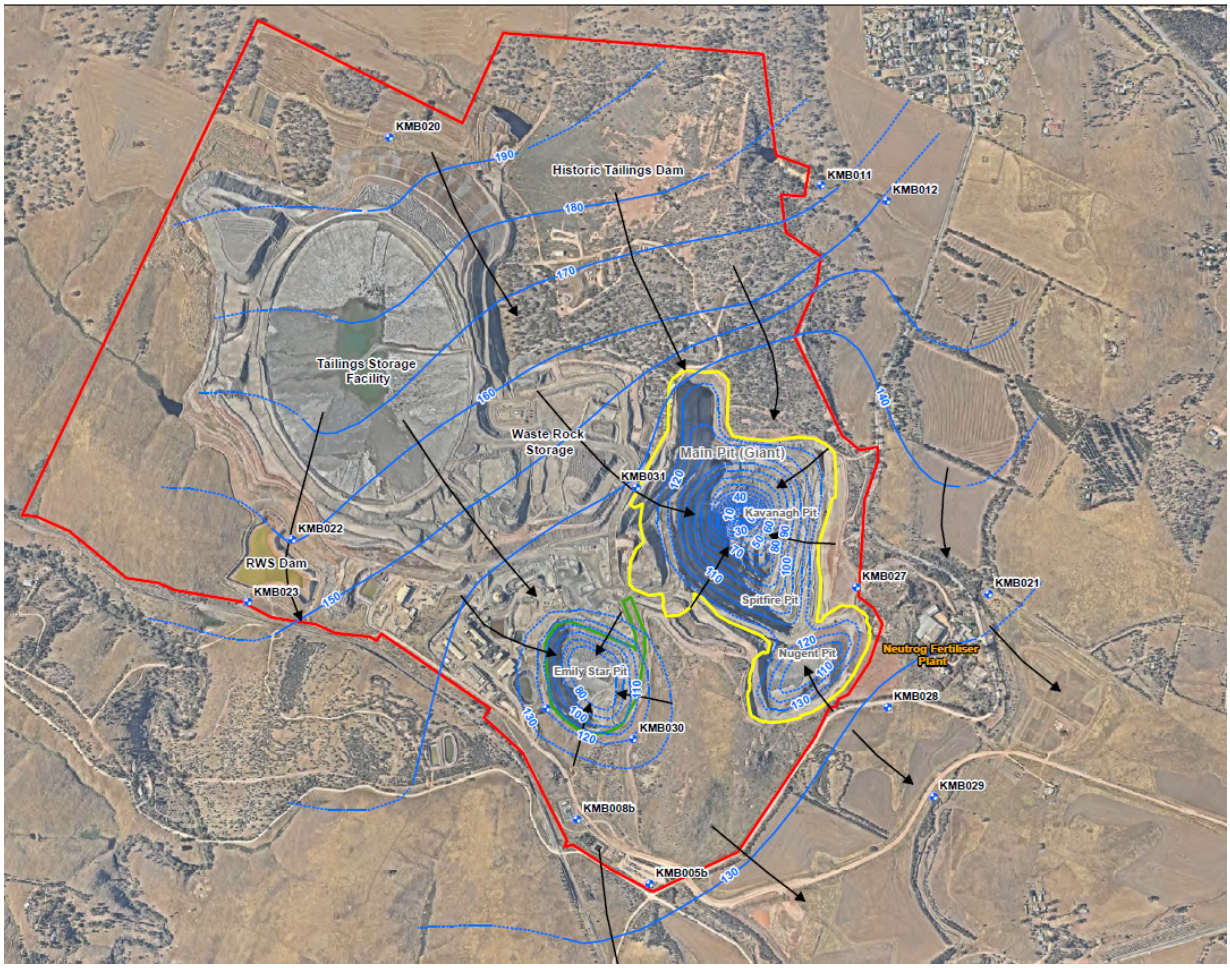


Figure 2-9 – Groundwater flow at the Kanmantoo Mine Site (Mining One 2019a)

The water quality in the area surrounding the ML area is generally potable, ranging from fresh to brackish, but sampling indicates occasional high concentrations of some metals such as copper, cobalt, iron and zinc. These concentrations are expected to be naturally occurring and related to regionally high metal content of local rocks rather than human activities.

Groundwater close to the former Kanmantoo Mine is acidic and contains elevated levels of heavy metals, a consequence of both the natural geology and ARD associated with previous mining activities including the historic waste rock dump and old tailings dam.

A three dimensional model has been developed and calibrated for the mine and utilises regional data as well as detailed site monitoring data of the last 15 years. The model and results of monitoring continue to show that the pit acts as a groundwater sink and will continue to do so into the future during underground mining and post-closure refer to Section 3.13.4.1). As a result, there has been no outward flow of acidic groundwater from the pit. Within the ML area, pH varies from acidic (near the pit) to neutral (further away), with concentrations of heavy metals decreasing with increasing distance from the pit.

The main uses of groundwater in the Eastern Mount Lofty Ranges are for stock and domestic purposes. The groundwater is sourced from relatively shallow bores equipped with windmills or low capacity submersible pumps.

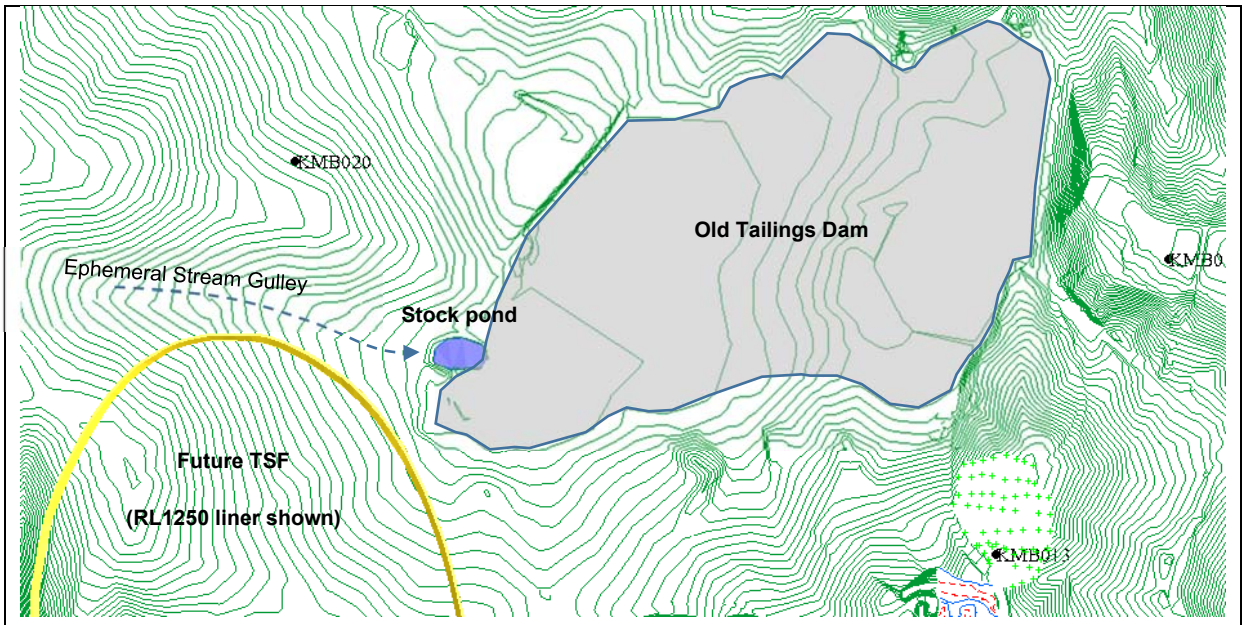
There are no groundwater dependant ecosystems identified in the ML area or the surrounding area. Groundwater monitoring to date has also not identified any groundwater impacts to quality or quantity of neighbouring bores (JBS&G, 2018a).

In 2018, water ponding at the northeastern base of the IWL on top of the adjacent old tailings dam (OTD) was identified. Investigation of this water was conducted by JBS&G (2018b). JBS&G identified that during construction of the IWL, a shallow “stock” pond, which may have been spring or stream fed, in the paddock to the north of the initial TSF embankment, was buried (Figure 2-10). Geochemical assessment of the ponded water was conducted and results compared to TSF underdrainage and surrounding groundwater bore water.

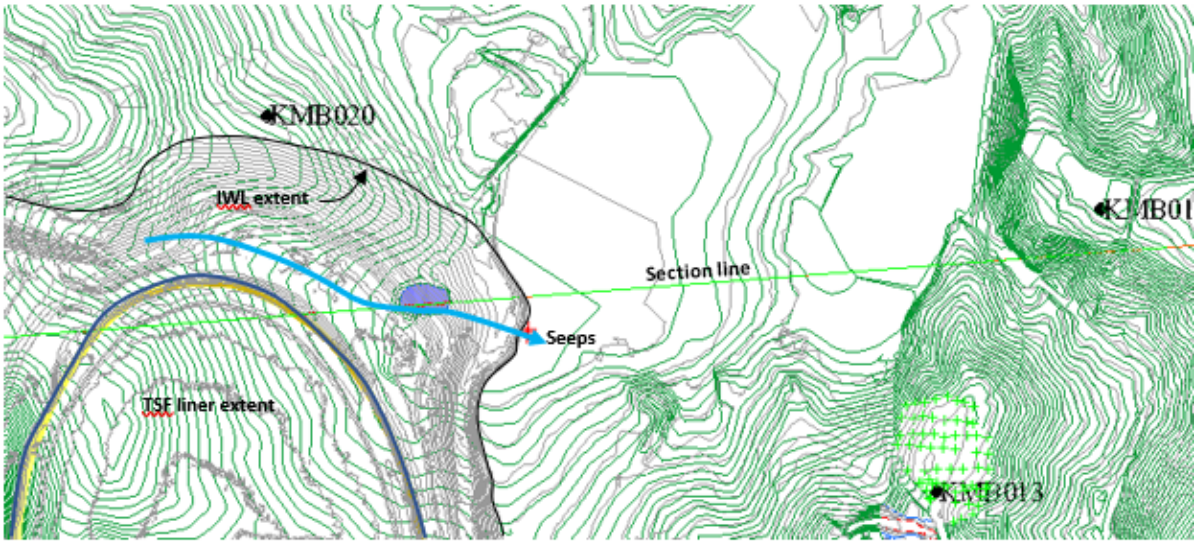
The assessment concluded that due to the absence of any material changes in the groundwater quality in monitoring wells installed to assess potential seepage from the TSF, and the absence of any observable increase in flow from the French Drains (leak detection) installed beneath the TSF, the groundwater mounding is considered unlikely to be associated with a breach of the TSF liners, rather a combination of spring discharge and groundwater mounding (JBS&G, 2018b – Appendix C). This conclusion was confirmed by David Williams in a review of available data (Williams, 2019 – Appendix D).

The ponded water is however, coming in to contact with the OTD tailings and as such is of relatively low quality, i.e., low pH and similar metal, sulphate and ammonia concentrations to a historic OTD seepage dam sample.

Mining One have further assessed the ponded water (Appendix E) and concluded that the surface expression of groundwater has most likely been exacerbated by groundwater mounding beneath the IWL and is the piston effect of the weight of the IWL mass on the groundwater (Figure 2-11).



Pre-Hillgrove conditions



2019 conditions

Figure 2-10 - Potential source of surface expression of groundwater

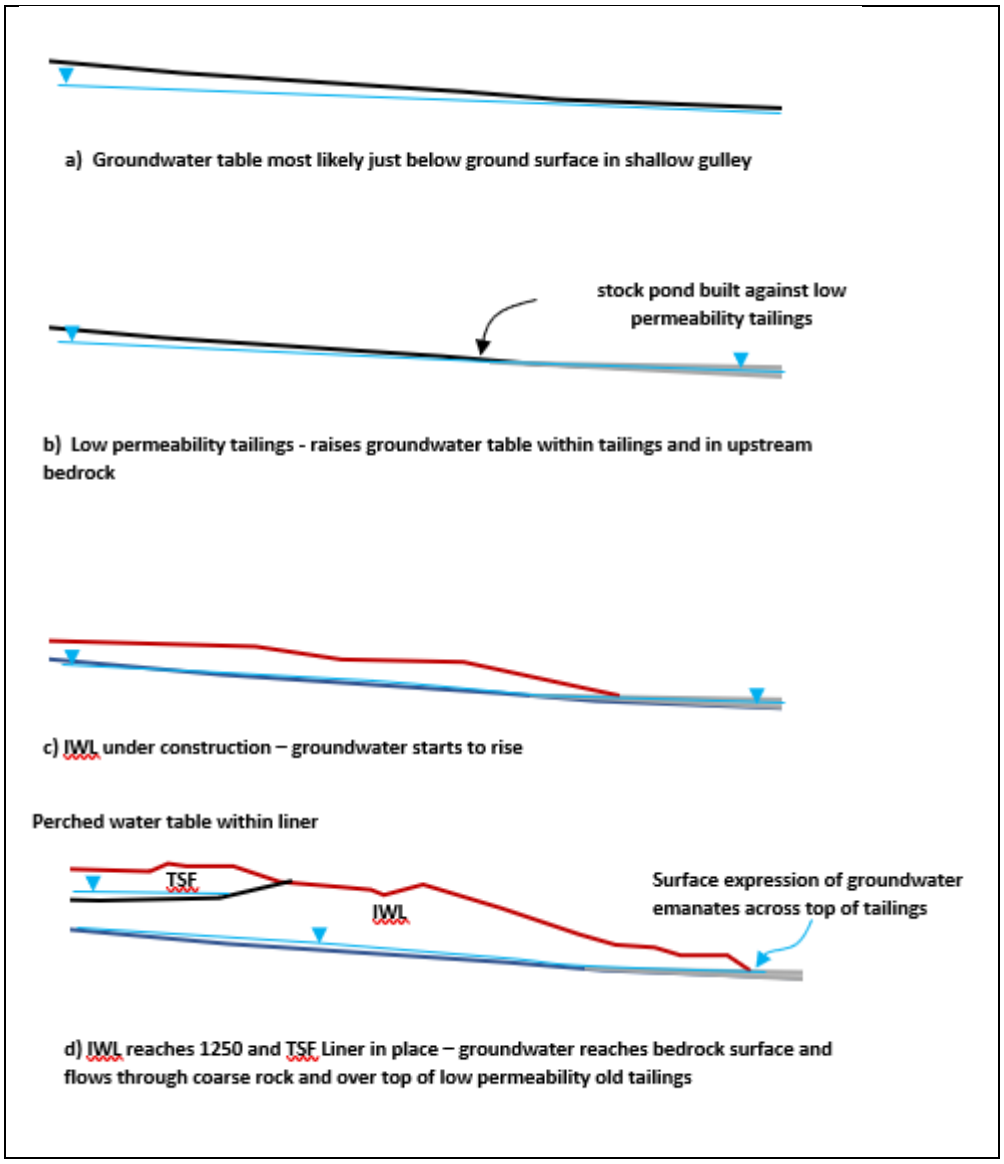


Figure 2-11 - Potential development of surface expression of groundwater

Hillgrove have constructed a temporary dam for capture of this water, from where it is pumped into the Tailings Storage Facility (TSF). Hillgrove have committed to constructing the northeastern sediment / evaporation dam to serve the dual purpose of catching sediment from the IWL in the long term and containing and evaporating the water from the surface expression of groundwater. JBS&G (2018b) identified the surface expression of groundwater is currently entering the temporary dam at approximately 0.8L/s and conducted a conservative water balance. The resultant requirement for the northeastern sediment / evaporation dam is 50ML capacity. Section 3.8.7 provides additional information on the northeastern sediment / evaporation pond.

2.9 Flora

Prior to 2010 (i.e., prior to Hillgrove operations), remnant native vegetation communities covered about 26% of the ML6345 area. The rest of the ML6435 area comprised open pasture and scattered trees (50% of the area) and areas significantly disturbed by previous mining activities (around 24%).

Vegetation quality varies, with condition linked to levels of previous clearing, mining, pasture management and grazing activity. Vegetation communities were originally classified by EBS Ecology in accordance with then valid regulator guidelines (DWLBC, 2005), which refined the initial vegetation

classifications, and this classification has become the basis for which impacts associated with clearing are assessed (Figure 2-12).

ML6436 does not contain any native vegetation communities and is heavily disturbed by previous mining activities, agricultural and industrial use.

Following clearance for the current mining operations, remnants of native vegetation communities, particularly native *Eucalyptus odorata* low woodland and *Lomandra effusa* open tussock grassland remain on site and are protected from disturbance. Further detail on these areas is included in Section 3.13.4 and the Native Vegetation Management Plan (NVMP) in Appendix A.

2.10 Fauna

Three major fauna habitats have been identified within ML6345: *Eucalyptus odorata* woodland, *Lomandra effusa* grassland and *Austrostipa* spp. grassland. Baseline fauna surveys of the ML area found 49 bird, 12 reptile, 3 amphibian and 15 mammal (11 native and 4 introduced) species. The greatest diversity and abundance of fauna was found in the *E. odorata* woodland in the north of the ML area, with this vegetation providing relatively complex habitat components such as hollows, understorey vegetation, logs and deep debris. Species diversity and abundances were lower in the *L. effusa* tussock grassland in the south of the area. However, this habitat type supports specialist grassland species that are unlikely to be found in other vegetation types in the ML area.

One threatened fauna species of national conservation significance (i.e., listed migratory under the EPBC Act), the rainbow bee-eater (*Merops ornatus*), is present within the ML area.

Additional species of state conservation significance (i.e., listed as vulnerable, endangered or rare under the South Australian *National Parks and Wildlife Act 1972*) that are present, or potentially present, within the ML area are the diamond firetail (*Stagonopleura guttata*), listed as vulnerable, the peregrine falcon (*Falco peregrinus*) and the brushtail possum (*Trichosurus vulpecula*), both listed as rare.

Four introduced vertebrate species (other than sheep and cattle) have been identified in the ML area and surrounding region: the European rabbit (*Oryctolagus cuniculus*), European (brown) hare (*Lepus capensis*), house mouse (*Mus domesticus*) and red fox (*Vulpes vulpes*). These species continue to be managed within the ML area.

2.11 Cultural Heritage

2.11.1 Indigenous Cultural Heritage

The ML area lies within the traditional territory of the Peramangk people.

No Native Title applications or registered claims exist over the ML area. The Kaurna Peoples Native Title claim lies approximately 12km to the west of Mt Barker and the Ngarrindjeri and Others Native Title Claim lies approximately 17km to the east, along the western border of the Ferries McDonald Conservation Park.

No sites or objects of Indigenous archaeological or cultural heritage significance have been identified within the ML area. A search for archaeological sites was also undertaken at three natural springs adjacent to the creeks. No archaeological material was observed in the vicinity of the springs and the springs themselves were not found to have any known traditional significance.

There are no registered Aboriginal Heritage sites in the ML area.

2.11.2 Non-Indigenous Cultural Heritage

Non-indigenous cultural heritage in the ML area is predominantly linked to farming and mining activities. Several historic buildings and unidentified building ruins have been identified in the ML area including the

Paringa Engine House, flue between the engine house and the chimney stack and stone stack, stone-settling tank and the mine manager's residence. None of these sites are registered or are considered to have heritage value according to the *Heritage Places Act 1993 (SA)*.

Remnant mining infrastructure from the Kanmantoo Mine within the ML area (Figure 2-13), inclusive of the historic open pit, old tailings dam, old processing plant and an old waste rock dump, and the old processing plant next to ML6436 currently utilised by Neutrog Fertilisers, is not considered to have heritage significance.

There are no State heritage listed places in the ML area.

2.12 Socio-economic

The ML area is located in a region of population growth with the closest towns, Kanmantoo (population 707) and Callington (population 387), both had a relatively stable population over the 5 years to 2017.

The main industries within the Mount Barker local government area (LGA) in which the ML area lies are mining, manufacturing and production and processing of farm products, including livestock, horticulture and field crops.

Unemployment levels within the Mount Barker District Council area were 7.6% during the March quarter of 2017, which was slightly higher than the South Australian average of 6.6% during the same period. Residents of the region commonly commute to Adelaide for work.

Community members have a generally positive attitude toward their respective communities. The relaxed and quiet lifestyle is most commonly cited as the best aspect of living in the Kanmantoo-Callington region, whereas the region's relative lack of facilities and available housing is a negative aspect of living locally.

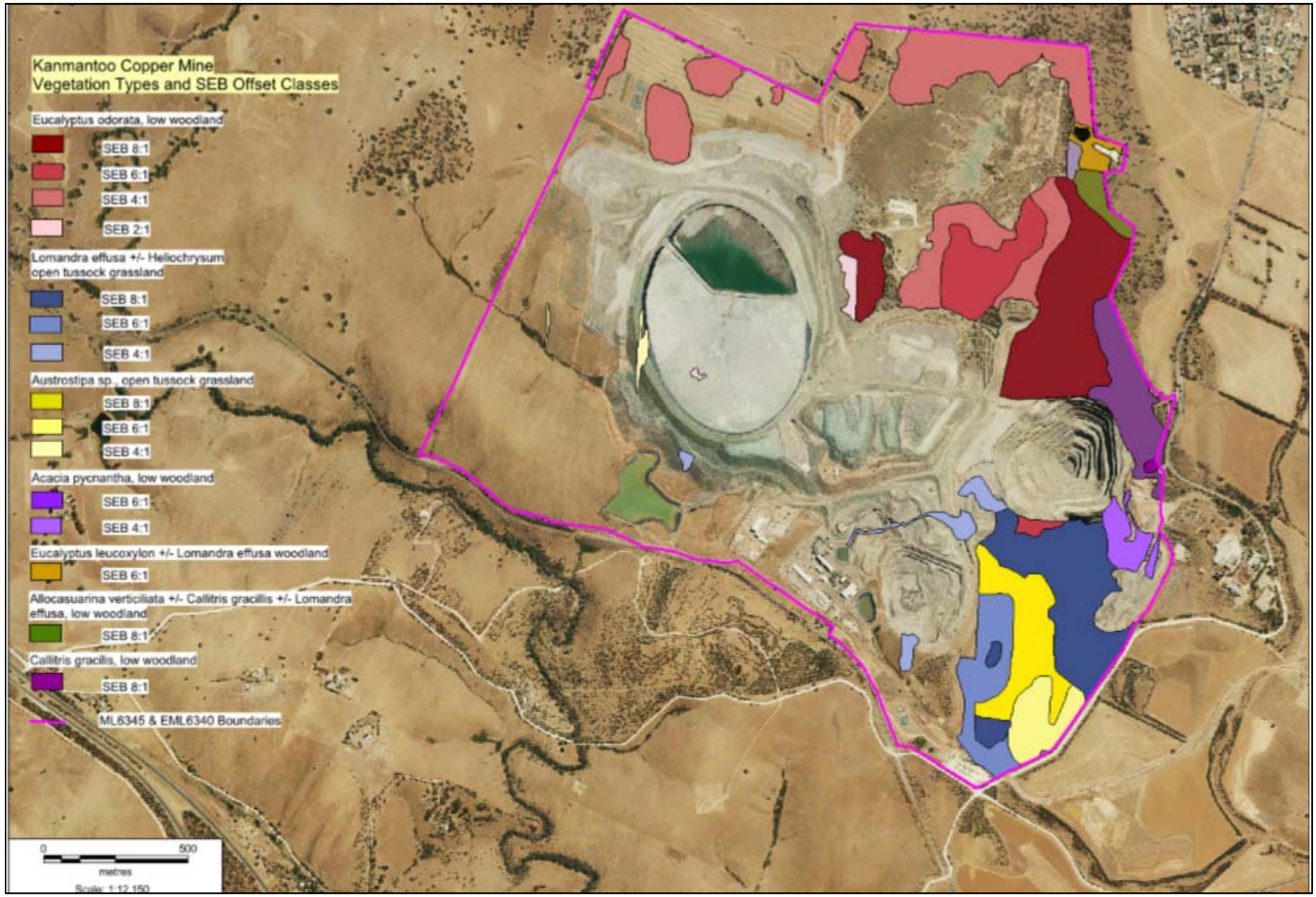


Figure 2-12 – ML area native vegetation

2.13 Land Tenure and Land Use

2.13.1 Land Tenure

The underlying tenure of the ML6345 comprises three freehold land titles (Paringa station, old integrated landfill and Paringa smelter block) that are held by Hillgrove's wholly owned subsidiary, Kanmantoo Properties Pty Limited (Figure 2-13). The land title details for the three titles underlying the ML area are provided in Table 2-1. The underlying tenure of ML6436 is one land title (Allotment 21, Deposited Plan 80644, Hundred Kanmantoo) held by Neutrog Australia Pty. Ltd (Neutrog).

Hillgrove has purchased a number of properties to the east of the Mine and Éclair Mine roads, the land title details of which are provided in Table 2-1 (proceeding from most southerly to northerly as shown in Figure 2-13), and has other forms of arrangements with the other surrounding landowners. Landholders adjacent to the ML area are also shown in Figure 2-13.

Table 2-1 - Land titles held by Hillgrove

Description	Allotment	Plan No.	Hundred
Within ML6345 area			
Old integrated landfill	59	D20509	Kanmantoo
Paringa station	58	D20509	Kanmantoo
Paringa smelter block	57	D20509	Kanmantoo
Surrounding Properties			
Lot adjacent to southeast corner of ML along Éclair Mine Road.	25	D60948	Kanmantoo
Lot adjacent to Neutrog with site access road bisected property.	21	D80644	Kanmantoo
Lot containing eastern component site access road.	5	F1636	Kanmantoo
Lot two blocks south of lot 62.	1	F1636	Kanmantoo
Lot one block south of lot 62.	61	F160800	Kanmantoo
Lot at northern end of Mine Road.	62	F160801	Kanmantoo

Source: DTEI, 2009.

2.13.2 Land Zoning

Land within ML6345 is zoned as 'Rural Kanmantoo' in the Mount Barker District Council Development Plan (MDC, 2009). The land surrounding the ML is predominantly zoned as 'Rural Kanmantoo'. The objectives of this zoning are to (MDC, 2009):

- Be an agricultural zone primarily comprising cropping and grazing activities on large rural holdings with intensive animal keeping in appropriate locations;
- Maintain open rural landscape and character; and
- Protect the fragile rural environment from activities that could lead to land degradation.

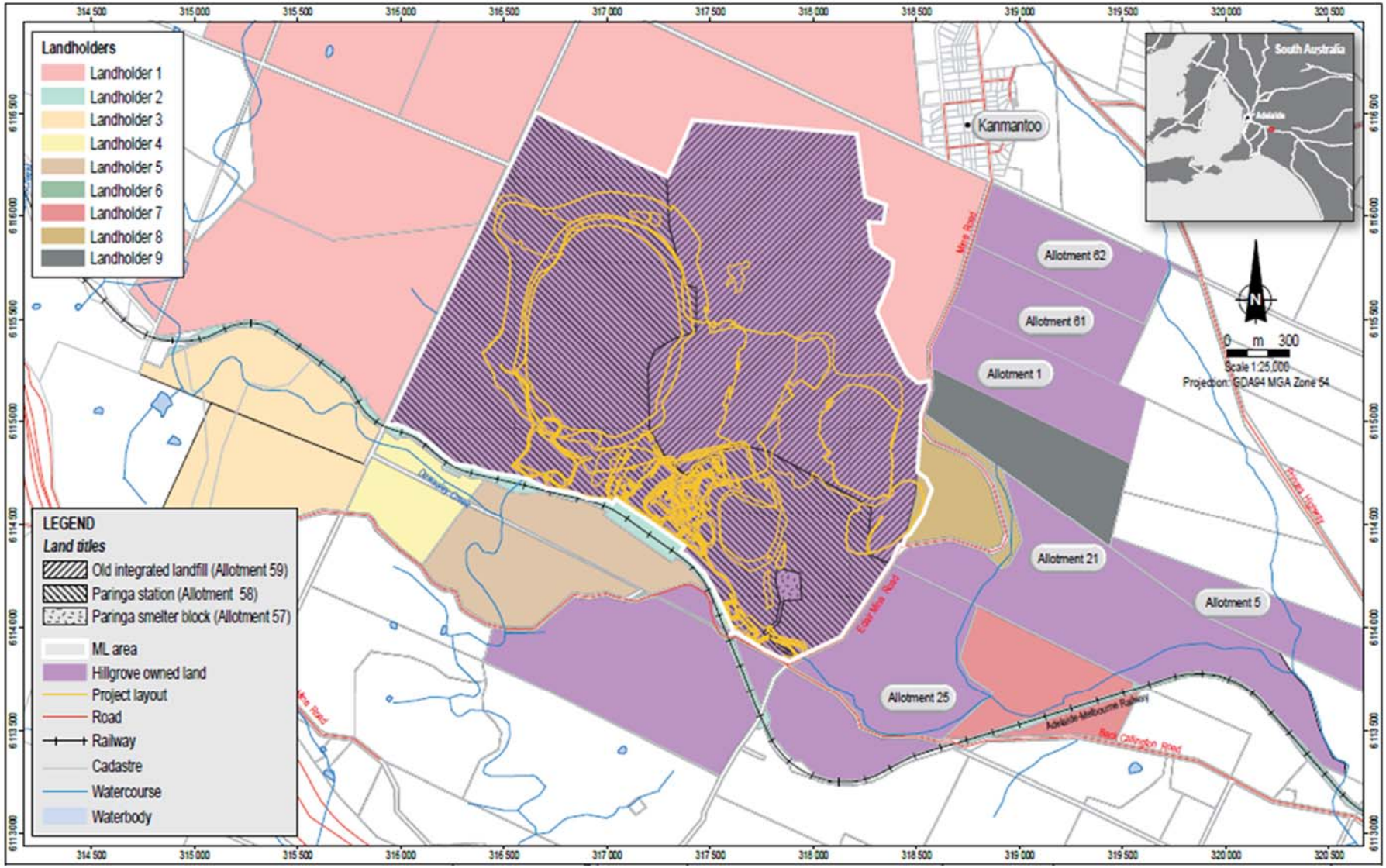


Figure 2-13 – Land tenure

Land within ML6436 and the underlying and surrounding title is owned and occupied by Neutrog, a fertilizer manufacturer connected by the gazetted b-double route through the township of Kanmantoo. This land was previously used as the administration buildings and mineral processing works associated with the old Kanmantoo mining operation. This area is zoned as 'Industry (Kanmantoo) Zone', the objectives of zoning are to (MDC, 2009):

- Provide a zone accommodating a range of industry activities that are compatible with one another;
- Provide a zone accommodating industrial development that is compatible with mining activities and the adjoining rural environment; and
- Provide a zone in which stormwater is carefully managed to prevent pollution of surrounding watercourses.

The ML area is in the Mount Barker District Council local government area. It is also within the Tributary Zone of the River Murray Protection Area.

2.13.3 Land Use

Areas of disturbance from previous and existing mining operations comprise approximately 103 ha (23.5%) of ML6345 and 2.1 ha (100%) of ML6436.

Prior to the current mining operation, approximately three-quarters (325 ha, 74%) of ML6345 was either cleared for agricultural purposes or affected by historic mining activity.

Apart from mining activity, over the past 50 years much of the ML area and surrounds have been extensively cleared for agriculture and used for grazing and/or cropping. Land within the Mount Barker LGA is predominately zoned as rural, with some land zoned as industrial.

2.14 Infrastructure

The mining lease area and associated infrastructure is connected to grid power through a dedicated 125KV transmission line to the ML's power sub-station, approximately 400m northwest of Gate 1. Mine infrastructure is supplied with electricity from the power substation via a network of underground 11KV power mains within the ML. The power mains supply power transformers located adjacent to each infrastructure precinct.

A purpose-built water pipeline delivers Class A recycled water from the Mount Barker effluent treatment plant to the Kanmantoo Copper Mine. An extension to this pipeline delivers Recycled water to irrigate the recreation grounds at Callington.

A water pipeline was constructed in 2016 between the ML and the Onkaparinga Pipeline to supply raw Murray River water to the ML. This supplements recycled water for ore processing and dust suppression, via a pumping station and header tanks located on the waste rock stockpile, 300m north of the processing plant. A spur line of the Murray Bridge to the Onkaparinga water pipeline runs between Kanmantoo and the mine site along Mine Road (this pipeline supplies the mine with its potable water requirements).

The local area is serviced by a number of minor and secondary roads and the South Eastern Freeway. Access to the ML for employees and service providers is via a purpose-built access road off the Old Princess Highway, commencing 3km east of Gate 1. The general public can access the ML either via Mine Road or Back Callington Road. The Adelaide to Melbourne Railway line is just outside the southern boundary of the ML.

The ML area is about 50 km by road from Adelaide, and 2.3 and 4.5km by road from Kanmantoo and Callington respectively.

Mine Road is utilised by Neutrog Fertilisers which makes between 1 and 10 haul trips per day (between 2 and 20 journeys), using trucks of varying sizes (including B-Doubles), depending on demand and season. Three roads used by school buses form part of the proposed haul route to and from the mine.

Infrastructure in the ML area includes remnants from the 1970s mining operation, agricultural fences and paddock access tracks from past and present agricultural activities. There are also a number of houses (sensitive residential receptors) surrounding the ML area, the closest of which is approximately 230 m away (SR4).

3.0 Description of Operations

3.1 General Description of Operations

3.1.1 Key Characteristics of Operation

The existing mine layout is provided in Figure 3-1.

The key project elements covered by this PEPR are:

1. Establishment, operation and completion of an underground mine, initially targeting the ore remaining below the base of Giant Pit;

2. Processing of remaining open pit ore stockpiles and underground ore, inclusive of associated tailings and water management activities; and

3. Implementation of mine closure and completion activities to the Kanmantoo Copper Mine with the aim of relinquishment.

Open pit mining ceased at Kanmantoo Copper Mine in May 2019 with the initial plan to then process the remaining ore stockpiles and close the mine. However, Hillgrove has identified a small underground resource accessible below the Giant Pit and intends to extract that resource for processing through the existing plant while ongoing closure activities are conducted on the remaining lease area. Copper-gold ore (which also contains silver) is currently processed at a rate of approximately 450 tonnes per hour (tph) using a conventional crushing, grinding and flotation circuit to produce between 60,000 and 90,000 tonnes per annum (tpa) of copper-gold concentrate (with silver credits). Upon completion of processing of the current open pit ore stockpiles, production rates through the processing plant from underground ore will reduce from approximately 3.5Mtpa to up to 2Mtpa. Due to the higher grade ore mined from the underground operation, the copper concentrate output will remain at similar rates to historical production.

The concentrate is transported by road to the Port of Adelaide for shipment to overseas smelters. Tailings are pumped to the integrated waste (tailings and waste rock) landform located adjacent to the pit and tailings water is reclaimed for use in the processing plant.

Key characteristics of the project are summarised in Table 3-1 along with where these aspects have changed from the existing operation.

Table 3-1 - Key characteristics of project

Characteristic	Description	Change
Project location	44km southeast of Adelaide, South Australia.	No change
Mining leases	ML6345 and ML6436.	No change
ML area	437.1ha.	No change
Project footprint	296.8ha (including areas of disturbance attributed to 1970s operation).	No change
Mining method	Underground mining – portals located in Giant Pit	New method
Commodity to be mined	Copper, gold, silver	No change

Characteristic	Description	Change
Mining inventory	Underground exploration targets estimated at 5 – 10Mt ore. Kavanagh exploration targets up to 4.8Mt ore (refer to Section 3.2.1.2).	New underground mine
Mine life	Dependant on underground exploration results. Based on current estimates, 2 to 5 years.	Extended mine life
Mining Rate	1 to 2Mt per year total material movement.	Relevant to underground mine
Processing rate	Up to approximately 450tph	No change
Processing method	Conventional, crushing, grinding and flotation.	No change
Processing stockpile inventory	2Mt low grade ore stockpiled at end August 2019.	Relevant to underground mine
Product	Up to 100,000tpa of copper-gold concentrate	Relevant to underground mine
Transport route	Dedicated site access road to Princes Highway, then East Terrace to the South Eastern Freeway to the Port of Adelaide.	No change
Site access	A dedicated site access road has been constructed across Hillgrove-owned land to avoid traffic through the town of Kanmantoo. This road was permitted under the Development Act (refer to Table 1-2).	No change
Operating hours	Continuous, 24 hours per day, 365 days per year.	No change
Tailings storage facility (TSF)	Integrated waste landform (IWL), TSF with an underdrainage system and HDPE liner. Final height of RL1274m including rehabilitation cover.	Additional TSF lift (Stages 8 and 9)
Electricity source	State grid, via a purpose-built 1.5-km overhead transmission line from the existing transmission line spur (near the Neutrog Plant).	No change
Electricity requirement	Maximum of 50GWh per annum.	No change
External raw water source	Treated water from the Mount Barker District Council's Laratinga effluent treatment facility and Murray Bridge Onkaparinga pipeline. SA Water provides potable water.	No change
Raw water (make-up) requirement	Indicatively between 499 to 1,889kL/day, depending on rainfall and evaporation levels.	No change
Workforce	In the order of 160 people during operations.	Relevant to underground mine

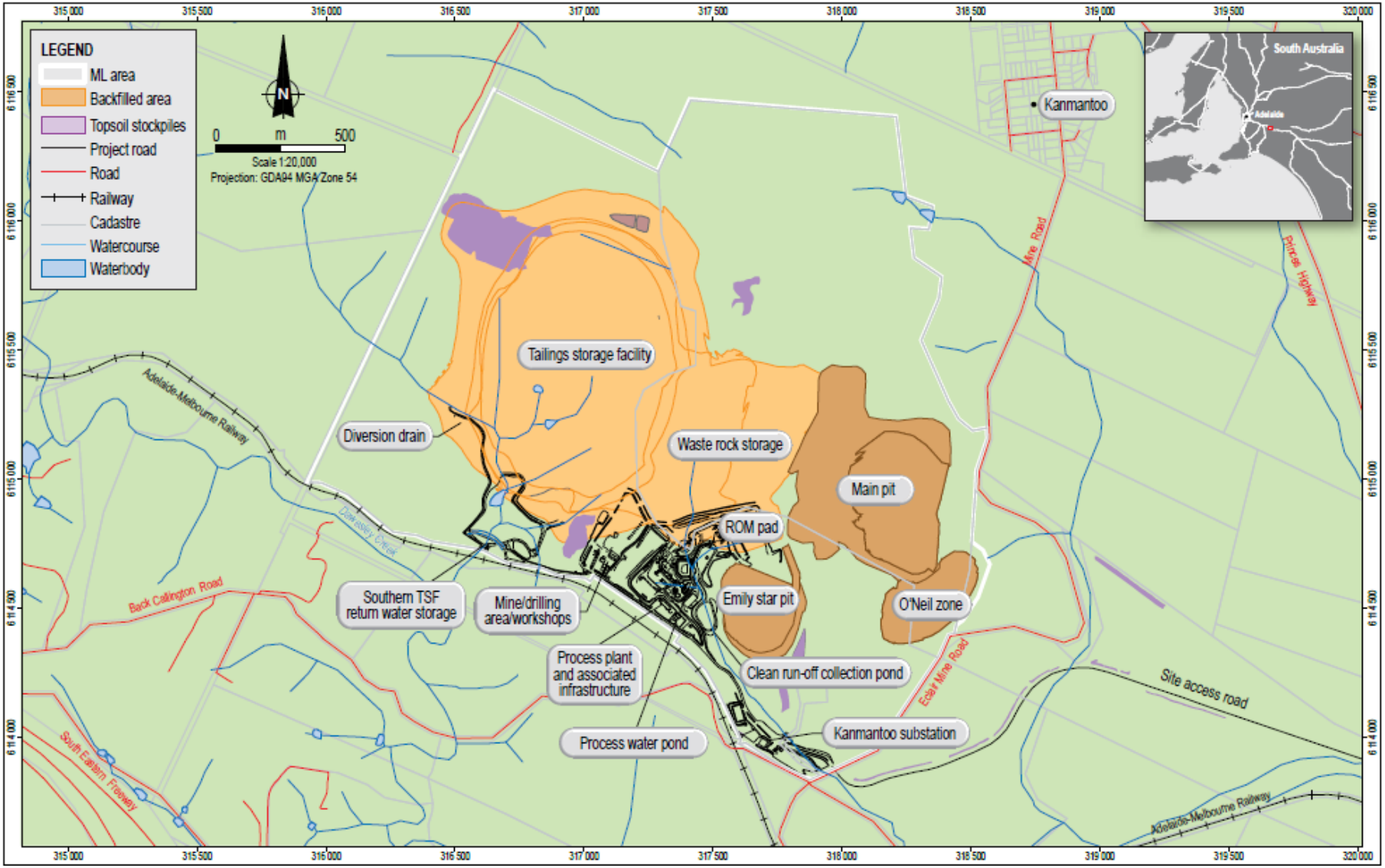


Figure 3-1 – Kanmantoo Copper Mine layout

3.1.2 Area of Disturbance

The major components of the project and their full disturbance footprints are identified in Table 3-2 and described in the following sections.

No additional disturbance is required for the underground operation or TSF lifts as detailed in this PEPR.

Table 3-2 - Project components and approximate footprints

Component	Total Disturbance Area (ha)
Giant (Main) Pit	40.3
O'Neil/Nugent Pit	7.2
Emily Star pit	8.6
Clean water runoff collection pond	0.5
Process plant runoff collection pond	0.3
IWL (including TSF of 44ha)	130
Waste rock storage (southern NAF stockpile)	1.1
Northern sediment diversion and pond	0.6
Southern TSF return water storage dam	5.3
Process plant	8.4
Run-of-Mine stockpile area	6.5
Topsoil stockpiles	13.0
Haul roads	5.3
Administration areas	1.1
Workshops	0.3
Hardstand areas (around workshops)	3.2
Car-park and access road	2.7
Total	**234.4**

3.1.3 Project Schedule

Figure 3-2 provides an indicative project schedule, based on currently identified mining targets. Should additional economic resource be identified, the mine life may be extended.

Activity	2019	2020				2021				2022				2023 onwards			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Underground mining																	
Ore processing (underground and remaining open pit stockpiles)																	
Progressive & final closure																	
Post-closure monitoring & maintenance																	

Figure 3-2 – Indicative project schedule

3.2 Reserves, Products and Market

3.2.1 Ore Reserves and Mineral Resources

3.2.1.1 Kanmantoo Deposit

The Kanmantoo copper-gold mineral system is located within a sequence of Cambrian-Ordovician sediments, intrusives and volcanics of the Kanmantoo Group. The Kanmantoo mineralising system is an epigenetic chlorite-garnet-quartz-sulphide vein and shear system that overprints the host andalusite, biotite and muscovite schists of upper-amphibolite metamorphic grade. There are numerous orebodies within the system, not all of which have been mined by the past and present open pits (Figure 3-3) (Rolley and Wright, 2016). Hillgrove has mined open pits on the Kavanagh, Spitfire, Emily Star and Nugent deposits.

Copper mineralisation occurs as chalcopyrite within a complex series of north-north-east trending steep northeast plunging pipes and lodes 3m to 80m wide. Mineralisation is characterised by chalcopyrite, pyrrhotite and magnetite. Mineralisation in the Nugent Zone is associated with a garnet-chlorite hydrothermal alteration zone with quartz veining. In comparison with the other zones, the Nugent and Spitfire Zones are enriched in gold.

Across the ML area, there is a distinct weathering zone of approximately 15m depth that appears to be completely oxidised.

Iron sulphides (pyrrhotite) are associated with the copper ore and rapidly diminish with distance from the ore zone indicating there is likely to be broad zones of non-sulphidic waste rock outside of the main mineralised blocks. This low-sulphide waste rock is an important source of non–acid–forming (NAF) material suitable for use in encapsulation of the potentially acid-forming (PAF) waste material (see Section 3.7.1.1).

All copper ore zones have been demonstrated by past drilling to extend to depth, and therefore open to depth, beneath the open pits and along strike from the open pits. Figure 3-4 shows one example of this ore continuity to depth below the open pit. These higher grade copper zones that extend beneath the open pit and along strike from the open pits are the focus of the proposed underground mining.

The mineralisation does not change with depth and remains as a chalcopyrite-pyrrhotite dominant ore zone within almandine (iron-rich) garnet and biotite alteration sequence, as has been mined from the open pits over the past eight years (Figure 3-5).

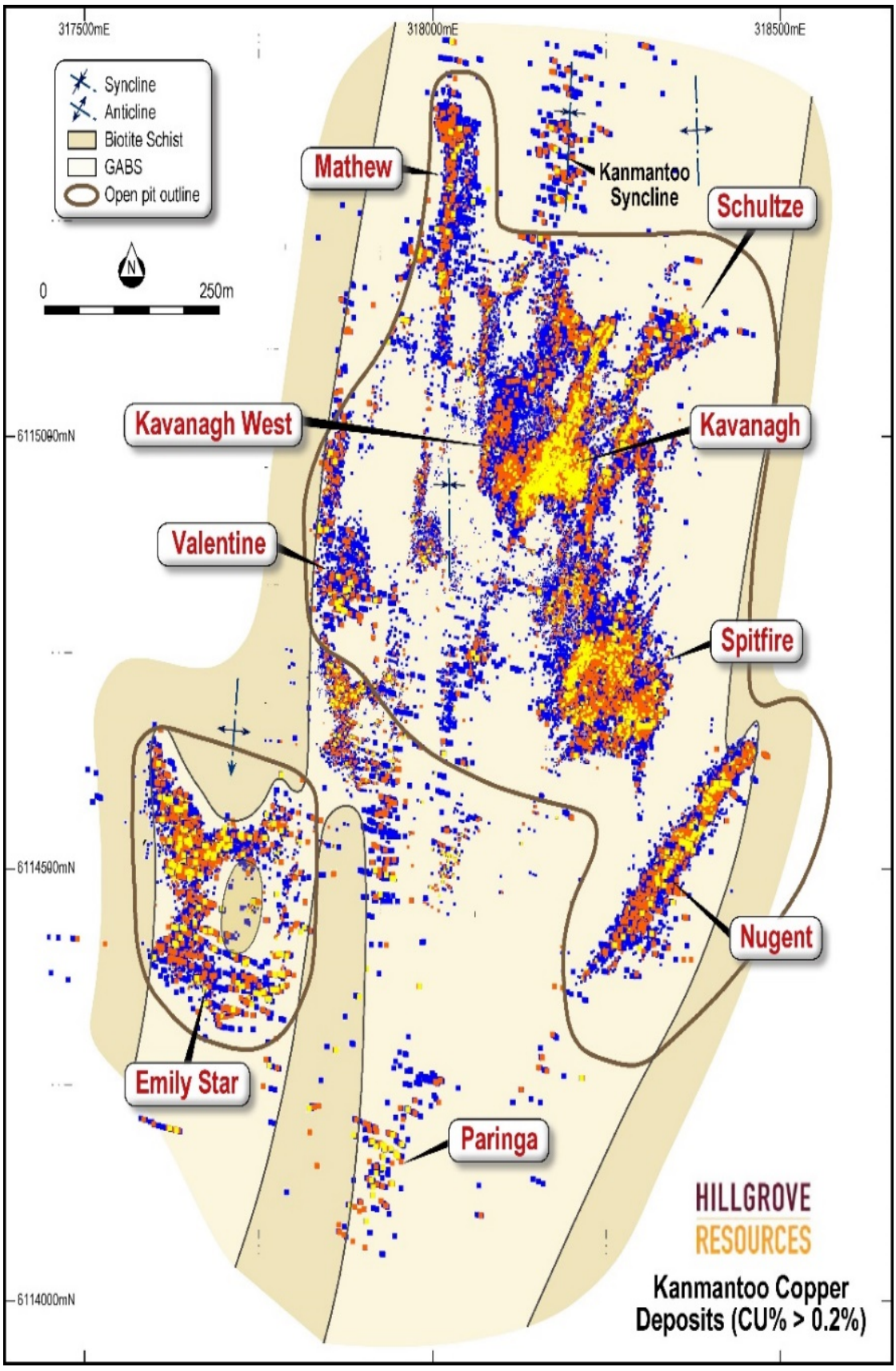


Figure 3-3 – Kanmantoo copper deposits

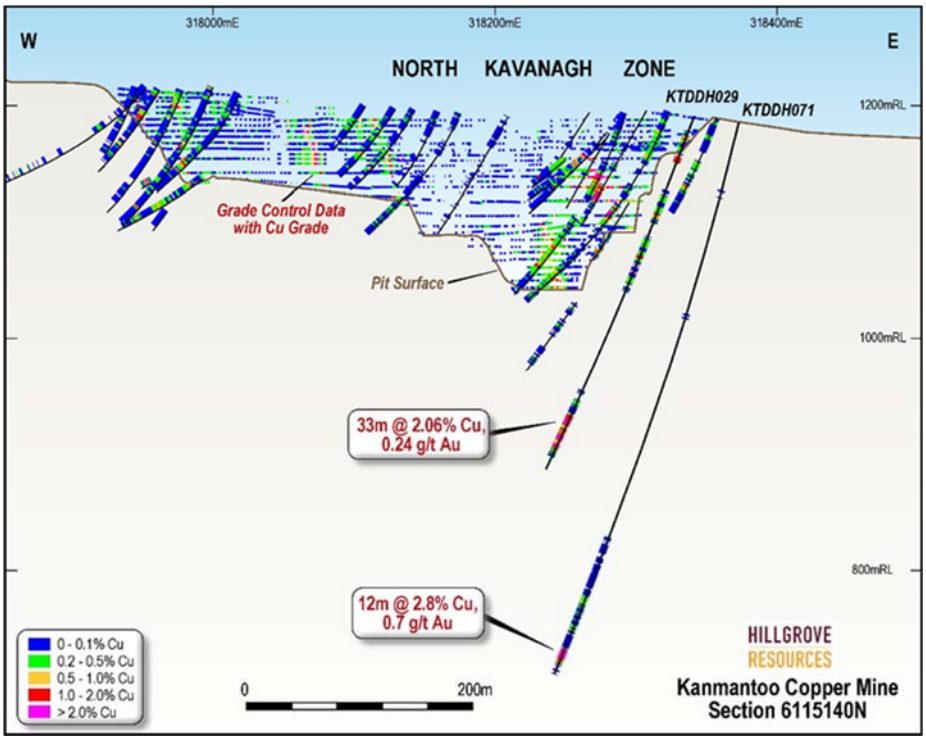


Figure 3-4 – Kanmantoo copper ore zone extension at depth

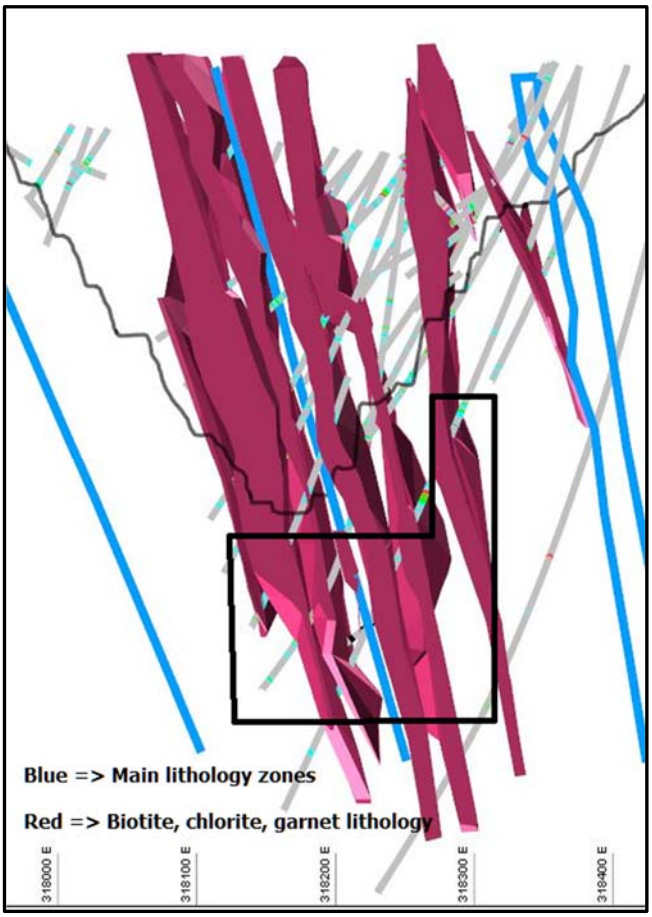


Figure 3-5 – Kanmantoo mineralisation extension at depth

3.2.1.2 Resource and Reserve

The Mineral Resources and Ore Reserves as reported by the Company in compliance with the JORC Code for Reporting of Mineral Resources and Ore Reserves as at December 2018 presented in Table 3-3.

Table 3-3 – Kanmantoo Copper Mine Mineral Resource and Ore Reserve estimate 31 December 2018

	JORC 2012 Classification	Tonnage (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Cu metal (kt)
Global mineral resource						
Kanmantoo copper mine, all deposits	Measured	5.1	0.6	0.1	1.3	33
	Indicated	9.0	0.6	0.1	1.5	57
	Inferred	10	0.6	0.1	1.0	60
TOTAL		**24**	**0.6**	**0.1**	**1.3**	**150**
Open pit ore resource						
Kanmantoo copper mine, Giant (Main) Pit	Proved	1.2	0.6	0.1	1.2	8
	Probable	0.3	0.5	0.1	0.8	1
TOTAL		**1.5**	**0.6**	**0.1**	**1.2**	**9**
Stockpiles		2.9	0.3			9

In addition to the above stated open pit ore reserves and mineral resources the Company has estimated an exploration target for the underground opportunities at Kanmantoo. Table 3-4 provides the underground exploration targets. The exploration targets are conceptual in nature as there has been insufficient exploration to define a Mineral Resource. It is uncertain if further exploration will result in the determination of a Mineral Resource. Figure 3-6 is a schematic of the location of the underground mining zones.

Table 3-4 – Underground Exploration Targets

Exploration Target	DH Width Range (m)	Tonnage range (Mt)	Grade Range (Cu %)	Grade Range (Au g/t)	Grade Range (CuEq%)
Coopers	6-10	0.1-0.3	1.5-2.0	0.4-0.8	1.8-2.5
North Kavanagh	6-10	0.1-0.7	1.5-2.0	0.4-0.8	1.8-2.5
North East Zone	12-33	0.4-0.7	2.0-2.5	0.4-0.8	2.2-3.0
East Kavanagh	10-24	0.4-0.8	2.0-2.5	0.05-0.2	2.0-2.6
Central Kavanagh	13-30	1.2-2.2	1.5-2.0	0.1-0.4	1.6-2.2
West Kavanagh	11-28	0.8-1.6	2.0-2.5	0.01-0.05	2.0-2.5
South West Kavanagh	7-22	0.8-1.0	1.8-2.2	0.1-0.4	1.8-2.4
Spitfire	16-37	0.4-0.7	1.5-2.0	1.5-3.0	2.5-4.0

Exploration Target	DH Width Range (m)	Tonnage range (Mt)	Grade Range (Cu %)	Grade Range (Au g/t)	Grade Range (CuEq%)
Nugent	8-15	0.8-2.0	1.5-2.0	1.5-2.5	2.5-3.5
TOTAL	**6-37**	**5.0-10.0**	**1.7-2.2**	**0.4-1.0**	**2.0-2.8**

The Phase 1 underground targets proposed to be developed as part of this PEPR will target the Kavanagh zones.

The proposed development of the Phase 1 underground targets to approximately 750m RL (local mine grid) is based on an exploration target of 3.6Mt to 4.8Mt at 1.1% to 1.7% copper and 0.05g/t to 0.10g/t gold.

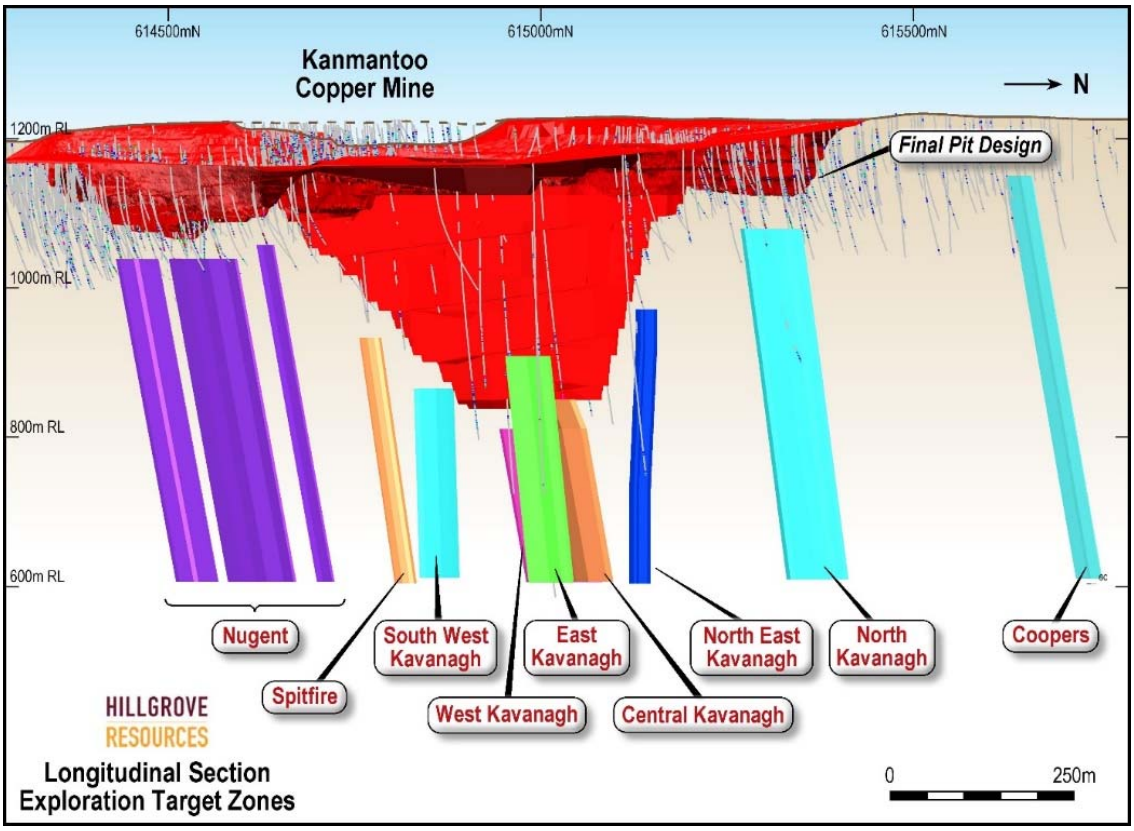


Figure 3-6 – Longitudinal section of the underground exploration targets

3.2.2 Production Rates and Product

The underground ore will contain on average 1.0% copper and copper recoveries of approximately 93% to 94% are expected to be are achieved. The plant will produce up to 100,000tpa of copper-gold concentrate (with silver credits) for export.

Copper concentrate is, and will continue to be, stored in the existing covered shed adjacent to the filter building. From there, concentrate will be transported 5 to 7 days per week, from the mine by road to the Port of Adelaide by trucks in sealed, custom-built, half-height sea containers, as per the current process.

Prior to leaving the site, the concentrate trucks will continue to pass over a wheel wash to ensure the outer surfaces are free of concentrate, or any other material. The containers are stacked on a hard

stand facility at the Port of Adelaide. Hillgrove has access to 450 containers, providing storage for approximately 12,000t to 13,000t of concentrate. The concentrate is loaded into ocean-going vessels in quantities of between 5,000 and 12,000 wet tonnes for shipment to overseas smelters.

3.3 Exploration and Resource Drilling

During the project Hillgrove will continue its exploration activities on the ML, which are undertaken in accordance with Department of Energy and Mining (DEM) guidelines with a view to expanding its underground resource/reserve estimates. Most exploration that has occurred on the ML in the past has been located in areas which have been extensively disturbed by historical mining operations.

Hillgrove will continue to follow the DEM guidelines relevant to exploration.

Key considerations in the planning and implementation of any exploration activities include the following.

- Minimising impact on the environment and sites of heritage significance and avoiding impacts where possible.
- Ensuring environmental requirements and objectives are well understood by employees and contractors.
- Appropriate storage, use and disposal of hazardous materials and wastes.
- Safety to personnel and public.
- Ensuring the location of exploration activities aims to minimise the need to excavate sites.

3.3.1 Purpose of Exploration Drilling

The exploration drilling to be undertaken within the ML area is for:

- delineating copper-gold-silver mineralisation within the lease area to assess if an economic opportunity is possible;
- infill drilling of the prospective area for the conversion of a mineralised zone to Resources/Reserves;
- estimation of geotechnical parameters for civil and/or mining opportunities;
- estimation of ground water parameters for civil and/or mining opportunities;
- estimation of mineral and metallurgical parameters for civil and/or mining opportunities; and
- estimation of Acid Mine Drainage parameters for civil and/or mining opportunities.

The exploration drilling will be undertaken from within the open pit, from underground platforms beneath the open pit and from natural surface.

In addition, grade control drilling will be undertaken from underground drill platforms beneath the open pit as required for detailed stope planning.

3.3.2 Types of Exploration Drilling

Exploration drilling will be by either reverse circulation percussion drilling (RC), or diamond drilling.

RC drilling is a method of drilling which uses dual wall drill rods that consist of an outer drill rod with an inner tube. These hollow inner tubes allow the drill cuttings to be transported back to the surface in a continuous, steady flow.

Unlike diamond drilling, it acquires sample rock cuttings instead of rock core. The drilling mechanism is most often a pneumatic reciprocating piston called a hammer, which in turn is driving a tungsten-steel drill bit, specifically made to be able to crush hard rock.

The hammer is used to remove rock samples which are pushed through the inner drill rods with compressed air. When air is blown down the annulus (ring-shaped structure) of the rod, the pressure shift creates a reverse circulation, bringing the cuttings up the inner tube. The cuttings travel in the compressed air flow from the steel rods into a reinforced plastic pipe and into a cyclone mounted at the side of the drill rig.

The drill cuttings will travel around the cyclone until the rock particles fall through the bottom opening of the cyclone and the exhausted air exits via an opening in the top of the cyclone. The rock particles that exit through the lower opening are collected in bags and available for assaying. The exhausted air is passed through a dust collector to remove all dust particles and then exhausted to the atmosphere.

Exploration diamond drilling differs from RC drilling in that a solid tube of core is extracted from depth, for examination on the surface. The tube bit that is impregnated with a diamond matrix is mounted onto a drill stem, which is connected to a rotary drill. Water is injected into the drill pipe, so as to wash out the rock cuttings produced by the bit and also to reduce the heat produced due to friction which causes less wear and tear of the bits. At the end of each 3m advance, the tube of rock “cored” from the rocks is withdrawn from the drill hole and placed into trays in the same order as extracted. The water is recirculated from down hole back to surface and collected in a plastic lined sump, the cuttings allowed to settle out, and the clarified water recycled back down the drill hole.

Usually RC Drilling is used to explore the rocks to a depth of 250m below surface, and diamond drilling thereafter. In addition, all geotechnical test work is via diamond drilling.

All exploration drilling from underground will be with a diamond drill rig.

3.3.3 Geophysical Techniques Used When Drilling

Geophysical techniques that measure various “in-situ” physical properties of the rocks down hole may include but not limited to:

- magnetic properties;
- gravity properties;
- induced polarisation electrical properties;
- electro-magnetic electrical properties;
- radiometric responses;
- spectral properties; and
- gamma responses.

External contractors will be used for all downhole geophysical data acquisition.

3.3.4 Earthworks for Exploration Drilling

Where possible existing access routes and drill pads will be used for all drilling activities. Should an existing access route or drill pad not be available in the near proximity of a proposed drill site, then access to and the location of exploration sites will be sited to minimise the clearance of and impact to native vegetation.

Sumps for retention of all ground water when diamond drilling will be excavated (approximately 20m^3) and plastic lined.

For the underground drilling, the drill site locations and access routes will be determined by the underground infrastructure. When drilling underground a combination of sumps and tanks will be utilised to retain ground water discharged for the drill hole.

3.3.5 Equipment Required for Exploration Drilling

Contractors will be utilised to supply the required RC and diamond drill rigs and support equipment. For surface RC or diamond drilling this usually includes:

- truck or track mounted diesel powered drill rigs;
- 2 x support trucks per drill rig;
- 1 x air compressor per drill rig and if deep RC drilling then also;
  - 1 x booster air compressor;
- 1 x lighting tower per drill rig;
- 1 x trailer mounted cyclone for drill cuttings per RC drill rig;
- 1 x 800 litre self bunded fuel trailer per drill rig; and
- 2 x 4WD vehicles per drill rig.

For underground drilling equipment required includes:

- Electric powered track or sled mounted diamond drill rigs;
- 1 x UG lighting tower per drill rig; and
- 2 x 4WD vehicles per drill rig.

3.3.6 Exploration Site Rehabilitation

Where excavations are required all topsoil and cleared vegetation will be stockpiled separately for rehabilitation purposes.

All exploration drill holes will be decommissioned in accordance with appropriate guidelines (DSD, 2012 and DSD, 2004) including progressive rehabilitation of disturbed land to a stable condition consistent with prior land use, except where the area will be consumed as part of the mine operations. Rehabilitation of drill holes includes removal or burial of all cuttings, capping of the hole and replacing with topsoil on completion of drilling. If the hole may be required for further exploration purposes it will be capped, collared and pegged.

Drill sumps will have the plastic liner removed and then backfilled, and topsoil if present replaced.

Underground drilling will have the drill holes plugged to minimise any water or air bursts

3.4 Description of Mining Operations

3.4.1 Open pit workings

Until now, the project has been mined through open pit methods, resulting in a Giant Pit (also referred to as Main Pit), which has two ore zones, namely the Main Zone and O'Neil/Nugent Zone, as is also referred to as Giant Pit, and Emily Star pit which was developed as a satellite pit to the south of Giant Pit.

There are no further open pit workings currently proposed as part of the Kanmantoo Copper Mine operations. Closure of the open pits on site is addressed in Section 3.13.4.1.

3.4.2 Underground workings

3.4.2.1 Underground Mining

Underground mining is to be carried out initially in the Kavanagh exploration targets located underneath the Giant Pit. Depending on drilling results, there may be potential to extend the underground to other underground exploration targets accessible from Giant Pit or from other surface portals within the ML.

Workings will be accessed via a portal located in the wall of the Giant Pit. The portal will be the start of the main decline for access to all working levels and will provide the primary entry and exit of all underground personnel and equipment.

A secondary portal or shaft, also located in the Giant Pit wall, will be constructed to establish the primary ventilation system.

Portals will be approximately 5m wide by 6m high. If a vertical raise bored shaft is used for ventilation it will be approximately 4m in diameter.

Additional access portals and ventilation portals/shafts may be required should additional ore zones be defined as being accessible from Giant Pit.

Underground production mining of mineralisation is to be carried out by a combination of uphole and downhole retreat stoping in narrow sections of mineralisation (Figure 3-7), with long hole open stoping used when the width of mineralisation allows.

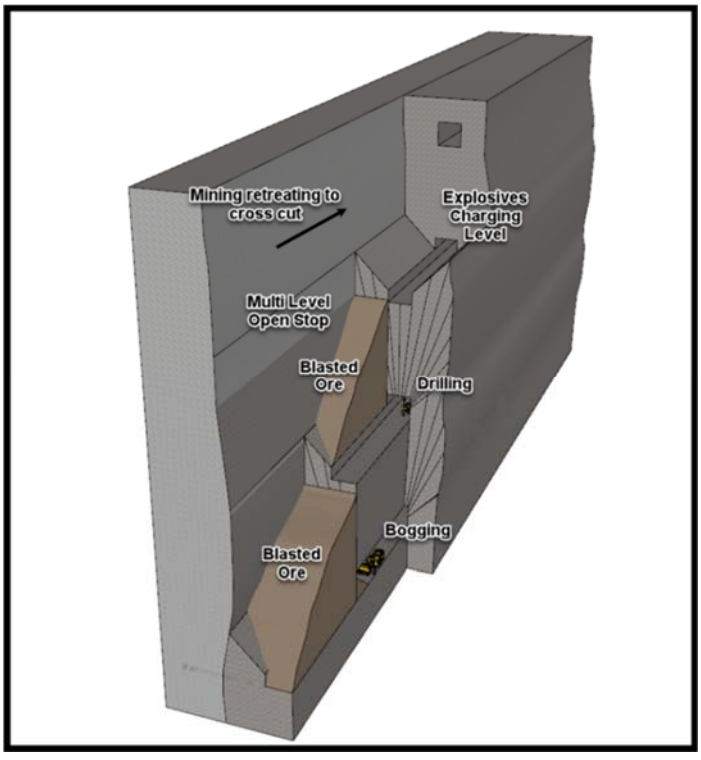


Figure 3-7 – Schematic of long hole uphole retreat stoping

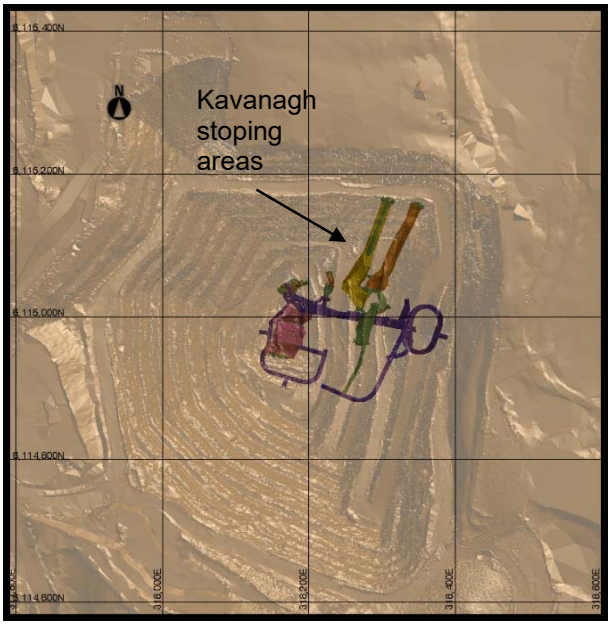
Drill and blast in development headings will be conducted using a jumbo to drill out the blast holes, which will then be loaded with explosives and fired. The broken rock will then be mined using an underground loader and loaded into the back of an underground type diesel haul truck. Waste rock fill from development headings will be placed in stope voids where available. If required for stope void stability waste rock fill from development will be used to buttress the stope walls.

Production stopes will be drilled with a production drilling jumbo. A slot will be drilled and loaded with explosives and fired. After the slot is opened up, rings drilled by the production jumbo will be loaded with explosives and fired to progressively open up the void. This will occur in retreat along the ore drive to the crosscut.

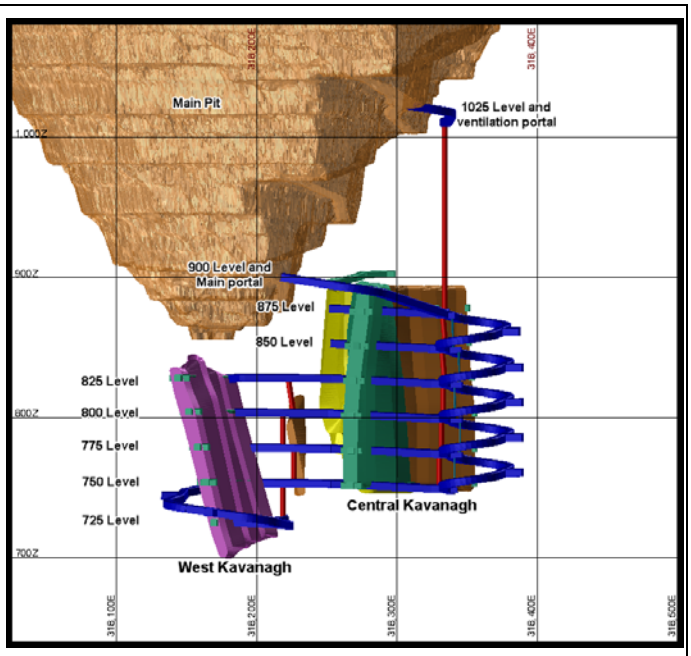
Broken (fired rock) will be loaded by the underground loader into the back of the haul trucks and transported to the Giant Pit run of mine (ROM) stockpile located adjacent to the portal.

A secondary means of egress will also be provided in accordance with the requirements of *Work Health and Safety Regulations 2012.*

A schematic of the proposed initial underground operation is provided in Figure 3-8, with ventilation and the secondary escapeway illustrated in Figure 3-9.



Plan view and location of underground workings in relation to Giant Pit



Proposed underground workings targeting Kavanagh exploration targets (facing north)

Figure 3-8 – Indicative Initial Underground Workings

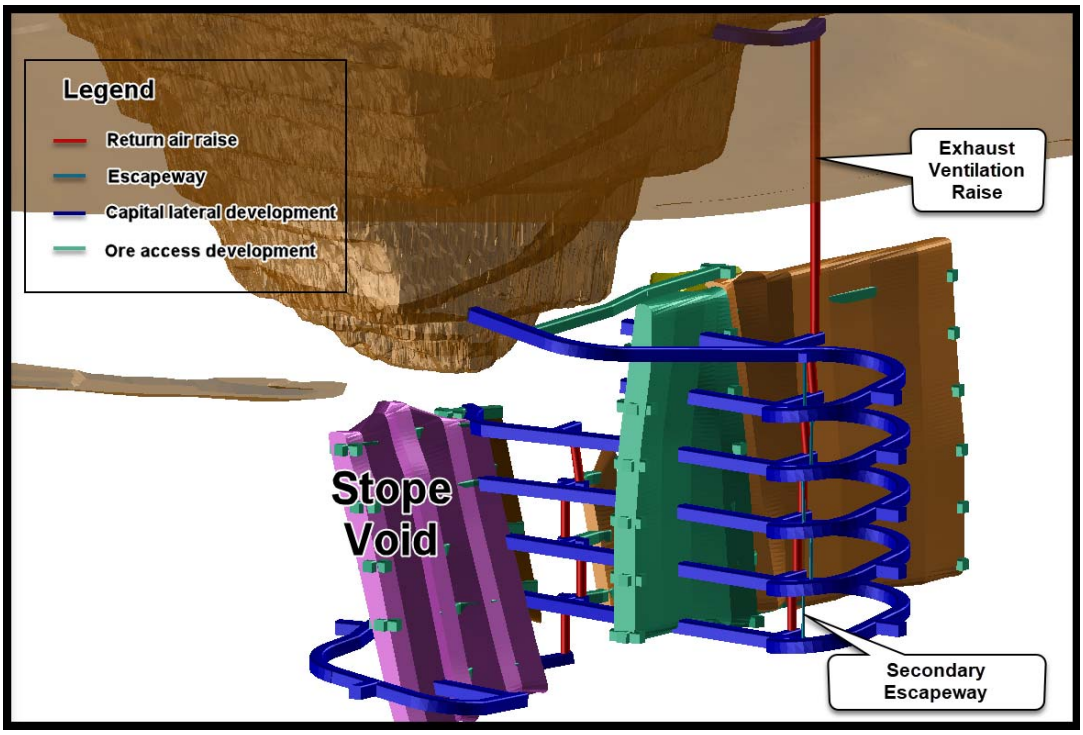


Figure 3-9 – Indicative Underground Safety and Ventilation

3.4.2.2 Ventilation

In order to maintain a healthy atmosphere underground, a primary ventilation system will be implemented. The system will draw fresh air through the primary portal /shaft, along the decline from where the air can enter the working levels. Air will be exhausted up the return air system which will comprise a series of linking vertical rises between levels with the final raise connecting to the ventilation portal/shaft in the Giant Pit wall. The primary ventilation fan will be located at the opening of this portal/ shaft. Flow regulators which act like valves will be placed in front of each exhaust raise and control the amount of air that enters a level. Air quality will be managed by the site Ventilation Officer in accordance with the requirements of the *Work Health and Safety Regulations 2012*.

Secondary ventilation fans attached to flexible material ductwork referred to as ‘vent bags’, will be used to guide fresh air from the primary ventilation system into blind headings where fresh air cannot flow through. The fresh air will be blown into the face or end of the drive with the exhaust air forced back along the drive until it reaches the primary ventilation system. Once the blind heading is developed and connects to the primary ventilation system, the secondary ventilation fans and vent bag will be removed.

In the initial stages of mining, prior to the primary ventilation system being established, all mining will take place under a secondary forced ventilation system. This will occur until the 875 level ventilation access, the 1025 level ventilation decline and the raise bore connecting the two drives is completed which is anticipated to be approximately three (3) months after mining commences.

Ventilation fans and compressors will be located within the Giant Pit or underground and ventilation fans will have silencers to attenuate the noise. It is not expected that significant noise compared to the previous open pit operations will occur however, noise monitoring will determine if further noise attenuation actions are required.

3.4.2.3 Underground Ground Control

Ground control requirements will be dependent on exact ground conditions encountered, however based on current knowledge of the area, as a minimum all lateral development will be bolted and meshed to the grade control line. In stopes, crown pillars will be subject to geotechnical review with cable bolts used as and where required.

As identified in Section 3.4.2.1, waste rock from development headings will be used to buttress stope walls as required once identified through geotechnical review from inspection and survey cavity monitoring.

A crown pillar of 20m to 27m thickness will be retained between the base of the open pit and top of the open stopes thereby providing adequate stability. Mining One conducted geotechnical stability modelling of the underground workings (Mining One Consultants, 2019b). The Factor of Safety (FoS) for the crown pillar in Kavanagh workings was modelled at greater than 2.8 in all model runs. Additionally, the hangingwall and footwall stability was also modelled as stable.

3.4.2.4 Open Pit Ground Control

The open pit has suffered some previous rock falls from the pit walls and access to the deeper portions of Giant Pit, where the portal will be located, has previously been shut down during high rain events due to the slippery nature of the biotite schist.

To ensure the safety of those accessing the portal from slippery road conditions and minor rock fall risks from the pit walls, the following controls will be implemented as applicable based on geotechnical assessment:

- All weather pavement provided on the open pit haul road through importation of suitable surface materials;
- The narrowing of remaining dual lane ramps to single lanes (on the outside of the ramp) with passing bays where necessary;
- Establishment of large windrows down the centre of the dual lane ramp to provide extra rockfall catch capacity;
- Refurbishment of existing drape mesh installations above critical areas of the lower east wall single lane ramp system;
- Additional drape mesh installation above critical underground infrastructure such as the portal;
- To protect the portal area from any potentially hazard of rocks becoming dislodged from the haul trucks, a rock catch fence will be installed on the outer ramp crest (Figure 3-10). In addition, a rock bund will be installed on the ramp side of the rock fence to prevent traffic from coming into contact with the rock fence and area above the portal;
- Implementation of a three-monthly scaling routine using a local rope specialist contractor;
- Cleaning of the ditches along the single lanes under the vertical pit walls to provide catch capacity to rockfalls that typically fall directly down the vertical batter; and
- The existing laser scanning monitoring regime of the east pit wall will be continued during underground mining.

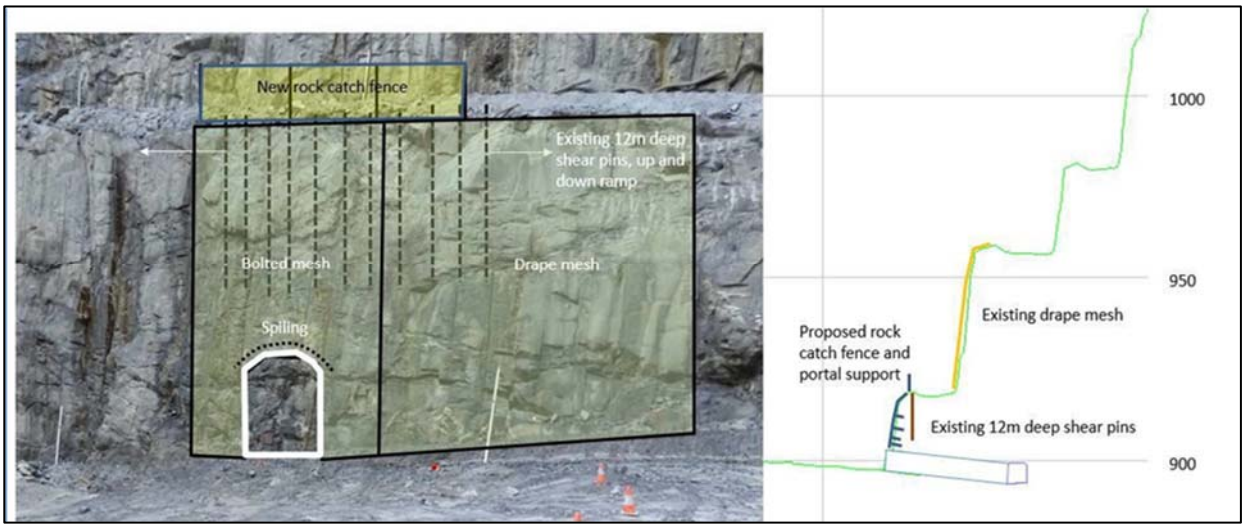


Figure 3-10 – Indicative portal support

3.4.2.5 Underground Services

Underground services are illustrated in Figure 3-11.

Water will be introduced into the underground operation for use in the development and long-hole drilling activities. The introduced water requirement from the mining activities is estimated to average 4L/s and will be sourced from the Murray River via the Murray Bridge - Onkaparinga (MBO) pipeline.

Electricity to the underground mine will initially be supplied using diesel generators located at the crest of the Giant Pit or in a suitable location on the haul road into the pit. A decision will be made on the installation of a mains power line from the existing high voltage switch room located in the processing plant based on cost estimates for such an undertaking once underground operations have commenced.

Communications to the underground mine will be through a UHF radio transmission system.

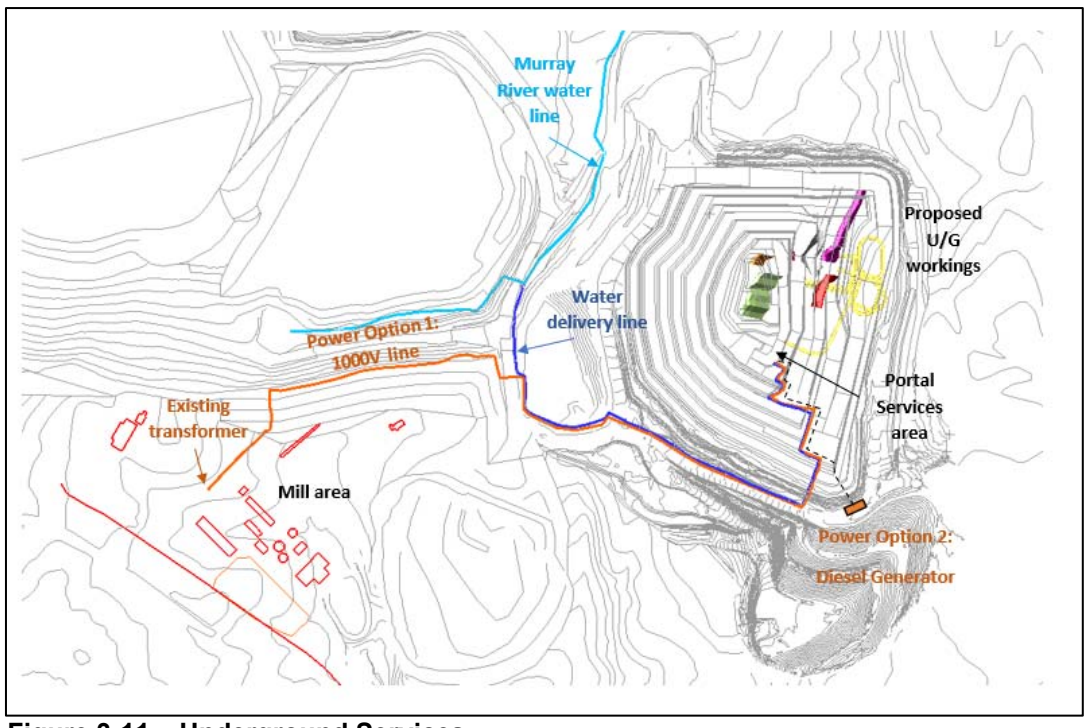


Figure 3-11 – Underground Services

3.4.3 Material Movements

All ore will be transported by trucks up the decline to the portal. The ore will then either be placed on the Giant Pit run-of-mine (ROM) stockpile located adjacent to the portal (Figure 3-12) or hauled directly to the processing plant ROM stockpile. In the event that the ore is placed on the Giant Pit ROM stockpile, surface haul trucks will then transport the ore to the processing plant ROM stockpile on a campaign basis.

Waste rock will be transported to the portal and placed in the bottom of the Giant Pit until empty stope voids are created in which waste rock can be placed.

Predicted waste rock volume to be bought to the surface and placed in Giant Pit based on the initial targets, with a 40% swell factor, is a maximum of 150,000m^3, while the maximum design stope void is 695,000m^3. There is approximately 220,000m^3 of capacity to store waste rock in Giant Pit up to the 890m level. The high range estimates for ore and waste rock production is provided in Figure 3-13.

All underground ore and waste rock is classified as potentially acid forming (PAF) and any runoff will drain to and be captured in the Giant Pit sump (refer to Section 3.4.7).

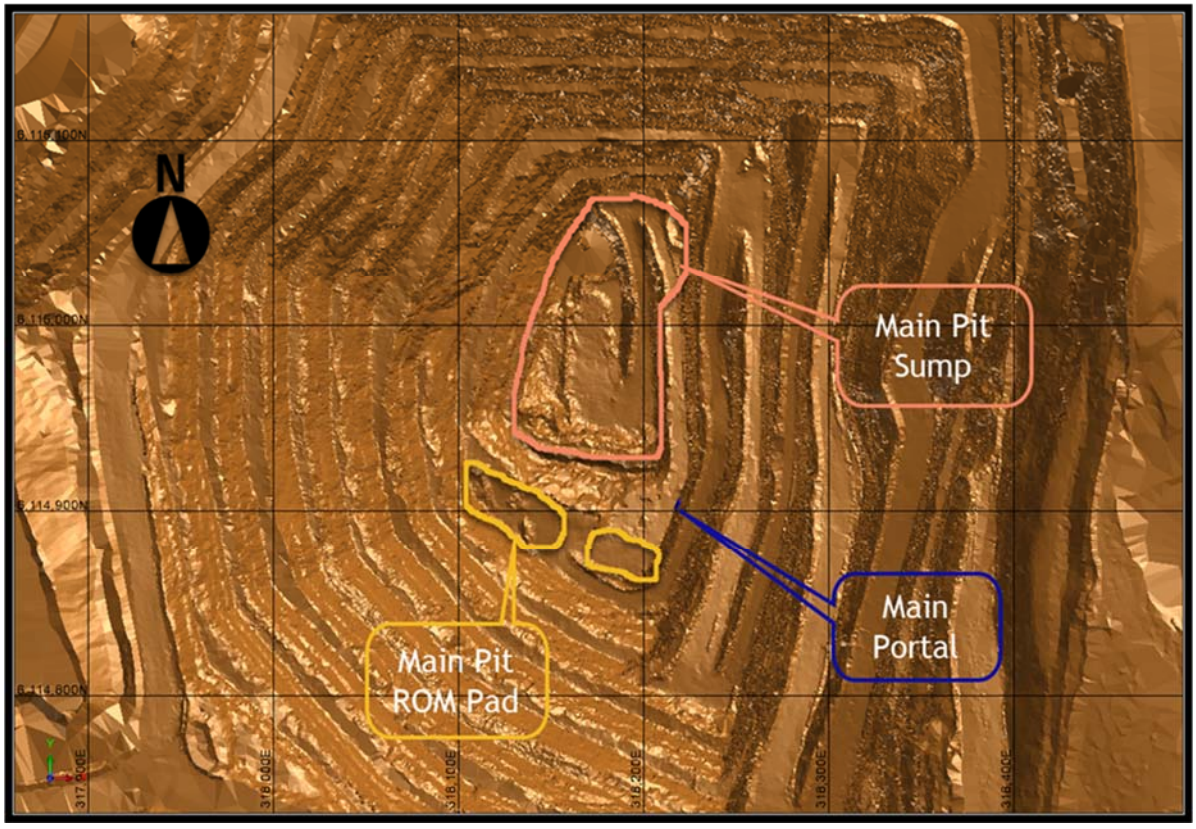


Figure 3-12 – Location of Giant (Main) Pit ROM pad and Giant (Main) Pit sump

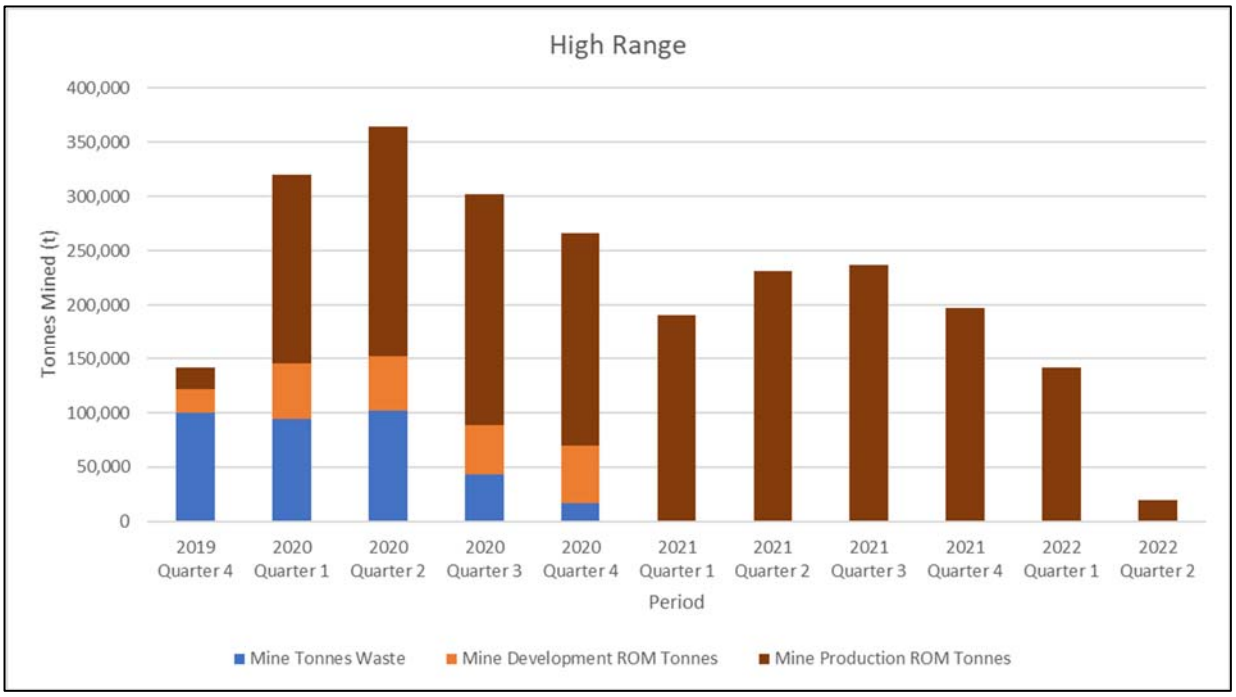


Figure 3-13 – Indicative high range estimate for ore and waste material movement – Kavanagh targets

3.4.4 Stockpiles

A temporary ROM pad will be located to in the Giant Pit for underground ore (refer to Section 3.4.3).

The existing primary ROM located near the primary crusher will continue to be used. The ROM stockpile allows for ore to be blended from the different mining sources to achieve consistent plant feed. Up to 200kt can be stored on the ROM stockpile.

At the end of August 2019, there remained approximately 2Mt of low grade ore stockpiled on the backfilled Emily open pit. This comprises material that was mined in 2018 and 2019 when the open pit ore production rate exceeded the ore processing rate. This ore is currently being reclaimed and trucked to the ROM pad for processing and is expected to be depleted by March 2020.

3.4.5 Use of explosives

The existing explosives storage area is located separately to the north of the old waste rock dump. The facility is designed to meet the requirements of the relevant Australian standards and state legislation (e.g., *Explosives Act 1936*), including the use of earth bunding around magazines, as required.

Underground mining will make use of this existing facility which has excess storage capacity for explosive volumes required for the underground mining operations.

Bulk explosives to be used are principally ammonium nitrate fuel oil (ANFO) with emulsion used for any wet holes encountered. Bulk explosive use is predicted to be up to 80t per month. Other explosives to be used include Nonel signal tube detonators and electronic detonators (up to 5000 per month) which initiate packaged explosives (boosters/primers will be used up to 1.5t per month) which in turn initiate the bulk explosives in each hole.

Underground development blasting will occur as required until multiple development headings are available which is once the 875 level cross-cut is developed. At this stage the preference will be to fire development headings at the end of each 12 hour shift at the designated firing time (for example,

approximately 6am and 6pm). Underground development firings will initiate a total of between 200kg and 350kg of explosives with approximately 5kg of explosives in each hole.

Underground production blasting will occur at the designated firing time at the end of each 12-hour shift on an as needed basis. This will occur roughly twice per week with about 8000t fired in each blast containing around 8t of explosives with a maximum instantaneous charge of around 350kg.

Explosives and blasting will be managed in accordance with the Explosives Management Plan presented in Appendix F.

3.4.6 Type of Mining Equipment

Indicative mining equipment to be used in the underground operation is given in Table 3-5. This equipment is based on the high range mine inventory plan, hence reflects a maximum equipment case.

Table 3-5 – Indicative underground mining equipment

Category	Equipment	Type/Capacity	Number
Surface fixed plant	Surface Ventilation Fans	Hownden & Sirroco or equivalent	1
Underground fixed plant	UG level pumps	Mono pumps or similar	As required
Underground fixed plant	Secondary Ventilation Fans	Clemcorp counter flow axial fans or equivalent	As required
Drilling equipment	Jumbo	Sandvik DD421-60C or equivalent	2
	Production drill rigs	Sandvik DL421-15C or equivalent	1
	Cable Bolter	Sandvik DS421 or equivalent	1
Loaders	Loaders	Sandvik LH621 (21t) or equivalent	3
Haulage trucks	Trucks	Sandvik TH663 (63t) or equivalent	Up to 4
Charge-up equipment	Charge Vehicles	Normet Charmec MC 605D or equivalent	2
Auxiliary equipment	Integrated Tool Carriers	Caterpillar 930M or equivalent	1
	Graders	Caterpillar 12M or equivalent	1
	Water Cart	Sandvik TH320 or equivalent	1
Miscellaneous	Light Vehicles	Toyota Landcruiser or equivalent	6
	Electrical generator	1000kVA or equivalent	1
	Underground diamond drill rig	Boart Longyear LM75 or equivalent	1

Category	Equipment	Type/Capacity	Number
	Air compressor	250 c.f.m or equivalent	1
	Raise Bore Machine	As required	

3.4.7 Mine dewatering

Underground water inflow from mining operations and groundwater inflow will be pumped to the Giant Pit sump (Figure 3-12). Transportable pumps will be placed in development headings as required to pump the water to a common pipeline that pumps to the Giant Pit sump. Should the sump fill and /or the level of water in the base of the open pit approach the underground portal, water will be pumped to either the TSF or to the backfilled Nugent open pit as per the existing operation.

Dewatering levels are predicted to be low based on existing Giant Pit dewatering levels and are estimated to be in the order of 86kL/d (refer to Section 3.6.2).

3.4.8 Sequence of Mining and Rehabilitation Operations

3.4.8.1 Sequence of Mining

The sequence of underground mining, key milestones and the duration of mining on each level is illustrated in Figure 3-14.

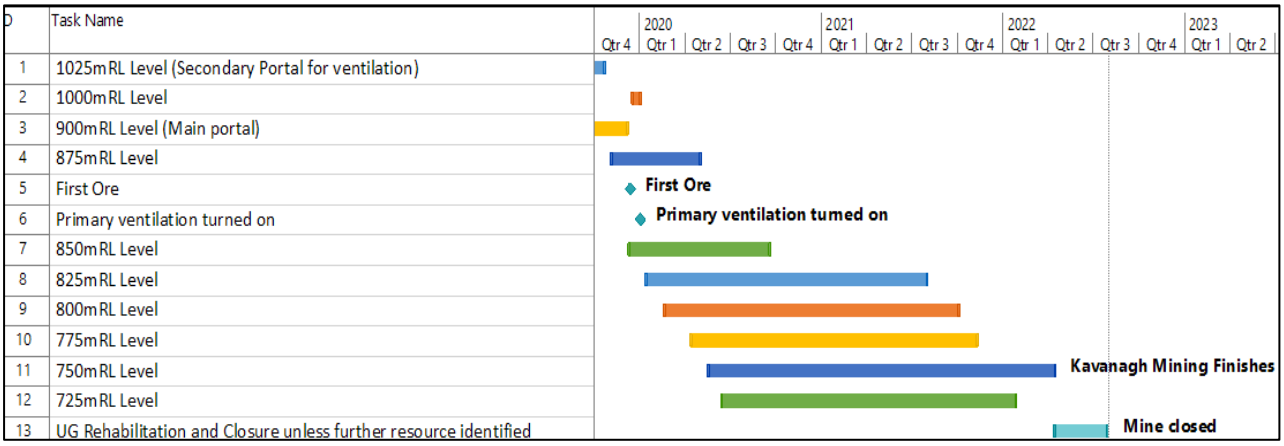


Figure 3-14 – Underground workings sequence

3.4.8.2 Sequence of Rehabilitation

Closure of the underground workings will consist of securing the portals – refer to Section 3.13.4.2.

3.4.9 Hours of Operation

Refer to Section 3.11.

3.4.10 Care and Maintenance

Refer to Section 3.12.

3.5 Description of Processing Operations

The processing facility comprises the following unit operations (Figure 3-15):

- Primary and secondary crushing;
- Coarse ore storage and reclaim;
- Grinding and classification;
- Copper flotation;
- Concentrate thickening, filtration, storage and dispatch; and
- Tailings thickening and transfer to the tailings storage facility (TSF).

A schematic of the ore concentrating process is shown in

Figure 3-16 and a brief description of each of the current unit operations is provided in the following sections.

3.5.1 Crushing and Grinding Plant

Ore is reclaimed from the run-of-mine (ROM) stockpile by a front-end loader and fed into the crushing plant, which reduces the ore size from 900mm to 20mm through a primary and secondary crusher and associated product screen. The crushing plant will continue to operate up to 24 hours per day. The crushed ore is stored on a coarse ore stockpile with a capacity of approximately 20,000t.

Ore is recovered from the coarse ore stockpile and conveyed to the semi autogenous grinding (SAG) mill, where the ore particle size is reduced to between 200 and 300µm to enable the valuable copper and gold minerals to be released and recovered by froth flotation.

3.5.2 Processing plant

The flotation circuit comprises roughing, scavenging and cleaning stages. Flotation reagents (lime, collector, gangue depressant and frother) are added in this circuit.

Copper-gold concentrate is thickened and then filtered using a pressure filter to produce a de-watered concentrate product with a moisture content of between 7% and 9%. Flotation tailings are thickened to a solids density of 55% or greater before being pumped to the tailings storage facility (TSF) (described in Section 3.7.2).

3.5.3 Process Water Management

The percentage of the total water supply requirements that water harvesting and recycling provide for the project is dependent on climatic conditions. The primary source of raw water for processing operations is sourced from the Laratinga effluent treatment facility owned by the District Council of Mount Barker (refer to Section 3.8.3.1). Hillgrove also has access to water from the Murray River through an offtake point on the Murray Bridge-Onkaparinga supply line via a pipeline owned by Hillgrove. This is used to supplement the primary source if required.

The raw water requirements for the site during an underground mining operation will be significantly lower than historical operations. This is due to the lower processing throughput rate resulting in a lower processing water requirement and the reduced footprint of haul roads required for underground operations will reduce the volume of water required for dust suppression.

Additional information on process water management is provided in Section 3.6.

3.5.4 Type of Mobile Equipment

The mobile equipment utilised in the processing plant includes the following:

- front end loaders – loading of ore from the ROM pad into the crusher circuit;
- mobile crane – perform maintenance tasks in the processing plant;
- skid steer – general clean up and loading of grinding media;
- excavators – general clean up and loading of ore;
- elevated Work Platforms – used to perform maintenance and operations tasks at heights;
- forklifts – moving palletised items; and
- light vehicles – personnel and equipment transportation.

3.5.5 Conveyors and Pipelines

There are a number of conveyors used in the processing plant for material handling purposes, including:

- crusher circuit – conveyors are used for the transfer of crushed ore between the primary crusher, secondary crusher, screening plant and the coarse ore stockpile;
- grinding circuit – conveyors are used to transfer crushed ore from the coarse ore stockpile to the grinding mill and for the mill recirculating load (pebbles) to be fed back to the mill feed conveyor belt; and
- filtration circuit – conveyors are used to transfer the filtered concentrate from the filter discharge to the concentrate storage shed.

Once water is added to the ore to produce a slurry in the SAG mill, pumps and pipelines are used to transport the ore, flotation concentrates and tailings around the processing facility and to the TSF.

3.5.6 Hours of Operation

Refer to Section 3.11

3.5.7 Rehabilitation Strategies and Timing

Refer to Section 3.13.

3.5.8 Care and Maintenance

Refer to Section 3.12.

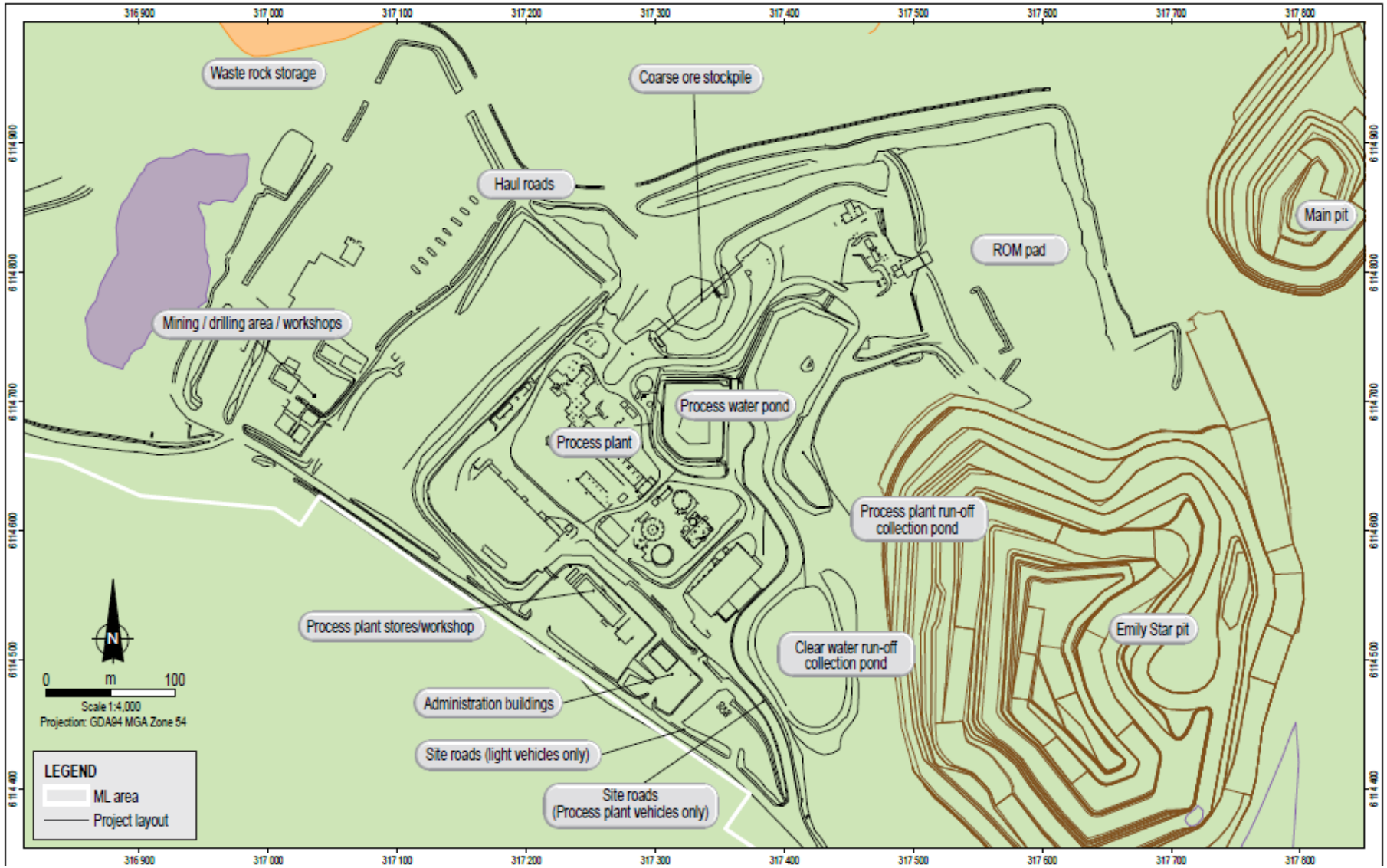


Figure 3-15 – Processing plant layout

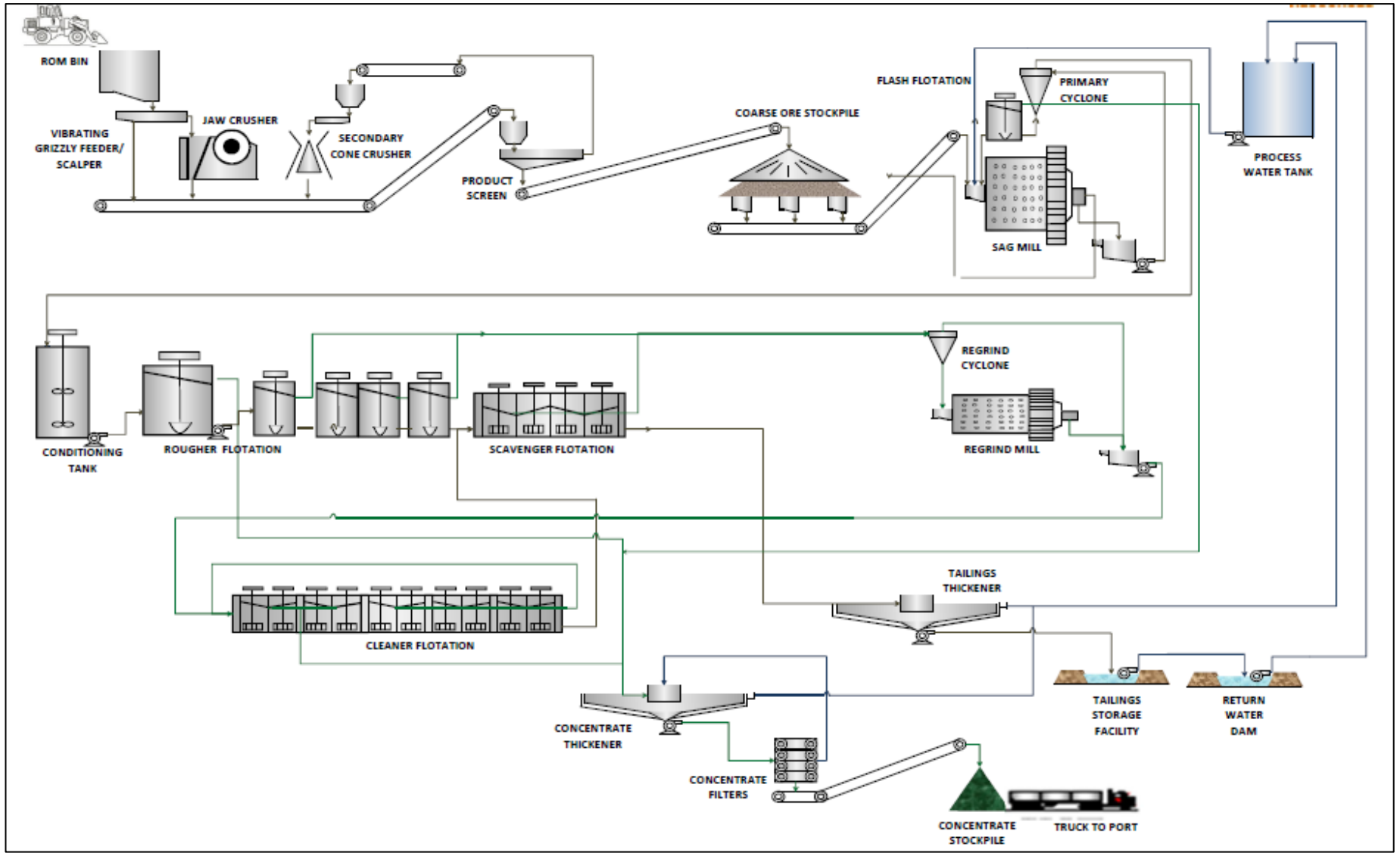


Figure 3-16 – Schematic processing flowsheet

3.6 Water Supply and Management

3.6.1 Water Sources

Hillgrove has an arrangement in place with the District Council of Mount Barker (DCMB) to supply water for the project from the Laratinga effluent treatment facility (treated to log 5 reduction (equivalent to Class 1A drinking water)). The agreement with the Council is for supply of up to 950 ML of water per annum. Hillgrove also has access to water from the Murray River through an offtake point on the Murray Bridge-Onkaparinga (MBO) supply line via a pipeline owned by Hillgrove. These sources area used to supplement the primary source if required.

Opportunities to harvest surface water and recycle process water on site have been maximised to reduce the volume of make-up water required. Four storages have been constructed on the site for the purposes of storing water:

- A double HDPE-lined TSF-return water storage with a leak detection system has been constructed on the southern side of the TSF to collect decant and underdrainage water from the TSF.
- A process water storage dam which is used as a store for in circuit process water and contaminated water from the bunded process plant area. This dam is HDPE lined.
- A clean water run off dam stores any rainfall runoff water from the broader plant area, i.e., outside the bunded process areas. This pond is not used to store process water, rather it captures plant runoff containing sediment and is HDPE lined to allow storage of DCMB recycled water or other potentially contaminated water if required. In the rare event there is sufficient volume in this storage, it is used to supplement the site water supply, predominately for dust suppression.
- A HDPE lined water storage dam is used by site water trucks to fill up with water for the purpose of wetting down roads and open areas for dust suppression using either DCMB or MBO water. This is located adjacent to the mining contractor workshop.

Water ingress into the open pit, including water to be pumped from the underground mine, will remain in the open pit sump unless the level of water in the open pit approaches the underground portal. In this case, water will be pumped to either the TSF or to the backfilled Nugent open pit as per the existing operation.

Previously, bores were installed and licenced for water supply, however these bores are not currently used for supplementing raw water.

3.6.2 Project Water Requirements

Project water supply requirements during operations comprise the following.

- Ore processing water – within the processing plant, water is used in the milling process primarily to slurry the ore. Other water uses include mixing reagents, sealing the glands on slurry pumps and for general wash-down and housekeeping purposes.
- Dust suppression and vehicle washdown water – water carts operate on haul roads, site access roads, in the processing plant and the ROM stockpile.
- Underground drilling and dust suppression.
- Potable water for site amenities and laboratory (approximately 1ML per month).

A water balance summary for dry, average and wet years is provided in Table 3-6, which also provides expected water usage for the site with the underground operation.

Note that while surface water runoff from specific active operational areas is captured and the open pit and TSF act as catchments for incident rainfall, the evaporation levels far exceed rainfall and this water is generally not available for reuse on site.

Table 3-6 – Indicative water balance summary by season (underground operation)

Flow (kL/day)	Dry Year (10th percentile)		Average Year (50th percentile)		Wet Year (90th percentile)	
	Summer	Winter	Summer	Winter	Summer	Winter
Typical month	(Dec)	(Jun)	(Dec-Feb)	(Jun-Aug)	(Dec)	(Jun)
Inputs						
ML area rainfall catchment[1]	51	163	293	574	644	1,028
Underground dewatering	86	86	86	86	86	86
MBO water pipeline and/or Laratinga effluent treatment facility	1,854	1,362	1,573	934	1,184	464
SA Water	35	35	35	35	35	35
Groundwater wells (no water is currently sourced from groundwater wells)	0	0	0	0	0	0
Total water inputs (noting not all is available water – see footnote**).**	**2,026**	**1,646**	**1,988**	**1,6301**	**1,949**	**1,613**
Outputs						
Product	35	35	35	35	35	35
Tailings water entrapment and TSF evaporation	836	884	836	884	836	884
Dust suppression	422	183	383	167	345	150
Evaporation	301	112	301	112	301	112
Retained in open pit	432	432	432	432	432	432
Total	**2,026**	**1,646**	**1,988**	**1,6301**	**1,949**	**1,613**

Potable water is sourced from an existing SA Water pipeline, which currently provides chlorinated water to the site. This pipeline feeds two 200kL head tanks. A gravity supply is installed to the site amenities, office buildings and laboratory.

[1] These numbers area based on rainfall across the entire ML area. The majority of incident rainfall on the ML area is diverted around the operational footprint and continues downstream. The very small volumes of incident rainfall on the TSF and open pit are largely evaporated given the excess evaporation to rainfall on site. Some small volumes of rainfall, hence runoff, are captured around operational areas as pollution control, i.e., sediment, and when or if this volume is sufficient, is used on site such as for dust suppression.

3.6.3 Water Management

3.6.3.1 Mine Water

Mine water comprises pit-dewatering water from groundwater inflows, water from underground activities and incident rainfall over the pit area. Underground mine water will be pumped to the Giant Pit sump and incident rainfall in the open pit above this point will also drain to this sump.

3.6.3.2 Process Water and TSF Decant

The bulk of the process water used in the plant is recovered in the tailings and concentrate thickeners, and recycled via the process water tank for immediate re-use. Water entrained in the tailings discharge is partially recovered by the TSF underdrainage and decant towers (the remaining moisture remains in the tailings or evaporates). The underdrainage and decant water gravitate via pipes to the TSF return water storage. The TSF return water storage is double HDPE-lined with leak detection and also collects rainfall runoff from the waste rock storage surrounding the TSF. Water collected in the storage is returned for use in the process plant.

Any wastewater arising from the mining services areas, such as from vehicle washdown, is collected, passed through an oil and grease trap and allowed to join other area runoff water that is collected in the process sediment pond for re-use as process water. The process sediment pond is HDPE-lined.

3.7 Wastes

3.7.1 Waste rock dumps

The majority of the waste rock generated from the open pits is stored in a waste rock storage, which forms part of the integrated waste landform (IWL) (see Figure 3-1). The Emily Star Pit and selected portions of the Giant Pit (including the O'Neil/Nugent Zone) were backfilled with waste rock. The placement of the open pit waste rock is detailed in Section 3.13.4.3.

Waste rock from the underground mine will be transported to the portal and placed in the bottom of the Giant Pit until empty stope voids are created in which waste rock can be backfilled as part of the ground support (Section 3.4.3).

3.7.1.1 Waste Rock Characterisation

An assessment of acid rock drainage potential was undertaken in 2010 by Environmental Geochemistry International Pty Ltd (EGi) and is available as Appendix 7C in the 2016 PEPR. The assessment involved inspection and chemical analysis of the old pit water and old waste rock dump and geochemical assessment of a selection of 99 representative waste rock samples from the site.

EGi originally determined a waste rock classification criteria from over 450 samples taken from across the mine site as follows:

- Non-acid forming (NAF) – total sulfate (S) less than or equal to 0.3%S; and
- Potentially acid forming (PAF) – Total S greater than 0.3%S.

This original cut-off grade resulted in 60% of the samples as either potentially acid forming (PAF), potential acid forming – lower capacity (PAF-LC) or uncertain, expected to be PAF (UC(PAF)). The remaining 40% of samples were classified as non-acid forming (NAF).

This original geochemical assessment assumed that acid generation is a result of pyrite and any neutralisation occurs as a result of carbonate. More recent test work conducted by Blue Minerals Consultancy in 2017 (Appendix G), however, has confirmed the dominant sulphur material in all waste

(non-ore zones) of the Giant Pit as pyrrhotite and the neutralising compounds as silicate almandine (garnet).

The results of this additional test work determined the following:

- The dominant sulphur bearing mineral is indeed pyrrhotite or other non-acid-forming sulphides (pyrite only 11% of the total sulphides) which does not generate significant acid, with all the test work samples with < 0.6% Total Sulphur generating negative NAPP values.
- There is sufficient (silicate) neutralising capacity from 13% almandine garnet and rate to ensure neutral to alkaline leachate from 0.3−0.6 wt %S waste rocks.
- The risk of metalliferous drainage is low. Aluminium leaching from almandine may occur but in practice both on-site ground and local off-site surface waters fall below the maximum ground water aluminium concentration threshold.

The geology in the underground is an extension of that encountered during mining of Giant Pit (refer to Figure 3-5), confirmed through logging of the underground exploration holes to define the resource (refer to Section 3.2.1.2). As such, the original and subsequent Blue Minerals geochemical assessments are applicable to the underground operation.

The sulphur block model also depicts an extension of the sulphur grades from the open pit through to the underground (Figure 3-17). As such, all ore and waste rock from the underground operation will be treated as PAF.

3.7.1.2 Waste Rock Management

As identified in Section 3.4.3, any minor volumes of waste rock from underground not used in void backfill, will be placed in the bottom of Giant Pit.

Applying the hierarchy of waste management, the following applies:

- Avoid – PAF material is unavoidable in the event mining at Hillgrove is to occur;
- Reduce – PAF material has been reduced to the extent possible through underground mining which minimises waste rock generation through targeted ore mining;
- Reuse – PAF material will be prioritised as underground void backfill. This will reduce the requirement for imported materials such as alternative waste rock or cement for geotechnical support. Additionally, this will cover any PAF material exposed in the underground pit walls where the backfill is placed;
- Recycle – See reuse. PAF waste rock is not suitable for any other form of recycling or reuse;
- Recover – See reuse;
- Treat – treatment is not a practical option for the underground PAF waste rock or void walls. The most common treatment is encapsulation and there is no available NAF in the underground to encapsulate the PAF material. Additionally, the potential change to the predicted water quality in the post-closure pit lake as a result of the additional PAF exposure has been modelled as immaterial compared to the poor water quality already predicted for the pit lake. As such, the additional resource requirements to truck NAF from the surface to the bottom of the open pit to encapsulate the waste rock PAF while leaving the pit wall PAF exposed is not considered reasonable or practical; and

- Dispose – disposal will occur with the maximum of 150,000m^3 material to be placed in Giant Pit. Tis volume is approximately only 20% of the maximum stope void volume – all remaining material is either ore (see reduce) or used for stop backfill (see reuse).

Figure 3-17 illustrates that the sulphur grades in the underground are slightly lower than those present in the Giant Pit walls, that is a higher portion of 0.3 to 0.6% and 0.6 to 1.0% sulphur rock. As such, the disposal of the PAF waste rock from the underground in the bottom of the open pit will cover some of the currently exposed pit walls of higher sulphur with lower sulphur waste.

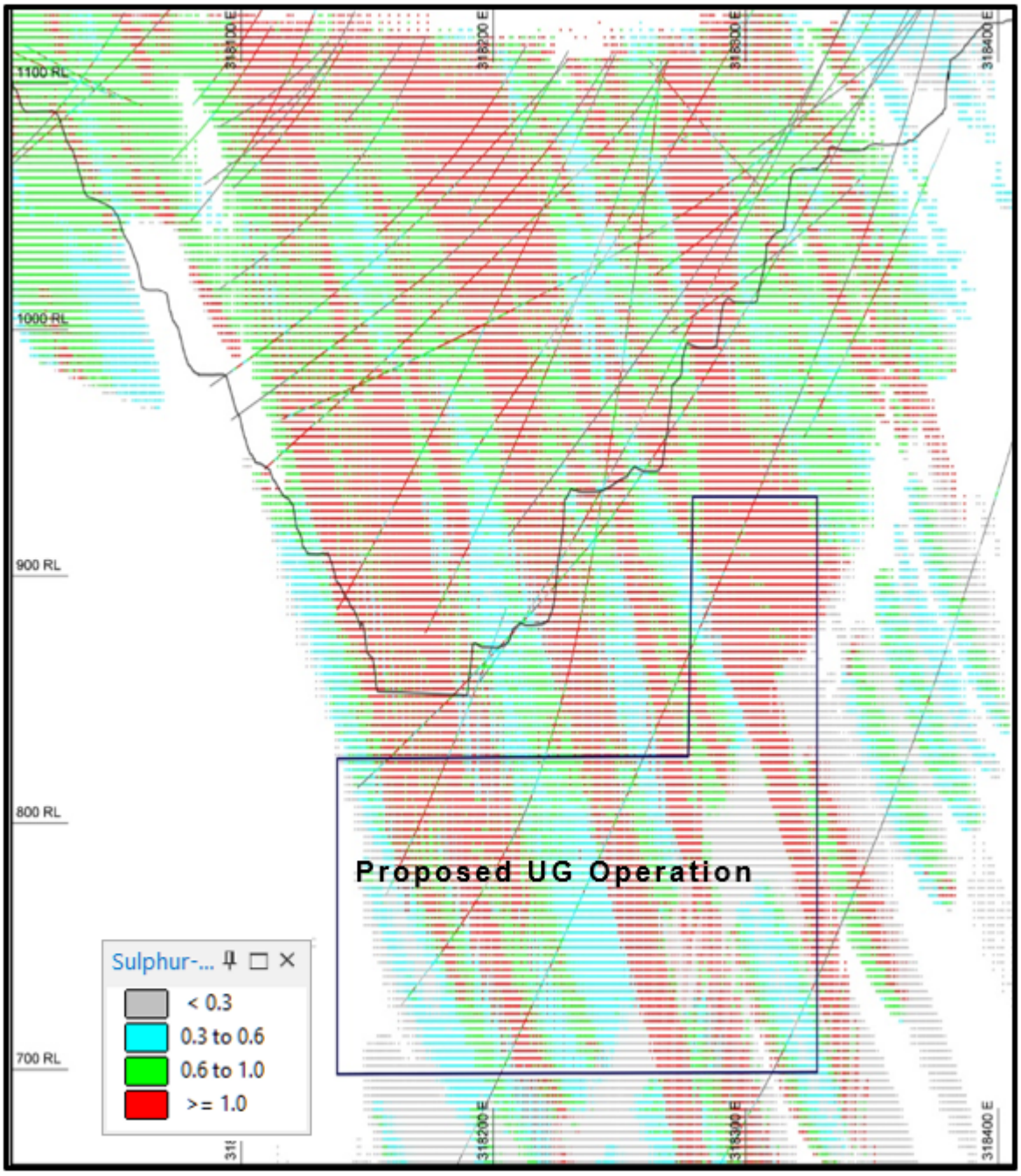


Figure 3-17 – Modelled Sulphur Grades in the Underground

Table 3-7 provides an inventory of materials moved during the open pit operations and to closure, including waste rock generation, use and disposal of waste rock on the site during the open pit

operations, including the backfilling of pits using waste rock, and the PAF/NAF material split. The stockpiled NAF waste rock and that required for rehabilitation is also identified in the table.

As part of previous open pit operations, to minimise the size and potential impact of the waste rock storage facility, Emily Star and parts of the Giant Pit (including the O'Neil/Nugent Zone) have been backfilled with PAF material.

The management and placement of PAF material in the IWL is detailed in Section 3.7.2.2.

Table 3-7 – Waste Rock inventory

Material Moved	Mt
Open pit waste rock production	
NAF production	19.7
PAF production	47.6
Total waste	**67.3**
Waste Rock Use other than in IWL	
Emily Star pit - backfill	8.5
O'Neil/Nugent pit - backfill	7.2
PAF estimated from Underground to end of mine life	
PAF waste rock to be used in underground backfill or placed at base of Giant Pit	0.3
NAF usage to end of mine life (as at May 2019)	
Already used for rehabilitation and other construction	11.1
Stockpiled for rehabilitation	4.1
Required for rehabilitation of site including IWL cover	1.5
Indicative excess stockpiled NAF	2.6

3.7.2 TSF

3.7.2.1 Tailings Characterisation

Geochemical Test Work

Geochemical test work in 2007 of a tailings slurry sample derived from a bench-scale metallurgical study indicated that the tailings would contain trace amounts of sulphide minerals in a gangue devoid of carbonate minerals (Table 3-8) (Campbell, 2007a, b, available as Appendix 7E of 2016 PEPR). The sample was dominated by marcasite with subordinate pyrrhotite and classified as potentially acid forming (PAF) due to the reactive nature of the marcasites.

Table 3-8 - Acid base analysis and net-acid-generation results for tailings sample (2007)

MC	Total-S	SO_4-S	Sulphide-	CO_3-C	ANC	NAPP	NAG	NAG-pH	Classification
(% w/w)	%	%	%	%	kg H_2SO_4/tonne				
20.5	0.80	0.03	0.78	0.01	9	16	13	3.6	PAF

Source: (Campbell, 2007a) MC = Moisture content, ANC = Acid-Neutralisation Capacity, NAPP = Net-Acid-Producing Potential, PAF = Potential-Acid Formation, NAG = Net-Acid Generation.

Table 3-9 provides the average value for major and minor ions as measured in the TSF underdrainage samples between 2012 and 2019. Where certain elements are not measured, these values are provided

by the original Campbell tailings sample liquor analysis (2007a). The multi-element composition and mineralogy of the tailings solids indicates the tailings are enriched in silver, bismuth and selenium; however the liquor is not enriched in these elements.

Table 3-9 – Tailings liquor analysis

Major-Ions (mg/L)								
Na	K	Mg	Ca	Cl	SO_4	HCO_3	CO_3	OH
379	322	110	577	547	2614	26	<1	<1
Minor-Ions (mg/L)								
Fe	Cu	Ni	Zn	Co	Al	Cd	Pb	Cr
74	19.6	0.2	0.84	0.6	0.24	0.0002	0.001	<0.01
Hg	As	Sb	Bi	Se	B	Mo	P	F
<0.0001*	<0.001	0.00014*	<0.000005*	0.0030*	0.04*	0.00009*	0.1*	0.2*
Ag	Ba	Sr	Tl	V	Sn	U	Th	Mn
<0.00001*	0.059*	0.38*	0.00006*	<0.01*	<0.0001*	0.00013*	<0.000005*	0.72*

Source: Average of quarterly underdrainage samples 2012 to 2019 where available (*otherwise Campbell, 2007a).

Physical Characteristics

The tailings are predominantly sand with non-plastic fines and are classified as Silty Sand (based on the unified soil classification). This means that the tailings settle rapidly, releasing water for return via a decant system, as they readily 'bleed', resulting in free water discharge. The tailings also 'self drain', resulting in water percolation through the tailings stack and reporting to the underlying underdrainage system.

3.7.2.2 Tailings Storage Facility Design and Construction

Existing TSF Design and Initial Construction

The TSF design is based on an integrated waste landform (IWL) concept where the TSF is surrounded by the waste rock storage.

The TSF design, including associated drainage and water storages is available as Appendix 7F, 8A and 8B in the 2016 PEPR and is summarised in this section. The current approved TSF design is to a final embankment elevation of RL 1263m containing approximately 13Mt of tailings. The TSF embankment has been constructed to RL 1263m and the tailings elevation at August 2019 is RL 1261m.

The TSF design incorporates a double HDPE lined section over the insitu base clay layer and underdrainage system over the TSF base. The double HDPE lined section has a leak detection system comprising of a Trinet T5 Triaxial Drainage Geonet (flownet) which is located between the layers. The protection layer on the base of the TSF consists of an additional layer of geotextile, while on the internal batters the protection layer is comprised of sand and tailings. The underdrainage system comprises of the flownet, geotextile and slotted pipes. The outer embankment has a single primary liner extending to an elevation of RL1250m. A secondary (double) liner and underlying leak detection geonet has been construction over the primary liner up to RL 1215m in the southern portion of the TSF and up to RL 1224m in the northern portion.

A system of vertical gravity decants, consisting two temporary decants and one permanent decant, are installed in the TSF to facilitate surface water recovery. A double HDPE lined return water storage (RWS) is located to the south of the IWL with a capacity of 125,000m^3 to contain water recovered by

the decant and underdrainage system. The RWS is also designed to capture storm water flows from extreme rainfall events.

The perimeter containment embankments of the TSF comprised a starter embankment constructed with a compacted sand or clay layer against the adjacent waste rock storage to RL 1,220 m. A minimum 5m thick NAF basal layer has also been installed directly under the TSF embankments (refer to Figure 3-34 in Section 3.13.4.3). Subsequent lifts were undertaken utilising the downstream construction method, in which raises are constructed outwards and overlap the top of existing embankments. The embankments have slopes of 1:1.5 to 1:2.0 (vertical to horizontal) for the inner slope. The outer or downstream slope is formed by the waste rock storage, which has been progressively rehabilitated. In order to achieve the then approved slightly domed surface and final elevated shape to meet the visual amenity outcomes for the site, internal coffer dams have been constructed as a series of internal concentric rings of tailings prior to placement of the final rehabilitation cover. This step-in process commenced in 2017. Closure and long term stability, physical and geochemical, of the IWL is discussed in Section 3.13.4.3.

The first section of the tailings delivery pipeline (i.e., the pipeline that delivers tailings from the plant to the TSF) is a steel pipeline with a polyethylene liner, the remainder of the pipeline is polyethylene only. Both the tailings delivery pipeline and the return water pipelines are bunded to contain any spillage of materials from leaks or ruptures.

A detailed description of the construction requirements and procedures for construction of the TSF perimeter embankments, underdrainage and decant are given in Appendix 8A and 8B of the original design report available in the 2016 PEPR. The construction of the TSF has been strictly monitored by a dedicated third party qualified engineer and these reports have been regularly incorporated into the Hillgrove MARCR.

Ongoing Embankment Lifts

The IWL has been constructed from the south towards the north, staged 5m to 10m-high horizontal lifts.

The waste rock from open pit mining has been placed on a waste rock dump adjacent to the TSF to create an IWL. The IWL has been constructed in lifts to match the TSF lifts and in a manner aimed at encapsulating PAF material. This ensures that PAF material is encapsulated and surface water/oxygen ingress into the PAF material is minimised.

During open pit mining operations, the location of the PAF waste rock zones was verified through assays from grade control and blasthole drilling. As the material was excavated the PAF waste rock was placed in the PAF waste rock zones of the waste rock storage and the backfilled areas of the pits.

The NAF waste was used to line the base of the IWL with survey pegs marking out the dumping boundaries. PAF material is placed only in areas where the 5.0m NAF base layer has been established.

To ensure the long-term geochemical and physical stability of the overall IWL structure and to ensure chimney erosion did not occur as a result of different lithological waste rock, the following PAF encapsulation approach which has been implemented on site (Hillgrove Resources Ltd, 2019b).

PAF compacted layer construction (>20°)

- The layers shall be restricted to 2m depth.
- The material shall be relatively free of large blocky rock material >1.0m. (an occasional large block is okay).
- The average block size should be 0.6m or less.
- There should be sufficient fines to fill all voids between the larger blocks.
- The material should be visibly compacted so that there are no voids.
- There should be no rock chimneys.
- NAF can be substituted for PAF if the above conditions are also met.

This construction method has been applied on the lower levels of the IWL and adjacent to the 1970's original Kanmantoo dump area where the bulk of the construction (1970's dump and TSF) was completed in stages, rather than to IWL from the beginning (refer to Figure 3-18).

PAF layer construction (<20°)

- The final PAF slopes are dozed down from the end-tipped 36° to less than 20°, thereby infilling the upper fines into the lower regions without any voids and compacting the upper layer of the PAF (Figure 3-19).

This construction method has been applied to all flatter slopes of the IWL.

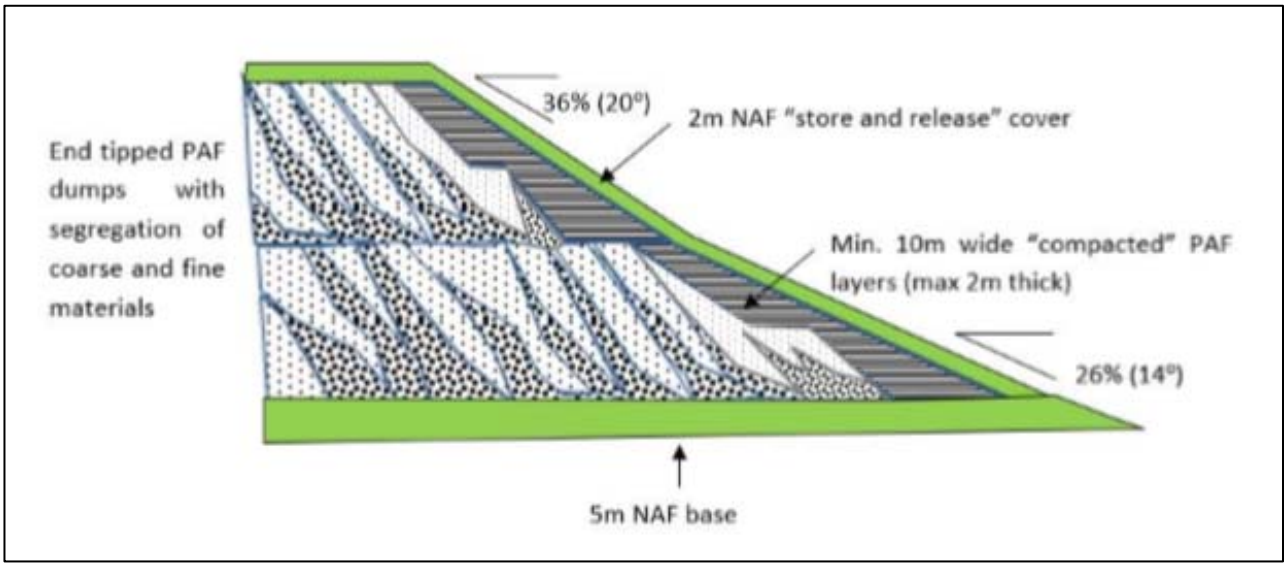


Figure 3-18 – Typical cover design with compacted PAF layers (Hillgrove Resources Ltd, 2019b)

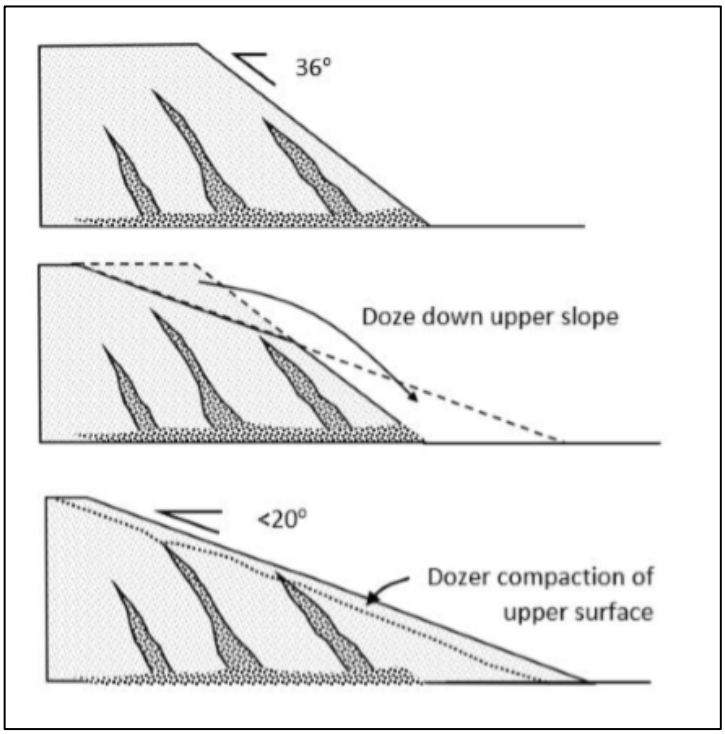


Figure 3-19 – Dozing End Tipped Upper PAF Slopes (Hillgrove Resources Ltd, 2019b)

Stage 6 and 7 lifts were raised entirely within the lined footprint and were constructed with waste rock partially directly placed on tailings, i.e., partial upstream construction.

Proposed Stages 8 and 9 Embankment Lifts

The currently approved RL1263 Stage 7 lift will allow for the remainder of the stockpiled Emily Star low grade ore to be processed, with 0.9Mm^3 (1.45Mt) of additional storage.

There are two stages of lift designed as follows.

- Stage 8 to RL1266m – this allows for the estimated 2.3Mt of underground ore (refer to Section 3.4.2.1) and provides for the 1m NAF cover (refer to Section 3.13.4.3).
- Stage 9 to RL1274m - this lift, to be constructed in two 4m lifts, allows for an additional 7.5Mt capacity. This capacity could allow for:
    - placing the 4Mt of the OTD tails into the TSF as part of the potential PHES option of constructing the upper dam on the old TSF; and / or
    - provide additional capacity for tailings from additional underground operations should the targets in Section 3.2.1.2 be converted; and
    - providing for the 1m NAF cover (refer to Section 3.13.4.3).
- The outer batter design angles for each lift is in the order of 18°.
- Embankment crest width is to be 18m minimum.
- Given there will be no waste rock from the underground bought to the surface, the waste rock for construction of the Stage 8 and 9 lifts will be retrieved from the waste rock that forms part of the IWL to the southeast side of the TSF. The borrow area will then be rebattered to slopes of less than 20° and rehabilitated in accordance with IWL closure requirements (refer to Section 3.13.4.3).

- The decant water system will be extended to accommodate the Stage 8 and 9 lifts through adding new sections of the outer decant pipe, decoupled from the current in-situ pipe, to reduce loads on the lower sections of the decant structure. This method has been used for all existing lifts above 1,230m RL.

The lift will be constructed in accordance with the currently approved method, as per the previous lifts on the TSF, i.e., upstream lifts to reduce the tailings area and create a more natural surface topography on top of the IWL to the extent possible for closure.

Quality control of the construction phases will be as per previous construction phases and as documented in *Specification for Construction Stage Inspection, Testing, Reporting and Certification of Protection Layer and HDPE Liner Works for the Tailings Storage Facility (TSF) at Kanmantoo Copper Resources*, Kanmantoo (PSM, 2012). Stage 8 and 9 lifts do not require HDPE liner installation hence these sections of the specification are not applicable.

The Stage 8 and Stage 9 lifts and the associated reduction in height of the adjacent IWL waste rock are depicted in Figure 3-20 and Figure 3-21 respectively. The volume for each lift is provided in Table 3-10. The embankment volumes will be comprised of PAF materials, with a 1m thick outer NAF layer.

Table 3-10 – Approximate stage volumes

Stage	Crest RL (mAHD)	Incremental Storage		Cumulative Volume	
		Tailings Storage (m^3)	Embankment (m^3)	Tailings Storage (m^3)	Embankment (m^3)
8	1266	860,000	545,000	860,000	545,000
9	1274	2,488,000	1,517,000	3,348,000	2,062,000

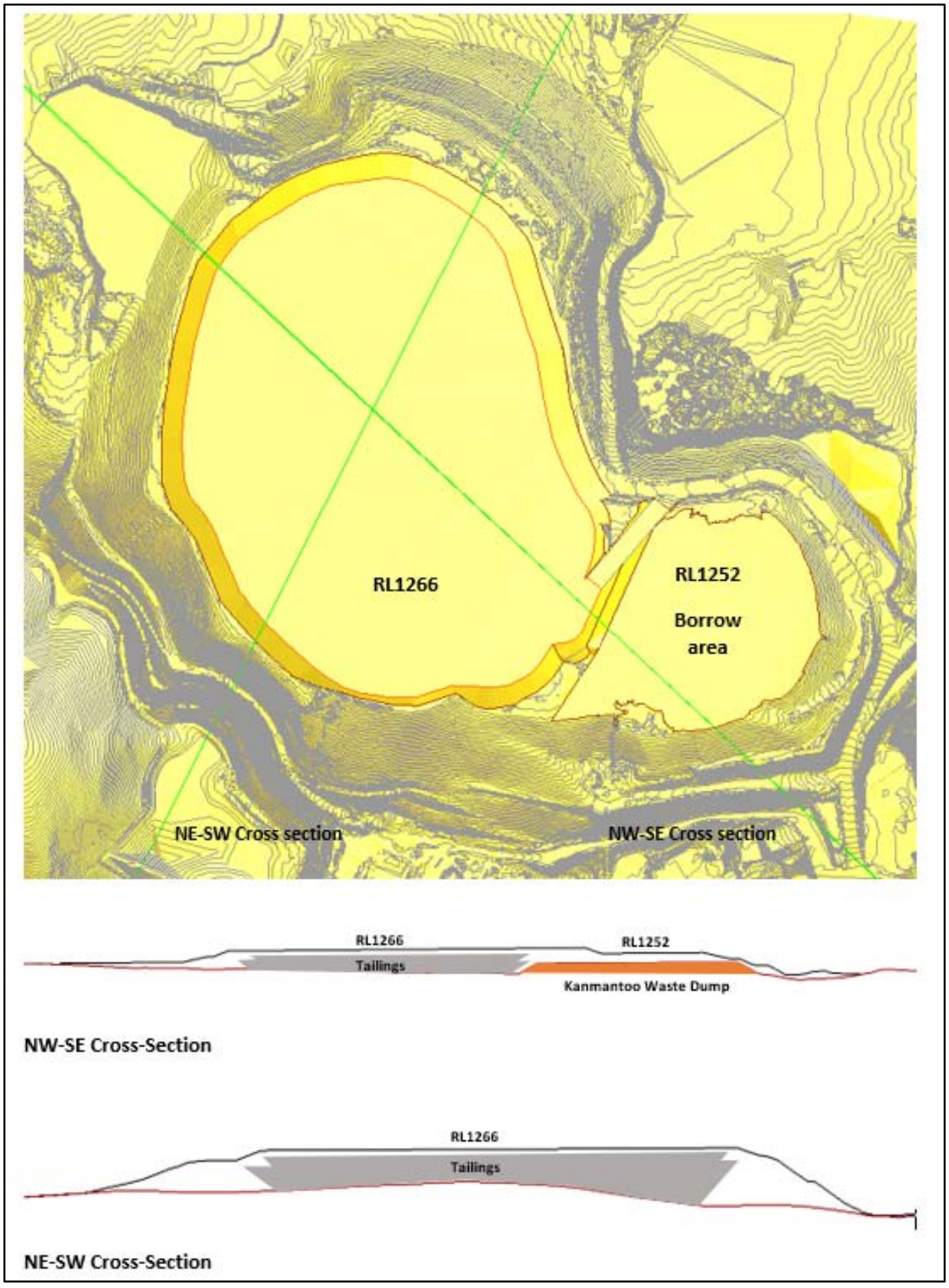


Figure 3-20 – Schematic TSF Stage 8 lift to RL1266

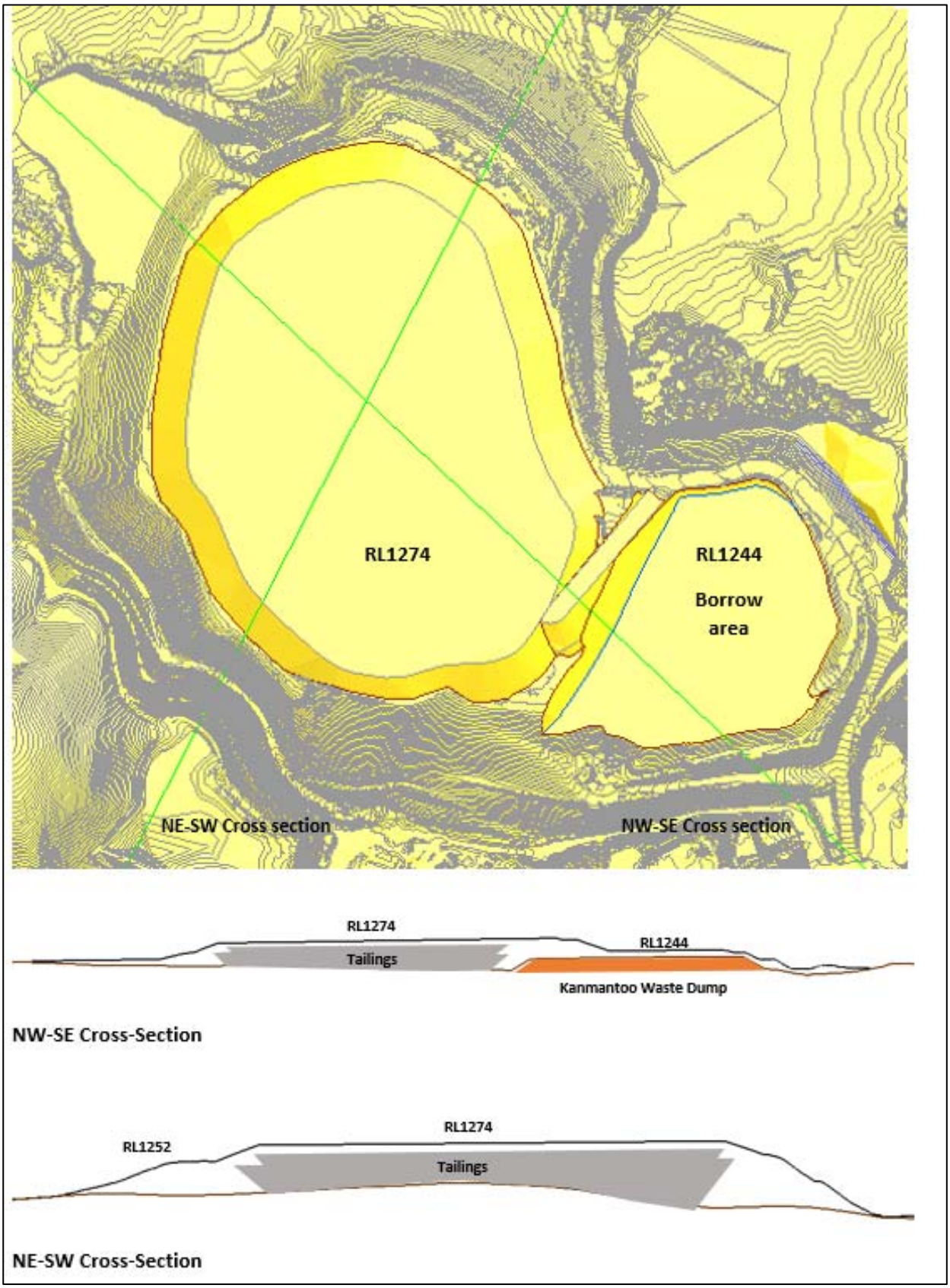


Figure 3-21 – Schematic TSF Stage 9 lift to RL1274

Stability

PSM conducted stability analysis of the TSF with Stage 8 and 9 lifts using the Rocscience Slide computer model (Appendix H) in accordance with ANCOLD 2012 requirements. The results of the assessment indicated the following.

- The TSF consequence category for embankment failure due to seismic action is identified as Significant based on the potential loss of life is expected to be less than 1 given the personnel on site and the relatively dry nature of the stored tailings.
- The TSF is classified as Class D based on the peak ground acceleration considered in the design.
- The potential for liquefaction of the TSF during operations is low under maximum design earthquake (MDE) conditions based on:
  - the potential for tailings liquefaction below 30m being unlikely due to confining stress; and
  - the potential for waste rock liquefaction being very low due to it being dry and protected by a liner.
- The potential for liquefaction of the TSF post closure is low under the design MDE.

Given Stage 8 and 9 will be upstream lifts, additional pseudo static stability analysis was conducted (Table 3-11) with section locations illustrated in Figure 3-22.

Table 3-11 – Stability assessment Stage 8 and 9

Section	Case	Failure Mechanism	Factor of Safety (FoS)	Comment
Downstream				
Section 1 East	Case 1 = circular static analysis with the water table at 10m depth.	Circular	1.74	Low FoS associated with shallow failures not resulting in tailings breach
	Case 2 = non-circular static analysis with the water table at 10m depth.	User defined	1.63	
	Case 3 = circular pseudo static analysis under the MDE and the water table at 10m depth.	Circular	1.29	
	Case 4 = non-circular pseudo static analysis under the MDE and the water table at 10m depth.	User defined	1.25	
Section 2 North	Case 1	Circular	2.03	
	Case 2	User defined	1.91	
	Case 3	Circular	1.49	
	Case 4	User defined	1.34	
Section 2 South	Case 1	Circular	1.87	
	Case 2	User defined	2.18	

Section	Case	Failure Mechanism	Factor of Safety (FoS)	Comment
	Case 3	Circular	1.43	
	Case 4	User defined	1.60	
Section 3 Southwest	Case 1	Circular	1.46	Low FoS associated with shallow failures not resulting in tailings breach
	Case 2	User defined	1.35	
	Case 3	Circular	1.08	
	Case 4	User defined	1.08	
Upstream				
Section 1 East	Case 1 = circular static analysis with the water table at 10m depth.	Circular	1.07	Minimum output FoS associated with shallow failures not resulting in tailings breach
	Case 3 = circular pseudo static analysis under the MDE and the water table at 10m depth.	Circular	0.86	
Section 2 North	Case 1	Circular	1.05	
	Case 3	Circular	0.85	
Section 3 Southwest	Case 1	Circular	1.11	
	Case 3	Circular	0.90	

The FoS values calculated by PSM for the downstream slopes were generally in accordance with the minimum values suggested by ANCOLD (2012) of > 1.5 for static loading and > 1.0 for earthquake loading, apart from those for surficial slip, i.e., Section 3 southwest adjacent to the RWS. This area has been steepened to accommodate the RWS. Further desktop assessment of this area identified a strong influence of 3D effects and an expected 3D FoS of 1.64. A peer review of this assessment identified conservative friction angles were selected by PSM for the tailings of 32º (compared to a measured value of 34º from direct shear strength testing), and for the PAF waste rock of 38º (which would likely be about 43º, and would increase the FoS by up to 20% for the portion of the slip surface passing through the PAF waste rock) (Appendix D). Further analysis is proposed to confirm PSMs desktop assessment of this area prior to closure (refer to Section 6.2).

The upstream analysis identified a FoS close to 1 for all cases, representing the short term worst case scenario of the full upstream embankment lift being constructed prior to tailings deposition. Additionally, the initially low geotechnical stability of the upstream slopes is of little consequence, since any slips would be surficial and limited to the PAF waste rock (Appendix D). Ensuring tailings are placed rapidly against the embankments will increase these FoS.

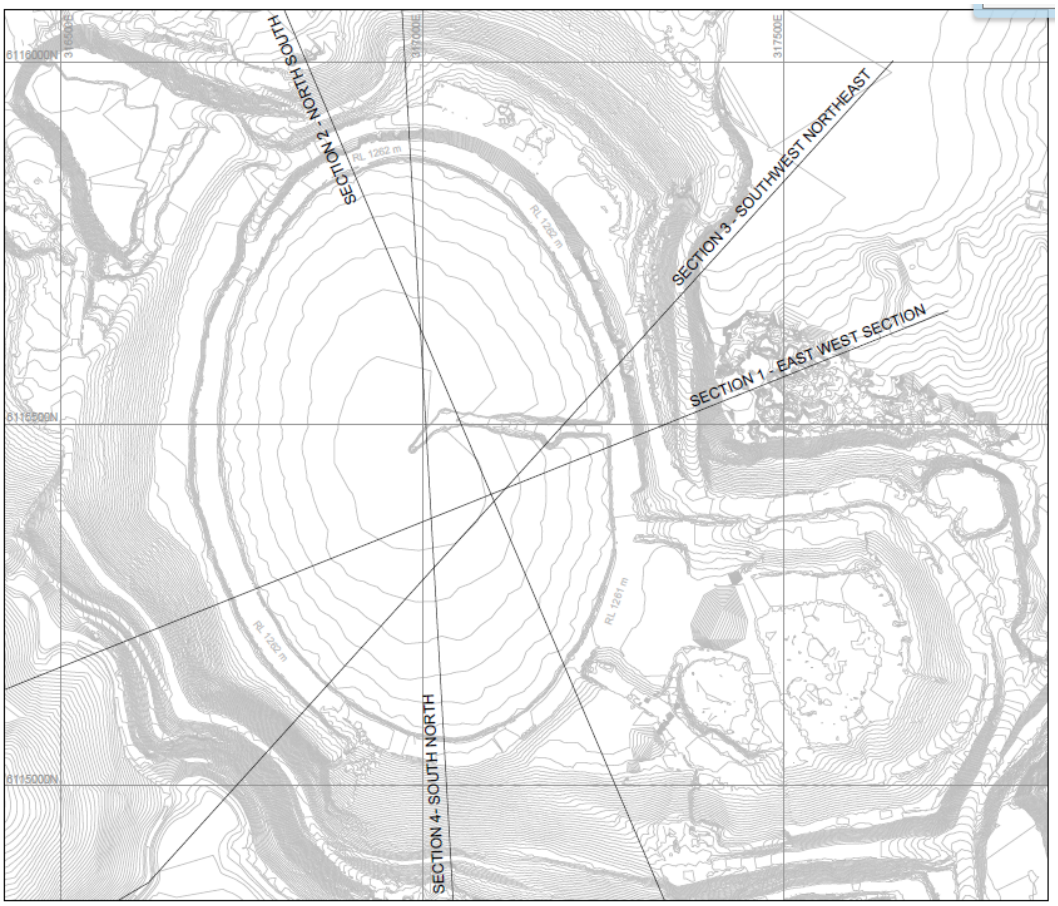


Figure 3-22 – TSF stability assessment sections

3.7.2.3 Tailings Storage Facility Operation

Tailings Discharge

Tailings in the form of a slurry (at least 55% solids) is discharged sub-aerially from around the TSF perimeter via one or more active discharge points, which are regularly moved to ensure even development of the tailings beach. Tailings will continue to be deposited using cyclical, perimeter spigoting for the operation of Stage 8 and 9.

The sloped tailings beach ensure that any surface water pond, formed from the liberation of water from the deposited tailing, is maintained around the central decant structure, which has a gravity outfall to the TSF return water storage.

The TSF design requires that a minimum freeboard equivalent to 300mm depth over the entire plan area of the TSF be maintained until closure will continue to be maintained throughout the operation of the Stage 8 and 9 lifts through ongoing implementation of the water recovery system.

Water Recovery System

TSF water management is, and will continue to be, through the decant drainage and underdrainage systems.

Underdrainage System

An underdrainage system has been installed in the base of the TSF, comprising flownet and Bidim A39 geotextile with associated slotted pipes placed over the HDPE liner to capture water which percolates through the tailings stack during the operation of the facility. The underdrainage system has a minimum design flow capacity estimated at approximately 2.6ML/day and a measured average flow (September to December 2018) of 3.48ML/day (Appendix H). PSM identify that although working above design capacity, the underdrainage is working effectively without reduction in overall effectiveness.

PSM assessed the subsequent likelihood of there being a loss of efficiency in the underdrainage system resulting in elevated pore pressure. The assessment results are presented in Table 3-12.

Table 3-12 – Potential for increase in pore pressure

Stage	Risk Conclusion: potential for increase in pore pressure as a result of underdrainage efficiency loss	Reasoning
8	Unlikely	• Underdrainage system is currently working efficiently and capturing around 76% of all liberated tailings water. • Majority of the system is below the design pressure of 1MPa and the design allows for self-regulation by rerouting of water through the system. • Pressure on collection pipes is below design limits and within acceptable design standards. • The Stage 8 load increment is a moderate 3m.
9	Moderate	• The Stage 9 load increment is 8m. • Majority of the system would be at or above the design pressure of 1MPa, limiting the ability for self-regulation. • Pressure on collection pipes would be approaching design standards.

Monitoring of pore pressure in the form of piezometers has been included in the monitoring program (Section 6.3.2) to ensure this risk is monitored throughout operations and managed as required.

Decant System

A system of gravity decants (two sacrificial and one permanent) facilitate surface water recovery (Figure 3-23). Recovered water flows by gravity to the TSF RWS from where it is pumped back to the processing plant for use in processing. The RWS is double HDPE lined with a capacity of 125,000m^3 to contain water from extreme rainfall events (72hr, 1:10,000 AEP storm event) during operations with management.

Each decant structure comprises slotted concrete pipes, which are surrounded by ‘clean’ rock fill to allow safe access to the structure for maintenance. The decant structures are raised along with the perimeter embankments as part of any stage construction works. Each decant system has a separate outfall and the design flow from the decant pipework is 12.96ML/day. The measured average flow (September to December 2018) is 1.08ML/day (Appendix H).

The difference between design and actual underdrainage and decant volumes is likely related to the difference between the assumed tailings permeability for the original design (long term permeability of

1x10^{-7}m/s) and the measured permeability of 5 to 10x10^{-7}m/s. Higher permeability results in a greater portion of liberated water reporting to underdrainage rather than the decant.

Stormwater System

The TSF is designed as a non-release dam. During operations, with tailings at beach angles steeper than 2%, the depressed cone forming the surface of the currently approved TSF design can provide up to 30 times the storage capacity for the extreme design storm, i.e., the 72-hr, 10,000 year ARI event. The Stage 8 and 9 lifts are designed to continue the system as a non-release dam, and by maintaining the operation of the central decant, underdrainage and the RWS until the last stages, the storm water storage and release strategy as per the approved TSF design is maintained.

Seepage

A key design aspect of the TSF is the return water storage (RWS), which is designed to store all decant water and underdrainage for reuse in the process plant. Storage of decant water in a separate HDPE lined RWS removes the majority of water from the TSF and subsequently the pressure head required for seepage to occur.

Seepage studies were initially undertaken to optimise the underdrainage design to effectively preclude vertical seepage using the two dimensional computer model, SEEP/W, which simulates pressure heads and water tables (phreatic surfaces) for the TSF. The studies considered a range of scenarios and underdrainage designs. The seepage interception layer installed between the HDPE liners underlying the TSF discharges to a pipeline that enters the RWS. This pipeline has recorded no discharge, hence zero seepage, for the life of the operations to date.

Once tailings deposition ceases, the TSF will be covered (refer to Section 3.13.4.3) thereby preventing any additional water entering the tailings stack and any increase in the hydraulic head.

The primary design measure for the liner and water management system is to achieve the pore pressures in the area of liner at or close to zero to reduce the risk of seepage. PSM conducted additional seepage analysis for the Stage 8 and 9 lifts in SEEP/W (Appendix H) to determine whether this condition could continue to be met.

Tailings pore pressures are governed by inflows relating to discharge of tailings and outflows relating to underdrainage and decant. The analysis results identified that seepage was not modelled to occur using a tailings permeability of 1.0 x 10-5m/s for the deposited tailings and a consolidated permeability of 1.0 x 10-7m/s for the consolidated tailings immediately above the liner, provided the decant pond if controlled to be within 100m of the decant structure. The permeability values used are based on PSM assessments of the TSF and observations of the water reclamation system efficiency over the operating life to date.

To ensure these design assumptions are met, monitoring of pore pressure for Stage 8 and 9 in the form of piezometers is proposed (refer to Section 6.3.2).

Using the pore pressures and tailings permeability data, PSM also calculated drainage of fluids through the tailings stack and into the underdrainage is predicted to continue for a period of 5 to 6 years once discharge is ceased (Appendix H).

Mining One (2019a) conducted particle tracking studies to investigate the potential migration of contaminants of potential concern from the TSF toward offsite receptors if the liner were to be breached. Particle tracking analysis produces lines that follow the direction of groundwater flow from a starting point underneath the liner to a future location and can be useful for identifying potential contaminant

transport pathways, would the liner fail. Five different particle tracking simulations were run based on differing values of porosity and dispersivity.

Particle path lines were simulated starting in 2013 and traveling to the end of the simulation. An effective porosity of one to two orders of magnitude higher than obtained during the calibration of the previous model was used to artificially accelerate the advection velocity: without this the distance travelled by the particles between 2019 and 2023 would not be visible on the model output.

The model identified that while some particles head south towards Dawseley Creek, the majority head towards the pit and some remain generally static. For the majority of the particles, the flow rate was almost nil, and they are stopped in unsaturated elements with no real flow or connectivity to groundwater. As such, even in the unlikely event of a liner breach, the majority of contaminants would then stop or be directed towards the groundwater sink of the open pit (Appendix E).

Although it is unlikely that the liner will fail, in the unlikely event that it did occur, the draining of the tailings upon closure of the TSF would greatly reduce the head pressures and the associated risk of transporting contaminants into the regional groundwater regime, resulting in a limited duration of impact. Additionally, there are no groundwater dependant ecosystems in the vicinity of the site to be impacted (Section 2.8).

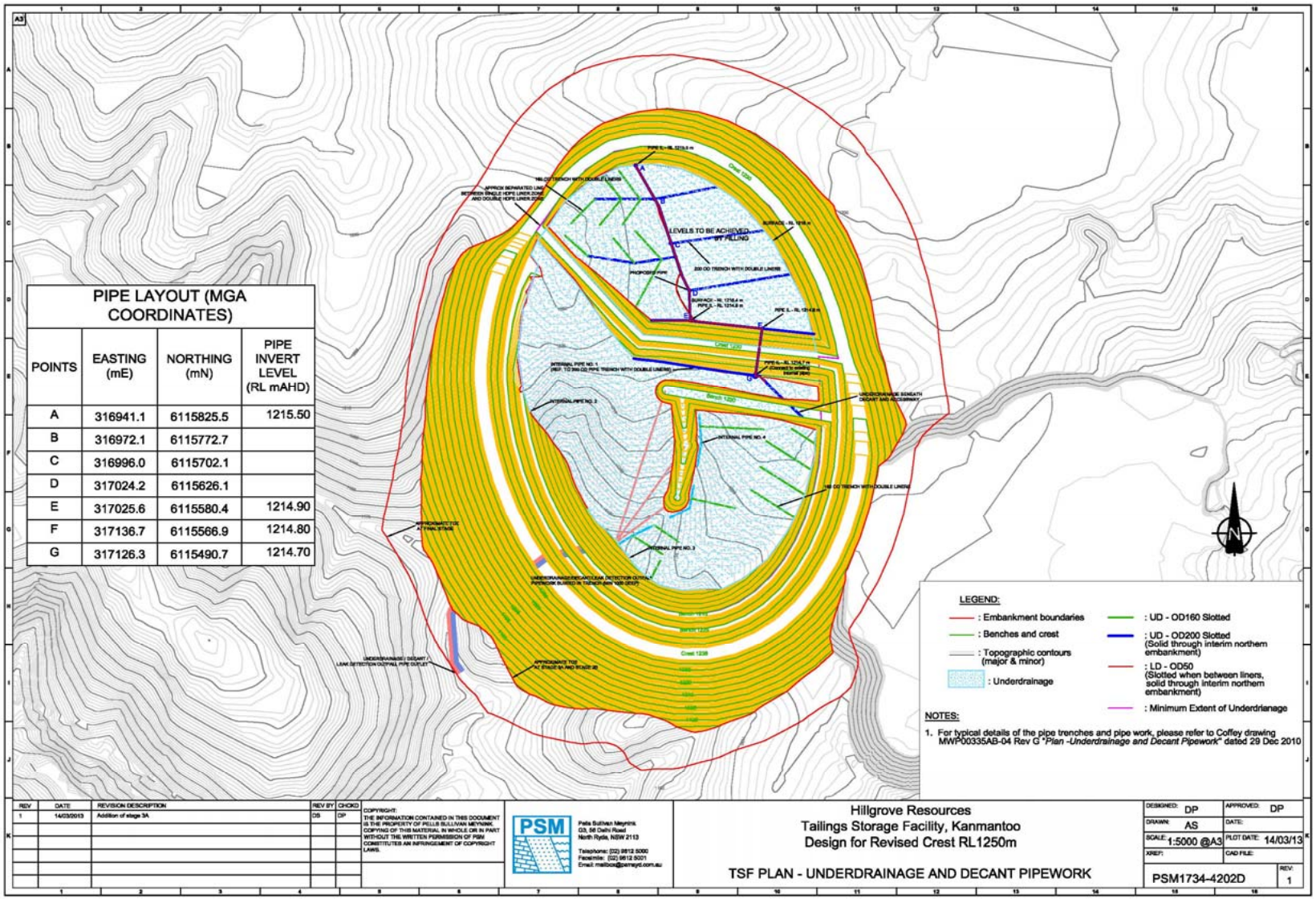


Figure 3-23 - TSF underdrainage and decant pipeline plan

3.7.2.4 Tailings Management

Operational monitoring procedures for the TSF include the following, with further detail is provided in the revised operating manual (Appendix I).

- Inspections each shift of the tailings delivery and discharge lines for leaks or breaks, discharge points for scour or damage to liner and beach consistency, freeboard, perimeter roadways and embankments for cracking, erosion, slumping seepage or any other impacts, exposed liners for splitting, slumping, anchor pull out, wind damage, vehicles or any other impacts.
- Daily inspections to examine decant intake for blockages and correct positioning of collars; underdrainage outfall pipes for blockages, poor water quality, poor water recovery, excessive outflow through the leak detection system and proper containment of the return water storage; and return water storage capacity, integrity of liner and embankments.
- Daily inspections to record the proximity of the surface water pond to the allowable design footprint.
- Continuous monitoring to enable immediate detection of a tailings line failure.
- Weekly measurements of the discharge rates from each drainage line and the leak detection line.
- Monthly surveys conducted by a qualified surveyor to measure the topography of the tailings surface and the extent of the surface water pond.
- Annual inspections conducted by the designer to review operation, safety and environmental aspects. It is anticipated that these routine inspections will coincide with routine inspections as part of construction works until the final stage of the TSF is completed.

3.7.3 Other Processing Wastes

There are no other processing wastes applicable to this operation.

3.7.4 Industrial and Commercial Wastes

3.7.4.1 Solid Waste Systems

During the operation, domestic and industrial wastes such as waste oils, packaging drums and general refuse are generated. Hazardous materials require specific transport, storage, handling and disposal procedures that comply with the relevant legislation, codes and manufacturer's material safety data sheet (MSDS). Only appropriately trained and licensed operators handle explosives, which are stored in secure, licensed magazines away from direct heat and ignition sources. Minimum practical bulk quantities of fuel and other hazardous wastes are ordered and stored in drums and tanks with impervious bunds to contain spillages.

Management measures that are currently implemented in accordance with licence conditions for the various types of solid wastes that are generated are summarised in Table 3-13 and incorporate the standard waste minimisation priorities of avoid, reuse, reduce, recycle, treat and dispose.

Table 3-13 - Solid waste management procedures

Waste Type	Minimise	Reuse/ Recycle	Treatment/ Destruction
Putrescible/ biodegradable litter	Minimise over-ordering.	-	Collect in 200L bins and bulk bins located at designated points around site. Once collected, the drums are taken offsite by a licensed contractor.

Waste Type	Minimise	Reuse/ Recycle	Treatment/ Destruction
Packaging, paper, plastic, recyclable cans, containers, glass	Purchase in bulk.	Separate paper and PET–HPDE, glass, plastic, cans and collect for recycling.	Collect in 200L drums located at designated points, transfer to holding point then send off site for recycling.
Scrap steel	Minimise over-ordering.	Collect for recycling.	Store at designated site and periodically sent off site for recycling.
Tyres	Maintain vehicles and equipment.	Collect for recycling.	Store at workshop and periodically sent off site for recycling.
Hazardous wastes	Minimise over-ordering/ purchase in bulk. Minimise spills.	Where possible return hazardous wastes and packaging to supplier for recycling.	Store in designated areas with periodic collection/disposal by registered contractor (or supplier).

3.7.4.2 Wastewater Systems

All process water on the site is reused until it is lost either to evaporation or locked up in the tailings in the storage facility or concentrate product. Water returned to the process plant from the tailings storage is tested and any acidity present neutralised before being re-used. Because of the losses, the mining operations have a net demand for raw water and there has been, and will continue to be, no need to release process or TSF decant water off site.

Domestic sewage from the offices and site amenities is treated and disposed of in accordance with SA Health requirements.

3.7.5 Care and Maintenance

Refer to Section 3.12.

3.7.6 Rehabilitation Strategies and Timing

Refer to Section 3.13.

3.8 Supporting Surface Infrastructure

3.8.1 Access

3.8.1.1 Site Access and Concentrate Export Route

Site access to the operation for heavy and light vehicles is via a private road between the mine site and the Princes Highway, which bypasses the township of Kanmantoo (Figure 3-1).

Concentrate is transported in trucks along the specially built designated heavy vehicle road to the Princes Highway having passed through a wheel wash prior to leaving site. The road is sealed immediately prior to the turnoff onto the Princes Highway and the mine road junction and vehicles pass over ‘rumble bars’ to minimise the transfer of sediment/mud onto the highway. Vehicles continue east down the Princes Highway, turn south into East Terrace and then on to the South Eastern Freeway interchange. From the interchange along the South Eastern Freeway, the vehicles follow a designated heavy vehicle route (Portrush Road and Grand Junction Road) to the Port of Adelaide.

The route from the Princes Highway and access road junction to the port is designated for B-double vehicles.

3.8.1.2 Traffic and Transport

The type and volume of traffic associated with the underground operation and potential closure traffic is shown in Table 3-14.

Table 3-14 - Estimated daily operation and closure traffic movements

Vehicle type	Operations	Active closure	Post closure monitoring and maintenance
	Typical year	Typical year	Typical year
Light vehicles	100	10	2
B-double trucks	<1	<1	<1
Trucks - including semi-trailers and concentrate trucks	12	1	<1
Oversize loads / low loaders	0	1	0
Total	**120**	**12**	**3**

3.8.2 Ancillary Infrastructure

Ancillary infrastructure located on the mining lease includes:

- Administration facility.
- Site amenities.
- Workshop and stores area.
- Wheel wash.
- Wash-down bay (in the mining area).
- Mine contractor's office, amenities and workshops.
- Explosives magazine.
- Reagents store.
- Fuel storage (in the mining area).

The administration facilities are transportable buildings that provide for the central administrative function of the mine. The offices are located near the processing plant and workshop areas so they can be shared by the different services. The workshop and stores facility accommodate maintenance, mechanical, boiler making, electrical and instrumentation equipment that is required to support mining and processing operations. The existing open pit mining workshop and store will be used by the underground contractor for the duration of mining.

All main site offices are equipped with telephone lines and internet ports. These systems are connected to the telephone system in Adelaide via communications towers and a microwave link.

3.8.3 Public Services and Utilities Used by the Operation

3.8.3.1 Water

Public water sources are discussed in Section 3.6.1. The water that will be used underground is water from the Murray River water line.

3.8.3.2 Power

Electricity is sourced from the state grid through a retail electricity provider. Accessing the state grid required the construction of an overhead transmission line from the existing transmission line spur (near the Neutrog

Plant) to a 132kV substation at the mine site. Power is distributed from the substation at 11kV via an overhead line and terminates at an 11kV switchboard at the processing plant site.

Refer to Section 3.4.2.5 for underground power.

3.8.3.3 Communications

Site communications are via a UHF radio system. Radio transceiver units include fixed base units at administration and workshop buildings, mobile units on light vehicles and mobile plant and hand held units.

3.8.4 Visual Screening

The visual screening conducted on the site includes trees planted along the sides of the access road to block out headlight intrusion of adjacent residents.

The processing plant is located in a hollow so as to not be visible from the freeway.

3.8.5 Fuel and Chemical Storage

3.8.5.1 Fuel

Site fuel usage with the underground operation is anticipated to be approximately 250,000L of diesel fuel per month. This fuel is stored in three bunded tanks located near the mining facilities (two 65,000L and one 30,000L tanks). There is a spill capture area underneath the fuel dispensing area.

3.8.5.2 Reagents and Consumables

The reagents used in the process plant include:

- Quick lime (ph modifier) – quick lime is delivered to site in bulk tankers and pneumatically transferred to a 75t capacity storage silo. It is added to the ore stream on the SAG mill feed conveyor belt to control the pH to the flotation circuit. Up to 1,500tpa of quick lime will be consumed.
- Hydrated lime (pH modifier) – hydrated lime is delivered in 1 tonne bulk bags. It is mixed in a mixing tank and transferred to an agitated storage tank. Hydrated lime is added to the flotation circuit through a ring main pipe and pneumatic valves. Up to 150tpa of hydrated lime will be consumed.
- Aerophine 3418A – solution is delivered to site in liquid form in 1m^3 bulk containers and pumped into a storage tank in the flotation building. From the storage tank, the Aerophine is dosed into the flotation circuit via pumps. Up to 40tpa of Aerophine will be consumed.
- Methyl iso-butyl carbinol (MIBC) (frother) – MIBC is delivered to the site in liquid form in 1 m^3 bulk containers and pumped to a storage tank in the MIBC dosing area. From the storage tank, the MIBC is dosed into the flotation circuit via pumps. Up to 40tpa of MIBC will be consumed.
- Flocculent – flocculent is delivered to site in 25kg bags, made up to a dilute solution (0.25% w/w) and dosed to each thickener by dosing pumps. Up to 50tpa of flocculent will be consumed.
- Sodium Isobutyl Xanthate (collector) – xanthate was previously delivered in bulk bags and mixed in a mixing tank with agitator to produce a 10% w/v solution, which was metered to the flotation circuit when oxide and transition ores were processed. This product is not currently used but a small amount of stock is retained on site for potential future requirements.
- Sodium hydrosulphide (NaHS) (sulphidising agent for oxide ore) – NaHS was previously delivered to site in bulk bags. The solid was mixed to a 35% w/w solution and dosed to the flotation circuit when oxide ores were treated. This product is not currently used but a small amount of stock is retained on site for potential future requirements.

The reagents store facilities are open, well ventilated and located near the reagents mixing area. These facilities comply with the appropriate EPA guidelines on storage and bunding. Material safety data sheets (MSDS) will be kept for all chemicals in the store.

3.8.6 Site Security

The ML area is fenced with a security post at the site main gate. Site Entry Officers and other personnel maintain the security of the site and, in particular, control access to and from the site.

3.8.7 Stormwater, Silt Control and Drainage

The surface water management plan is based on the principle of diverting clean surface water runoff away from disturbed areas, and intercepting runoff from disturbed areas and directing it through sediment control structures prior to discharge to the downstream environment. Hillgrove have implemented the surface water management designs as presented in the Aquaterra reports in Appendix 2C and 2D of the 2016 PEPR.

Potentially contaminated run-off from washdown and/or spills in bunded areas within the process plant and ROM area is collected in the process water storage dam and recycled through the process.

Figure 3-24 shows the main surface water management features constructed on the site. The key features of the surface water management system are as follows.

- A diversion channel to ensure a Dawesley Creek ephemeral tributary is not hindered by the interception of the integrated waste landform. The diversion channel allows water to flow around the toe of the IWL and join with the creek on the southern boundary of the site.
- Diversion bunds at the base of the integrated waste landform to separate sediment runoff from the clean runoff diversion channel. The diversion bund directs clean water around these structures and off-site. Sediment-laden runoff is directed to either the TSF return water storage or to the northern sediment diversion and pond.
- A series of silt traps associated with each individual topsoil stockpile to reduce the sediment load arriving at the larger sediment ponds and at the watercourses.
- Bunding and small scale sediment traps around the ROM stockpile. Overflow is directed to the runoff collection pond. Clean water is directed to the clean run-off collection pond adjacent to the processing plant.
- Drains and culverts along haul roads and access track to direct runoff to a number of small sediment traps.

To protect the downstream environment from potential contamination, oil water separators are included (where required) as close as possible to the potential source of the containment. There are two oil water separators associated with workshop wash down bays. These facilities are regularly inspected as part of workshop inspections and are pumped out as required.

The northeast sediment / evaporation pond (Figure 3-25) is to be constructed for the dual purpose of capturing sediment from the IWL as it stabilises over time as well as capturing and evaporating the surface expression of groundwater as detailed in Section 2.8. This structure will be constructed with a capacity of 66ML to contain the 50ML capacity requirement identified by JBS&G (Appendix C) to capture the surface expression of groundwater, the 17,000m^3 as identified by Landloch for adequate sediment capture (refer to Section 5.2.3.5) and potential stormwater inflows. This structure will be lined with HDPE to avoid seepage of any captured water and engineered with a minimum 0.3m freeboard maintained for high wind and / or storm conditions. The pond has also been engineered to facilitate the gravity collection of the surface expression of groundwater from the areas highlighted below and top of bank to be below the known surface expression level of the groundwater at RL 98m.

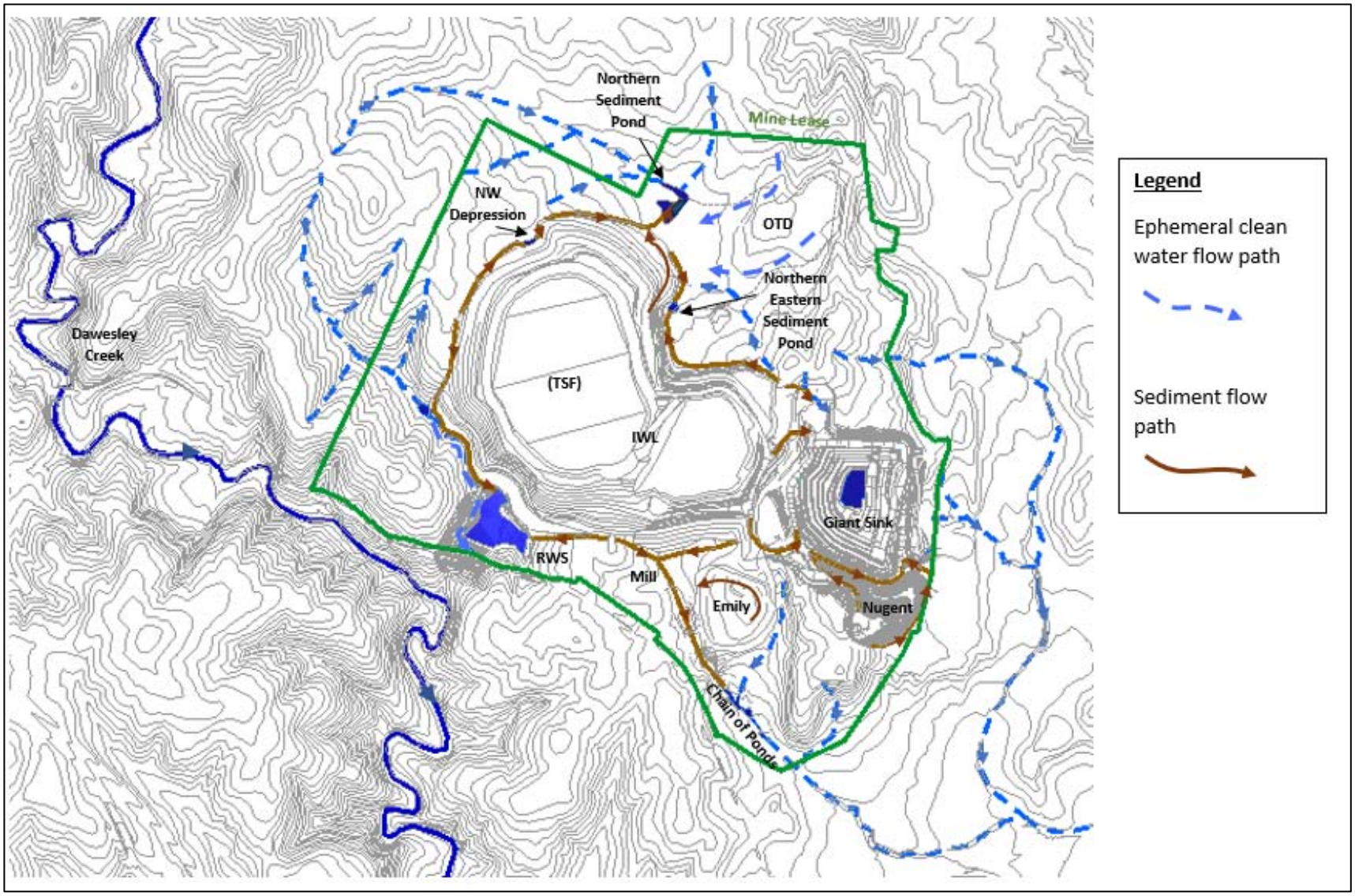


Figure 3-24 – Existing surface water drainage and sediment control

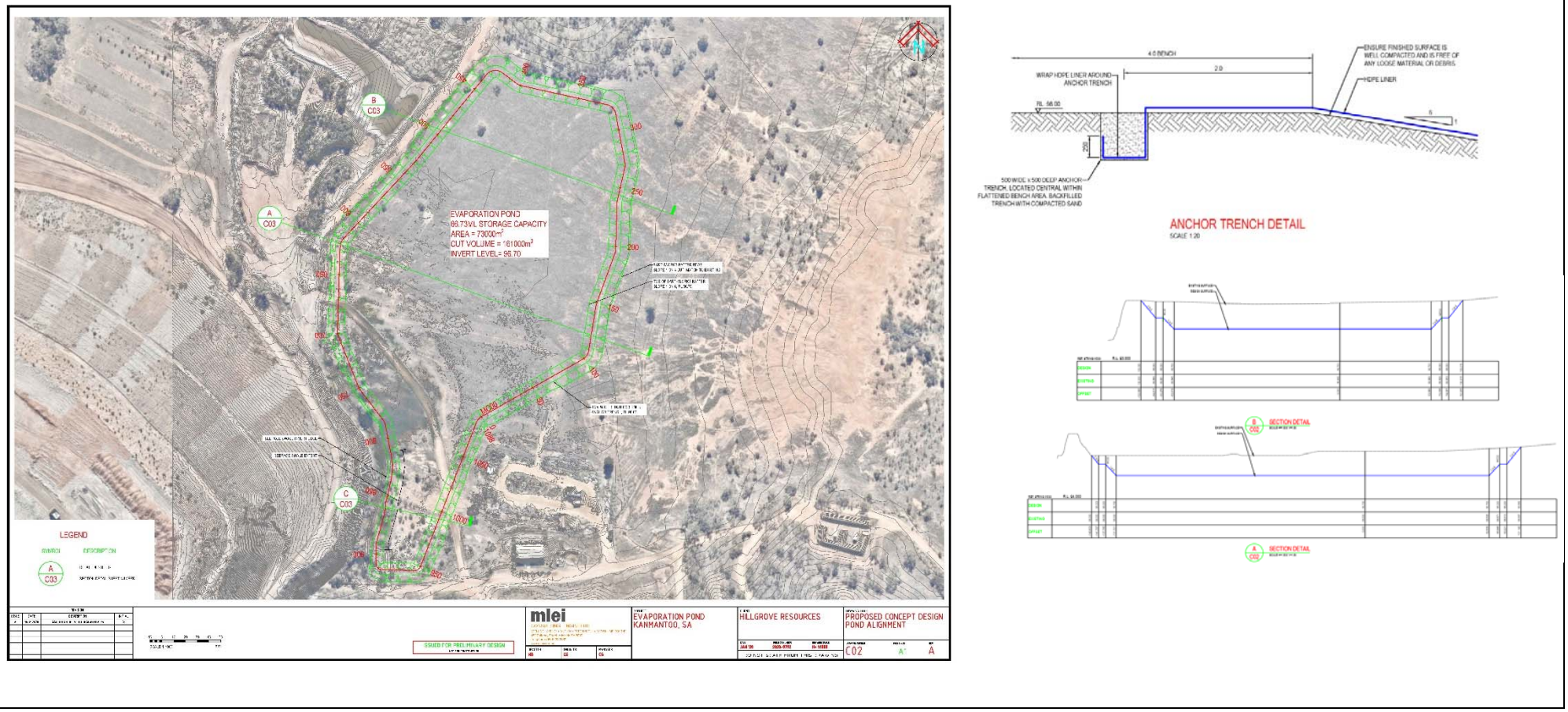


Figure 3-25 – Design details for proposed northeastern sediment / evaporation pond

3.8.8 Care and Maintenance

Refer to Section 3.12.

3.8.9 Rehabilitation Strategies and Timing

Refer to Section 3.13.

3.9 Vegetation Clearance

A total of 30.59ha of native vegetation and 56 native trees have been cleared throughout the life of mine for the operation. The remainder of the area required for the mine was already disturbed from historic mining operations or was introduced pasture land.

Clearing of native vegetation in South Australia is legislated under the *Native Vegetation Act 1991* and requires the provision of a significant environmental benefit (SEB) offset, either in the form of payment into the native vegetation fund or creation of offset vegetation areas to replicate the vegetation that has been cleared.

At the time of the various clearances, Hillgrove produced Native Vegetation Management Plans (NVMPs) which included commitments to meet SEB offsets through recreation of the native vegetation communities cleared. These commitments were made in the following NVMPs:

- The **Original NVMP** (Coffey Environments, 2010) submitted in association with the Hillgrove's first phase of mining operations.
    - Included details of approved native vegetation disturbance and agreed Significant Environmental Benefit – Offset (SEB-offset) obligations for vegetation disturbed by initial mine construction and mining operations.
    - Offsets were to be delivered within the ML on rehabilitated mine landforms or other appropriate areas.

- The **Life of Mine Extension NVMP (LOM NVMP)** (Hillgrove Resources Ltd, 2014). The LOM NVMP appended the Original NVMP and included details of additional disturbance to native vegetation communities for mine expansion, where the disturbed vegetation fell into two broad types;
    - Vegetation communities which had become classified as 'critically endangered' under the EPBC Act required Federal Government approval for disturbance (which was granted as Controlled Action EPBC 2013/6965). The LOM NVMP detailed how and where appropriate SEB-offsets would be delivered for approved disturbance of EPBC Act listed vegetation communities.
    - Vegetation communities not listed as critically endangered by the EPBC Act, where the LOM NVMP detailed suitable SEB-offset provision for the approved disturbance of those communities.
    - In both cases, SEB-offsets for disturbance of EPBC-listed vegetation and non-EPBC-listed vegetation were co-located on Hillgrove-owned land directly adjacent to the ML.
- The **Giant Pit Cutback Addendum to the LOM NVMP** (Hillgrove, 2016a), which included details of approved vegetation disturbance, required for an emergency cut-back of the Giant Pit crest (also referred to as 'Giant' Pit) required for geotechnical stability and worker safety purposes.
    - The cut-back occurred in the northeast corner of the Giant Pit, within a mining area referred to as 'Schultze' and did not involve disturbance of an EPBC-listed vegetation community.
    - A SEB-offset for approved disturbance of the vegetation community associated with the Giant Pit 'Schultze' cutback, was co-located with other offset vegetation on Hillgrove-owned land directly adjacent to the ML.

The Original NVMP was developed with an expectation that a pipeline of additional mine asset developments by Hillgrove would support the progressive establishment of SEB-offsets associated with vegetation disturbance required for the commencement of mining operations, expansion of the historic Giant Pit and construction of Nugent and Emily Star Pits.

As the mine plan progressed, unexpectedly difficult mining conditions associated with the ore body and its related geotechnical issues presented significant, ongoing operational constraints for the mining operations on site. This restricted funds and prevented further mine asset development by Hillgrove during the operational life of the mine. With the restriction of operational cashflow, progressive rehabilitation and SEB-offset establishment programs were not implemented as rapidly as initially planned during the operating life of the mine. Additionally, the lack of development of additional assets reduced the anticipated mine life of the operation which does not provide sufficient time for the establishment of the SEB-offset and EPBC-vegetation offset areas to the maturity likely required to meet the objectives, without a unrealistically long monitoring and maintenance period post-closure of the mine.

With the LOM extension completed and following the conclusion of mining at Kanmantoo in May 2019, even with potential short-mine-life underground extensions, further SEB-offset establishment and long-term support of the SEB-offset maintenance objectives described in the previous Hillgrove NVMPs are now unlikely to be achievable by Hillgrove.

As such, the Mine Closure NVMP, presented in Appendix A, identifies a plan to pay into the native vegetation fund (NVF) to meet SEB offset requirements rather than continuation of on-ground establishment. This is applicable to the non-EPBC Act offset commitments. Amendment to the EPBC offset commitments is subject to further consultation with the Commonwealth government.

Under this revision of the NVMP, Hillgrove will pay $1,688,710.70 to the NVF (pending review of the land value calculation) as payment in full for disturbance of all non-EPBC Act listed vegetation during the Hillgrove mining operations. The payments will be staged to reflect the potential future changes associated with the EPBC offsets that require agreement with the Commonwealth Government.

It is important to note that while areas paid into the fund will no longer be SEB they will remain rehabilitated areas with mixed natives and pasture species.

Consultation with the KCCCC identified a strong community desire to have the funds paid into the NVF to be used in the local area (refer to Section 4.3.3). As such, a NVMP sub-committee of the KCCCC will be established to generate ideas for the Native Vegetation Council (NVC) to consider regarding use of funds paid to the NVF in the local area. This sub-committee will develop project plan(s) within 6 months of PEPR approval for NVF grant consideration. Any application for an NVF grant will be subject to assessment against NVC requirements set out in the Council's policy for SEB.

Further information on vegetation clearance, SEB offsets, work conducted to date and the ongoing maintenance of these areas until lease relinquishment or other responsibility transfer is detailed in the Mine Closure NVMP (Appendix A).

3.10 Resources Inputs

3.10.1 Workforce

The operations workforce has reduced with the cessation of open pit mining. As the mining will be contractor mining, the contractor workforce will increase.

Where possible, employees are recruited in and from South Australia, but additional recruitment from the rest of Australia is at times necessary. Indicative personnel requirements during the underground operations are summarised in Table 3-15.

Table 3-15 – Indicative Underground Operations workforce

Position	Employee Number	Contractors
Administration	20	
Mining technical services (Hillgrove)	12	
Mining Workforce		80
Processing Workforce	50	
Total	**82**	**80**

On closure the workforce will further decrease to the contingent required to implement the closure activities, then decrease further to that required for monitoring and maintenance during the post-closure period to relinquishment.

3.10.2 Energy Sources

3.10.2.1 Consumption and Demand

The average electrical power load during operations is approximately 5.87MW, with the total annual energy consumption approximately 52.1 GWh when the processing plant is operating 24 hours a day, 7 days a week (Table 3-16).

When the processing plant operates on a campaign basis (refer to Section 3.11), the power demand will reduce significantly.

Table 3-16 - Indicative maximum annual power consumption

Component	Installed Power (kW)	Utilisation (%)	Load Factor	Average MWh Consumed (Annually)
Crushing	462	75	0.69	2,558
Milling (excluding SAG mill)	1,389	91.3	0.75	8,358
SAG mill	3,600	91.3	0.69	20,008
Flotation, concentrate handling and tailings pumping	2,120	91.3	0.77	13,107
Concentrate regrind mill	800	91.3	0.89	5,706
Buildings and underground mining services	186	100	0.53	857
Water pumping	304	100	0.58	1,538
Totals	**8,861**			**52,132**

3.10.2.2 Supply Infrastructure

Power supply is detailed in Section 3.8.3.2.

3.10.3 Water Sources

Water sources are identified in Section 3.6.1.

3.11 Hours of Operation

The hours of operation for Kanmantoo Copper Mine for underground mining, ongoing processing and closure activities are as follows.

- Underground mining - will operate on 24 hours a day, 7 days a week basis, using a four panel 7 days on / 7 days off roster.
- Processing - the quantity of ore being processed through the plant from underground operations (up to 2Mtpa) will be lower than previously experienced with the open pit operation. Once stockpile processing has ceased, there will be surplus capacity in the processing plant, hence the plant will be operated on a campaign basis, likely for 10 to 20 days per month for the duration of the underground operation. The processing plant will operate for 24 hours per day when processing ore during these campaigns and will be shut down during periods when ore stocks from the underground mine are being built.
- Closure related activities including progressive rehabilitation - will continue to be conducted on 24 hours a day / 7 days a week basis in campaigns as areas are available.

3.12 Care and maintenance

In the event that the operation should have to be suspended for a period of time, the following activities have been identified as a minimum requirement to maintain equipment in workable form, maintain the site in a safe manned, ensures lease conditions and statutory requirements are still achieved, mine closure strategies are not compromised, and economic extraction of ore can recommence, should the circumstances change.

1. Develop a detailed Care and Maintenance Plan, which at a minimum, covers:
    a. care and maintenance of plant and equipment;
    b. ongoing monitoring and reporting requirements;
    c. demonstration that relevant lease conditions will continue to be met;
    d. identifies statutory and documented commitments related to care and maintenance activities; and
    e. documents resource requirements.
2. Mining care and maintenance
    a. Depending on the duration of the care and maintenance period, one of the following options would be implemented.
        i. All the blasting agents in the bulk storage facilities will be used. The bulk storage facilities will be washed down and cleaned. Other explosives such as detonators and primer will be returned on consignment to the supplier. There will be no explosives stored at site during care and maintenance.
        ii. The existing explosives store would be maintained along with an appropriate level of site security.
    b. Mine dewatering will continue to maintain the integrity of the underground workings. Water will be pumped to the Giant Pit sump.
    c. Giant Pit wall monitoring will continue with regular surveying to detect any wall movement.
    d. Mining equipment will be removed by the mining contractor depending on the anticipated period of care and maintenance.
    e. The primary ventilation system will be tested and maintained under the manufacturers recommended time interval.
3. Processing plant care and maintenance
    a. Reagents held in the reagent storage will be maintained at the current volumes required for care and maintenance. Reagent storages will be maintained in operational condition.

b. Processing plant, inclusive of the crushing and grinding circuit, will be emptied so that no solids remain within the machinery. All mechanical equipment will be greased and sumps pumped out.

c. The care and maintenance plan will include a schedule and checklist for mechanical and electrical checks to ensure all electric motors are tested on a regular basis to ensure the plant remains in a sound mechanical condition.

d. Regular maintenance will be implemented to ensure key processing plant equipment components do not seize up.

e. The immediate areas surrounding the crushing and grinding area and the process plant in general will be cleaned to remove the possibility of fugitive dust emissions due to a build-up of loose material.

f. Any immediate ore stockpiles are minimised and sprayed with a dust inhibitor.

4. TSF care and maintenance

   a. Pumping to maintain freeboard within the return water dam would continue or the underdrainage valves would be closed.

   b. Integrity monitoring of the TSF structure would continue.

   c. Periodic third-party TSF inspections will be implemented as required by ANCOLD.

5. Landform care and maintenance

   a. Rehabilitation will be maintained throughout the care and maintenance period to the extent that there is no detriment to the level of rehabilitation already implemented.

6. General care and maintenance activities

   a. Diesel held in the diesel storage will be reduced to the minimum volume required for care and maintenance, as will workshop hydrocarbon supplies such as hydraulic oil. Storages for diesel will be maintained in operational condition.

   b. The mine access road and critical internal mine roads required for monitoring and care and maintenance activities will be maintained.

   c. The mine site will be completely enclosed with security fencing that restricts access with signage to deter unauthorised entry. There will be 24-hour security for the mine, plant, offices and infrastructure.

   d. Offices will be cleaned and maintained in operable order during the period of the cessation.

   e. Power, water, data and telecommunications infrastructure will be maintained during the period of cessation.

   f. All storm water, silt control and drainage structures in place during the operation will be maintained in good working order. Maintenance activities to include maintenance of drains and catchments, particularly prior to and following storm events.

   g. An emergency response action plan would be developed and in place with clear lines of communication.

   h. Maintain the public complaints line and community consultation on a reduced frequency.

3.13 Mine Completion

3.13.1 Introduction

Open pit mining at Kanmantoo Copper Mine ceased in May 2019. Once underground mining has been completed, unless additional resource is identified, and all processing has been completed, the mine will close. As such, this PEPR document covers mine closure and completion to relinquishment, with the detail presented in this section.

Hillgrove has been implementing progressive closure since 2015 and as such, has been able to trial different rehabilitation techniques and determine appropriate and tested closure techniques.

Mine closure planning has been a continuous process that started prior to project development. The Mine Closure and Completion Plan (MCCP) and the technical requirements of closure have been progressively refined and adapted throughout the life of the mine in light of project experience, further site information that has become available during construction and operations, and changes in regulations, stakeholder expectations, technology, knowledge and mine planning. A key aspect to mine closure is the progressive rehabilitation of the site during operations, which has enabled rehabilitation techniques to be trialled and refined prior to closure.

Hillgrove made a commitment to review and update a MCCP to reflect legislative requirements, various closure commitments made by Hillgrove in PEPR documents and feedback from stakeholder engagement. Given the mine closure and completion works are integrated into the operations, this PEPR now merges the MCCP with this section of the PEPR, hence there is now no standalone MCCP document.

The purpose of this section is to:

- Provide an evolved closure plan that can be further reviewed and updated throughout the remaining project life.
- Identify potential future land uses for the site.
- Provide relevant information upon which stakeholders can provide feedback on.
- Ensure that closure planning (including accountability and resourcing) is incorporated into project development, construction and operations.
- Estimate the costs for implementing closure to enable Hillgrove to provide for mine closure over the life of the mine.

The closure activities and commitments will be reviewed regularly to allow the mining regulator to review Hillgrove's bond so that it can be recalculated to reflect the current level of disturbance and rehabilitation liabilities. Review of the bond is undertaken every year or as otherwise determined by the SA Government Minister responsible for mineral resources and development at that time.

Closure planning and management of rehabilitation activities through operations is the responsibility of the Kanmantoo General Manager. Post-closure, mine decommissioning and rehabilitation activities will also be the responsibility of the Kanmantoo General Manager.

3.13.2 Performance Standards

The design and implementation of the closure activities has considered the relevant aspects of the following codes and best practice guidelines:

- Leading Practice Sustainable Development Management booklet series (Commonwealth Department of Industry, Innovation and Science):
    - Tailings Management (2016) – addresses tailings management through the life of the project (including planning, design, operation and closure of tailings storage facilities).

- Biodiversity Management (2016) – guidelines addressing the broad issue of biodiversity management for mining operations, including environment protection and conservation legislation, flora and fauna and environmental offsets.

- Mine Closure (2016) – guidelines for the closure and completion of mines.

- Mine Rehabilitation (2016) – guidelines and practices for mine rehabilitation.

- Preventing Acid and Metalliferous Drainage (2016) – addresses management issues related to the environmental impacts and remediation of acid and metalliferous drainage in the mining industry.

- Stewardship (2006) – guidelines to encourage the application of stewardship.

- Community engagement and development (2016) – addresses the key issues related to how mining companies interact with people (including community engagement and community development) and offers insights and approaches on the challenges that companies may encounter as they engage with local communities and seek to contribute to their long-term development.

- Guidelines on Dam Safety Management (ANCOLD, 2012) – provides relevant guidelines for the design, construction, operation and rehabilitation of large dams.

- Environmental risk management–Principles and process (HB203:2006) (Standards Australia/Standards New Zealand, 2004) – presents an integrated framework of principles, practices and criteria for implementing best practice in environmental risk management.

- National Environment Protection Measure of Assessment of Site Contamination (NEPC, 1999) – aimed at establishing a nationally consistent approach to site contamination assessment and provides a recommended general process for assessment of site contamination.

- Strategic Framework for Mine Closure (ANZMEC and MCA, 2000) – provides a framework for mine closure in Australia without prescriptive measures. It outlines strategies for stakeholder involvement, planning, financial provisions and closure implementation.

3.13.3 Description of Mine Site at Completion

To determine the appropriate post-closure land use(s) for the ML area, it is necessary to determine the capability of the area to support that use. The site has been divided into a number of primary domains (Figure 3-26), which were assessed for their capability to support the intended post-closure land use (Figure 3-27). The identified proposed land uses for each domain is presented in Table 3-17, with a preference towards land uses which are complementary with each other and to the surrounding existing land uses.

Table 3-17 - Proposed land uses for each domain on closure

Domain	Proposed land use
Open pits	Giant Pit (open pit void with plugged / backfilled underground portal) – pit lake of poor water quality. Backfilled pit areas: modified landform of mixed native and pasture vegetation.
Underground	Underground voids, portal within open pit.
Integrated waste landform (IWL)	Modified landform of mixed native and pasture vegetation

Domain	Proposed land use
Infrastructure	Industrial Park (Should the Industrial Park not be realised, the area will be rehabilitated to mixed native and pasture vegetation)
Surface water structures	Those structures not required for an Industrial Park will progressively become filled with silt. In time, they will revegetate with mixed native and pasture vegetation through natural recruitment
Native woodland	Native woodland habitat
Native grassland	Native grassland habitat
Introduced pasture	Unchanged retained as introduced pasture
Enhanced vegetation areas	Unchanged – enhanced vegetation areas Note – these are areas that have been converted from introduced pasture through planting of native species
Old tailings dam	Unchanged – remains as old tailings dam with incident vegetation cover
ElectraNet Infrastructure	The ElectraNet power substation is located near the main entrance to the ML. It supplies the power requirements of the MLs processing plant and support infrastructure. This substation is the property of ElectraNet and they hold full management responsibility. The substation may continue to be required if the infrastructure domain is retained as an industrial park and will remain the responsibility of ElectraNet. If the substation is no longer required, removal and any remediation and rehabilitation will be the responsibility of ElectraNet. Hillgrove has no current or future responsibility for management of this area.
Other disturbed areas	Mixed native and pasture vegetation

The base case for closure of the Kanmantoo Copper Mine ML area is a mixture of remnant native vegetation and rehabilitation consisting of natives and pasture species, similar to the surrounding lands, with the infrastructure domain retained as an Industrial Park (see Section 3.13.4.4).

Rezoning activities are currently underway for the Industrial Park and should this option be realised, some of the infrastructure and services may remain and be transferred to third parties for use within the Industrial Park (see Section 3.13.4.4).

There is also the potential for a pumped hydro-electricity scheme (PHES) to be implemented on the northern portion of the ML. In the event the PHES is implemented, a number of the above domains would be partially impacted (Figure 3-26). This PEPR details the closure assuming PHES does not go ahead. Should the PHES be implemented, the closure applicable to the PHES area is presented in the Partial Lease Relinquishment Plan (Appendix J) and all non-PHES areas remain subject to the requirements detailed within the PEPR.

Table 3-18– Kanmantoo Copper Mine PHES closure domains

Domain	Description of domain in potential PHES partial lease relinquishment area
Open pits	Completely incorporates • Giant Pit: open pit void • Matthew and Valentine cutbacks: partially backfilled with waste rock.
Underground	Underground voids, portal within Giant Pit.
Integrated waste landform	Incorporates the bottom toe of the northern batter (approximately 6ha)
Infrastructure	The infrastructure areas in the Partial lease relinquishment area are: • Seed production area (SPA) • Magazine (nitrogen shed) • Laydown area • Monitoring sites: redundant air quality monitor, vibration monitor, groundwater bore KMB020
Surface water structures	Completely encapsulates the northern sediment pond
Native woodland	Remnant native woodland
Enhanced vegetation areas	Unchanged – enhanced vegetation areas Note – these are areas that have been converted from introduced pasture through planting of native species
Introduced pasture	Remnant introduced pasture.
Old tailings dam	Completely included in the Partial lease relinquishment area
Other disturbed areas	A number of pre-HGO unsealed tracks exist in the Partial lease relinquishment area. There are also a number of topsoil stockpiles within the Partial lease relinquishment area adjacent to the IWL.

A full description of each domain is presented in the following sections.

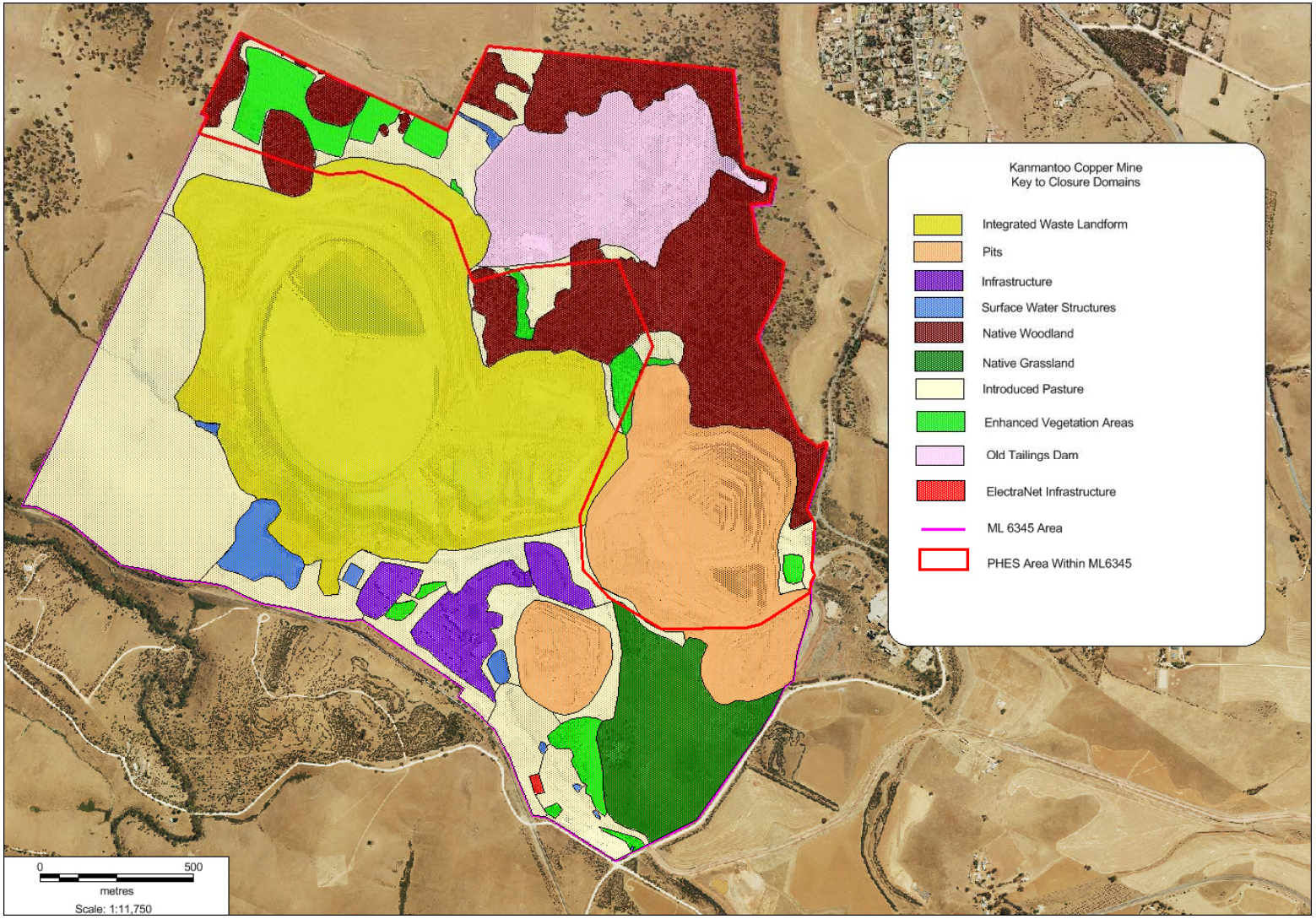


Figure 3-26 – Closure domains

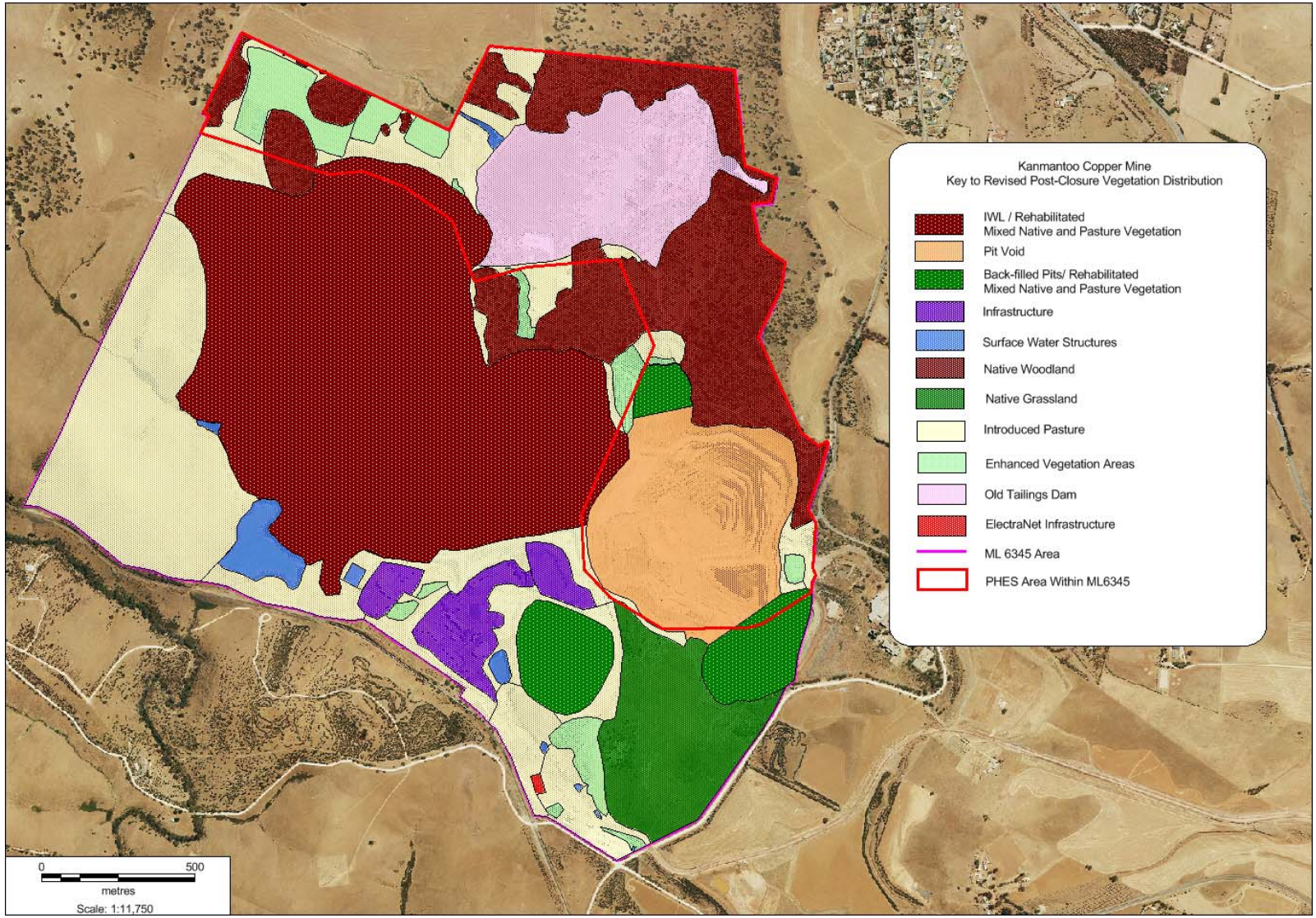


Figure 3-27 – Post-closure land use (base case)

3.13.4 Description of Closure by Domain

3.13.4.1 Open pit workings

Until now, the project has been mined through open pit methods, resulting in a Giant Pit, which has two ore zones, namely the Main Zone and O'Neil/Nugent Zone, and Emily Star pit which has been developed as a satellite pit to the south of Giant Pit.

Giant Pit

Giant Pit, also known as 'Main Pit', is an enlargement of the historic 1970's open-cut pit, including a northern slot-extension known as Matthew, the O'Neil/Nugent Zone to the south east of the primary pit area and further defined specific work areas known as Valentine, Falcon, Spitfire Schultze and Kavanagh.

The Giant Pit is approximately 840m long and 650m wide at the surface, a maximum 363m deep and has slope parameters as detailed in Table 3-19.

Table 3-19 – Giant Pit slope parameters

Parameter	North Wall	East Wall	South Wall	West Wall
Batter Angle (°)	50, 90	50, 90	50, 60, 73	50, 73, 60
Berm Width (m)	10-18	10	8-11.5	11.5 -15
Batter Height (m)	24-36	12-36	12-36	20, 36
Inter-ramp angles (°)	64-70	70-84	54-58	55-59
Overall slope angle (°)	60	52	42-44	45-55

Note:
- batter angles vary from upper to lower levels (upper, lower) or (upper, middle, lower) due to variable weathering and rock types; and
- berm widths and batter heights vary due to rock types and interactions between various cutbacks.

The bulk of the Giant Pit will remain as a permanent void in the landscape, with the primary post-closure risks being public safety and protection of groundwater. The O'Neil/Nugent zone and the northwestern Matthew cut back part of the Giant Pit are backfilled to the extent that is technically feasible.

The Matthew backfill is located above the predicted inundation level of the pit lake in perpetuity.

As identified in Section 3.4.2, a portion of the waste rock from the underground operations will also be placed in the bottom of Giant Pit.

Abandonment Bund

An abandonment bund, or other suitable alternative, will be constructed around the pit to prevent inadvertent public access. This will be located 10 m beyond the zone of potential pit wall failure in accordance with the WA Department of Industry and Resources Guidelines (1997). The bund location has been amended to use previously disturbed land (e.g., haul roads and access tracks) where possible (refer to Figure 3-28 and Figure 3-29). The proposed bund construction method is a combination of reinforcing existing earth windrows with an un-weathered NAF-rock shell and construction of new sections of bund with end dumped, un-weathered, free draining NAF rock.

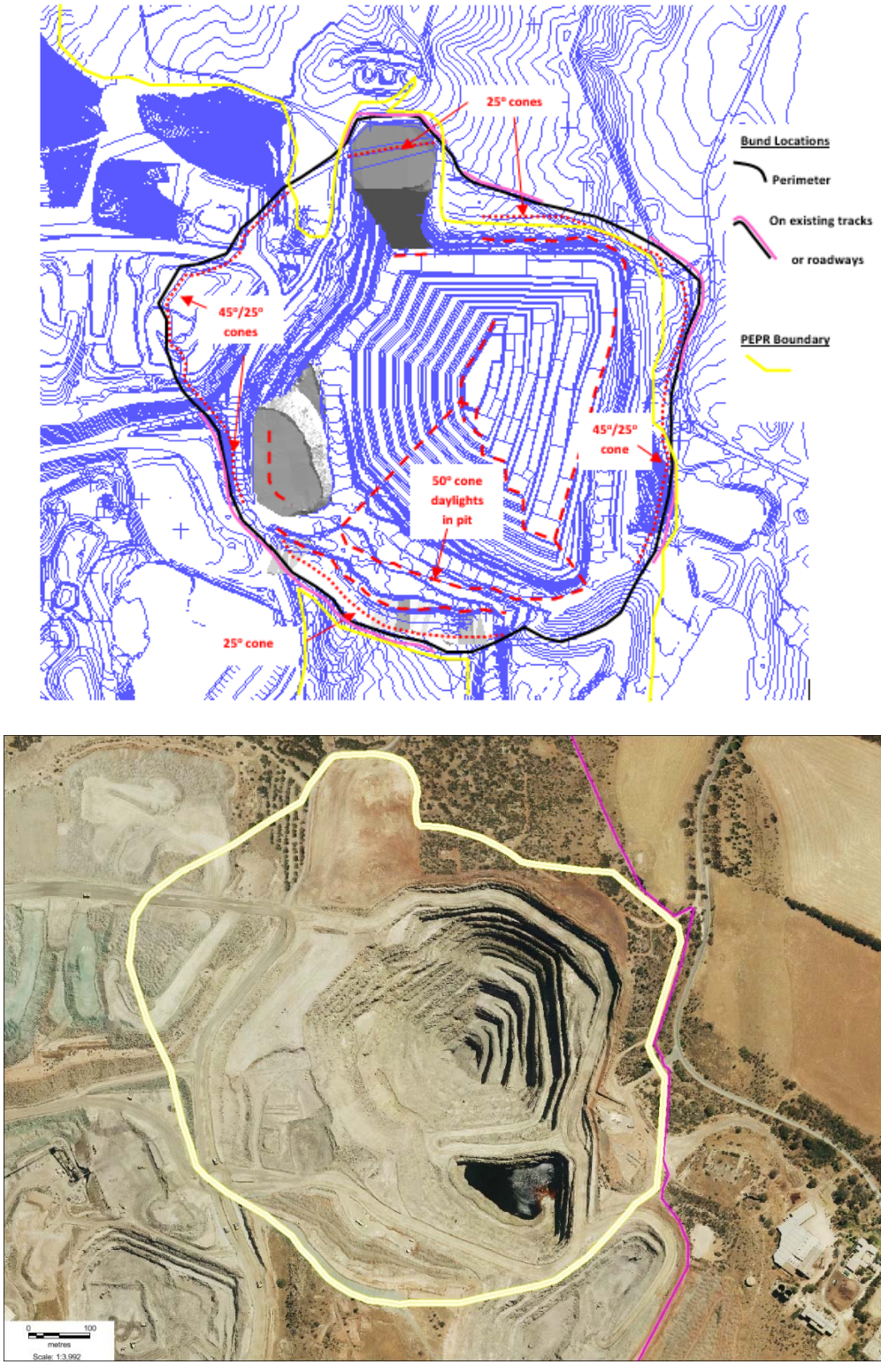


Figure 3-28 – Giant Pit abandonment bund location[2]

[2] Hillgrove Resources (2017) Kanmantoo Mine Giant Pit Abandonment Bund Report July 2017

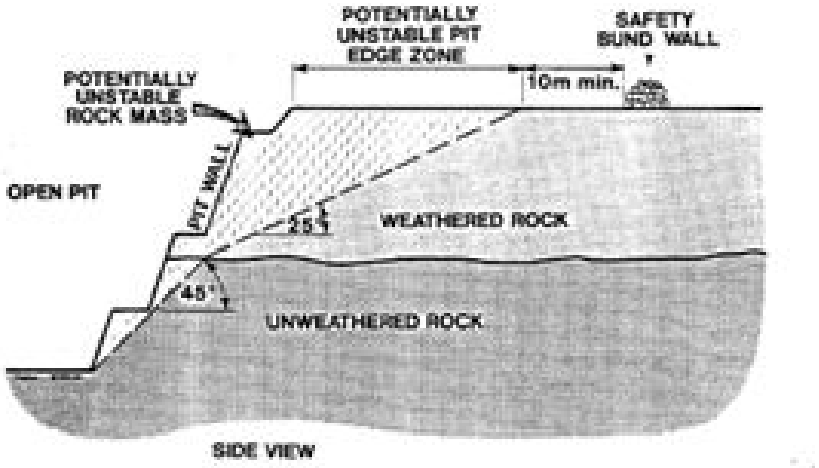


Figure 3-29 – Theoretical placement of abandonment bund as determined by pit conditions (after WA Guidelines, 1997)

The resultant final structure will be difficult for a reasonable person to traverse and will prevent a vehicle or motorcycle from crossing the bund. It will have a minimum height of 2m and a minimum base width of 5m.

The full bund report is in Appendix K and provides the dimensions and construction for the bund.

Pit Lake

On the cessation of mining and dewatering activities, Giant Pit will gradually fill with water from the surrounding fractured rock aquifer, with extremely slow ingress of groundwater into the open pit, evidenced by open pit dewatering rates of less than 0.06m^3/day during operations. The recovery rate of pit water pond levels will reduce as groundwater inflows reduce (due to reduced head of water above the pit water pond level).

Assessment by REM Consultancy in 2007 indicated that groundwater levels will not recover fully to pre-mining levels. Modelling indicated that the water levels are expected to stabilise at about 15m to 50m below the surrounding baseline water table and that the open pit will act as a groundwater sink in perpetuity, as it currently does, due to the slow inflow of groundwater and the high evaporation rate from the pit lake. Groundwater inflows from the southern and eastern site boundaries will continue to be captured in the pit.

Pit lake water quality in the Giant Pit was predicted to be of poor quality, similar to that of the pre-Hillgrove pit water quality, i.e., acidic, elevated cadmium, cobalt, copper, zinc, lead, nickel and manganese (Mining One, 2019a).

This water will be contained within the pit as the water level will be below surrounding groundwater levels and the pit will continue to act as a groundwater sink.

Further groundwater modelling by Mining One (Mining One, 2019a), conducted as part of the proposed PHES assessments, confirmed the REM modelling, i.e., the Giant Pit void is currently and will remain a permanent groundwater sink in which evaporative losses will exceed rainfall and groundwater inflows. In the long-term steady state period after mine closure, groundwater inflows will be sustained by slow regional recharge.

Additional modelling was conducted by Mining One to consider the potential impact on the pit lake of the underground void (Mining One 2019a Appendix E). This assessment identified:

- the pit lake will still remain a perpetual groundwater sink; and
- the pit lake is predicted to stabilise at a level of 895.6m RL (60m depth) within 50 years and remains at this level for the remainder of the 250 year modelled period.

Pit lake modelling was first commenced in 2007 by REM Consulting and was based on the existing water quality of the historic pit lake. Revision of the two-dimensional water model was conducted in 2014, calibrated against dewatering and groundwater quality and level monitoring data. This modelling was then further enhanced by the current Mining One three-dimensional groundwater model, further calibrated with site monitoring data. As such, the level of confidence in the pit lake quality and quantity modelling is high.

Mining One (2019a) also modelled the pit lake should 4GL of RWS water be pumped to the open pit during the first five years of closure, as a result of drainage from the TSF. In this scenario, the pit lake rises to 929m RL (93m depth) and stabilises at this level for the remainder of the 250 year modelled period.

In both cases, the water quality of the pit lake is predicted to be poor and exceed groundwater management objective (GMO) values in the Groundwater Management and Monitoring Plan (GMMP)[3]. Parameters predicted to exceed the groundwater management objective values in the GMMP include copper, iron, manganese, nickel, aluminium, cadmium, cobalt, copper, iron, mercury, nickel, zinc, nitrogen, phosphorous and pH. This predicted water quality is consistent with the quality of the historic pit lake existing prior to Hillgrove mining operations, which was acidic with high metal concentrations.

The interaction of the pit lake with the small volume of waste rock from the underground operation that will be placed at the base of Giant Pit and the additional exposure of groundwater to the PAF material in the underground void may result in a minor change to the chemistry of the in-pit water, however it is not assessed to result in a material quality change from that already predicted from the open pit. Additionally, as the pit lake is predicted to be a perpetual groundwater sink under prevailing climatic conditions, is not predicted to affect the surrounding groundwater. Similarly, the addition of RWS water, should it be required, will not significantly degrade the already poor water quality of the pit lake.

Nugent / O'Neil Backfill Rehabilitation

Progressive rehabilitation of the backfilled Nugent/O'Neil zone has been completed (Figure 3-30) and involved the following activities.

- The backfilled pit has been shaped to allow for settlement.
- Application of a NAF cover layer with an average thickness of 2m.
- Application of a minimum of 150mm of topsoil over the NAF layer, before being deep-ripped parallel to the batter contours.
- Hydroseeded with a native seed mix similar to that presented in Section 3.13.6.2.

The end land use for the backfilled Nugent pit is a modified landform of native and pasture vegetation.

[3] The GMO values are based on the adoption of the (former, now superseded) SA Environment Protection (Water Quality) Policy 2003 water quality criteria for freshwater aquatic ecosystems or existing baseline values, whichever was higher. With the exception of the GMO for nickel, the adopted GMOs are based on baseline conditions (i.e. values are higher than the freshwater ecosystem criteria).

Figure 3-30 - Backfilled Nugent pit during hydroseeding (light green areas) May 2018

Emily Star Backfill Rehabilitation

The Emily Star Pit has been mined and progressively backfilled to surface level with PAF waste rock from Giant Pit cutbacks and shaped to allow for settlement.

Rehabilitation of the backfilled Emily Star pit has been commenced through application of a NAF cover with an average thickness of 2m. A layer of red-brown clay subsoil was then deposited over the backfilled pit surface as a visible interface marker, before a low-grade ore stockpile was constructed over the backfilled pit. The remainder of the pit surface was used as the open pit mining go-line and employee crib facilities, through to the end of open-pit mining operations in Q2 2019.

Once the ore has been removed to the level of the interface marker layer, the rehabilitation process will follow the same sequence as described for Nugent Pit.

3.13.4.2 Underground workings

At the completion of underground mining, the underground portals will be coarse filled to 10m from the entry. The primary access portal will be at or below the long term sink water level. Should ventilation entry be a portal it would be closed in a similar manner, should it be a vertical shaft, it will be closed with a concrete cap.

Egress into the pit will be blocked and bunded as a further protectant as per Section 3.13.4.1.

The underground voids will slowly fill with water from the surrounding groundwater and once the water is past the portal level, it will continue to fill the Giant Pit void as detailed in Section 3.13.4.1.

3.13.4.3 IWL

The integrated waste landform constitutes the most significant closure feature within the Kanmantoo Copper Mine's landscape. It is the largest area of disturbance requiring rehabilitation and encompasses a total area of approximately 130ha, comprising 44 ha for the TSF and 86ha for the waste rock storage (which includes the TSF batters).

The primary completion outcome for the integrated waste landform is to ensure that the final landform is physically and chemically stable. In addition, its ecosystem and landscape function should be resilient, self-sustaining and comparable to surrounding area and the IWL's post-closure visual amenity should be at least consistent with the pre-2010 baseline.

The existing IWL batter angles and those expected if the TSF were to be closed without Stage 8 and 9 lifts are identified in Figure 3-31. The proposed TSF Stage 8 and 9 lifts involve creating a very shallow saddle profile towards the resultant top surface reaching RL1274m (Figure 3-32). This profile has been and will continue to be constructed using the following method (Figure 3-33):

1. constructing upstream waste rock embankments and spigoting tailings from a circumferential main rings,

2. once final height is achieved, forming the final profile by spigotting from the northern and southern ends progressing towards the decant, and

3. dozing in the rock embankments from the eastern and western sides post-final tailings deposition.

By forming the landform in this method rather than doming, the central decant pond will remain until tailings deposition is completed. If the previously considered doming scenario was to be undertaken, a central discharge system would be required and the pond would need to be moved outwards outside the double liner extent or extensive and expensive mass movement of tailings would be required to form a dome, once the beach fully dried.

The final TSF surface will be covered by the store and release cover. Incident rainfall is anticipated to not result in overland flow as a result of the store and evaporative release of incident rainfall in the store and release cover (refer to following sections on store and release cover design) placed over the entire landform.

In the unlikely event surface flows are generated, the top surface will be profiled to ensure any excess rainfall flows slowly, ultimately to the centre of the top surface where it will be stored and released in the store and release cover (PSM, 2019 – Appendix H). Crest bunds will also be constructed to avoid shedding of concentrated surface water flows over the embankments which could exacerbate erosion. In the unlikely event that incident rainfall results in surface water flows on the batters, any runoff that is not captured by the store and release cover system will flow to the sediment ponds placed at strategic locations around the toe of the landform (refer to Figure 3-24). These structures have been sized for stormwater flows and sediment capture in the long term (refer to Section 5.2.3.5).

This runoff control system which relies predominately on the store and release cover which has been designed for and proven effective in site conditions, will remain post closure for long term surface water management.

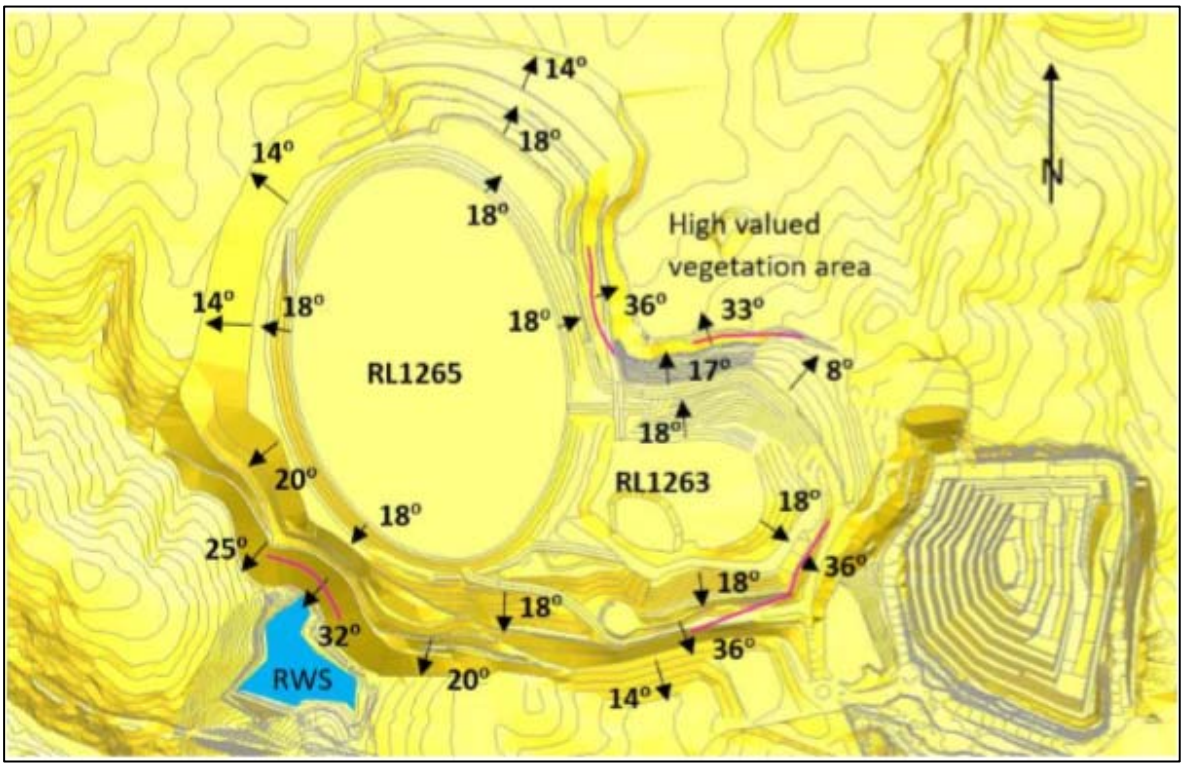


Figure 3-31 – Existing IWL batter angles

Geochemical Stability

Initial geochemical assessment of the waste rock and tailings identified the potential for both to be PAF. The presence of PAF material in the IWL construction and TSF required a detailed, engineered cover system on the IWL, specifically designed to manage long-term ARD risk. Prevention of ARD is achieved on Hillgrove's IWL by ensuring that reactive PAF material has limited exposure to water and oxygen (refer to Figure 3-18). This prevents the oxidative reactions which characterise ARD formation and inhibits the formation of ARD on the IWL.

Surface water and groundwater monitoring conducted to date has not identified any seepage from the TSF (refer to Sections 2.7 and 2.8 respectively) and the PSM assessment of seepage potential (refer to Section 3.7.2.3) does not anticipate any occurring over the life of the facility.

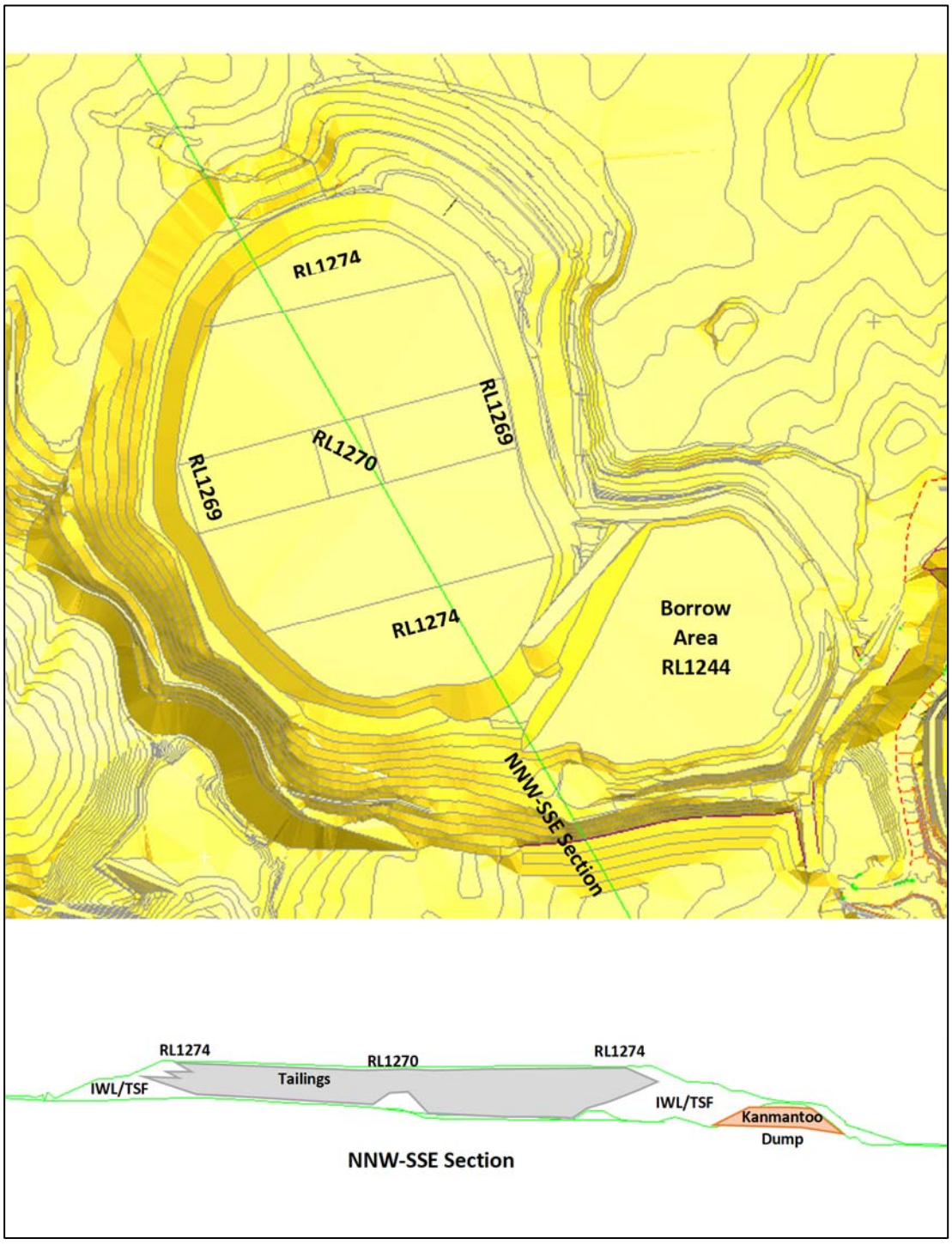


Figure 3-32 – IWL 'saddle' closure landform topography

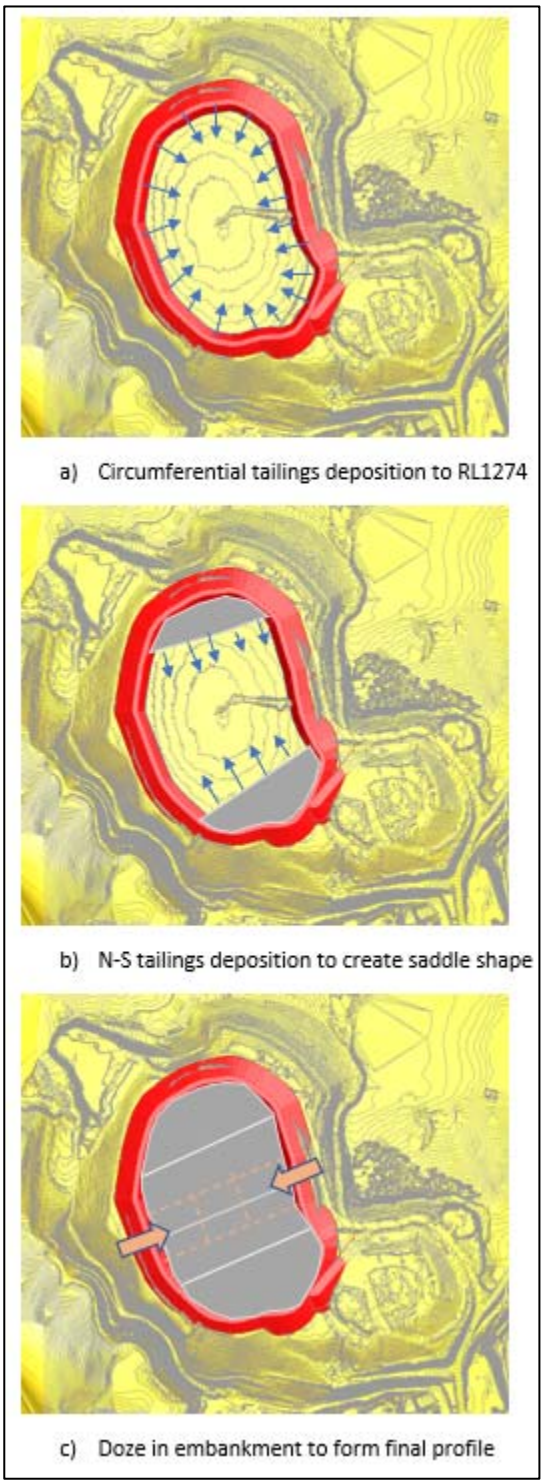


Figure 3-33 – Creation of closure surface topography for TSF

Physical Stability

Landform stability of the TSF was assessed by PSM with results presented in Section 3.7.2.2. The assessment considered earthquake loading and liquefaction potential.

All FoS were identified to meet ANCOLD (2012) requirements with the exception of Section 3 southwest. This area has been steepened to accommodate the RWS. Further desktop assessment of

this area identified a strong influence of 3D effects and an expected 3D FoS of 1.64. While this stability is expected to continue post-closure in the long term, PSM suggest further analysis to confirm this prior to closure (refer to Section 6.2). A peer review by Professor David Williams, University of Queensland, of the stability assessment (Appendix D) concluded: *Overall, the downstream and upstream slopes of TSF upstream Stages 8 and 9 are considered to have adequate geotechnical stability.* (Section 2.1.3 Appendix D), *as supported by:*

- *The initially low geotechnical stability of the upstream slopes is of little consequence, since any slips would be surficial and limited to the PAF waste rock.*
- *A very conservative friction angle of 38° was selected by PSM for the PAF waste rock. A more likely value would be about 43°, which would increase the FoS by up to 20% for the portion of the slip surface passing through the PAF waste rock.*

The geotechnical stability of the upstream slopes would improve markedly as tailings are deposited against them, raising the FoS values to well above the minimum values suggested by ANCOLD (2012).

With respect to potential liquefaction:

The tailings are not expected to be susceptible to earthquake-induced or static liquefaction, as supported by:

- *PSM assessed the risk of liquefaction of the tailings as LOW.*
- *Under operating conditions, the tailings underlying the upstream raises are well-drained, and the PGA is below the typical threshold for liquefaction of about 0.13g; hence earthquake-induced liquefaction would not be expected.*
- *Static liquefaction is also unlikely, since the upper 10 m depth of the tailings underlying the upstream Stages 8 and 9 are unsaturated.*
- *The maximum earthquake-induced settlement estimated by PSM of about 180 mm or a minor 0.2% of the maximum embankment height of 91 m for no liquefaction of the tailings, and 700 mm, or 0.8%, assuming liquefaction of the upper 30 m depth of tailings, which is considered unlikely. In neither case is there a potential for loss of tailings.*
- *Post-closure, the tailings are expected to drain down further and hence would not be expected to liquefy under the MCE (*Section 2.1.3 Appendix D).

Erosional stability of the IWL relates to the cover materials and is addressed in Section 5.2.3.3 and below as part of the cover design assessment.

Drainage

PSM (2019, Appendix H) have, using the pore pressures and tailings permeability data, calculated drainage of fluids through the tailings stack and into the underdrainage is likely to continue for a period of 5 to 6 years once discharge is ceased (refer to Section 3.7.2.3). As such, the underdrainage system will remain open for this period of time, with the underdrainage directed to the RWS for evaporation and pumping from the RWS to the open pit as required to maintain a minimum freeboard of 0.5m. Provided the maximum stagnant water in the return water dam is maintained at less than 60,000m^3 (note that the RWS has a total capacity in the order of 125,000m^3) this volume is sufficient to contain a 72 hr, 1:100 AEP storm event.

Cover Design

The IWL cover design is based on a store and release cover concept, developed with input from Ward Wilson of USEL, which has been included in PEPR documentation for the site since 2010.

The suitability of a store and release cover for the site was assessed against the primary factors which govern the success of a store and release cover, namely:

- quantity and distribution of annual precipitation and potential evaporation;
- soil properties of site specific cover (NAF) material with respect to hydraulic conductivity and soil water retention or storage characteristic (Ksat and the Soil Water Characteristic Curves);
- cover thickness (and availability of suitable material for that thickness);
- establishment of permanent vegetation; and
- erosion and stability control to ensure long term sustainability (based on the Landloch modelling discussed above).

The assessment identified the suitability of a store and release cover for the IWL. Table 3-20 provides a summary of the assessment of these aspects, with further detail provided in the following sections and in Appendix L.

Table 3-20 – Store and Release Cover Suitability Assessment Summary

Variable	Store and Release Cover requirements	Design implication at Kanmantoo
Evaporation and precipitation	The store and release cover approach is considered suitable if the quantity of annual potential evaporation exceeds precipitation by a factor of two.	The evaporation to precipitation ratio at Kanmantoo is 3.4:1 (1450mm evaporation potential / 424mm precipitation) (refer to Section 2.2). Design implication: a store and release cover system is suitable at Kanmantoo.
Soil properties	Store and release cover systems rely on the water retaining capacity of the soil within the root zone of the cover to retain infiltration for a sufficient period of time such that the excess soil moisture can be taken up and returned to the atmosphere through the process of evapotranspiration.	The NAF waste rock material at Kanmantoo has suitable hydraulic conductivity for the construction of store and release cover systems when placed in an uncompacted state. The NAF has a wide range in soil suction between the air entry value and the residual water content, which indicates a high capacity to store and release moisture over an extended range of suction corresponding to wet and dry conditions (refer to Appendix A of Appendix L). Design implication: a store and release cover system is suitable at Kanmantoo.
Cover thickness	The cover thickness is required to be greater than the active wetting front to ensure water does not interact with PAF material or erode to a depth that would expose PAF material	Net infiltration is predicted to be negligible for poorly vegetated NAF cover even under very high rain fall conditions. Initial modelling showed that the active wetting front is restricted to the top 0.5m from surface. Design implication: a store and release cover needs to be at least 0.5m before accounting for the wetting front as well as erosion and stability.

Variable	Store and Release Cover requirements	Design implication at Kanmantoo
Establishment of permanent vegetation	Vegetation increases evapo-transpiration, reducing net infiltration and the active wetting front. It also assists in erosion control. The key aspects of vegetation are sustainability over the longer term and evapotranspiration capability.	Trials on the IWL demonstrate that cover can be established in the NAF material with a regolith of topsoil. Design implication: the IWL cover surface requires vegetation that is self-sustaining and survives climatic variation. This can be achieved via native vegetation and suitable introduced species proven to grow on the landform initially through rehabilitation trials and now broad application (refer to revegetation section below and Section 3.13.6).
Erosion and stability	The landform is subject to erosion, settlement and stability over time, which needs to be accounted for in the design to ensure that cover thickness maintains adequate cover.	Landloch erosion modelling is detailed in (Appendix B of Appendix L) and in the section below and is summarised as: • Steep slopes (> 20°); worst case scenario of 0.1m of erosion and 0.3m of additional thickness is required to account for long term rilling; and • Flat slopes (≤ 20°); worst case scenario of 0.01m of erosion, while rilling is only expected on steeper slopes. Design implication: • Steep slopes (> 20°) – adding the 0.01m of erosion and 0.3m required to mitigate long term rilling with the 0.5m for the required active wetting front, the minimum cover thickness requirement is 0.9m. • Flat slopes (≤ 20°) - adding the 0.1m of erosion with the 0.5m for the required active wetting front, the minimum cover thickness requirement is 0.6m.

Combining all of the information from the various assessments has resulted in the cover design parameters being determined, as provided in Table 3-21 and depicted in Figure 3-34. Summaries of the individual assessments are presented in the following sections and detailed in the Cover Design Summary Report presented in Appendix L.

Table 3-21 – IWL Store and Release Cover Parameters

Slopes	NAF store and release cover thickness	Assessed factor of safety in maintaining 0.5m thickness required	Requirements for Cover
0° (flat) to 20°	1m	2.2	• Design depth: 1m of NAF + 0.1m of topsoil = 1.1m • Minimum cover for wetting front: 0.5m • Uncompacted 1m thick layer (tipped and then dozer spread). • A high proportion of fine material >30%. • The majority of the material should have an average block size of < 0.5m • The occasional large block is acceptable if surrounded by fines.

Slopes	NAF store and release cover thickness	Assessed factor of safety in maintaining 0.5m thickness required	Requirements for Cover
> 20°	2m	2.3	• Design depth: 2m of NAF + 0.1m of topsoil = 2.1m • Minimum cover for wetting front: 0.5m • A high proportion of fine material >30%. • The majority of the material should have an average block size of < 0.5m • The occasional large block is acceptable if surrounded by fines.

Soil Properties

The University of Queensland and Landloch conducted a number of materials characterisation tests on the NAF material and determined the following.

The following characteristics of the bulk sample material were derived from the testing.

- pH of the materials is slightly alkaline to circum-neutral and are within the range typically suitable for plant growth.
- Salinity of the topsoil is low to highly saline, and of the NAF waste moderate.
- Structural decline potential, based on Exchangeable Sodium Percentage (ESP), magnesium concentrations, salinity and physical characterisation (i.e., percentage of fine sand, silt and clay), identified topsoil is prone to structural decline however NAF has a low potential for structural decline.
- NAF cover material particle size showed approximately 20% to 40% passing the 75µm sieve, which makes this soil an ideal candidate for a store and release cover. The high fines content offers excellent moisture retention capacity while the well graded texture provides resistance to erosion.
- The hydraulic conductivity (Ksat) of the sampled loose material was measured to be 1.0×10^{-6}m/sec while the compact sample was measured to be 7.8×10^{-7}m/sec.

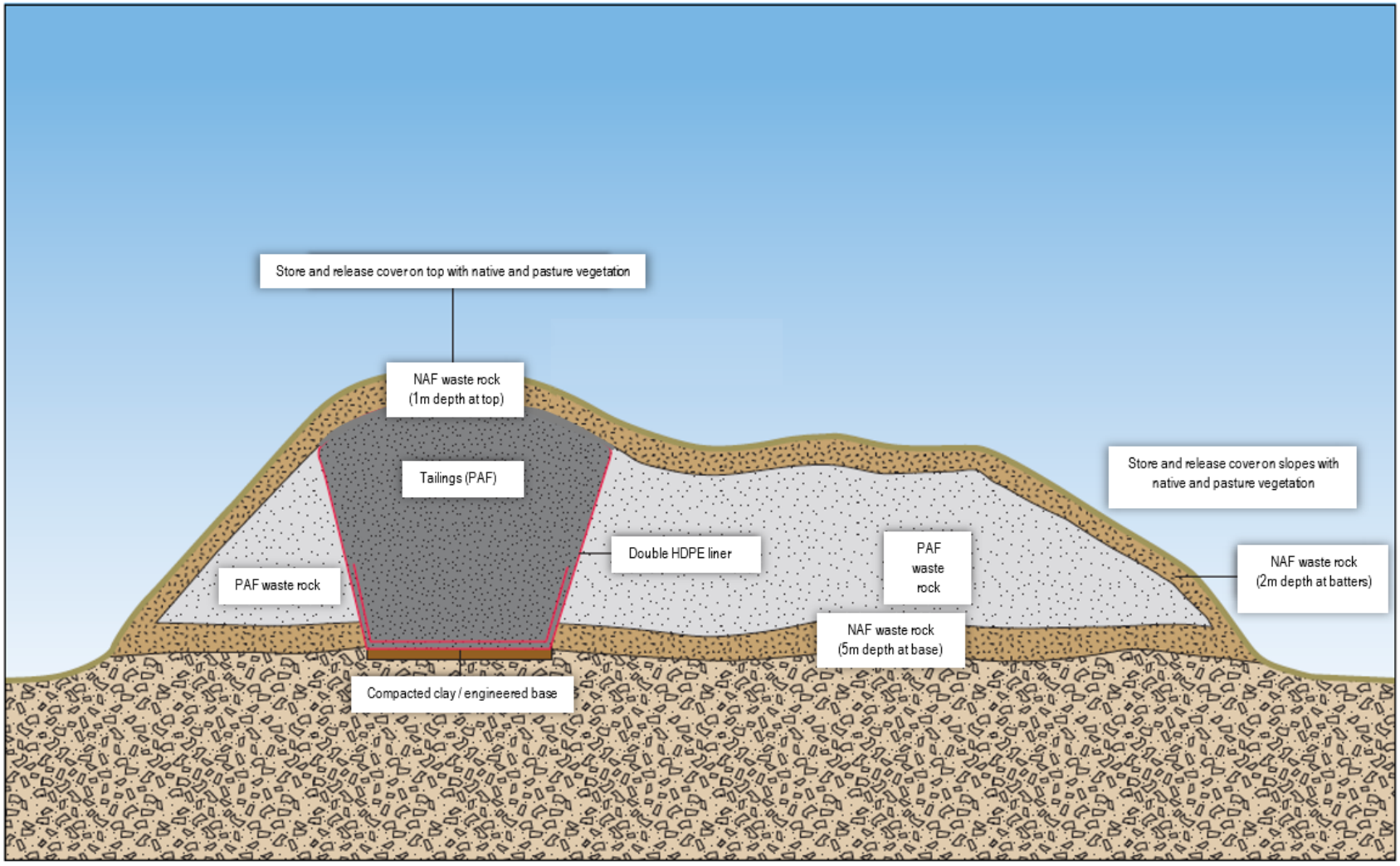


Figure 3-34 – IWL cover design

Cover Thickness

Numerical modelling software SoilCover was used to determine the thickness required for the NAF material at the site to act as an effective cover system. The modelling was conducted using a range of scenarios, including no and poor surface vegetation on the cover, varying rainfall, and varying surface water runoff.

Further soil water characteristic curve (SWCC) modelling was conducted in 2019, using results from laboratory testing conducted at the University of Queensland on eight samples of the NAF material being used for the store and release cover (included as Appendix A of the Cover Design Summary Report (Appendix L)). The modelling was conducted on two scenarios (Figure 3-35).

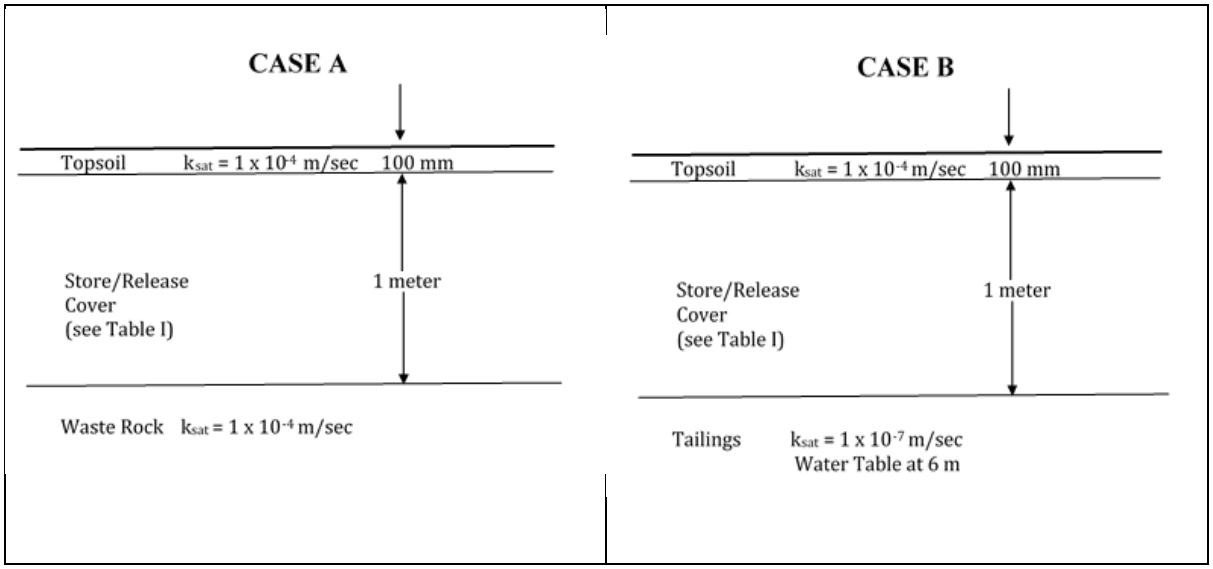


Figure 3-35 – SoilCover modelling scenarios

The results of this modelling, which also incorporated poor to no vegetation scenarios and a higher (580mm/y rainfall and 1187mm/y evaporation) and lower (437mm/y rainfall and 1435mm/y evaporation) climate scenario, identified the following:

- Changing the SWCC and increasing or decreasing the Ksat value does not significantly change the computed flux at the base of the cover. The flux calculated at the base of the cover are extremely low and can be consider equal to zero as they are well below the accuracy of the SoilCover model (i.e. less than 25mm/y).

- The cover directly over top tailings (Case B) shows a small base of cover flux equal to 22.4mm/y for a non-vegetated cover. This flux reduced to 4.4 mm/y with poor vegetation on the surface of the cover.

- A wetting front was observed to develop in the upper half of the cover profiles on Day 101, followed by rapid drying on Days 201and 301. The simulations also show the covers to continue to lose water until Day 365, which illustrates the strong drying capacity of the semi-arid climate at the site, even with the initial content established at a high moisture content.

- Regardless of the climatic regime applied, the 1m thick store and release cover continues to provide very low fluxes at the base of the cover, even in the case of non-vegetated cover.

In summary, the SoilCover model results indicated net infiltration rates at the base of the 1m thick store and release cover profile that can be considered equivalent to zero (i.e. below the accuracy of the numerical model and less than a compacted clay or a HDPE liner) for a range of material properties, vegetation covers and climate conditions.

Vegetation

SoilCover modelling was completed for both no and poor surface vegetation on the cover scenarios. The scenarios with vegetation cover, even poor vegetation cover, resulted in reduced net infiltration, approaching zero. Vegetation cover is also beneficial to stabilising landforms and reducing erosion. Hillgrove has conducted vegetation trials on the northern slope of the IWL using different growth media, i.e., NAF only, topsoil and 'weedy' topsoil'. Through these trials, Hillgrove determined the optimal revegetation procedures which are detailed in Section 3.13.6.

A peer review by Professor David Williams from the University of Queensland, of the SoilCover modelling (Appendix D) concluded:

A store and release cover for the IWL is appropriate for the climatic setting of Kanmantoo, and the design implemented has been demonstrated to limit the net percolation of rainfall into the underlying PAF waste rock, as supported by:

- *The choice of a store and release cover for the IWL was based on recommendations in the GARD Guide (2009), which relates annual rainfall to the potential evapotranspiration to rainfall ratio.*
- *Underlying the IWL is a 5m thick base layer of NAF waste rock, which will serve to pass any uncontaminated surface flows beneath the IWL.*
- *To limit oxygen ingress into the PAF waste rock, a thick encapsulation of PAF waste rock was dozed and compacted against the sides of the IWL.*
- *NAF waste rock was dozed over the sides of the IWL to form a 2 m thick store and release layer, with a nominal slope of 20o over the upper half of the slope, and 14o over the lower half of the slope, with a 100 mm thickness of topsoil added and ripped, prior to revegetation.*
- *The final top of the IWL will be relatively flat, on which a 1 m thickness of loose NAF waste rock will be placed, and 100 mm of topsoil will be added and ripped, prior to revegetation.*
- *Hillgrove Resources reported on soil moisture, climate and water quality monitoring, obtained from the four monitoring stations located up a sloping section of the IWL. Revegetation had established to decreasing degrees from the Bottom monitoring station up the slope. The monitoring has covered two winters and one summer, during which time the Top-Slope, Mid-Slope and Bottom monitoring stations show the majority of the moisture variation within the upper 0.5 m of the 2 m deep store and release cover, as expected from the preliminary SoilCover modelling, indicating the effective removal of rainfall infiltration via evapotranspiration. The Top-Cap monitoring station showed preferred pathway flow due to a sinkhole through the topsoil, which has since been filled.*
- *USEL reported the results of SoilCover simulations of the performance of the store and release cover, which showed extremely low (unvegetated) to negative (vegetated) infiltrated moisture at a depth of 1 m within a store and release NAF waste rock layer, due to cycling of moisture mainly within the upper 0.5 m depth.*

Erosion

Hillgrove commissioned Landloch to assess the long term erosional stability of the IWL based on the final design to RL1274m (Landloch 2019 report provided as Appendix B of the Cover Design Summary Report (Appendix L)).

Method

The erosion modelling was conducted on the cover parameters that have been applied and will continue to be applied in accordance with the design presented in Section 3.13.4.3. As identified in Section 3.13.4.3, for the store and release cover to remain effective, a minimum of 0.5m NAF material must remain in place over the long term.

Landloch assessed the following two surface cover types that comprise the outer layer of the IWL:

1. A 1:5 mixture of topsoil to NAF waste rock representing 1-part soil to 5-parts rock ripped to a depth of 0.5m. This will be applied to the majority of the IWL, where slope gradients are <20° (~82% of the landform); and

2. A thin layer of topsoil (0.1m) spread over the NAF waste rock. This will be applied where slope gradients are >20° (~18% of the landform).

Characteristics such as erodibility, dispersion and particle size distribution of the material were derived from testing of a bulk sample from the IWL. The specific inputs based on the actual site material obtained for use in the subsequent WEPP modelling were:

- simulated rain and measurement of runoff rate and sediment loads in runoff to obtain estimates interrill erodibility (K_i) and hydraulic conductivity (K_e);

- concentrated surface water flows and measurement of flow characteristics and sediment loads to obtain estimates of rill erodibility (K_r) and rill initiation (T_c); and

- settling columns to obtain estimates of settling velocity that in turn was used in the model to describe sediment particle size and density distributions.

The WEPP model simulates runoff and erosion using a daily time step. A 100 year synthetic climatic sequence was applied to the WEPP model, created using available data from the weather stations at Kanmantoo (#23724) and Lenswood (#23801).

The WEPP model was used to predict the erosion over a period of 300 years and to produce the inputs for the SIBERIA landform evolution model. SIBERIA modelling was then used to provide visualisations of erosion and deposition patterns of the cover material of the IWL landform over the same 300 year period.

Vegetation cover was also assumed based on the existing levels of cover in the various areas of the IWL that have been progressively rehabilitated, including areas of just NAF and areas of NAF and topsoil application. Areas with both topsoil and NAF and topsoil alone applied have evidence of vegetation establishment. As there are significant differences in the level of vegetation cover, a conservative, lower end vegetation contact cover of 30% was adopted for both WEPP and SIBERIA simulations.

Erosion Targets

Erosion targets were established for the landform based on the requirement for ongoing effectiveness of the store and release cover as well as establishing an ‘acceptable’ level of erosion that will prevent the generation of significant rill erosion. These targets are:

1. Minimum of 0.5m thickness of NAF cover

    a. That is, gully depths that are less than 0.5m on <20° slopes with 1m NAF applied and less than 1.5m on >20° slopes with 2m NAF applied.

    b. For effective operation of the store and release cover in the long term based on the cover design in Section 3.13.4.3; and

2. 5t/ha/yr erosion

a. Based on the experience of Landloch of landforms exhibiting a low tendency to rill.

Landform Evolution Modelling Results

Results for the simulations with 1:5 topsoil:NAF mix applied to slopes <20° and topsoil applied to slopes >20° with 30% vegetation contact cover are presented in Table 3-22 and illustrated in Figure 3-36 and Figure 3-37.

Table 3-22 - Summary of SIBERIA simulations of the IWL with topsoil:NAF applied to slopes <20° and topsoil applied to slopes >20° with 30% vegetation cover

Simulation Year	Average gully depth (m)	Average gully length (m)	Average erosion (t/ha/y)	Average erosion (mm/y)	Cumulative erosion (mm)
Topsoil : NAF mix on slopes <20°					
50	-	-	0.88	0.06	2.9
100	-	-	0.54	0.04	4.7
200	-	-	0.37	0.02	7.2
300	-	-	0.31	0.02	9.3
0.1m (100mm) topsoil cover on slopes >20°					
50	-	-	21.8	1.45	52
100	-	-	13.7	0.91	80
200	-	-	0.37	0.02	102
300	-	-	0.31	0.02	104

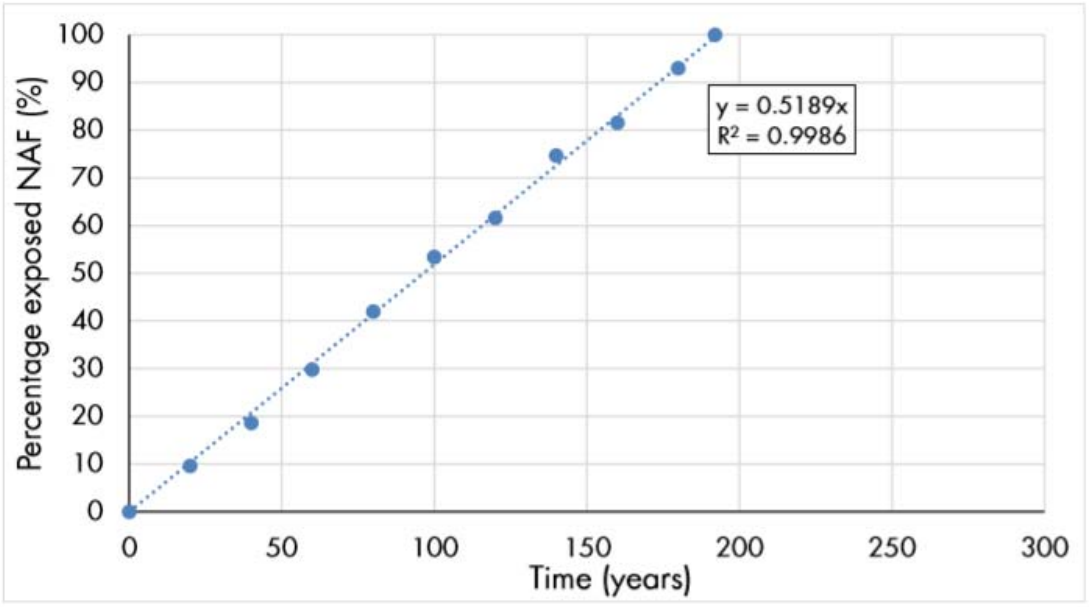


Figure 3-36 - Percentage of exposed NAF as the 0.1m topsoil cover is eroded from slopes >20°

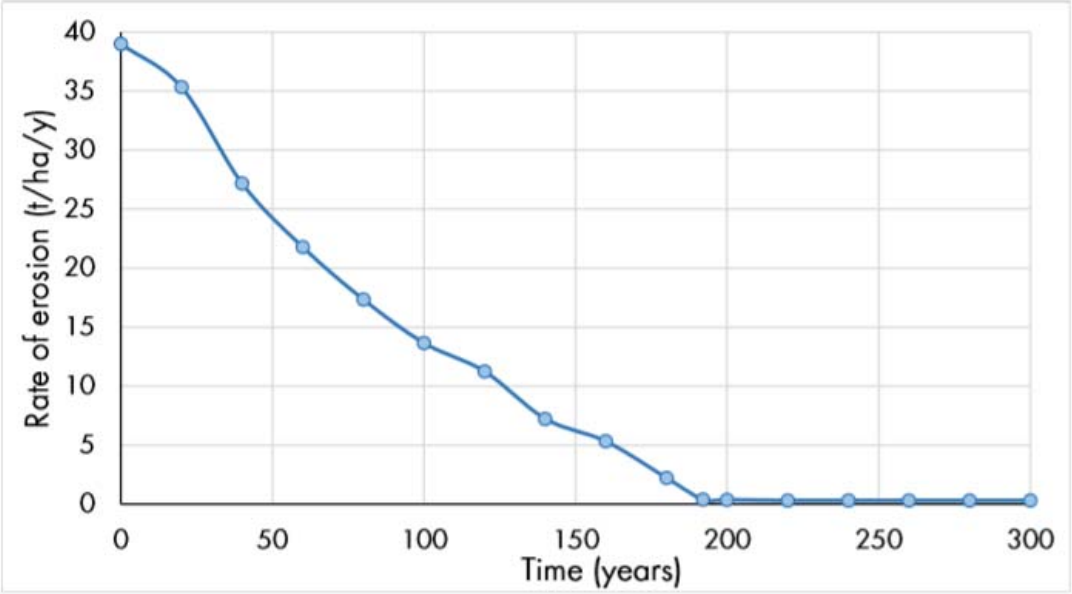


Figure 3-37 - Rate of erosion in t/ha/y of the steeper slopes >20° as the underlying NAF is exposed

The results indicate that the overall IWL will erode at very low rates for the 300-year simulation. Erosion on the >20° slopes (with a 0.1m topsoil cover applied) are initially high due to the erodible nature of the topsoil. Over time, the 0.1m cover is eroded, exposing the underlying NAF. As the NAF is more erosionally stable, the rate of erosion dramatically decreases and by year 192, the majority of the 0.1m topsoil cover has been removed, with the underlying NAF eroding at very low rates.

Although the 0.1m topsoil cover on the steep slopes is predicted to be mostly removed by year 192, the underlying NAF will remain stable and erosion is not predicted to exceed 1.5m at any point on the landform after 300 years with 30% vegetation cover. It must also be noted that in practise, not all topsoil will be eroded. There will likely be pockets where topsoil will move into the voids of the underlying NAF or be trapped by vegetation on the surface.

With respect to erosional rate, the topsoil:NAF mix is predicted to erode below the acceptable threshold levels (<5t/ha/y) when applied to slopes <20°. The 0.1m topsoil cover on slopes >20° will initially erode at rates above the acceptable threshold level however the continuation of the higher erosion rates in the longer term (>year 192) will be slowed significantly by exposure of the underlying NAF waste rock that is very erosion resistant. As a result, no gullying is predicted to occur on these slopes in the long term.

No gully erosion is predicted to occur on any point on the landform. Small rills are predicted to form but remain <0.3m deep after 300-years of simulation. Across the entire landform, erosion is not predicted to reach more than 0.5m at any point in time.

Results also indicate that the topsoil:NAF mix will erode within acceptable threshold levels without vegetation cover and that vegetation cover in excess of 60% on the topsoil only areas would decrease the rate of erosion to within threshold levels. Vegetation cover currently present on the IWL varies between 30-90%, indicating that there is a high potential to establish vegetation on these materials. As such, it is likely that vegetation will establish and provide protection against erosion in the long term.

As such, at no point on the IWL will the 0.5m of NAF be eroded hence the effectiveness of the store and release cover will be maintained.

While the erosion modelling results do not indicate the need, Landloch has suggested a small crestal rilling bund be installed along the perimeter of the top IWL surface on closure to prevent rill erosion from overflow from the top surface down the IWL slopes.

A peer review by Professor David Williams, University of Queensland, of the erosion modelling (Appendix D) concluded:

Site observations, and WEPP and SIBERIA modelling, demonstrated that the store and release cover will be stable against erosion for over 300 years, as supported by:

- *Landloch described the NAF waste rock exposed on angle of repose slopes as generally blocky and erosion resistant, with the likelihood that any fines will have washed in or off the slope. It has no to some capacity to support grass.*
- *Topsoil, ripped to bring some NAF waste rock to the surface, can be used on the IWL, possibly amended with gypsum to reduce potential clay dispersion.*
- *It will be critical to retain runoff on the top of the rehabilitated IWL, since the discharge of concentrated flows from the top of waste landforms onto the outer batter slopes is a very common cause of gullying and landform failure. This can be controlled by crest bunding.*
- *Rip lines on the side slopes of the IWL should be no deeper than 300 mm from peak to trough to concentrated flow and rilling.*
- *Predictions from WEPP modelling with no or 30% revegetation on the topsoil:NAF mixture, both of which are conservative assumptions, that the IWL will remain erosionally stable, with erosion rates of < 1 t/ha/year on average after 300 years of simulation.*
- *Predictions from SIBERIA modelling of the two cover scenarios on the IWL with 30% revegetation cover on the topsoil:NAF mixture that erosion will not exceed 0.5 m deep at any point on the IWL after 300 years, well within the cover thicknesses of 1 m on shallower slopes (< 20o, comprising approximately 82% of the IWL surface), and 2 m on steeper slopes (> 20o, comprising approximately 18% of the IWL surface).*
- *No gully erosion is predicted to occur on any point of the IWL.*
- *The three sediment containment structures proposed to be in place at closure: the RWS dam, the Northern sediment pond and the North-eastern sediment pond (proposed, but not yet constructed), are considered to provide ample storage capacity for the expected sediment off the IWL over 300 years.*

Cover Effectiveness and Performance Monitoring

To assess and confirm the efficacy of the store and release cover progressively being constructed on the IWL, Hillgrove has established soil moisture monitoring, consisting of four monitoring stations on the rehabilitated section of the northern portion of the IWL. The four monitoring stations are located in sequence from the bottom of the northern batter to the top cover over tailings as illustrated in Figure 3-38. The four monitoring stations contain an identical suite of monitoring sensors, while the mid-slope station also contains meteorological instruments including a rain gauge, thermometer and relative humidity sensor (refer to Figure 3-39).

The volumetric change in water content recorded at each sensor depth provides a tangible, quantifiable indication of how much water has reached that sensor depth, i.e., the depth to which a wetting front is present. Similarly, if no wetting front is identified at the next sensor below a sensor registering a change in soil moisture, it can be assumed that the wetting front stopped infiltrating at some point between the two sensor depths.

General Location of Soil Moisture Monitoring Sites

Location Detail and Soil Moisture Monitoring Site Nomenclature

Bottom station

Mid-slope station

Top-slope station

Top-cap station

Figure 3-38 – IWL soil moisture monitoring system

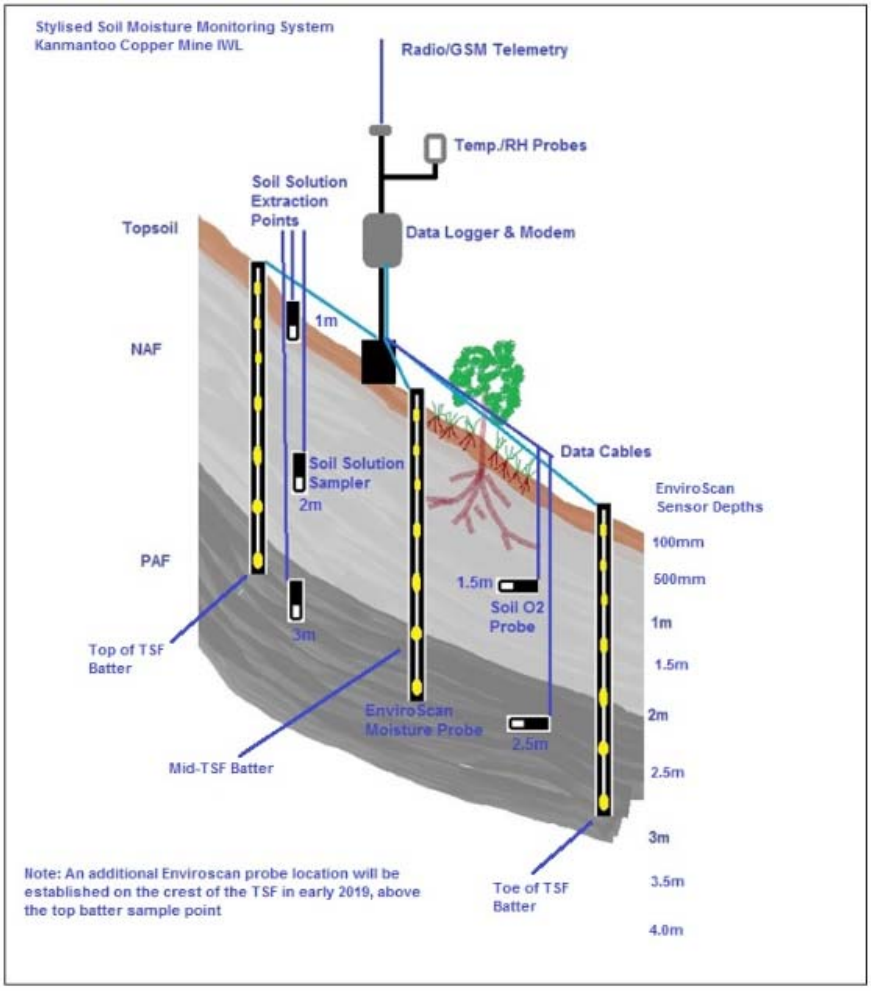


Figure 3-39 – IWL soil moisture monitoring station

Conversely, decreasing soil moisture recorded at sensor depths indicates that water is being released from that portion of the soil profile, through capillary wicking and surface evaporation supplemented by root uptake and evapotranspiration from the vegetation cover.

Oxygen sensors have also been co-installed to detect any air movement and gaseous exchange in porous media as well as rainfall, temperature and humidity sensors to reflect changes over time in respect to groundcover.

Sensors at each monitoring station area located at the following depths:

- 10cm, 30cm, 50cm and 80cm for 1m array (i.e., each sensor provides an estimate of the soil moisture content at the centre of 10cm layer (or 'slice') of the soil profile that is 1m x 1m in size) and
- 10cm, 50cm, 100cm, 150cm, 200cm, 250cm, 300cm, 350cm and 400cm for the 4m array.

Monitoring has been conducted since April 2019 for the 1m array sensors, while data for the 4m arrays extends back to January 2018 for the bottom three monitoring locations. The 'top cap' monitoring location was installed in April 2019.

Vegetation cover has established to varying extents at each of the monitoring stations, relative to when the specific areas were rehabilitated. The bottom station and mid-slope stations have been

rehabilitated and seeded and the ground surface is covered in vegetation, while the top station has intermittent vegetation cover, being revegetated two years after the bottom two locations. The top cap station has yet to be revegetated and is bare (Figure 3-38).

The monitoring has covered two winters and one summer to date. During this time, the top-slope, mid-slope and bottom monitoring stations show the majority of the moisture variation within the upper 500mm of the 2m thick store and release cover. This confirms the effective removal of rainfall infiltration via evapotranspiration as was expected.

The upper top cap station is still settling in and is awaiting completion of the fully surrounding rehabilitation work, having only a small square completed around the station.

Peer review of the cover monitoring system (Appendix D) identified the current cover monitoring system, as installed and operated, adequately monitors the wetting and drying front depths into the cover and validates its operating efficiency. Further, the adequacy of the number of monitoring sites was assessed. The number of monitoring sites are considered representative of the IWL in that they are located to represent the different aspects of the landform; i.e., the toe (bottom slope), mid-slope, upper slope (being steeper than the lower slope area) and the top cap (i.e., top surface) area. The data from these monitoring locations are robust and representative to date. This monitoring then provides a relevant analogue for the material types and cover system placed across the entirety of the IWL. These monitoring locations are placed on the portion of the IWL that was covered first, hence providing the longest possible dataset for cover monitoring. As such, these four sites are considered sufficient for verification of the IWL cover efficiency (Appendix D).

Cover quality control

The quality assurance measures adopted for the construction of the IWL and cover are as follows.

- Surveys of underlying NAF base thickness
  - The top of the minimum 5m thick NAF base layers under the TSF embankments and outer PAF dumps waste are surveyed and as-built files created.
- Surveys of PAF compaction layer thicknesses
  - As the 2m layers are constructed the surveyors create as-built survey files.
- PAF and NAF layer cover thickness conformance
  - Initially a survey and trench inspection system was used to assess the NAF cover thickness. In 2016, a more robust procedure, using a laser scanner, was implemented by Hillgrove to survey the PAF after the PAF embankment was profiled and to later scan the profiled NAF store and release cover layer. Software is then used to show the thickness achieved.
- NAF and PAF layer trenching
  - Trenches are excavated and records/photos taken across the layer to check for evidence of compaction, block size distribution and lack of voids and inspection files kept.

The results of the above-mentioned quality assurance measures are collated into IWL Store and Release Cover Construction reports. To date three construction reports have been produced covering the ongoing IWL works in 2014, 2015 and 2016 (HGO 2015a, 2015b and 2016b) and reported to DEM

in the annual Mining and Rehabilitation Compliance Report (MARCR). A penultimate IWL construction report will also be produced upon completion of the IWL up to mid-2019 as a collation of all existing data.

- Performance monitoring

  - In situ soil monitoring to measure the soil wetting and drying fronts at varying profile depths has been installed at four locations down the rehabilitated northern slope of the IWL (Figure 3-38).

Rehabilitation

Rehabilitation has been progressing on the IWL over the life of mine, with approximately 32% of the final design landform completed as at August 2019. The following rehabilitation procedure has been conducted to date and will continue to be implemented on the remainder of the IWL as it becomes available.

Once the design criteria of the IWL landform have been met, the top non-acid-forming (NAF) layer is covered with a 0.15m layer of topsoil, which is then ripped parallel to the landform contours with a bulldozer. This acts to partially incorporate the topsoil and NAF at the surface, while creating surface dips and swales to intercept rainfall and limit runoff.

Where the IWL surface is too steep to rip, stockpiled topsoil with high residual pasture seed content (harvested during initial site clearance), is cast down-slope with an excavator bucket until the required topsoil deposition thickness is achieved.

As soon as possible after topsoil application, the IWL surface is hydroseeded with a mixture of locally-grown and locally collected native plant species (refer to Section 3.13.6.2).

3.13.4.4 Infrastructure

Infrastructure areas within the ML include the processing plant, workshops, office complex, ROM ore stockpile and workshops.

ROM Pad

On completion of mining, the remaining ore on the ROM stockpile will be fed to the concentrator. Any contaminated material will be removed and either processed or placed in the TSF. The ROM pad will then be rehabilitated following the same approach for the IWL.

Infrastructure area

The community, through the Kanmantoo Callington Community Consultative Committee (KCCCC) Master Planning Sub-Committee, have expressed a strong desire to retain some of the infrastructure and the infrastructure area of the mine such that it can be re-purposed as a local industrial park, or used in other ways to support community activities. On 13 August 2019 the Mount Barker District Council lodged a Statement of Intent to the Minister for Planning, Mr Stephan Knoll, to support a Developer funded Development Plan Amendment to rezone the Infrastructure Area domain to “Urban Employment Zone”. This is expected to be formalised prior to mid-2020. This will allow for the establishment of an Industrial Park which will result in repurposing of all or some of the existing infrastructure and services, e.g. water supplies, electricity sub-station and buildings, laydown areas and concrete pads, in this domain.

Establishment of the Industrial Park will involve determination of which infrastructure and disturbance footprints are to be retained for future use.

Where some items of infrastructure require removal, or should the base case industrial park vision not be realised, infrastructure would be demolished or dismantled and removed. Following removal of machinery and buildings, concrete pads and structures would be demolished. No demolition or industrial wastes will be disposed of in the ML area. In the event that they are to be removed and depending on their condition, major items such as the crusher, conveyors and modular buildings, would be sold for re-use on other projects. The remaining items will be sold as scrap metal.

Once plant and equipment are removed, contaminated material will be removed and remediated or disposed at an appropriate registered facility. Large concrete footings and foundations will be made safe and buried in situ with the 1m NAF layer that would be placed over the disturbance footprint. The NAF layer would then be profiled to blend with the surrounding terrain. Finally, topsoil would be applied, ripped and hydroseeded with a seed mix as for the backfilled pits in the open pit domain (Section 3.13.4.1).

The explosive magazines are remote from the primary infrastructure area. On completion of mining, magazine compounds will be dismantled and all infrastructure removed from the site for reuse elsewhere or recycled. Unless required for the Industrial Park or otherwise agreed, concrete pads would be removed and disposed of in an appropriate manner. Where required, topsoil will be replaced on the disturbed area, which will then be ripped and seeded.

3.13.4.5 Surface Water Structures

Major surface water retention structures on the ML area comprise the following.

- Southern TSF RWS.
- Process plant runoff collection pond.
- Clean water runoff collection pond (head pond in chain of ponds).
- Northern sediment pond.
- Northeastern sediment / evaporation pond (pending construction).

Following closure, all pipework and infrastructure will be removed. Residue material in the ponds will be analysed to determine contaminant concentrations. If enriched with metals, the residue may be removed and reprocessed or placed in the TSF.

Immediately following closure it is likely that these ponds will continue to be required to capture any sediment from the recently rehabilitated areas and to demonstrate that water quality objectives have been achieved.

Once vegetation has established and runoff water quality from the previously disturbed areas meets water quality operational and completion criteria (refer to Section 6.3), the water storages will be allowed to silt up and reintegrate to the natural topography over time, unless of use to the Industrial Park.

3.13.4.6 Native Woodland

Areas of remnant *E. odorata* woodland exist on the site, particularly to the north of Giant Pit. Other areas of degraded woodland are found within the site. Targeted management programs have been implemented during operations to improve the quality of degraded woodland, by reducing exotic weeds, encouraging the development of native species and removing grazing by domesticated

livestock or feral herbivores. Remnant woodlands has also been used as an important source of seed for use in rehabilitation of areas around the site.

A weed management plan has been implemented to control weeds within the woodlands and subsequently encourage the regeneration of native species. Feral animal control programs have also been undertaken to reduce grazing pressure from species such as rabbits. Revegetation of sections of introduced pasture with *E. odorata* and other species present in this vegetation community has been commenced to meet SEB off-set obligations and link remnant woodland areas.

These remnant areas will continue to be managed in accordance with the commitments made in the NVMP (Appendix A) until relinquishment and will remain as native woodland land use on relinquishment.

3.13.4.7 Native Grassland

Native *Lomandra* grasslands occur mainly to the south of Giant Pit. During operations, a weed management plan has been implemented to control weeds within the remnant native grassland and enhance this habitat. An ongoing feral animal control program has also been implemented to reduce grazing pressure within the ML and on surrounding properties. Significant regeneration has been observed within the native grasslands since 2010, with both species diversity and plant densities improving visibly.

These remnant areas will continue to be managed in accordance with the commitments made in the NVMP (Appendix A) until relinquishment and will remain as native grassland land use on relinquishment.

3.13.4.8 Introduced Pasture

Areas of introduced pasture not covered by the IWL or revegetated to native woodland have and will remain unaffected by ongoing and proposed operational activities. Introduced pasture areas are included in ongoing weed control programs to prevent the ingress of pest-plant species into rehabilitated areas within the ML. This improves the quality of introduced pastures, making them attractive to herbivorous native fauna and reducing pressure on areas rehabilitated with native vegetation.

On closure, this domain will remain introduced pasture.

3.13.4.9 Enhanced Vegetation Areas

Some areas of introduced pasture within the ML have been enhanced through establishment of new *E. odorata* native woodland patches during the life of mine as part of the original SEB offset commitments.

Conversion has been carried out through the ‘Topsoil Pre-Strip’ technique (intermittent stripping of weed-infested topsoil prior to revegetation), followed by direct seeding with a mixture of local-provenance seeds. The seed mix has been formulated to represent the plant species and proportions of those species normally associated with a *E. odorata* woodland communities at Kanmantoo. The locations of this enhancement have been designed to link adjacent areas of remnant *E. odorata* woodland, to form continuous habitat patches at the northwest corner and northern boundary of the ML.

Hillgrove has applied the information gained by revegetating areas of introduced pasture to assist with design and application of revegetation of the IWL.

These areas will continue to be managed in accordance with the commitments made in the NVMP (Appendix A) until relinquishment and will remain as a native woodland and pasture mixed land use on relinquishment.

3.13.4.10 Old Tailings Dam

No activities are planned within the Old Tailings Dam domain which is a remnant of the historic mining operations. Subsequently no rehabilitation activities are proposed.

Note that AGL, as part of the PHES (refer to Section 3.13.3), are assessing the feasibility of digging out the Old Tailings Dam to create the upper pond. As such, the TSF lift presented throughout this PEPR and specifically in Section 3.7.2, has been sized to allow for the storage of this material, should this activity occur. The actual activity of removing the Old Tailings Dam material, however, would require additional approvals and is not addressed in this PEPR.

3.13.4.11 Other Disturbed areas

The other disturbed areas domain includes areas such as laydown areas, borrow pits, NAF and topsoil stockpile footprints and roads.

Maintenance of a road into the site and to designated monitoring locations will be required to enable monitoring and maintenance activities to be undertaken during the post-closure period to relinquishment. Roads and hardstand / laydown areas not required for long term monitoring and maintenance or the industrial estate will be rehabilitated in the following manner.

- Remove any contaminants such as hydrocarbons and dispose of appropriately.
- Remove pipes and culverts to re-establish water courses or drainage lines.
- Redirect local drainage as necessary to minimise erosion until regrowth is established.
- Deep rip road surfaces to break the compacted surface and enable infiltration of rainwater and root penetration.
- Scarify surface and direct seed or hydroseed with appropriate native plant seed mixes and soil amendments.

Unless otherwise agreed for transfer to a third party, e.g., if required for the Industrial Park, groundwater bores, above ground pipeline infrastructure, power lines, electrical substations and communication towers will be removed when they are no longer required, with the recovered materials sold for recycling, reused or disposed of appropriately.

Groundwater bores will be capped below ground level and the upper casings removed unless otherwise agreed. Buried metal plates will be installed to allow bores to be located, using a metal detector and geographical positioning system, if required for future re-establishment. The plates will then be spread with topsoil, ripped and seeded.

3.13.4.12 Master Planning

As a result of community consultation on mine closure (see Section 4.0), a master planning process was initiated. The Master Plan for the Kanmantoo Callington area has been developed to provide a vision of how the local community would prefer to see its future after the mine closes. The aim is to use the Master Plan as a guide to make suggestions to the Hillgrove about how their mine closure activities can contribute to the next stage of the area's development and identify what the community can do to make these opportunities a reality.

The Master Plan, developed by the KCCCC with input from the wider community, identifies opportunities like recognising the potential for a mining history and heritage tourism industry, securing and building on existing successful business activity, utilising the area's unique natural environmental

assets like its geology, and native flora and fauna, and enhancing the area's strengths like its rural lifestyle and primary production potential.

It is important to note that the Master Plan includes both activities which fall within the scope of Hillgrove mine closure, such as the potential establishment of an industrial area to maximise beneficial use of existing infrastructure and services, as well as projects that are outside the scope of Hillgrove mine closure.

Hillgrove has committed to supporting the projects outside the scope of mine closure to the extent practicable, however is not responsible for their delivery. Additionally, these projects require support from the Council and may require inclusion in the Council's Development Plan.

3.13.5 Progressive Rehabilitation

Progressive rehabilitation of the site during the operational life of the mine demonstrates the success of closure strategies prior to actual closure. It also enables adjustments to closure strategies as a result of experience gained, or changes to strategies to meet changing stakeholder and regulator expectations. Progressive rehabilitation is also an important way of reducing the long-term closure liability accrued on-site, by progressively closing and rehabilitating domains as they become available to do so. The ability to complete large areas of rehabilitation during operations has been and will continue to be influenced by the mine schedule, availability of areas (some areas such as the surface of TSF will not be available until closure) the availability of materials and site conditions.

Progressive rehabilitation conducted to date includes:

- Establishment of engineered cover trials.
- Testing of material properties of oxide waste rock and modelling of final landform.
- Revegetation of introduced pasture to enhanced vegetation.
- Weed control in native vegetation communities.
- Rehabilitation of areas such as:
  - Road verges, areas around the process plant and office buildings;
  - Progressive rehabilitation of embankment batters of the IWL,
  - Conversion of pasture areas adjacent to Mine Road to native vegetation; and
  - General construction disturbance outside areas of permanent operations.
- Planting of visual screening along access road.

As at August 2019, 43ha of progressive rehabilitation has been conducted, with a total estimated area of 116ha remaining for full rehabilitation of the site. The indicative plan for completion of the rehabilitation, assuming there is no further mining following the underground Kavanagh mine, is presented in Figure 3-40.

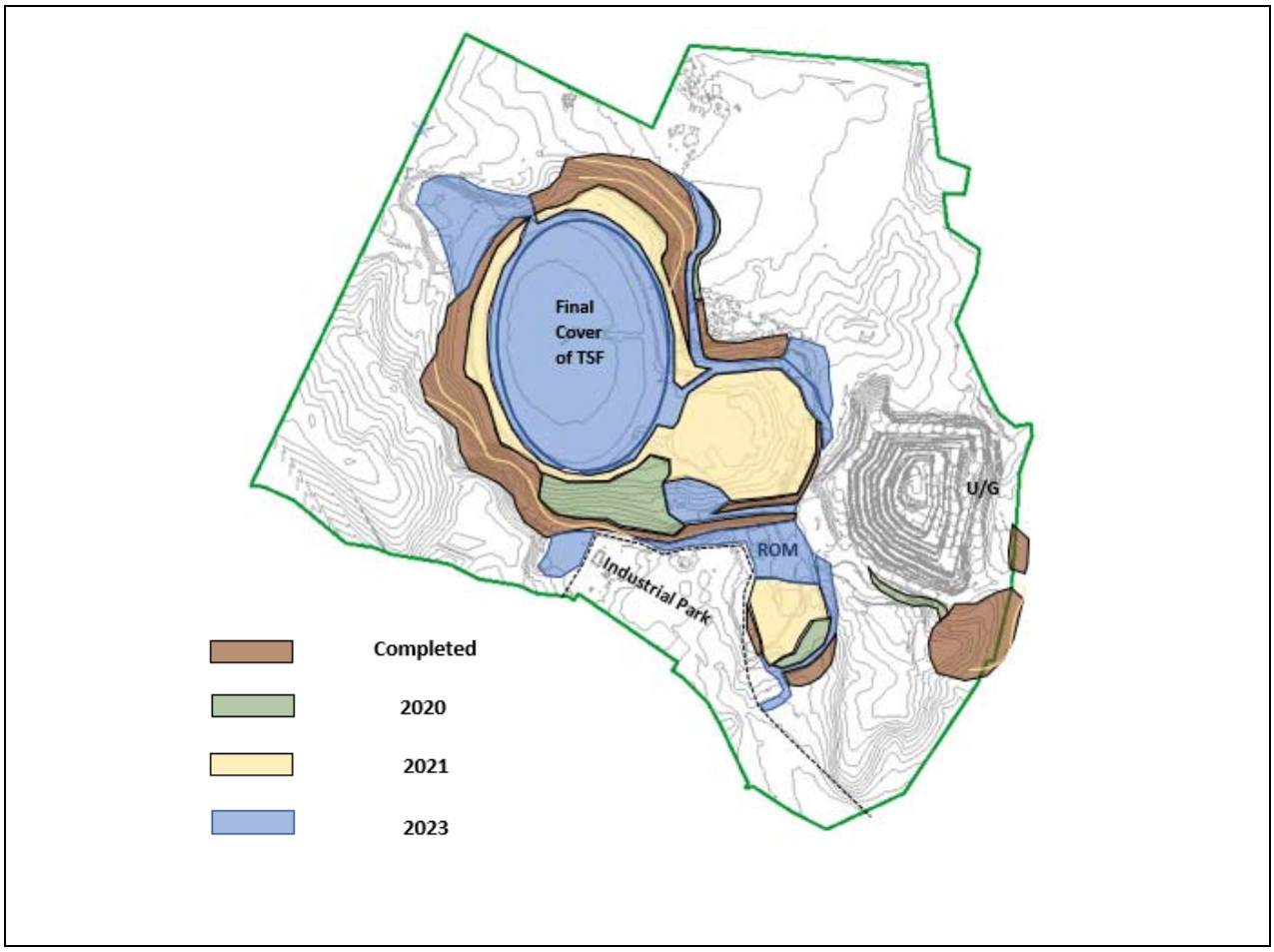


Figure 3-40 – Indicative rehabilitation schedule for mine completion

The estimated materials inventory for remaining NAF requirements and stockpiles, along with topsoil, as at May 2019 are presented in Table 3-23. There are excess rehabilitation materials to complete the required closure activities within the ML area.

Table 3-23 – Estimated Closure Material Inventory

Closure Material Requirement	Mm^3
NAF Waste Rock	
Already used for rehabilitation and other construction	4.39
Stockpiled for rehabilitation	1.98
Required for rehabilitation of site including IWL cover	0.71
Indicative excess stockpiled NAF	1.26
Topsoil	
Topsoil stockpiles	0.26
Topsoil requirement to closure	0.11

3.13.6 Rehabilitation Techniques

3.13.6.1 Area Preparation

Sites available for progressive rehabilitation are prepared by using the following sequence of processes.

- Deep ripping compacted areas of soil.
- Re-profiling ripped or stockpiled soil.
- Re-spreading topsoil
- Scarifying before seeding.

3.13.6.2 Plant Species Selection

The species seed mix and planting densities for revegetation in disturbed areas was initially determined based on the native grassland and woodland species composition. The seed mix includes native trees, as well as a range of native shrub and grass species for structural integrity of the established vegetation. Additional pasture species have been added for soil stability and rapid ground cover. The indicative hydroseeding species list is provided in Table 3-24.

The on-site seed production area (SPA) and off-site seed management area (SMA) have jointly produced over 1000kg of native seed to date. Hillgrove will continue to use the same seed sources for hydroseeding for as long as seed sources remain viable. In the event of sit-base viable seed no longer being available, Hillgrove would investigate wild seed collection and seed purchase.

Table 3-24 - Indicative seed mix composition for hydroseeding

Species	Native or pasture	Species	Native or pasture
Acacia pycnantha	Native	*Allocasuarina verticillata*	Native
Eucalyptus odorata	Native	*Vittadinia sp.*	Native
Dodonaea viscosa	Native	*Maireana brevifolia*	Native
Callitris gracilis	Native	*Rytidosperma sp.*	Native
Maireana brevifolia	Native	*Austrostipa/Rytidosperma*	Native
Rytidosperma sp. (Danthonia)	Native	*Austrostipa sp.*	Native
Atriplex semibaccata	Native	*Chloris truncata*	Native
Enchylaena tomentosa	Native	*Senna artemisioides*	Native
Convolvulus erubescens	Native	*Austrostipa/Rytidosperma*	Native
Vittadinia blackii	Native	*Chloris truncata*	Native
Maireana brevifolia	Native	*Cullen australasicum*	Native
Rytidosperma sp. (Danthonia)	Native	*Allocasuarina verticillata*	Native
Austrostipa/Rytidosperma mix	Native	*Dodonaea viscosa*	Native
Austrostipa sp.	Native	*Callitris gracilis*	Native
Cullen australasicum	Native	Dactylis spp.	Pasture*
Enchylaena tomentosa	Native	Festuca spp. (grass)	Pasture*
Atriplex semibaccata	Native	Lolium spp.	Pasture*
Dodonaea viscosa	Native	Trifolium spp.	Pasture*
Enchylaena tomentosa	Native	Medicago spp.	Pasture*
Callitris gracilis	Native		

* The pasture species which are best suited to the specific rainfall region (425mm), with the best prospects of establishing and persisting, will be selected.

As part of the original SEB offset commitments to recreate *Lomandra* grassland (refer to NVMP Appendix A), Hillgrove partnered with the Adelaide Botanic Gardens Seed Conservation Centre to develop a seed treatment which significantly improves the germination of *Lomandra effusa* seed. Treated seed can be successfully grown as tube stock by specialist nurseries.

During 2017, the first 1000 tube stock plants were produced for planting at Kanmantoo by the Mt Lofty Botanic Gardens nursery. This tubestock was planted on the rehabilitated batters of the Nugent and Emily Star backfilled open pits and the northern IWL batter which had also been hyrdoseeded. Lomandra seed collection and tube stock propagation will continue as applicable throughout Hillgrove's closure and rehabilitation program.

3.13.6.3 Planting Methods

The following various planting methods have been used at Kanmantoo Copper Mine, depending on the access to the area and the post-closure land use objective.

- The 'topsoil pre-strip' method, which involves removal of weed-bearing topsoil in strips, to reduce weed competition prior to direct seeding in abandoned pasture land.
- Seed broadcasting (by hand or machine).
- Direct seeding/ hydroseeding.
- Spreading of seed-bearing slash (especially for Eucalypt and Acacia species).
- Nursery-grown tube stock.
- Transplantation.

3.13.6.4 Timing

Revegetation is undertaken in early autumn (March and April) where possible, when autumn rains naturally stimulate the growth of native seed shed during summer and promote germination in direct seeded or hydroseeded areas. Revegetation undertaken in autumn also ensures that winter rains in the following months provide adequate moisture for maximum seedling survival and growth.

3.13.7 Closure Maintenance

Rehabilitated areas within the ML area subject to the Mine Closure NVMP (Appendix A) and Hillgrove's land management programs. The objective of the land management program is to continue management of areas under Hillgrove's stewardship until lease relinquishment or some other agreement for management transfer is approved.

Hillgrove's vegetation and land management programs will aim to achieve the following:

- The progressive establishment of resilient, self-replicating vegetative covers on safe, stable rehabilitated mine landforms and on other closure domains within the ML.
- The prevention of pest plant and feral animal proliferation within rehabilitation areas, through the system of programmed weed control and feral animal control programs established within the ML since 2010.
- Access by foot will be restricted. Access will only be permitted for vegetation management and vertebrate pest management activities.

- Vehicle traffic will only be permitted on established roadways.
- Monitoring fauna within the ML vegetation areas and on Hillgrove-owned properties through annual spring fauna surveys, to ensure that species diversity is being maintained.
- Monitoring vegetation using landscape function analysis (LFA) monitoring within the ML vegetation and rehabilitation areas through annual surveys to ensure that species diversity is being maintained.
- The prevention of grazing by commercial livestock within the ML.
- The management of grazing by native animals within land under Hillgrove's control (predominantly kangaroos), through fence maintenance, interruption of grazing and/or or approved culling programs where necessary.

Additional information on pest plant and feral animal control can be found in the Mine Closure NVMP (Appendix A).

Where monitoring identifies significant erosion, weed invasion, failure of revegetation (to any material degree) or excessive grazer damage to regenerating vegetation, maintenance activities are implemented to ensure regeneration progresses successfully and rapidly. These maintenance activities include the following.

- Repairing eroded areas.
- Weed control (chemical, mechanical and manual methods).
- Pest control (baiting).
- Infill planting.
- Spot sowing.
- Reseeding.

Maintenance of the site will continue until all lease conditions and completion criteria (refer to Section 6.3.3) have been achieved or otherwise agreed.

3.13.8 Relinquishment Process and Transfer of site

3.13.8.1 Relinquishment Process

Post-active closure of the site, Hillgrove will continue to monitor and maintain the lease area until such time as the lease can be relinquished.

Section 82 of the Mining Act provides for the surrender of a tenement: *The Minister may, upon receipt of an application in a manner and form determined by the Minister by the holder of a lease or licence under this Act, consent to the surrender of the lease or licence.*

Prior to surrender of the tenement, the Minister must be satisfied of proper rehabilitation through submission of a final compliance report. Successful closure is accomplished through demonstrating that the agreed completion criteria have been met. The completion criteria and how each will be measured to provide evidence of achievement is presented in Section 6.3.3.

Only when compliance with all requirements has been verified will the bond be returned, and the tenement relinquished. The following indicative process for full or partial lease relinquishment has been provided by the Department for Energy and Mining (DEM)[4].

1) Submission (cover letter and / or appendices) by proponent including:
   (a) Form 14;
   (b) Any additional supporting information including new lease boundary in the event of partial lease relinquishment; and
   (c) Final compliance report (Reg 86(8)).
2) Initial validation of completeness by the DEM.
3) Form 14 processed: Recorded on Mining Register that surrender application received and a decision pending (becomes visible on SARIG and under public register search of tenement reports)
4) Information circulated internally:
   (a) Mining Regulation (Compliance and Assessments);
   (b) Exploration compliance.
5) Verification of:
   (a) Rental and caveats;
   (b) Royalties and returns;
   (c) New spatial data as applicable.
6) Any additional information requirements are identified and requested by DEM.
7) DEM prepares surrender report and a recommendation for decision maker (Minister or Delegate)
8) IF CONSENT GRANTED:
   (a) Partial surrender instrumented into Mining Register;
   (b) Tenement (same #) Polygon updated on SARIG;
   (c) Underlying EL reinstated;
   (d) Notification of decision provided to tenement holder.
9) IF CONSENT REFUSED:
   (a) Notification of decision provided to tenement holder.

Note that if consent is refused based on the basis of insufficient information or completion criteria not yet being met, DEM will provide guidance to Hillgrove on how to resolve any lack of information for demonstrating achievement of completion criteria. Hillgrove would then work with DEM to meet the requirements and enable relinquishment to occur as per the above process.

Section 103E of the Environment Protection Act sets out obligations for liability of contaminated sites. Hillgrove will liaise with the EPA prior to relinquishment to define any contaminated sites within the ML area and implement relinquishment requirements associated with these liabilities.

3.13.8.2 Transfer of Site

Hillgrove may sell the freehold land beneath the ML area to third parties post-closure of the site. Post-closure land holders may include a mix of owners of the PHES, owners of the Industrial Park, private

[4] Michael Smith -Senior Case Manager, Department for Energy and Mining – 1 May 2019

land holders for the vegetated and pasture areas and conservation agencies for native vegetation remnants.

Regardless of the post-closure land holder, where there is a requirement for ongoing monitoring, maintenance or transfer of a contaminated site prior to lease relinquishment, Hillgrove will ensure that suitable legally binding arrangements, such as a land management agreement, are in place and agreed with the regulator, prior to executing the sale. These arrangements would include any aspects required to meet all completion criteria to allow for lease relinquishment, e.g., ongoing access for monitoring, maintenance of sediment ponds, restricted use of the IWL landform and the like.

Unless otherwise transferred with approval of the Department, Hillgrove will retain responsibility for meeting all completion criteria until the ML is relinquished.

3.13.9 Rehabilitation Liability Estimate

As at September 2019, Hillgrove holds a bond of AUD$9.1 million for the remainder of the rehabilitation required at the Kanmantoo Copper Mine.

The proposed bond is depicted in Table 3-25, calculated using the July 2019 version (V5.21) of the DEM rehabilitation liability estimation calculator. The final bond amount will be confirmed in consultation with DEM. This calculation is based on the assumption that Hillgrove leaves the site and DEM must engage third parties to complete the work.

Table 3-25 – Rehabilitation liability calculation including underground

Closure Domain	Calculated rehabilitation liability
Exploration	$38,383
Underground	$70,600
Open Pits	$127,800
Waste rock dumps (including low grade stockpiles)	$425,394
Processing facilities	$677,472
TSF	$1,193,010
ROM area	$216,477.89
Haul and access roads	$0
Administration and accommodation	$31,215
Ancillary areas	$0
Borrow pits	$7,759
Service Infrastructure (water, sewage, power)	$65,464
Water management	$52,630
Equipment mobilisation and demobilisation	$19,965
Monitoring, maintenance and other indirect costs (based on standard DEM %)	$1,645,729
TOTAL	**$4,571,898**

4.0 Stakeholder and Community Consultation

Hillgrove (including the board and executive management) recognise that effective stakeholder and community engagement is essential to maintain the project's social licence to operate and to minimise any stakeholder concerns related to the operation or its closure.

Consultation commenced with key interest groups and individuals in early 2004, has continued during the operation phase, and will continue through to mine closure. During the approvals process for the original mine lease application, the relationship between the company and the community became more structured with the formation of the Kanmantoo Callington Community Consultative Committee (KCCCC) in 2007. This group arose as a natural progression from broader public forums and shifted the focus from the company informing the community to the company and the community engaging in meaningful consultation to add value and improve decision-making.

As the life of mine diminishes the focus of the consultation has shifted from operational issues to closure and achievement of community benefit. The KCCC has also now grown to include other operational entities such as Neutrog and Hanson Australia.

4.1 Consultation Program Objectives

The primary goals of Hillgrove's consultation program are as follows.

- Ensure effective communication and exchange of information between Hillgrove and its stakeholders.
- Ensure the smooth and efficient development, operation and closure of the project. The specific best practice objectives that will allow these goals to be met are to ensure that:
    - The local and regional community is kept fully informed about each stage of the mine's development through the provision of clear, accurate and unbiased information in appropriate formats and delivered through a variety of ways to suit the community.
    - Stakeholder and community awareness is built to provide an understanding of, and support for, the company and the Kanmantoo Copper Mine.
    - The company understands its stakeholders and the wider community with a focus on identifying and addressing priority issues of concern in a timely manner.
    - Opportunities for the company to participate are identified and realised, as a member of the community, and deliver real and measurable benefits to the community.
    - Community input into topics and issues help to inform and improve the company's decision making with recent focus moving to mine closure and achievement of community benefit.
    - That the relevant regulatory requirements related to community engagement are met.

To meet these objectives Hillgrove has established a consultation framework, program and stakeholder and community engagement plan that is supported by relevant technical investigations, i.e., the updated Stakeholder and Community Engagement Plan (Appendix 6A of the 2016 PEPR). This plan outlines the company's commitments, which are to:

- Clearly understanding the purpose of effectively engaging with stakeholders and the wider community.
- Communicating clearly, in accurate and unbiased terms.

- Communicating in a timely fashion with stakeholders and the wider community with particular appreciation of the likely changes to priorities through various stages of the mine's development, operation and closure.
- Understanding, appreciating and being sensitive to the nature of the community in which we are operating.
- Behaving in a genuine manner with a particular emphasis on 'doing what we say we will do'.
- Encouraging innovative and creative solutions to issues and realising opportunities by listening to and appreciating community input.

4.2 Stakeholders

Stakeholders are parties with an interest in the project and who can potentially influence, or are influenced by, its development. The site stakeholders include those identified in Table 4-1.

Table 4-1 – Kanmantoo Copper Mine Stakeholders

Stakeholder Group	Definition and Inclusions
Local residents of Kanmantoo and Callington	The KCCCC is a forum where the many and varied groups with an interest in the mine can come together. As well as those listed separately below there are a number of smaller groups like the Oval Committees, sports clubs and local youth all of which can be heard through the KCCCC.
Local residents of Kanmantoo directly impacted	The Kanmantoo Action Group was formed in 2013 to represent local residents of Kanmantoo directly impacted by the mine with a focus on environmental matters and emissions particularly.
Local government	District Council of Mount Barker is the local government area in which the mine is located
State government and agencies	The South Australian Department for Energy and Mining (DEM) is the state's regulator for mining. Other departments and agencies that have a significant interest in the mine and its operations include SafeWork SA, the SA Department of Environment and Water, Environment Protection Agency (EPA) and SA Department of Planning, Transport and Infrastructure (DPTI).
Australian Government	Including the Commonwealth Department of the Environment and Energy and interested ministers and members of parliament.
Local elected members of state and commonwealth government	Dan Cregan MP is the State Government's elected member for Kavel, which is the State electorate in which the mine is located. Rebekha Sharkie MP is the Commonwealth Government's elected member for Mayo, which is the Commonwealth electorate in which the mine is located
Emergency services	The Callington – Kanmantoo CFS unit
Special interest groups	Including Kanmantoo–Callington Landcare Group, Adelaide Hills Regional Development and Murraylands Regional Development Board Inc., University of South Australia,
Culture and heritage interest groups	Peramangk people are the traditional owners of the region. A local non-indigenous heritage group is emerging from interested individuals particularly with an interest in the mining past of the area.

Stakeholder Group	Definition and Inclusions
Education and training	The Kanmantoo Primary School is the local school closest to the mine. Other education and training groups include TAFE (at Mt Barker) and primary and high schools with regional catchment
Regional development	The Southern Hills and Fleurieu Local Government Association and the Adelaide Hills, Fleurieu and Kangaroo Island Regional Development Australia (RDA) Board are regional development stakeholders.
Tourism bodies	The SA Tourism Commission and Adelaide Hills Tourism are stakeholders with an interest in tourism opportunities in the area including mine tourism.
Media	The Courier is the regional Newspaper that covers issues related to the mine PowerFM and radio 5MU are located at Mt Barker, ABC 891 is a radio station relevant to the region. State and National media are also relevant to the mine's operations given its significance to the State
General public	General public (particularly within South Australia).
Financial stakeholders	Financiers (e.g., brokers, bankers and investors) and their advisors and the Australian Stock Exchange (ASX)
Mining industry	Including other mineral explorers or producers in the area, South Australian Chamber of Mines and Energy (SACOME), the Minerals Council of Australia (MCA) and Resource Industry Alliance
Internal stakeholders	Including Hillgrove (e.g., board, employees and shareholders) and contractors/suppliers (including infrastructure providers) to Hillgrove

4.3 Consultation Outcomes

4.3.1 Introduction

Past PEPRs identify the broad outcomes of consultation activities conducted to date. One of the key outcomes include the preparation of Draft Community Action List (KCCCC website). This action list was developed by KCCCC and Hillgrove in response to the views expressed by the local community during consultation on the life of mine extension project. The purpose for developing this action list is to demonstrate company commitment to achieving positive, measurable outcomes.

Consultation and outcomes specific to the underground and mine closure activities are presented in the sections below.

4.3.2 Summary of Consultation to Date

Consultation conducted until the submission of the October 2016 PEPR is presented in that PEPR.

Consultation that has occurred since the submission of the October 2016 PEPR and specific to mine closure activities including industrial rezoning, inclusive of the potential PHES and amendment to the NVMP, and the underground operations, is provided in Table 4-2. The consultations in Table 4-2 are additional to the meetings held with regulators including DEM, EPA, DPTI, DEW and SafeWork SA during the preparation of this PEPR.

Table 4-2 – Consultation specific to underground mining and mine closure

Date	Forum	Present	General Discussion Topics
10 Nov 2016	KCCCC	Community	• Progress of rehabilitation against plan • Mine Closure and Completion Plan progress • Master planning working party discussions
2 Mar 2017	KCCCC	Community	• Master planning working party discussions • Discussions on priority for community benefit projects • Discussion about retaining infrastructure for a future industrial area
1 June 2017	KCCCC	Community	• Mining Heritage Indicative Plan and potential related amendment to Mine Closure and Completion Plan
21 Sept 2017	KCCCC	Community	• Community benefit plan projects • Mine tourism opportunities • Mine closure and completion plan progress
14 Dec 2017	KCCCC	Community	• Master Planning and the mine closure and completion program • General mine update
15 Mar 2018	KCCCC	Community	• Master Planning and the mine closure and completion program • General mine update • Potential for PHES and underground development
21 Jun 2018	KCCCC	Community	• Master Planning and the mine closure and completion program • PHES • Rehabilitation being conducted
20 Sep 2018	KCCCC	Community	• Master Planning and the mine closure and completion program including heritage trail discussions • Site visit – Brand SA • K4C site visit viewing progress of rehabilitation and proposed open pit lookout site • Growth project updates – PHES and exploration projects • Rehabilitation trial update
29 Nov 2018	KCCCC	Community	• Master Planning and the mine closure and completion program, including community benefit • Community action plan update • Mine update • Growth project updates – PHES and exploration projects • Rehabilitation being conducted
15 Feb 2019	Meeting	Adam Schutze (NVC)	Discussed intent to review NVMP and explore possibility of payment into the NV fund followed by letter of intent to review NVMP (15/2/19)
7 Mar 2019	KCCCC	Community	• Master Planning and linking to Council Strategic Plan • Growth project updates – PHES and exploration projects • Compliance • Rehabilitation

Date	Forum	Present	General Discussion Topics
17 Apr 2019	Phone call	Ross Oke (KCCCC committee member)	NVMP amendments and SEB requirements
23 Apr 2019	Phone call	Harry Seager (KCCCC committee - Portfolio Environment)	NVMP amendments
2 May 2019	Phone call	Ross Oke (KCCCC committee member)	NVMP amendments and SEB requirements
13 May 2019	Meeting	Sarah Reachill (NVC), Russel Seamen (DEW) Zita Fewster (DEW) and DEM	Discussed intent to review NVMP and further define requirements for payment into the NV fund
20 Jun 2019	Site visit	Ross Oke (KCCCC committee member), Zita Fewster (DEW)	Discussion with DEW (Zita Fewster NVC) regarding payment of SEB into NVF
20 Jun 2019	KCCCC	Community	• Proposal to pay SEB into NVF • Presentation by DEW (Zita Fewster NVC) regarding SEB and NVF • Proposed underground mining • Key proposed changes to PEPR • AGL presented PHES project • Rehabilitation status
24 Jun 2019	Phone call	Harry Seager (KCCCC committee - Portfolio Environment)	NVMP amendments
18 Jul 2019	Site visit	DEM (17 people)	Site visit of underground, potential PHES area and closure / rehabilitation areas
8 Aug 2019	Meeting	Adam Schutze (NVC)	Further discussion on updated NVMP and intent to pay into the NV fund
15 Aug 2019	KCCCC	Community	• Specific focus on the underground and associated PEPR revision • Rehabilitation status • Industrial park plan for closure • Proposed underground operation and potential risks related to dust, noise, vibration (blasting), traffic, light and groundwater • Visual amenity assessment of TSF lift • NVMP amendment to pay into NVF • Employment opportunities
20 August 2019	In house meeting	Harry Seager (KCCCC committee - Portfolio Environment)	• NVMP amendments • Opportunities for community/environmental benefit
30 August 2019	In house meeting	Harry Seager (KCCCC committee - Portfolio Environment)	Provide feedback to Hillgrove on areas of private land adjoining Hillgrove land where landholders were amenable to establishment of SEB
12 September 2019	KCCCC	Committee Meeting	• Minor change notification • NVMP amendment to pay into NVF • Master Plan

Date	Forum	Present	General Discussion Topics
26 September 2019	KCCCC	Community	• Industrial re-zoning • NVMP - subcommittee formation • Community Action List to re-commence tracking/record • Master Plan • Environmental emissions • Mine closure and completion planning
3 October 2019	KCCCC	Community	Master Plan
25 October 2019	KCCCC/HGO	Community	Joint presentation of Master Plan and Future plans at the Callington Show

4.3.3 Consultation Outcomes

The primary consultation outcomes arising since the 2016 PEPR and specific to mine closure and the underground mining project detailed in this PEPR are identified in Table 4-3, as well as where these aspects are discussed in this PEPR, where applicable.

As identified in Section 3.13.4.12, while Hillgrove is assisting the community to deliver and develop the master plan, it is not the responsibility of the company and as such, consultation outcomes related to the master plan is not included in the specific consultation outcomes below. Section 3.13.4.12 provides a summary of the initiatives and projects being progressed as part of the master plan consultation.

Table 4-3 – Consultation Outcomes since 2016 PEPR

Aspect / Area of Concern or Opportunity	Concern or Opportunity	Addressing of Concern / Opportunity	PEPR Inclusion and Section
Infrastructure	Mine development has added considerable infrastructure to the existing resources of the area like water supply, enhanced electricity supply and improved access arrangements. Suggestions for the mine closure plan includes a consideration of what useful existing infrastructure may be left behind after mining like access tracks, water management facilities, electricity substation and open space for car parking. May also provide employment post closure for Hillgrove employees.	Inclusion of Industrial Park in the mine closure plan and action has commenced to rezone the area to allow for this post-closure land use.	Mine closure and completion – refer to Section 3.13.4.4 Infrastructure domain
Dust	Potential toxicity of the dust from site and understanding that there are many contributors to regional dust, of which the Kanmantoo Copper Mine is one, although a major contributor.	Dominant dust source is TSF. Details of dust controls including sprays, progressive rehabilitation and dust suppression, trigger action plans and monitoring provided.	
Native vegetation and SEB offsets	The community has raised opportunities through the rehabilitation of disturbed areas and new plantings as part of the Significant Environmental Benefits (SEB) program and other native vegetation initiatives to link up with the work of other private land owners to produce contiguous ecosystems to support native flora and fauna. Community is concerned the payment into the NVF will result in loss of the original benefit intended by the SEB offset.	Consultation regarding the cessation of SEB offset planting and rather paying into the fund have resulted in the community requesting that the fund then be used in the local area. While NVC cannot guarantee this, they have explained their process to the community which includes added weighting in their assessment criteria towards projects in the area from which the funds originated. It has been determined during consultation with the KCCCC that a NVMP sub-committee would be established to generate ideas for the NVC to consider regarding use of funds paid to the NVF in the local area.	HGO continues to consult the KCCCC regarding payment into the NVF. PEPR Section 3.9 NVMP – Appendix A

Aspect / Area of Concern or Opportunity	Concern or Opportunity	Addressing of Concern / Opportunity	PEPR Inclusion and Section
Land access for underground (or other) development	In response to presentations on exploration activities by Hillgrove: “what if something is found on my property” and potential impact on land values	Response provided in meetings include - private negotiation between the company and the landholder, and that mining can co-exist with current land use. Mining can also bring employment into the region. Mark Stewart from DEM responded that a property is exempt from mining if there is a dwelling on it, and needs waiver/signed agreement from landholder before any progress toward mining could be made. There is no compulsory acquisition in SA, and a mining company cannot force a landholder from their land, it can only make an offer you may accept or reject.	No additional land is required for the project proposed in this PEPR – refer to Section 3.1.1
Native vegetation	Desire for the protection of the northwest native woodland remnants	These remnant woodlands will continue to be protected until lease relinquishment or other transfer of responsibility.	Mine closure and completion – refer to Section 3.13
Rehabilitation	General commentary about being impressed with the level of effort put into progressive rehabilitation.	Noted	Mine closure and completion – refer to Section 3.13

Aspect / Area of Concern or Opportunity	Concern or Opportunity	Addressing of Concern / Opportunity	PEPR Inclusion and Section
Rehabilitation	Preference for developing corridors rather than pockets of native vegetation as an outcome for rehabilitation and SEB programs.	Rehabilitation of disturbance areas will occur on disturbed areas. It has been determined during consultation with the KCCCC that a NVMP sub-committee would be established to generate ideas for the NVC to consider regarding use of funds paid to the NVF in the local area.	Mine closure and completion – refer to Section 3.13 NVF payment - Section 3.9 NVMP – Appendix A
Rehabilitation	Request for additional information on rehabilitation trials being conducted on IWL	Carbon Cycle Trial information provided at meeting – trial involves the addition of biochar, fibre mulch, soil conditioners and propriety ingredients to kick start micro-organisms that aid germination and survival	Not applicable
Rehabilitation	Request for additional information about NAF encapsulation and why it is important	Information on PAF encapsulation and management was provided, including TSF design and underdrainage.	PAF encapsulation – Section 3.7.1.2 IWL NAF cover – Section 3.13.4.3 TSF design – Section 3.7.2.2

Aspect / Area of Concern or Opportunity	Concern or Opportunity	Addressing of Concern / Opportunity	PEPR Inclusion and Section
Land access to site post closure	Access to the site after mining was completed was discussed in terms of recreational, educative and tourism opportunities, including bird watching through rehabilitation and SEB areas. Useful infrastructure identified included viewing platforms, walking tracks, fencing and security. The potential to link up various land use options (like recreation / education and tourism) was seen as an efficiency that may improve the chances of other stakeholders like Council getting involved. Feedback from public that Paringa chimney is important beautiful and interesting. The need to provide levels of certainty about future access to the area through mechanisms like Land Management Plans and Environmental Heritage Agreements was raised.	Committee needs to focus on offsite opportunities while the ML is still in place. Access post-closure will depend on the post-closure land owner.	Mine closure and completion – refer to Section 3.13

5.0 Environmental Outcomes and Impact Assessment

5.1 Environmental Outcomes

The environmental and social outcomes that Hillgrove is committed to implementing for the life of mine of the project are presented for each environmental aspect in Table 5-1. The outcomes are based directly on the lease conditions and have not changed since the 2016 PEPR.

ML 6345 Lease condition 28 requires leading indicators to be prepared for certain outcomes: these are marked with an asterisk in Table 5-1.

Mine closure outcomes have also been developed. The outcomes are based directly on the lease conditions, primarily ML 6345 Lease condition 27, what is technically possible given the length of experience Hillgrove has had on the site and Hillgrove's public commitments made over the life of mine.

Table 5-1 - Tenement conditions and associated outcomes

Tenement and Condition #	Condition	Outcome
ML6345 – Schedule 2 Condition 1	**Visual Amenity** The Lessee must in constructing and operating the Lease, ensure that the visual impact of the process plant from the South Eastern Freeway is minimised to the satisfaction of the Director of Mines If any areas are visible to the public and where it is not possible to completely ameliorate visual impacts, bunding and/or vegetation should be used to improve visual impact and all external materials, colours and finishes should be non-reflective and a colour to blend in with the landscape.	**Outcome 28** Visual impact of the process plant from the South Eastern Freeway is minimised to the satisfaction of the Director of Mines. **Outcome 31** The form, contrasting and reflective aspects of the mining operations will blend with the surrounding industrial landscape. On completion of mining operations the pit will be backfilled as per Outcome 13b.
ML6345 – Schedule 2 Condition 2	**Noise** The Lessee must in constructing and operating the Lease, ensure that there are no public nuisance impacts from noise emanating from the operating site. Noise must at all times comply with relevant environmental protection policy under the *Environment Protection Act, 1993.*	**Outcome 16** No public nuisance impacts from noise emanating from the operating site. Noise must at all times comply with the relevant environment protection policy under the *Environment Protection Act* (1993).
ML6345 – Schedule 2 Condition 3 ML6346 – Schedule 2 Condition 1 - Blasting	**Blasting** The Lessee must in constructing and operating the Lease, ensure that there are no adverse public health and/or nuisance impacts from airblast, flyrock and vibration caused by blasting.	**Outcome 17** No adverse public health and/or nuisance impacts from airblast, flyrock and vibration caused by blasting.
ML6345 – Schedule 2 Condition 4 ML6346 – Schedule 2 Condition 1 – Air quality	**Air Quality** The Lessee must in constructing and operating the Lease, ensure that there are no adverse public health and nuisance impacts to local residents from air emissions, dust and odour generated by mining operations.	**Outcome 15** No adverse public health and nuisance impacts to local residents from air emissions, dust and odour generated by mining operations.

Tenement and Condition #	Condition	Outcome
ML6345 – Schedule 2 Condition 5	**Fire** The Lessee must ensure that that no uncontrolled fires caused by mining operations effect remnant vegetation on or off the mine site.	**Outcome 19** No uncontrolled fires caused by mining operations effect remnant vegetation on or off the mine site.
ML6345 – Schedule 2 Condition 6	**Unauthorised Access*** The Lessee must in constructing and operating the Lease, ensure that there are no public injuries and or deaths resulting from unauthorised entry to the site that could have been reasonably prevented.	**Outcome 25*** No public injuries or deaths will result from unauthorised entry to the site that could have been reasonably prevented
ML6345 – Schedule 2 Condition 7	**Transport*** The Lessee must in constructing and operating the Lease, ensure that traffic movements, noise, dust and/or dragout to and from the mine site cause no adverse public impacts.	**Outcome 30*** Traffic movements, noise, dust and/or dragout to and from the mine site cause no adverse public impacts.
ML6345 – Schedule 2 Condition 8	**Community Consultation** The Lessee must take responsibility for developing and operating a community engagement plan, as part of the PEPR, to the satisfaction of the Director of Mines which ensures effective communication and exchange of information between the operator and stakeholders including but not restricted to landowners, Callington/Kanmantoo communities or individuals.	**Outcome 23** Operate a community engagement plan to the satisfaction of the Director of Mines which ensures effective communication and exchange of information between the operator, Hillgrove and their stakeholders (including but not limited to landowners, Callington/ Kanmantoo communities or individuals).
ML6345 – Schedule 2 Condition 9	**Public Complaints** The Lessee will be responsible for recording and addressing in manner and form specified by the Director of Mines any complaints received from the public.	**Outcome 24** Any complaints received from public recorded and addressed in manner and form specified by the Director of Mines.

Tenement and Condition #	Condition	Outcome
ML6345 – Schedule 2 Condition 10	**Land Use** The Lessee must in constructing and operating the Lease, ensure that there are no adverse impacts to adjacent public roads, railway, and adjacent land use. ML6345 adds - The Lessee must maintain a buffer zone of 10 meters from the Lease boundary with no workings within that zone. The Lessee must ensure that the current disturbed areas are stabilised to prevent sediment from leaving the Lease area.	**Outcome 1a** Maintain a buffer zone of 10 m from the lease boundary with no workings* within that zone. **Outcome 1b** *(new outcome to capture entire intent of tenement condition)* No adverse impacts to adjacent public roads, railway, and adjacent land use outside the ML area. **Outcome 2** The current disturbed areas are stabilised to prevent sediment from leaving the lease area.
ML6345 – Schedule 2 Condition 11	**Infrastructure*** The Lessee must in constructing and operating the Lease, ensure that there is no unauthorised damage to adjacent public or private infrastructure.	**Outcome 29*** No unauthorised damage to adjacent public or private infrastructure (e.g., roads, power supplies).
ML6345 – Schedule 2 Condition 12	**Aboriginal and European Heritage** The Lessee must in constructing and operating the Lease, ensure that there is no disturbance to Aboriginal or European artefacts or sites of significance unless prior approval under the relevant legislation is obtained.	**Outcome 26** No disturbance to Indigenous artefacts or sites of significance unless prior approval under the relevant legislation is obtained. **Outcome 27** No disturbance to non-Indigenous artefacts or sites of significance unless prior approval under the relevant legislation is obtained.
ML6345 – Schedule 2 Condition 13	**Fauna** The Lessee must in constructing and operating the Lease, ensure that there are no net adverse impacts from the site operations on the native fauna abundance or diversity in the Lease area and in adjacent areas.	**Outcome 21** No net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas.

Tenement and Condition #	Condition	Outcome
ML6345 – Schedule 2 Condition 14	**Flora** The Lessee must, in constructing and operating the Lease, ensure that all clearance of native vegetation is authorised under appropriate legislation and ensure no permanent loss of abundance or diversity on or off the Lease.	**Outcome 18** All clearance of native vegetation is authorised under appropriate legislation and no permanent loss of abundance or diversity on or off the lease due to operations.
ML6345 – Schedule 2 Condition 15	**Weeds and Pests** The Lessee must in constructing and operating the Lease ensure no introduction of new weeds, plant pathogens or pests (including feral animals), nor increase in abundance of existing weeds or pest species in the Lease area and adjacent areas caused by mining operations.	**Outcome 20** No introduction of new weeds and plant pathogens, nor increase in abundance of existing weed species in the lease area and adjacent areas caused by mining operations. **Outcome 22** No introduction of new pests (including feral animals), nor increase in abundance of existing pest species in the lease area and adjacent areas caused by mining operations.
ML6345 – Schedule 2 Condition 16 ML6346 – Schedule 2 Condition 1 - Soil	**Topsoil*** The Lessee must in constructing and operating the Lease ensure that the existing soil quality and quantity is maintained.	**Outcome 3*** Existing soil quality and quantity is maintained.
ML6345 – Schedule 2 Condition 17	**Groundwater and Hydrology*** The Lessee must in constructing and operating the Lease ensure that there is no adverse impact to the quality and quantity of surface or groundwater caused by mining operations to water dependent ecosystems or existing users unless adequate alternate supplies are provided in accordance with Condition 18.	**Outcome 9*** No adverse impact to the quality and quantity of groundwater caused by mining operations to water dependent ecosystems or existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions.

Tenement and Condition #	Condition	Outcome
		Outcome 5* No adverse impact to the quality and quantity of surface water caused by mining operations to water dependent ecosystems or existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions.
ML6345 – Schedule 2 Condition 18	**Groundwater and Hydrology*** If the Lessee adversely affects the ability of other persons to take water from any watercourse, well or dam, the lessee must replace or deepen existing wells if they are substantially affected by dewatering activities, or provide alternative water sources for the affected users regardless of cessation of mining operations whereby: A 'substantial affect' is determined by the movement of physical or chemical parameters of the water in the subject well beyond normal seasonal variation. This is to be determined by the relevant authority, and; An 'alternative water source' includes the potential to lower pumps, deepened weeks, extend supply from one of the Lessee's wells, or connection the SA Water mains. In the case of any dispute, the final decision on an alternative water source is to be determined by DSD (now DEM) in consultation with the affected landholder and the Lessee.	This lease condition is not a desired outcome. It relates to what is to occur should Hillgrove fail to meet Outcome 9 or Outcome 10. Hillgrove is committed to following this course of action should it be required.
ML6345 – Schedule 2 Condition 19	**Groundwater and Hydrology*** The Lessee must in ensure that the contaminated water within the pit does not alter groundwater systems outside the extent of mining operation.	**Outcome 10*** Contaminated water within the pit does not alter groundwater systems outside the extent of mining operation.
ML6345 – Schedule 2 Condition 20 ML6346 – Schedule 2 Condition 1 - Stormwater	**Stormwater*** The Lessee must in constructing and operating the Lease ensure no stormwater contaminated as a result of mining operations is to leave the Lease area or result in contamination of soil at closure within the Lease area.	**Outcome 6*** No stormwater contaminated as a result of mining operations is to leave the lease area or result in contamination of soil at closure within the lease area.

Tenement and Condition #	Condition	Outcome
ML6345 – Schedule 2 Condition 21	**Flooding/Runoff** The Lessee must in constructing and operating the Lease ensure no water runoff from the Lease results in flooding of adjacent areas, to an extent greater than that that could reasonably be expected to occur prior to mining operations being established on the Lease.	**Outcome 7** No water runoff from the lease results in flooding of adjacent areas, to an extent greater than that that could reasonably be expected to occur prior to mining operations being established on the lease.
ML6345 – Schedule 2 Condition 22	**Waste Disposal and Hazardous Substances** The Lessee must in constructing and operating the Lease ensure that no contamination and/or pollution of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site is caused by waste products (other than mine waste and tailings) and hazardous materials used in mine operations.	**Outcome 12** No contamination and/or pollution of groundwater occurs either on or off site is caused by waste products and hazardous materials used in mine operations. **Outcome 8** No contamination and/or pollution of natural water drainage systems, streams and rivers, land and soils occurs either on or off site is caused by waste products and hazardous materials used in mine operations.
ML6345 – Schedule 2 Condition 23	**Waste Disposal & Hazardous Substances** The Lessee must in ensure that no demolition, industrial or solid domestic (other than treated sewage) wastes are to be disposed of within the Lease.	**Outcome 11** No demolition, industrial or solid domestic (other than treated sewage) wastes are to be disposed of within the lease.
ML6345 – Schedule 2 Condition 24	**Waste Disposal & Hazardous Substances** The Lessee must ensure that fuel and liquid chemical storage is adequately bunded to capture spillage and to prevent the migration or infiltration of any spillage or leakage to the surrounding environment in conformance with relevant Environment and Protection Authority guidelines.	**Outcome 4** Fuel and liquid chemical storage is adequately bunded to capture spillage and to prevent the migration or infiltration of any spillage or leakage to the surrounding environment in conformance with relevant Environment and Protection Authority guidelines.

Tenement and Condition #	Condition	Outcome
ML6345 – Schedule 2 Condition 25 ML6346 – Schedule 2 Condition 1 – Acid Mine Drainage (AMD)	**Acid Mine Drainage*** The Lessee must in constructing and operating the Lease ensure that no contamination of natural drainage systems, streams and creeks, and no contamination beyond approved EPA limits for groundwater, land and soils occurs either on or off the site resulting from permanent or temporary storage of the mine waste and tailings.	**Outcome 14*** No contamination of natural water drainage systems, streams and creeks and no contamination beyond approved EPA limits for groundwater, land and soils occurs onsite or offsite resulting from permanent disposal or temporary storage of the mine waste and tailings.
ML6345 – Schedule 2 Condition 26	**Backfilling of Mine Pits** The Lessee must backfill with waste rock into the Emily Star Pit and the O'Neil/Nugent zone to the extent it is technically feasible.	**Outcome 13** The Emily Star pit and the O'Neil/Nugent zone will be backfilled with waste rock to the extent that it is technically feasible.
ML6346 – Schedule 2 Condition 1 – Adjacent Land Use	**Adjacent Land Use** The Lessee must, in constructing and operating the Lease, ensure that there are no adverse impacts to adjacent land use.	**Outcome 1** Maintain a buffer zone of 10 m from the lease boundary with no workings* within that zone.
ML6346 – Schedule 2 Condition 1 – Backfilling of mine pits	**Backfilling of Mine Pits** 2. The Lessee must backfill the O'Neil/Nugent pit void with waste rock, suitably rehabilitated for future industrial use, with any PAF material encapsulated to ensure achievement of AMD lease condition 7.	**Outcome 13b** The O'Neil/Nugent pit void on ML6436 will be backfilled with waste rock and rehabilitated so suitable for future industrial use. PAF material will be encapsulated to ensure achievement of Outcome 14.
Completion Outcomes		
ML6345 – Schedule 1 Condition 13	**Reporting** Prior to Lease relinquishment, the Lessee must provide to the Minister a Mine Completion Report prepared in consultation with the landowner and in accordance with guidelines approved by the Director of Mines, which demonstrates achievement of the closure criteria as specified in the current PEPR.	**Completion Outcome 8** A Mine Completion Report prepared in consultation with the landowner and in accordance with guidelines approved by the Director of Mines, which demonstrates achievement of the closure criteria as specified in the current PEPR has been provided to the Minister prior to lease relinquishment.

Tenement and Condition #	Condition	Outcome
ML6345 – Schedule 1 Condition 14	**Insurance** The Lessee must, prior to commencing operations under this Lease and for the duration of the lease maintain public liability insurance to cover all operations under the Lease (including sudden and accidental pollution) in the name of the Lessee for a sum not less than $50 million or such greater sum as specified by the Director of Mines, and make such amendments to the terms and conditions of the insurance as the Director of Mines may require. A copy of the cover note or certificate of currency for the insurance must be provided to the Director of Mines upon request. If requested by the Director of Mines, the Lessee must engage an independent and reputable risk assessor to prepare a risk assessment report detailing the public liability risks arising out of the conduct of operations on the lease, and recommending the level of public liability cover (in respect of any one occurrence) that should be effected and maintained by the Lessee. In preparing the risk assessment report, the assessor must consult with the landowner and the Director of Mines. In specifying the level of insurance required, the Director of Mines accepts no liability for the completeness, adequacy of the sum insured, the limit of liability, the scoped coverage, the conditions or exclusions of the insurance in respect of how the Lessee may or may not respond to any loss, damage or liability.	**Completion Outcome** No completion outcome required - on completion the requirement for this insurance is extinguished.
ML6345 – Schedule 1 Condition 16 ML6346 – Schedule 1 Condition 5	**Bond** In requesting a review of the bond required under the Mining Act, the Minister may request that written quotes from a third party are obtained by the Lessee for the cost of rehabilitating the site to the requirements specified in the approved PEPR. The Lessee must meet all the charges and costs in obtaining and maintaining the Bond.	**Completion Outcome** No completion outcome required - on completion the requirement for this insurance is extinguished.

Tenement and Condition #	Condition	Outcome
ML6345 – Schedule 2 Condition 27.1	**Rehabilitation** The external visual amenity of the site is comparable with the surrounding areas and in accordance with the reasonable expectations of relevant stakeholders including removal of all mine related infrastructure (unless otherwise approved by the Director of Mines in consultation with relevant stakeholders).	**Completion Outcome 2** The external visual amenity of the site is comparable with the surrounding areas and in accordance with the reasonable expectations of relevant stakeholders including removal of all mine related infrastructure (unless otherwise approved by the Director of Mines in consultation with relevant stakeholders).
ML6345 – Schedule 2 Condition 27.2	**Rehabilitation** The risks to the health and safety of the public and fauna are as low as reasonably practical.	**Completion Outcome 3** The risks to the health and safety of the public and fauna are as low as reasonably practical.
ML6345 – Schedule 2 Condition 27.3	**Rehabilitation** Ecosystem and landscape function is resilient, self-sustaining and indicating that an ecosystem and landscape function comparable to the surrounding areas will ultimately be achieved.	**Completion Outcome 1** Ecosystem and landscape function is resilient, self-sustaining and indicating that an ecosystem and landscape function comparable to the surrounding areas will ultimately be achieved.
ML6345 – Schedule 2 Condition 27.4	**Rehabilitation** No compromise of the quality and quantity of surface water to existing users and water dependent ecosystems.	**Completion Outcome 6** No compromise of the quality and quantity of surface water to existing users and water dependent ecosystems.
ML6345 – Schedule 2 Condition 27.5	**Rehabilitation** No compromise of the quality and quantity of groundwater to existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions.	**Completion Outcome 4** No compromise of the quality and quantity of groundwater to existing users unless adequate alternate supplies are provided.
ML6345 – Schedule 2 Condition 27.6	**Rehabilitation** The site is physically stable.	**Completion Outcome 7** The site is physically stable.

Tenement and Condition #	Condition	Outcome
ML6345 – Schedule 2 Condition 27.7	**Rehabilitation** All mining waste and tailings left onsite are chemically and physically stable.	**Completion Outcome 5** All mining waste and tailings left onsite are chemically and physically stable.

5.2 Impact Assessment

5.2.1 Impacts Already Identified

Table 5-2 provides a delta impact assessment for the activities proposed in this PEPR against the operational and closure impacts already identified in the 2016 PEPR, along with the applicable outcomes.

Where impacts are not considered to be different or changed as a result of the underground operation or TSF lift, they are not assessed further in this PEPR. Identification of the potential impacts is based on knowledge of the existing environment, experience with similar operations elsewhere and the issues of concern raised by key stakeholders particularly those raised during meetings with the KCCCC and government agencies (stakeholder concerns are also discussed in Chapter 4).

New and different impacts are assessed in Section 5.2.3.

5.2.2 Impact Assessment Method

Table 5-3 provides the impact assessment of the new or different potential impacts as a result of the proposed operations identified within this PEPR. The following aspects have been assessed to provide the information in the table.

- Potential impact and associated outcome.
- Existing controls, i.e., avoidance, mitigation and management measures, are listed. These measures detail Hillgrove's commitment to environmental management for the Kanmantoo Copper Mines. The measures described are technically and economically feasible within the context of the project's setting.
- The impacts are then assessed using a Source-Pathway-Receptor model where the following definitions apply:
    - Source - the source of the potential impact event which alone or in combination has the potential to cause harm to an environmental receptor;
    - Pathway – the means or route (with consideration of any natural barriers) by which an identified environmental receptor can be exposed to, or may reasonably be expected to be impacted by an identified source; and
    - Receptor - receptors that may reasonably be expected to be adversely impacted by the source, taking into account the considerations for the element of the environment
- Verification as to whether the source, pathway or receptor exists with existing controls applied, hence whether the impact is credible, i.e., verified, or not. A summary statement of the assessed impact is provided, based on the information provided in Section 5.2.3.
- Any additional controls required to mitigate or negate the potential impact at the source, pathway or receptor are provided.
- Any uncertainties associated with the assessment of the impact or the effectiveness of the controls.

Table 5-2 – Delta Impact Assessment: changes to existing impacts

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
Land use				
I01 - Land use impact due to contamination of land or water resources. I02 - Land use impact due to soil erosion	**Outcome 1a:** Maintain a buffer zone of 10 m from the lease boundary with no workings* within that zone.	• Mine layout designed to allow 10 m buffer zone to the lease boundary with no workings in this zone. • Demarcation of buffer zone adjacent to process plant (during construction only) and adjacent to O'Neil/Nugent zone with pegging and signage to indicate no workings permitted within buffer zone. • Buffer zone marked on project GIS and construction plans. • Regular review and site inspections. • Land owners access compensation agreement with landowner & restoration of land to agreed conditions.	No change – no new surface processes, disturbance or landforms. Tailings to be placed on IWL same as existing tailings (refer to Section 3.7.2). The underground mine extent does not cross into ML 6438, hence no change as a result of this PEPR.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
	Outcome 1b: No adverse impacts to adjacent public roads, railway, and adjacent land use outside the ML area.	Open Pit • Giant Pit stability monitoring. IWL • Construction of IWL as per design, which has been designed for long term geotechnical and geochemical stability.	Increased potential adverse and / or new impacts I53 - Underground workings impacts Giant Pit stability I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability I57 - Siltation of water control structures as a result of sedimentation from IWL post-closure results in overtopping during flood events and impact to surrounding land uses, including adjacent rail infrastructure.	New outcome to reflect full intent of tenement condition
I01 - Land use impact due to contamination of land or water resources. I02 - Land use impact due to soil erosion	**Outcome 2:** The current disturbed areas are stabilised to prevent sediment from leaving the lease area.	• Regular review and audit of management practices. • Utilisation of erosion controls on disturbed areas to ensure they are stabilised. • Constructing sediment basins, bunds for surface water collection and treatment. • Development of landowners access compensation agreement with landowner and restoration of land to agreed conditions.	Increased potential adverse and / or new impacts I55 - Additional lift on TSF impacts erosional forces and increases erosion, hence sediment from IWL landform I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability	No change Outcome still valid.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I01 - Land use impact due to contamination of land or water resources. I02 - Land use impact due to soil erosion	**Outcome 3:** Existing soil quality and quantity is maintained.	• Implementation of waste management SOP (including spill response procedures). • Regular review and audit of management practices. • Remediation of contaminated soil where necessary. • Integrated waste landform designed and constructed to avoid formation of ARD from waste rock (by encapsulating PAF material and implementing a cover on closure). • Utilisation of erosion controls on disturbed areas to ensure they are stabilised. • Dispose of putrescibles/ biodegradable litter in accordance with EPA guidelines. • Topsoil stripped and stockpiled in mounds that are no greater than 2m in height and are shaped to aid the capture of incident rainfall and encourage biological activity within the soil. • Records of topsoil volumes maintained including detail of volumes harvested, volumes stockpiled and volumes respread.	No change – no new surface processes, disturbance or landforms. Rehabilitation method to continue to be implemented as per existing operation.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
I01 - Land use impact due to contamination of land or water resources. I02 - Land use impact due to soil erosion	**Outcome 4:** Fuel and liquid chemical storage is adequately bunded to capture spillage and to prevent the migration or infiltration of any spillage or leakage to the surrounding environment in conformance with relevant Environment and Protection Authority guidelines.	• Adequate design, construction and maintenance of bunds. • Regular internal inspection of bunds.	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Surface water				

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I03 - Adverse effects on aquatic fauna and habitats due to increased sediment loads. I04 - Adverse effects on aquatic fauna due to chemical contamination of watercourses. I05 - Adverse effects on aquatic fauna and riparian vegetation due to altered flow regime.	**Outcome 5:** No adverse impact to the quality and quantity of surface water caused by mining operations to water dependent ecosystems or to existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions	• No groundwater dependent ecosystems have been identified on the ML area or immediate surrounds. • Construction, and regular inspection, of surface water drainage/diversion system and sediment controls. • Diversion of clean up-gradient runoff around infrastructure and back into the existing drainage path using channels and bunds • No off-site discharge of mine-contaminated water. • Re-use or treatment of contaminated water. • Integrated waste landform designed and constructed to avoid formation of ARD from waste rock (by encapsulating PAF material and implementing a cover on closure). • HDPE liner on TSF floor and underdrainage system to collect seepage. • Ensuring areas to be disturbed are minimised and clearing complies with relevant requirements. • HDPE liner on TSF floor and underdrainage system to collect seepage. • Progressively rehabilitating cleared land. • Ensuring areas to be disturbed are minimised and clearing complies with relevant requirements. • Maintenance of freeboards on water storage facility. • Progressively rehabilitating cleared land. • Maintenance of freeboards on water storage facility.	Increased potential adverse and / or new impacts I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability I55 - Additional lift on TSF impacts erosional forces and increases erosion, hence sediment from IWL landform I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability I64 – Surface expression of groundwater results in contamination of local surface water	No change Outcome still valid.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I03 - Adverse effects on aquatic fauna and habitats due to increased sediment loads. I04 - Adverse effects on aquatic fauna due to chemical contamination of watercourses. I05 - Adverse effects on aquatic fauna and riparian vegetation due to altered flow regime. Continued		• In the event that discharge runoff monitoring results exceed criteria the following actions would be implemented: 1. Discussion with hydrological consultants. 2. Resampling where possible to confirm sample results. 3. Review site activities that may have resulted in contaminants release. 4. Review structural integrity of water storages across site. • Upon confirmation of non-compliance, implement additional frequency of monitoring as required and /or implement remedial measures such as improve water management structures as required from the outcomes of investigations.		
I03 - Adverse effects on aquatic fauna and habitats due to increased sediment loads. I04 - Adverse effects on aquatic fauna due to chemical contamination of watercourses. I05 - Adverse effects on aquatic fauna and riparian vegetation due to altered flow regime.	**Outcome 6:** No stormwater contaminated as a result of mining operations is to leave the lease area or result in contamination of soil at closure within the lease area.	• Collection and reuse of surface water runoff from operational areas as appropriate. • Construction, and regular inspection, of surface water drainage/diversion system and sediment controls. • Diversion of clean up-gradient runoff around infrastructure and back into the existing drainage path using channels and bunds.	Increased potential adverse and / or new impacts I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability I55 - Additional lift on TSF impacts erosional forces and increases erosion, hence sediment from IWL landform I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I03 - Adverse effects on aquatic fauna and habitats due to increased sediment loads. I04 - Adverse effects on aquatic fauna due to chemical contamination of watercourses. I05 - Adverse effects on aquatic fauna and riparian vegetation due to altered flow regime.	**Outcome 7:** No water runoff from the lease results in flooding of adjacent areas, to an extent greater than that that could reasonably be expected to occur prior to mining operations being established on the lease.	• Construction, and regular inspection, of surface water drainage/diversion system and sediment controls. • Diversion of clean up-gradient runoff around infrastructure and back into the existing drainage path using channels and bunds. • Maintenance of freeboards on water storage facilities.	Increased potentially adverse impact I57 - Siltation of water control structures as a result of sedimentation from IWL post-closure results in overtopping during flood events and impact to surrounding land uses, including adjacent rail infrastructure.	No change Outcome still valid.
I03 - Adverse effects on aquatic fauna and habitats due to increased sediment loads. I04 - Adverse effects on aquatic fauna due to chemical contamination of watercourses. I05 - Adverse effects on aquatic fauna and riparian vegetation due to altered flow regime.	**Outcome 8:** No contamination and/or pollution of natural water drainage systems, streams and rivers, land and soils occurs either on or off site is caused by waste products and hazardous materials used in mine operations.	• Construction, and regular inspection, of surface water drainage/diversion system and sediment controls. • No off-site discharge of mine-contaminated water. • Remediation of contaminated soil where necessary. • Integrated waste landform designed and constructed to avoid formation of ARD from waste rock (by encapsulating PAF material and implementing a suitable cover on closure). • Dispose of putrescible/ biodegradable litter in accordance with EPA requirements.	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Groundwater				

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I07 - Reduced groundwater flows and availability for other users due to mine dewatering (and potentially groundwater extraction from bores). I08 - Reduced stream recharge from groundwater. I09 - Deterioration in groundwater quality affecting suitability for water uses (domestic use and stock watering).	**Outcome 9:** No adverse impact to the quality and quantity of groundwater caused by mining operations to water dependent ecosystems or existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions.	• Monitoring (levels and quality) of regional and ML area groundwater (as per GMMP) • Establishment of supply well extraction rate for sustainable use. • Review groundwater monitoring results annually and amend GMMP as applicable. • As per condition 18 of the lease conditions if the operation adversely affects the ability of other persons to take water from any watercourse, well or dam, the lessee must replace or deepen existing wells if they are substantially affected by dewatering activities, or provide alternative water sources for the affected users. • An annual groundwater monitoring report has been made available to stakeholders /regulatory authorities via the DEM website. • Undertake leachate collection and monitoring from the tailings dam. • Risk based engineering design for TSF completed to RL1274 to meet and maintain design intent for existing conditions and outcomes. • TSF operating manual updated for revised design. In the event that monitoring triggers the leading indicator criteria or compliance, the following will occur: **Quantity** 1. Where water quality has been affected in a neighbouring landholder's supply bore, then Hillgrove will also make good the landholders' water supply in accordance with Mining Lease Condition 18 by: • Replacing the bore in an area where water quality has not been impacted; or • Supplying an alternative water supply of similar quality to the affected bore.	Increased potential adverse and / or new impacts Groundwater drawdown may change during operations and pit lake chemistry may change post closure. I58 - Underground operation results in change to water quantity available to surrounding users due to dewatering I59 - Underground operation results in change to water quality available to surrounding users due to exposure of PAF material I60 – Increased height of TSF results in seepage thereby influencing water quality and quantity available to surrounding users	No change Outcome still valid.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I07 - Reduced groundwater flows and availability for other users due to mine dewatering (and potentially groundwater extraction from bores). I08 - Reduced stream recharge from groundwater. I09 - Deterioration in groundwater quality affecting suitability for water uses (domestic use and stock watering). Continued		**Quality** 1. Undertake a confirmatory round of groundwater sampling and analysis of the exceeding COPC at the impacted location(s) within eight weeks of the event that recorded the exceedance(s). 2. If the exceedance(s) is confirmed, then: • Undertake more frequent sampling and analyses and complete statistical trend analysis of the data collected from the impacted location(s) (e.g. Mann-Kendall Trend Test) to assess if an increasing trend in COPC concentrations is evident; • Consider installation of additional monitoring wells to better understand the potential source of the impact and/or define the impacted area; • Confirm actual threshold criteria and environmental values of groundwater in the area of concern; and • Consider modelling the predicted fate of COPC, focusing on protection of environmental values and known groundwater uses at down hydraulic gradient receptors, should such a receptor exist. 3. If step 2 shows that impacts are unacceptable with reference to relevant water quality criteria, then remedial measures will be implemented following preparation of a remedial options assessment (ROA) report which will be submitted to DEM and the SA EPA for comment and approval. Such remedial options may include: • Natural attenuation (and associated monitoring); and • Pump and treat.		

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I07 - Reduced groundwater flows and availability for other users due to mine dewatering (and potentially groundwater extraction from bores). I08 - Reduced stream recharge from groundwater. I09 - Deterioration in groundwater quality affecting suitability for water uses (domestic use and stock watering).	**Outcome 10:** Contaminated water within the pit does not alter groundwater systems outside the extent of mining operation.	• Continued monitoring (levels and quality) of regional and ML area groundwater in accordance with the GMMP • Establishment of supply well extraction rate for sustainable use.	Increased potential adverse and / or new impacts Pit lake chemistry may change post closure. I61 – Underground workings alter pit lake system in terms of ability to alter groundwater systems outside the extent of mining operation.	No change Outcome still valid.
I07 - Reduced groundwater flows and availability for other users due to mine dewatering (and potentially groundwater extraction from bores). I08 - Reduced stream recharge from groundwater. I09 - Deterioration in groundwater quality affecting suitability for water uses (domestic use and stock watering).	**Outcome 11:** No demolition, industrial or solid domestic (other than treated sewage) wastes are to be disposed of within the lease.	• Waste management is undertaken in accordance with the site waste management plan. • Existence of waste removal contract. • Implementation of waste management SOP (including spill response procedures). • Regular review and audit of management practices. • Ensuring staff and contractors have a high level of operator training. • Good housekeeping practices in all areas. • Waste segregated and transported offsite and appropriately disposed.	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I07 - Reduced groundwater flows and availability for other users due to mine dewatering (and potentially groundwater extraction from bores). I08 - Reduced stream recharge from groundwater. I09 - Deterioration in groundwater quality affecting suitability for water uses (domestic use and stock watering).	**Outcome 12:** No contamination and/or pollution of groundwater occurs either on or off site is caused by waste products and hazardous materials used in mine operations.	• Continued monitoring (levels and quality) of regional and ML area groundwater (GMMP Appendix M) • Existence of waste removal contract. • Implementation of waste management SOP (including spill response procedures). • Regular review and audit of management practices. • Ensuring staff and contractors have a high level of operator training. • Good housekeeping practices in all areas. • Waste segregated and transported offsite and appropriately disposed.	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
I07 - Reduced groundwater flows and availability for other users due to mine dewatering (and potentially groundwater extraction from bores). I08 - Reduced stream recharge from groundwater. I09 - Deterioration in groundwater quality affecting suitability for water uses (domestic use and stock watering).	**Outcome 13:** The Emily Star pit and the O'Neil/Nugent zone will be backfilled with waste rock to the extent that it is technically feasible. **Outcome 13b** The O'Neil/ Nugent pit void on ML6436 will be backfilled with waste rock and rehabilitated so suitable for future industrial use. PAF material will be encapsulated to ensure achievement	Adherence to milestones as reported in Chapter 5 of the 2016 PEPR.	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.

I07 - Reduced groundwater flows and availability for other users due to mine dewatering (and potentially groundwater extraction from bores). I08 - Reduced stream recharge from groundwater. I09 - Deterioration in groundwater quality affecting suitability for water uses (domestic use and stock watering).	**Outcome 14:** No contamination of natural water drainage systems, streams and creeks and no contamination beyond approved EPA limits for groundwater, land and soils occur onsite or offsite resulting from permanent disposal or temporary storage of the mine waste and tailings.	• Continued monitoring (levels and quality) of regional and ML area groundwater (GMMP). • Regular review and audit of management practices. • Ensuring staff and contractors have a high level of operator training. • Good housekeeping practices in all areas. • TSF and IWL design, construction and operation.	Tailings to be placed on TSF are geochemically the same as existing tailings. Increased potential adverse and / or new impacts I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability I55 - Additional lift on TSF impacts erosional forces and increases erosion, hence sediment from IWL landform I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability I57 - Siltation of water control structures as a result of sedimentation from IWL post-closure results in overtopping during flood events and impact to surrounding land uses, including adjacent rail infrastructure. I59 - Underground operation results in change to water quality available to surrounding users due to exposure of PAF material I60 – Increased height of TSF results in seepage thereby influencing water quality and quantity available to surrounding users	No change Outcome still valid.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
			I61 – Underground workings alter pit lake system in terms of ability to alter groundwater systems outside the extent of mining operation.	
Air quality				
I10 - Decrease in air quality due to dust emissions. I11 - Decrease in air quality due to combustion emissions. I12 - Decrease in air quality due to odour.	**Outcome 15:** No adverse public health and nuisance impacts to local residents from air emissions, dust and odour generated by mining operations.	• Establishment and maintenance of separation distances between operation and nearest receptors. • Use of water or dust suppressants to control dust emissions including water sprays on ROM hopper, conveyor and transfer chutes. • Use of dust extraction systems and enclosure of some parts of process plant. • Progressive rehabilitation of disturbed areas. • Maintenance of vehicles and roads. • Reduction of vehicle speeds on roads used by mine traffic. • Limiting high dust-generating activities during adverse wind conditions. • Use of a weather station. • Cleaning up spillage promptly and keeping vehicles clean. • Sealed concentrate transport. • Complaints register. • Real-time dust monitoring and fugitive dust trigger and response dust management plan.	Decrease in air emissions due to underground nature of mining.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Noise and Vibration				

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I13 - Disturbance to residents from noise and vibration.	**Outcome 16:** No public nuisance impacts from noise emanating from the operating site. Noise must at all times comply with the relevant environment protection policy under the *Environment Protection Act* (1993).	• Establishment and maintenance of separation distances between operation and nearest receptors. • Establishment of a noise and vibration monitoring program for early stages of construction and operation to confirm modelling predictions. • Management of blasting operations, including timing of blasting to minimise disturbance. • Ongoing review and implementation of Explosives Management Plan updated for the underground (see Appendix F and continued assessment conducted to determine K factors from blast. • Blasting based upon risk • assessments per blast. • Periodic risk control review of blasting via the Integrated Risk Management System (IRMS). • Implementation of mitigation measures upon project onset, including acoustic treatment and shielding techniques and treatments as applicable at sensitive receivers.	Decrease in noise and emissions due to underground nature of mining.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I13 - Disturbance to residents from noise and vibration.	**Outcome 17:** No adverse public health and/or nuisance impacts from airblast, flyrock and vibration caused by blasting.	• Establishment and maintenance of separation distances between operation and nearest receptors. • Management of blasting operations, including timing of blasting to minimise disturbance. • Establishment of additional containment measures as a secondary safety source from flyrock. • Each blast designed based upon risk assessment (K factors) per Blast Management Standard considering boundaries, sensitive receptors etc.. • Ongoing implementation and review of Blasting Management Standard and Plan. • Implementation of mitigation measures upon project onset, including acoustic treatment and shielding techniques. • Boundary protection shall be in place at least 10m from the nearest blast hole, prior to priming or loading activities taking place. • Implementation of reduced hole diameters, long stemming lengths and cover cages or conveyor belting in the O'Neil/Nugent pit to ensure flyrock does not leave the lease area.	Decrease in vibration and overpressure primarily during blasting the initial portal and no fly rock due to underground nature of mining. Increased potential adverse and / or new impacts I62 – impact to public health and/or nuisance impacts from vibration caused by underground blasting.	No change Outcome still valid.
Greenhouse gas emission				
I14 - Increase in greenhouse gas (GHG) emissions.	No applicable outcome	• Implementation of maintenance programs to maximise efficiency of fuel burn and minimise GHG emissions. • Identify and implement energy efficiency initiatives as applicable.	Decrease in greenhouse gas emissions due to reduced fleet and material movement	No applicable outcome
Flora				

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I15 - Significant impacts to threatened vegetation communities: *Austrostipa* sp. open tussock grassland. *Callitris gracilis* low woodland. *L. effusa* open tussock grassland/*E. odorata* low woodland in poor to moderate condition. *L. effusa* open tussock grassland/*E. odorata* low woodland in good to very good condition. I16 - Significant impacts to threatened flora species. I17 - Reduced species abundance (as a result of clearing). I18 - Reduced species abundance (as a result of grazing). I19 - Reduced conditions favourable for plant growth due to dust. I20 - Reduced conditions favourable for plant growth due to disturbance, soil or water contamination, physical damage to vegetation, changed surface water hydrology and groundwater extraction. I21 - Introduction of new weed species and increased weed density and distribution. I22 - Introduction of a native vegetation SEB offset area, which will: Improve the condition of *E. odorata* woodland in the ML area. Improve the condition of *L. effusa* grassland in the ML area. Provide long-term protection of the native vegetation in the ML area.	**Outcome 18:** All clearance of native vegetation is authorised under appropriate legislation and no permanent loss of abundance or diversity on or off the lease due to operations.	• Clear identification and documentation of areas to be protected and areas to be cleared. • Ensuring areas to be disturbed are minimised and clearing complies with relevant requirements. • Implementation of the native vegetation management plans and flora management plan. • Clearing to be undertaken in accordance with Hillgrove's Ground Disturbance SOP. • Establishment and ongoing management of SEB offset areas. • Avoidance of threatened vegetation communities and flora species during the design phase where practicable. • Progressive rehabilitation. • 'No go zones' clearly defined. • Implementation of the native vegetation management plans to ensure SEB offset requirements are met (Appendices 9A and 9B of the 2016 PEPR). • Fauna and threatened species management plans produced.	No change – no new surface processes, disturbance or landforms. Rehabilitation will continue to be implemented. **Changes to controls:** SEB offsets to be paid into the NV fund. NVMP updated to reflect payment into the fund (refer to Appendix A)	No change Outcome still valid.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I15 - Significant impacts to threatened vegetation communities I16 - Significant impacts to threatened flora species. I17 - Reduced species abundance (as a result of clearing). I18 - Reduced species abundance (as a result of grazing). I19 - Reduced conditions favourable for plant growth due to dust. I20 - Reduced conditions favourable for plant growth due to disturbance, soil or water contamination, physical damage to vegetation, changed surface water hydrology and groundwater extraction. I21 - Introduction of new weed species and increased weed density and distribution. I22 - Introduction of a native vegetation SEB offset area	**Outcome 19:** No uncontrolled fires caused by mining operations effect remnant vegetation on or off the mine site.	• Clear identification and documentation of areas to be protected and areas to be cleared. • Installation of fire breaks. • Control measure relating to fire hazards are summarised in Section 7.15 of 2016 PEPR. • All fires caused by mining operations are controlled.	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I21 - Introduction of new weed species and increased weed density and distribution.	**Outcome 20:** No introduction of new weeds and plant pathogens, nor increase in abundance of existing weed species in the lease area and adjacent areas caused by mining operations.	• Inspection and wash down of vehicles and project equipment. • Control of declared weed species. • Regular monitoring for weed outbreaks and implementation of weed control measures. • Minimisation of disturbance areas. • Implementation of Hillgrove's Weed and Pathogen Management SOP.	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Fauna				
I23 - Reduced species abundance. I24 - Significant impacts to threatened species.	**Outcome 21:** No net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas.	• Establishment and ongoing management of SEB offset areas (including the implementation of a threatened species management plan). • Implementation of the native vegetation management plans to ensure SEB offset requirements are met (Appendices 9A and 9B of the 2016 PEPR). • Project infrastructure located outside areas of very good quality *E. odorata* low woodland where possible. • Clearly identifying and documenting areas to be protected and areas to be cleared. • Minimising the area of direct land clearing. • Progressively rehabilitating cleared land. • Additional surveying of diamond firetail populations.	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I25 - Increased abundance of introduced species.	**Outcome 22:** No introduction of new pests (including feral animals), nor increase in abundance of existing pest species in the lease area and adjacent areas caused by mining operations.	• Prohibition of pets and feeding of animals. • Controlled extermination of introduced fauna species. • Internal and external auditing to assess housekeeping standards (in particular litter control). • Implementation of Hillgrove's Feral Animal Control SOP.	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Social and economic				

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I26 - Negative change in value of rural property. I27 - Increased pressure on police resources. I28 - Increased scarcity of rental accommodation. I29 - Competition for skilled labour. I30 - Benefits to the South Australian and Australian economies I31 - Economic benefits to communities I32 - Training and education I33 - Increased employment opportunities I34 - Increased support to communities I35 - Increased industry diversity I36 - Increased skills base I37 - Increased demand for temporary and rental accommodation I38 - Increased residential property value I39 - Improved service provision	**Outcome 23:** Operate a community engagement plan to the satisfaction of the Director of Mines which ensures effective communication and exchange of information between the operator, Hillgrove and their stakeholders (including but not limited to landowners, Callington/Kanmantoo communities or individuals).	• Amelioration of impacts during the design phase where possible and enforcement of high housekeeping standards. • Minimisation of dust emissions. • Establishment and maintenance of separation distances between operation and nearest residents to mitigate noise. • Maintenance of complaints register. • Operations of the community engagement plan. • Information provision to Hills Murray Local Service Area police and real estate agents. • Involvement in training and education to build levels of skilled labour and to train employees for the project. • Standard project management procedures, fostering of high performance culture. • Maximise mine life. • Sponsorship, donations and in-kind support. • Provision of information about volunteer initiatives such as the CFS and sporting teams on Hillgrove notice boards.	Reduced workforce, however implementation of this project provides for ongoing benefits to the local community with fewer negative impacts such as air and noise emissions.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
	Outcome 24: Any complaints received from public recorded and addressed in manner and form specified by the Director of Mines.	• Maintenance of complaints register.	No change – complaints will continue to be managed.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I26 - Negative change in value of rural property. I27 - Increased pressure on police resources. I28 - Increased scarcity of rental accommodation. I29 - Competition for skilled labour. I30 - Benefits to the South Australian and Australian economies I31 - Economic benefits to communities I32 - Training and education I33 - Increased employment opportunities I35 - Increased industry diversity I36 - Increased skills base I37 - Increased demand for temporary and rental accommodation I38 - Increased residential property value I39 - Improved service provision	**Outcome 25:** No public injuries or deaths will result from unauthorised entry to the site that could have been reasonably prevented.	• Implementation of appropriate fencing and signage where required. • Site security implementation. I28 control: • Reduced workforce by cessation of open pit mining	No change to site security.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Indigenous cultural heritage				

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I40 - Disturbance to potential Indigenous sites of moderate (or higher) scientific/Indigenous significance (without prior approval). I41 - Disturbance to potential Indigenous sites of limited scientific/Indigenous significance.	**Outcome 26:** No disturbance to Indigenous artefacts or sites of significance unless prior approval under the relevant legislation is obtained (note: no known sites exist within the ML area).	• Implementation of the cultural heritage management plan (including identification of the zone of potential sensitivity on all base maps of the ML area, use of an appropriate Indigenous/trained monitor during excavation within the potentially sensitive zone, the cessation of activities at location if a significant site is discovered, employee training on importance of identifying and protecting these sites).	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Non-Indigenous cultural heritage				
I42 - Disturbance to the Paringa smelter flue between the engine house and chimney stack. I43 -Disturbance to the Paringa smelter engine house. I44 - Disturbance to the stone settling tank. I45 -Disturbance to the Paringa homestead. I46 -Disturbance to the three ruins of limited significance. I47 -Disturbance to potential non-Indigenous historic and cultural heritage sites.	**Outcome 27:** No disturbance to non-Indigenous artefacts or sites of significance unless prior approval under the relevant legislation is obtained.	• Implementation of the cultural heritage management plan (including restricting unauthorised access, fencing and other means of securing the sites).	No change – no new surface processes, disturbance or landforms.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Landscape and visual amenity				

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I48 -Visual amenity during construction and operations. I49 -Visual amenity post closure. I50 -Improved visual amenity post closure.	**Outcome 28**: Visual impact of the process plant from the South Eastern Freeway is minimised to the satisfaction of the Director of Mines.	• Amelioration of impacts during the design phase where possible (including incorporation of stakeholder feedback). • Implementation of a progressive rehabilitation plan. • Enforcement of high housekeeping standards. • Minimise dust emissions. • Establishment of trees and native shrubs around the processing plant. • External materials used in process plant to have colours and finishes that are non-reflective and a colour to blend in with the landscape where possible.	No change – the process plant will remain as is.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
I48 -Visual amenity during construction and operations. I49 -Visual amenity post closure.	**Outcome 31:** The form, contrasting and reflective aspects of the mining operations will blend with the surrounding industrial landscape. On completion of mining operations the O'Neil/ Nugent pit void on ML6436 will be backfilled as per Outcome 13b.	• No waste rock to be stored on ML6436 (except as backfill upon completion of mining). • Implementation of a progressive rehabilitation plan. • Enforcement of high housekeeping standards. • Minimise dust emissions.	No change – the process plant will remain as is. Increased potential adverse and / or new impacts I63 – TSF lift results in increased visual impact	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Infrastructure and transport				

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
I51 - Road and traffic disruption during construction. I52 - Disruption to local traffic during operations. I53 - Adverse effects on South Australia's power supplies. I54 - Adverse effects on local and regional water supplies. I55 - Adverse effects on other infrastructure.	**Outcome 29:** No unauthorised damage to adjacent public or private infrastructure (e.g., roads, power supplies).	• Implementation of the Traffic Management Plan. • Liaison with appropriate agencies (e.g., District Council of Mount Barker, Murray Bridge Council, DPTI and Transport SA) regarding infrastructure.	Reduced impact with less traffic due to reduced workforce and production rate.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
I51 - Road and traffic disruption during construction. I52 - Disruption to local traffic during operations.	**Outcome 30:** Traffic movements, noise, dust and/or dragout to and from the mine site cause no adverse public impacts.	• Heavy vehicle access is via private access road (as is most light vehicle access). • Implementation of Hillgrove's consultation program to inform road users of any changed road conditions. • All accidents and near-misses appropriately investigated and management measures revised if required. • Include a cattle grid/rumble strips at the end of the access road.	Reduced impact with less traffic due to reduced workforce and production rate.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
Completion outcomes				

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
(note that no completion impacts are identified in the previous PEPR hence change has been identified in relation to the outcomes)	**Completion Outcome 1** Ecosystem and landscape function is resilient, self-sustaining and indicating that an ecosystem and landscape function comparable to the surrounding areas will ultimately be achieved.	• Ongoing implementation and review of the mine closure and completion commitments (Section 3.13) and native vegetation management plans (NVMP) (Appendix A), to incorporate the findings of annual fauna and flora surveys and monitoring data resulting from soil moisture probes and landscape function analysis monitoring. • Continue to implement the development of a methodology for successful establishment of a self- sustaining ecosystem and where practicable progressive rehabilitation. • Contaminated soil investigation post decommissioning and comparison against baseline / control site.	No change – rehabilitation activities will continue using methods as have been applied to date.	No change Outcome still valid and will continue be met through implementation of existing controls summarised here and detailed in the 2016 PEPR - not addressed further.
(note that no completion impacts are identified in the previous PEPR hence change has been identified in relation to the outcomes)	**Completion Outcome 2** The external visual amenity of the site is comparable with the surrounding areas and in accordance with the reasonable expectations of relevant stakeholders including removal of all mine related infrastructure (unless otherwise approved by the Director of Mines in consultation with relevant stakeholders).	• Implement NVMPs (Appendix A). • Incorporate stakeholder feedback from KCCCC and the original Visual Impact Assessment (Urbis/Coffey, 2013). • Provide confidence in the mine's ability to achieve a positive visual amenity outcome in real time through progressive rehabilitation where practicable.	Increased potential adverse and / or new impacts I63 – TSF lift results in increased visual impact	No change Outcome still valid.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
(note that no completion impacts are identified in the previous PEPR hence change has been identified in relation to the outcomes)	**Completion Outcome 3** The risks to the health and safety of the public and fauna are as low as reasonably practical.	Open pit • Abandonment bund will be constructed outside potential break back zone (Section 3.13.4.1)	No change – open pit will be closed in manner planned	No change Outcome still valid.
		Underground • Refer to Section 3.13.4.2	Increased potential adverse and / or new impacts I53 - Underground workings impacts Giant Pit stability	No change Outcome still valid.
		IWL • Construction of IWL as per design, which has been designed for long term geotechnical and geochemical stability. • Performance monitoring of PAF and NAF placement and water infiltration • Refer to Section 3.13.4.3	Increased potential adverse and / or new impacts I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability	No change Outcome still valid.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
(note that no completion impacts are identified in the previous PEPR hence change has been identified in relation to the outcomes)	**Completion Outcome 4** No compromise of the quality and quantity of groundwater to existing users unless adequate alternate supplies are provided.	Underground • Refer to Section 3.13.4.2	Increased potential adverse and / or new impacts I58 - Underground operation results in change to water quantity available to surrounding users due to dewatering I59 - Underground operation results in change to water quality available to surrounding users due to exposure of PAF material	No change Outcome still valid.
(note that no completion impacts are identified in the previous PEPR hence change has been identified in relation to the outcomes)	**Completion Outcome 5** All mining waste and tailings left onsite are chemically and physically stable.	Underground • Refer to Section 3.13.4.2	Increased potential adverse and / or new impacts I53 - Underground workings impacts Main pit stability	No change Outcome still valid.
		IWL • Construction of IWL as per design, which has been designed for long term geotechnical and geochemical stability. • Performance monitoring of PAF and NAF placement and water infiltration • Refer to Section 3.13.4.3	Increased potential adverse and / or new impacts I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability	No change Outcome still valid.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
		Underground • Refer to Section 3.13.4.2	Increased potential adverse and / or new impacts I61 – Underground workings alter pit lake system in terms of ability to alter groundwater systems outside the extent of mining operation.	No change Outcome still valid.
		IWL • Construction of IWL as per design, which has been designed for long term geotechnical and geochemical stability. • Performance monitoring of PAF and NAF placement and water infiltration • Refer to Section 3.13.4.3 • Implementation and regular update of the Groundwater Monitoring and Management Plan (GMMP) (Appendix M)	Increased potential adverse and / or new impacts I60 – Increased height of TSF results in seepage thereby influencing water quality and quantity available to surrounding users	No change Outcome still valid.
(note that no completion impacts are identified in the previous PEPR hence change has been identified in relation to the outcomes)	**Completion Outcome 6** No compromise of the quality and quantity of surface water to existing users and water dependent ecosystems.	IWL • Construction of IWL as per design, which has been designed for long term geotechnical and geochemical stability. • Performance monitoring of PAF and NAF placement and water infiltration • Refer to Section 3.13.4.3 • Implementation and regular update of the Groundwater Monitoring and Management Plan (GMMP) (Appendix M)	Increased potential adverse and / or new impacts I55 - Additional lift on TSF impacts erosional forces and increases erosion, hence sediment from IWL landform impacts on surface water	No change Outcome still valid.

Existing Impact	Applicable outcome	Summary of Existing Control Measures	Change to Impact	Change to Outcome
(note that no completion impacts are identified in the previous PEPR hence change has been identified in relation to the outcomes)	**Completion Outcome 7** The site is physically stable.	IWL • Construction of IWL as per design, which has been designed for long term geotechnical and geochemical stability. • Performance monitoring of PAF and NAF placement and water infiltration • Refer to Section 3.13.4.3 • Implementation and regular update of the GMMP (Appendix M)	Increased potential adverse and / or new impacts I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability I57 - Siltation of water control structures as a result of sedimentation from IWL post-closure results in overtopping during flood events and impact to surrounding land uses, including adjacent rail infrastructure.	No change Outcome still valid.

5.2.3 New or Different Potential Impacts

This section identifies the new and different potential impacts as a result of the activities included in this PEPR.

A summary of the impact assessment for the new and different activities included in this PEPR is presented in Table 5-3.

5.2.3.1 I53 - Underground workings impacts Giant Pit stability

The underground workings will be located in in the garnet andalusite biotite schist (GABS) unit and the competent GDM1a geotechnical domain (refer to Section 2.6). The open pit is excavated with steep 75°-90° batters, up to 36m in height. On the western side of the Giant Pit there is a well-established foliation discontinuity set, however on the eastern side of the pit foliation discontinuities are rarely seen.

The controls identified in Section 3.4.2.4 will be implemented to ensure the open pit stability does not impact on underground operations or workers.

The underground workings will not affect the overall stability of the open pit as there will be an adequate crown pillar retained between the base of the open pit and the underground stopes (refer to Section 3.4.2.3).

This potential impact is considered assessed with no further controls required other than those detailed in Section 3.13.4.3, including the continuation of the existing laser scanning monitoring regime of the east pit wall conducted for safety purposes.

5.2.3.2 I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability

PSM assessed the potential impact of the Stage 8 and 9 lifts on the IWL stability (refer to Section 3.7.2.2 and 3.13.4.3).

The stability analysis concluded that the IWL has FoS greater than the minimum FoS recommended in ANCOLD (2012) for all embankments with the exception of the batter adjacent to the RWS. For this section, PSM concluded the FoS is expected to be higher than modelled due to the 3D effects given the area is locally constrained. A peer review by Dr Williams reached the same conclusion (Appendix D).

Based on PSMs long history with the site and extensive site-based data and observations, the conservative parameters used in the modelling, the proposed lifts being staged to ensure they are not greater than 4m in height, the low liquefaction potential and the free draining nature of the tailings the stability of the tailings embankments during operations and post-closure to be acceptable.

PSM also noted the likelihood of piping or internal erosion through the embankments would be considered rare based on the sandy nature of the tailings, the operational control of the decant pond location and the deposition of tailings will result in a widening embankment over time.

The requirement to confirm the assumptions of post-closure stability has been identified in Section 3.7.2.2 and the additional pore pressure and embankment settlement monitoring proposed by the current design engineers (PSM) to confirm the stability assumptions are included in Table 6-2 against Outcome 5. This monitoring is reiterated in the TSF Operating Manual (Appendix I).

The monitoring will trigger action should the results exceed the leading indicator criteria. The basis for the trigger values and relevant actions are as follows.

- Embankment pore pressure: Pore pressures are expected to rise as the Stage 8 and 9 embankment construction passes over the piezometer and to then dissipate with time. The maximum expected rise is the vertical height of placed fill expressed as an equivalent height of water. If pressures fail exceed expected rise or fail to dissipate, the trigger levels will require increased result review frequency (weekly for amber and daily for red) and design engineer investigation. Should exceedances occur frequently during the operation of Stage 8, the design engineer will also advise on the viability of constructing and operating Stage 9 and recommend remedial actions.

- Tailings pore pressure: During deposition the perched water table is expected to remain at or below RL1240m. Some increase in this level may occur due to variation in feed rates or additional pressure on the underdrainage system. If the equivalent perched water table exceeds RL1240m the design engineer will be notified and appropriate action identified and implemented. Following tailings deposition being ceased at the end of operations, the pressures are expected to gradually drop as the tailings are drained through the underdrainage system until reaching a steady state. Failure to drain would result in a design engineer investigation and advice on potential remedial actions.

- Embankment settlement: During operations some embankment settlement is expected. Results of embankment settlement monitoring is to be used to assess short and long term settlement trends. The design engineers have identified settlements of more than 10 mm/day or 100 mm in total are considered to be larger than expected and will trigger review by the design engineers, followed by recommendation and implementation of any applicable remedial action.

Store and release cover settlement monitoring will also be conducted. After tailings deposition ceases and new monitor points are installed, the design engineers will review the monitoring data (refer to Table 6-2). In the even the settlement is more than 700mm in the central monitor location, investigation will occur and remedial action implemented as applicable.

5.2.3.3 I55 - Additional lift on TSF impacts erosional forces and increases erosion, hence sediment from IWL landform

Long term erosion potential from the closed IWL landform has been assessed by Landloch and is presented in Section 3.13.4.3, with the full report attached as Appendix A of the Cover Design Summary Report (Appendix L).

The results indicate the overall IWL will erode at very low rates for the 300-year simulation. Erosion on the >20° slopes (with a 0.1m topsoil cover applied) are initially high due to the erodible nature of the topsoil. Over time, the 0.1m cover is eroded, exposing the underlying NAF. As the NAF is more erosionally stable, the rate of erosion dramatically decreases and by year 192, the majority of the 0.1m topsoil cover has been removed, with the underlying NAF eroding at very low rates.

No gully erosion is predicted to occur on any point on the landform. Small rills are predicted to form but remain <0.3m deep after 300-years of simulation. Across the entire landform, erosion is not predicted to reach more than 0.5m at any point in time.

Additionally, after 300 years of modelled simulation, at no point on the IWL will the 0.5m of NAF be eroded hence the effectiveness of the store and release cover will be maintained in the long term.

As such, the potential increase of sediment is possible, however there will be no risk to the cover of the IWL with respect to PAF exposure.

This potential impact is considered assessed with no further controls required other than the application of the cover as designed and detailed in Section 3.13.4.3. No additional monitoring is proposed for this impact.

5.2.3.4 I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability

PSM assessed the potential for increased TSF embankment instability as a result of the waste rock from the southeast portion of the IWL being removed for construction of the lifts (refer to Figure 3-20, Figure 3-21 and Appendix H).

The borrow area will be rehabilitated with external batters with a slope of less than 20°.

More critical sections of the TSF embankment, such as the Section 4 southeastern batter (Figure 3-22) which is 84m high, were assessed for stability and concluded to be stable under normal and seismic conditions during operations and in perpetuity post closure. As a result, the borrow section, which is 40m lower in height at 44m, with similar piezometric conditions and waste rock properties, can also be considered stable for operations and in perpetuity post-closure.

As such, no additional controls or monitoring are proposed for this impact.

5.2.3.5 I57 - Siltation of water control structures as a result of sedimentation from IWL post-closure results in overtopping during flood events and impact to surrounding land uses, including adjacent rail infrastructure.

Long term erosion potential from the closed IWL landform has been assessed by Landloch and is presented in Section 3.13.4.3, with the full report attached as Appendix A of the Cover Design Summary Report (Appendix L). To ensure that long term sediment caused by erosion from the IWL is retained within the surface water control structures, Landloch calculated the volumes of sediment likely to enter those structures over the 300 year simulation period. The results were as follows.

- Return Water Storage (RWS)
  - Storage of the RWS is 125m³ (PSM, 2013). Areas feeding into the RWS include the southern section of the IWL (accounting for ~62% of all flows), and the surrounding natural catchment (accounting for ~38% of all flows).
  - Approximately 36,639m^3 of sediment will be deposited into the RWS over the 300 year period. This equates to ~30% of the RWS's capacity.
  - Even with capacity of the RWS reduced by up to 60,000m^3, the remaining RWS capacity is sufficient to contain a 72hr, 1:100 AEP storm event.
  - During extreme storm events (noting this has not occurred during the operational life to date), the RWS spillway would discharge at the diversion channel discharge, direct to the culverts under the rail line.
- Northern sediment pond
  - Potential storage of the Northern sediment pond to be 53,998m^3. Areas feeding into the pond include the northern section of the IWL (accounting for ~16% of all flows), and the surrounding natural catchment (accounting for ~84% of all flows).
  - Approximately 3,950m^3 of sediment will be deposited into the Northern sediment pond over the 300 year period. This equates to ~7% of the pond's capacity.
- Northeast sediment / evaporation pond
  - The northeast sediment /evaporation pond is a proposed pond that is yet to be constructed. It will be located to the northeast of the IWL to collect sediment from the IWL batters and surrounding catchments.

- Areas feeding into the pond include the north-eastern section of the IWL (accounting for ~62% of all flows), and the surrounding natural catchment (accounting for ~38% of all flows). The section of the IWL that contributes sediment to the northern pond is ~54% 1:5 topsoil:NAF mixture, and ~46% topsoil.
- Approximately 5,555m^3 of sediment will be deposited into the pond over a 300 year period.
- To allow for additional capacity, it is proposed that the sediment pond is constructed to capture ~17,000m^3 of sediment, resulting in the Northeast sediment pond being at ~33% capacity after 300 years.

All of these structures have been sized for storm events. If significant rainfall were to result in overflow, it would be during a regional rainfall event impacting the entire catchment. Critical infrastructure downstream of the RWS is protected via the large culverts installed downstream of the ML area with capacity for valley flow.

The two northern ponds are in a 10m deep large basin formed by the Old Tailings Dam and therefore would not overflow downstream off the ML area.

This potential impact is considered assessed with no further controls required other than the application of the cover as designed and detailed in Section 3.13.4.3. No additional monitoring is proposed for this impact.

5.2.3.6 I58 - Underground operation results in change to water quantity available to surrounding users due to dewatering

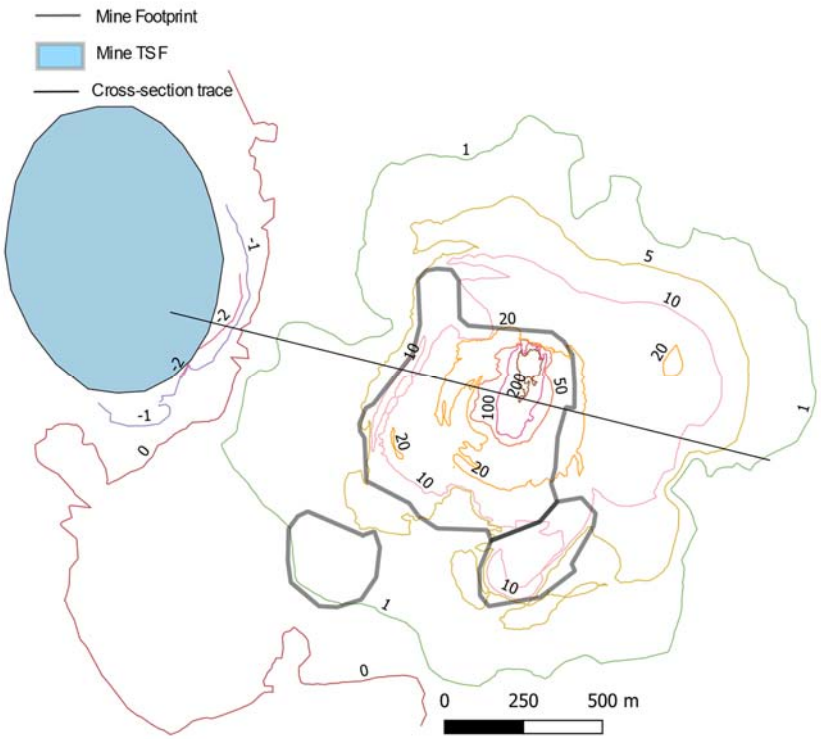
Mining One conducted additional modelling of the groundwater system around the mine to account for the dewatering of groundwater from the underground operations and the subsequent filling post-cessation (Appendix E).

The modelling identified that worst case, i.e., during maximum dewatering between 2019 and 2023, the groundwater level in the immediate vicinity of the underground workings will decrease in the order of 200m (Figure 5-1). This large magnitude change is steep and predominantly laterally contained in the footprint of the open pit mine.

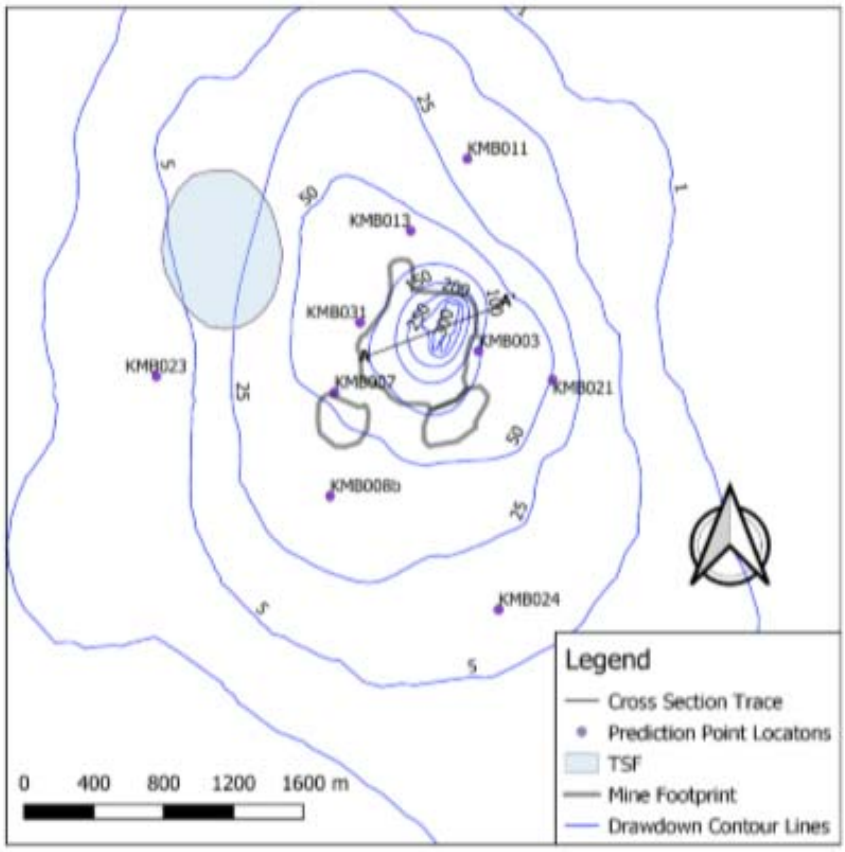
Outside the footprint of the open pit mine, simulated water table changes due to underground mining outside the existing mine footprint are less than 25m in magnitude, exceed 5m only on the east side of the pit, and are contained within 800m of Giant Pit (Figure 5-2). The location of the change in water table elevation to the east of the pit coincides with a higher hydraulic conductivity zone east of the Giant Pit.

The contour plots identify that the 1m drawdown impact from the mine dewatering remain within approximately 4km radius of the mine pit, while the 5m drawdown impact remains within 2km of the pit in the long term. The nearest third party bores is approximately 1.1km from the pit crest. Given the depth to groundwater, a 5m drawdown is not considered to significantly impact the water quantity available from the bore. Should quantity be significantly affected, as per ML condition requirements, Hillgrove would provide an alternate water supply.

As such, no additional controls are proposed for this impact and groundwater monitoring will continue as defined in Table 6-2 with no change.



Difference in 2023 water table elevations due to underground operation dewatering



250 year drawdown contours

Figure 5-1 – Groundwater drawdown impact due to underground operation dewatering (Mining One 2019a)

5.2.3.7 I59 - Underground operation results in change to water quality available to surrounding users due to exposure of PAF material

As identified in Section 3.13.4.1, Mining One (Mining One 2019b) assessed the potential for the underground working to alter the pit lake quality. This assessment identified:

- the pit lake will still remain a perpetual groundwater sink;
- the small volume of waste rock from the underground operation that will be placed at the base of Giant Pit and the additional exposure of groundwater to the PAF material in the underground void may result in a minor change to the chemistry of the in-pit water, however it is not assessed to result in a material quality change from that already predicted from the open pit; and
- the pit lake is modelled to be of poor quality and the pit remains a perpetual sink, hence surrounding groundwater is not predicted to be impacted post-closure.

Pit lake modelling was first commenced in 2007 by REM Consulting and was based on the existing water quality of the historic pit lake. Revision of the two-dimensional water model was conducted in 2014, calibrated against dewatering and groundwater quality and level monitoring data. This modelling was then further enhanced by the current Mining One three-dimensional groundwater model, further calibrated with site monitoring data. As such, the level of confidence in the pit lake quality and quantity modelling is high.

As such, no additional controls are proposed for this impact and groundwater monitoring will continue as defined in Table 6-2 with no change.

5.2.3.8 I60 – Increased height of TSF results in seepage thereby influencing water quality and quantity available to surrounding users

The PSM assessment of seepage from the TSF as a result of the Stage 8 and 9 lifts is presented in Section 3.7.2.2 and Appendix H.

Tailings pore pressures are governed by inflows relating to discharge of tailings and outflows relating to underdrainage and decant. The analysis results identified that keeping the pore pressure above the liner at or as close to zero as possible is met where a tailings permeability of 1.0×10^{-5}m/s for the deposited tailings and a consolidated permeability of 1.0×10^{-7}m/s for the consolidated tailings immediately above the liner is achieved. This also requires the decant pond to be controlled to within 100m of the decant structure. The permeability values used are based on PSM assessments of the TSF and observations of the water reclamation system efficiency over the operating life to date.

To ensure the design assumptions are met, monitoring of pore pressure for Stage 8 and 9 in the form of piezometers is proposed (refer to Section 3.7.2.3and Table 6-2).

Section 3.7.2 provides information on particle tracking modelling from the TSF conducted by Mining One. The modelling identified the majority of the potential contaminant particles, the flow rate was almost nil, and they are stopped in unsaturated elements with no real flow and connectivity to groundwater. As such, even in the unlikely event of a liner breach, the majority of contaminants would then stop or be directed towards the groundwater sink of the open pit.

5.2.3.9 I61 – Underground workings alter pit lake system in terms of ability to alter groundwater systems outside the extent of mining operation.

Section 3.13.4.1 identifies the small volume of waste rock from the underground operation that will be placed at the base of Giant Pit and the additional exposure of groundwater to the PAF material in the

underground void may result in a minor change to the chemistry of the in-pit water, however it is already modelled to be poor, hence the change will not be significant. The modelling also confirmed the pit lake will remain as a perpetual sink (modelled for 250 years with steady state achieved by 50 years), hence any poor quality water within the open pit during operations and post-closure is not predicted to affect the surrounding groundwater

As such, no additional controls are proposed for this impact and groundwater monitoring will continue as defined in Table 6-2 with no change.

Figure 5-2 – Difference in groundwater head in 2023 between no underground and underground + TSF level 1266m RL (Stage 8)

5.2.3.10 I62 – Impact to public health and/or nuisance impacts from vibration caused by underground blasting

An assessment of potential underground blasting impact has been conducted, using site factors from previous open pit blasting. As identified in Section 3.4.5, the underground blasting will use approximately 5kg of explosives per hole for development blasts and 350kg for production blasts.

Figure 5-3 provides the estimated peak particle velocity[5] (PPV) impact at various distances from the blast holes. There are no sensitive receptors within 400m of the open pit crest. As such, it is expected that all PPV readings will be below the HGO criteria for 95 % of blasts, which is well below the AS 2187.2 limit. The Neutrog facility is within 400m of the open pit crest, however as it is an industrial facility is subject to a higher PPV criteria and are not classified as a sensitive receptor (refer to Table 6-2).

Air blast overpressure will also continue to be monitored. Hillgrove has recorded only 17 blasts during open pit operations exceeding the overpressure criteria as defined by AS 2187.2 between June 2011 and April 2019. This record of compliance is expected to continue with the underground operations given they are directly below the open pit.

Blasting will continue to be designed and executed by a certified shot firer and no additional controls to those identified in Table 5-3 are proposed. Blast monitoring including PPV and overpressure will continue as defined in Table 6-2 with no change.

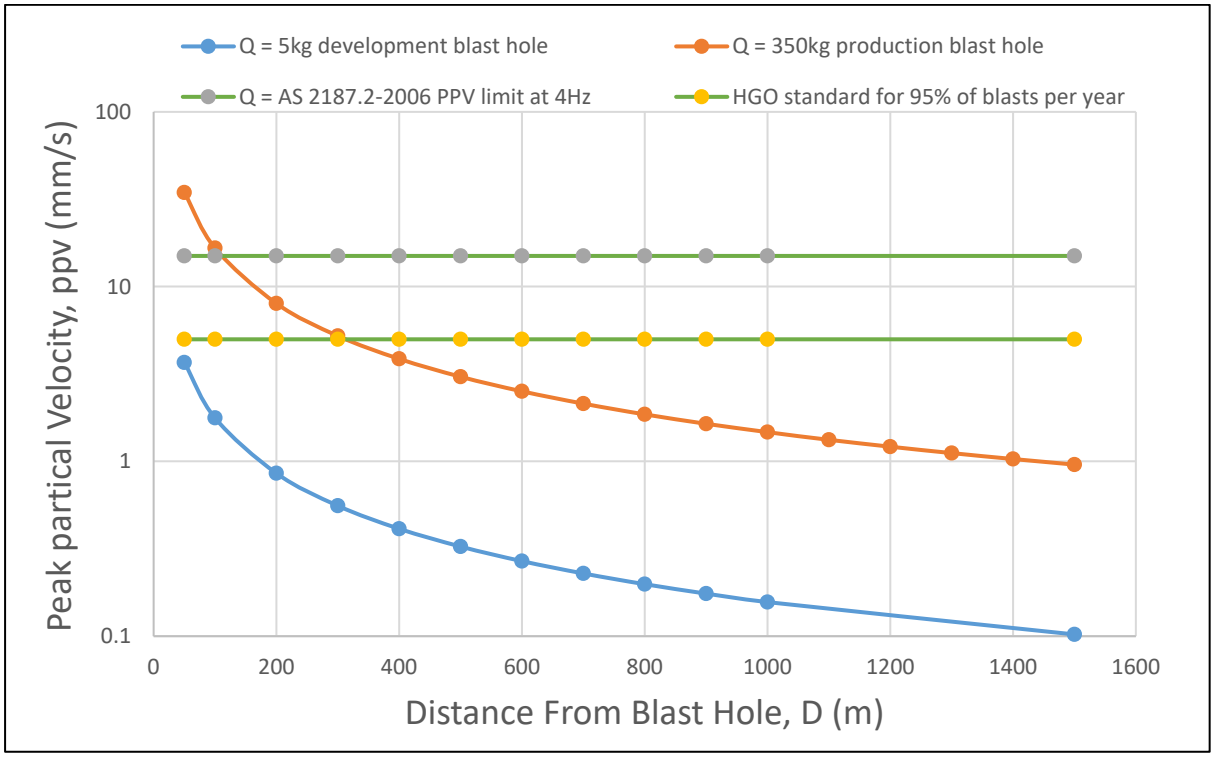


Figure 5-3 – PPV assessment for underground blasting

[5] The instantaneous sum of the velocity vectors (measured in millimetres per second) of the ground movement caused by the passage of vibration from blasting

5.2.3.11 I63 – TSF lift results in increased visual impact

JBS&G conducted a visual impact assessment for the IWL as the prominent visible feature of the Kanmantoo Copper Mine. The full report is available as Appendix B. The visual assessment considered the following scenarios:

- The current TSF elevation of 263m AHD (1,263m RL).
- Increase of the TSF by 3m as the Stage 8A lift - increases the final height of the IWL to 266m AHD (1,266m RL), an increase of 5.1% over the existing landform.
- Increase of the TSF by 11m as the final landform after Stage 8B lift - increases the final height of the IWL to 274m AHD (1,274m RL), an increase of 18.6% over the existing landform.

Method

JBS&G assessed the visual amenity using two different methods, namely:

1. visibility of the IWL from within a theoretical zone of visual influence (TZVI). The TZVI is the area within which the development of the TSF is theoretically visible from a human receptor standing on the ground. The key factors in determining this are the visual capability of humans (human field of vision), the dimensions of the development, and the nature of the surrounding topography. It has been defined by a 6km radius from the IWL and assessed through comparative viewshed analysis; and
2. visibility of the IWL from the four viewpoints identified in Section 2.4.3 using a photomontage assessment, i.e., a comparison of photos of the existing view from each location and photos edited to include the final raised TSF.

The TZVI method assessed the viewshed around the site, with the following commentary made.

- The area north of the ML area is characterised by moderately high topographical relief with sporadic peaks particularly to the northwest of the TSF, with the area directly north of the site contains the highest degree of woody vegetation with fragmented areas of Eucalyptus woodland.
- Views of the TSF from Kanmantoo are screened by hills between the receptor and TSF as well as the presence of vegetation on ridgelines. In addition, it is unlikely that views of the TSF from the Old Princess Highway will exist due to its situation in a valley adjacent to the ridgeline that obstructs potential views.
- The area to the east of the ML area contains the largest area of low elevation, coupled with fragmented vegetation which provides a low degree of screening capacity. As the Old Princess Highway extends in a northwest to southeast direction, views of the TSF can be gained in proximity to the intersection of the mine site access road. It is not anticipated that the site will be visible from receptors within Callington due to the high visual absorption capacity of other existing structures including buildings, infrastructure and vegetation
- South of the ML area there are several potential views of the TSF. Due to the presence of narrow valleys, infrastructure is present along several ridgelines which host clear views of the mining operation. In addition, there is a trainline that ferries viewers in an east to west direction immediately south of the ML area. Typical views from the trainline are short duration and transient in nature. There are several residences located on high points between the South Eastern Freeway and Dawesley Creek, these are scattered agricultural homesteads accessed with Back Callington Road and host almost unobstructed views of the TSF.
- The landscape west of the site is characterised by undulating ridges which decrease in elevation from west to east with Dawesley Creek occurring in a valley. Due to the increased elevation, there are more elevated vantage points west of the site which provide a view of the TSF, however roadside planting provides an effective screen along the majority of the road.

The TZVI for both the Stage 8A and 8B lifts were calculated based on topography and elevation of the TSF. Receptors within the TZVI were then identified based on a number of factors including elevation, distance to the TSF, frequency of viewing, receptor type, and extent of TSF visibility.

Theoretical Zone of Visual Influence Results

Figure 5-4 provides the resultant identification of increased TZVI and additional receptors as a result of the Stage 8 lifts.

The assessment identified those receptors within 400 m would be most impacted by the increase in the TSF height, however no sensitive receptors were identified within this distance and within the TZVI of the 11 m TSF. Within 401m to 1,200m of the TSF one receptor was located, however this was not within the TZVI of the 11 m TSF.

The largest number of receptors (104) were more than 2,801m from the TSF. A total count of 63 (43%) of these receptors were within the TZVI of the 11m TSF lift and are unlikely to be significantly impacted by the proposed TSF lift.

The change to the current TSF height is not expected to significantly alter the character of the current landscape, noting there is currently a TSF present and related mining activities in the area. Once works are complete, the rehabilitation of the final surface which will include shaping, placement of topsoil and planting of suitable vegetation will assist in reducing the visual impact of the TSF as a feature on the landscape. The final TSF landform has been designed to integrate within the landscape and reflect the surrounding landscape character and topography.

Photomontage Results

The results of the JBS&G photomontage assessment for the TSF height of 1,274m RL (274m AHD) (11m lift) are summarised below and presented in full in Appendix B.

- Viewpoint 1 Photomontage Analysis: Petwood Road, Petwood, looking east (VP1) (Figure 5-5)
  - The increase in visibility is small and provides a moderate impact. The viewpoint location is located more than 2.8 kms from the TSF and is considered distant.
  - The mitigating effects of the landscape character and vegetation provide a natural visual screen and the overall visual impact from the viewpoint location is considered to have a low visual impact.
- Viewpoint 2 Photomontage Analysis: Old Princes Highway, Kanmantoo, looking west north west (VP2) (Figure 5-6)
  - The increase in visibility is very small and will not be obvious. The viewpoint location is located more than 2.8 kms from the TSF and is considered distant.
  - The mitigating effects of the landscape character and vegetation provide a natural visual screen and the overall visual impact from the viewpoint location is considered to have a very low visual impact.
- Viewpoint 3 Photomontage Analysis: Ironstone Range Road, Petwood, looking south east (VP3) (Figure 5-7)
  - The increase is large and the visible amount of TSF is approximately double. The viewpoint location is located more than 2.8 kms from the TSF and is considered distant.
  - The mitigating effects of the landscape character and vegetation provide a natural visual screen and the overall visual impact from the viewpoint location is considered to have a very low to moderate to low visual impact.

- Viewpoint 4 Photomontage Analysis: Back Callington Road, Petwood, looking north east (VP4) (Figure 5-8)
    - The increase in visibility is small and provides a moderate impact. The viewpoint location is located more than 1.2 kms from the TSF and is considered far.
    - The mitigating effects of the landscape character and vegetation provide a natural visual screen and the overall visual impact from the viewpoint location is considered to have a low visual impact.

5.2.3.12 I64 – Surface expression of groundwater results in contamination of local surface water

The surface expression of groundwater identified at the northeastern base of the IWL on top of the adjacent old tailings dam (OTD) is detailed in Section 2.8. Investigation into this water identified that it is not seepage from the TSF, rather groundwater being expressed at surface and ponding on the old TSF, thereby is of relatively low quality (low pH and similar metal, sulphate and ammonia concentrations similar to a historic OTD seepage dam sample).

Hillgrove have already constructed a temporary facility to hold this water, and plans to construct a permanent structure of sufficient capacity to hold the predicted seepage, sediment and stormflows, as designed by JBS&G (refer to Section 2.8 and Section 3.8.7).

This control will be implemented (Table 5-3). The northeastern sediment / evaporation pond has also been added to the surface water monitoring regime for water quality in Table 6-2 (Outcomes 5 and 7).

5.2.3.13 Summary of New and Different Impacts

Table 5-3 provides a summary of the potential new and different impacts related to the underground operation and proposed TSF lifts and includes a risk assessment as required in PEPRs where there is a change to operations.

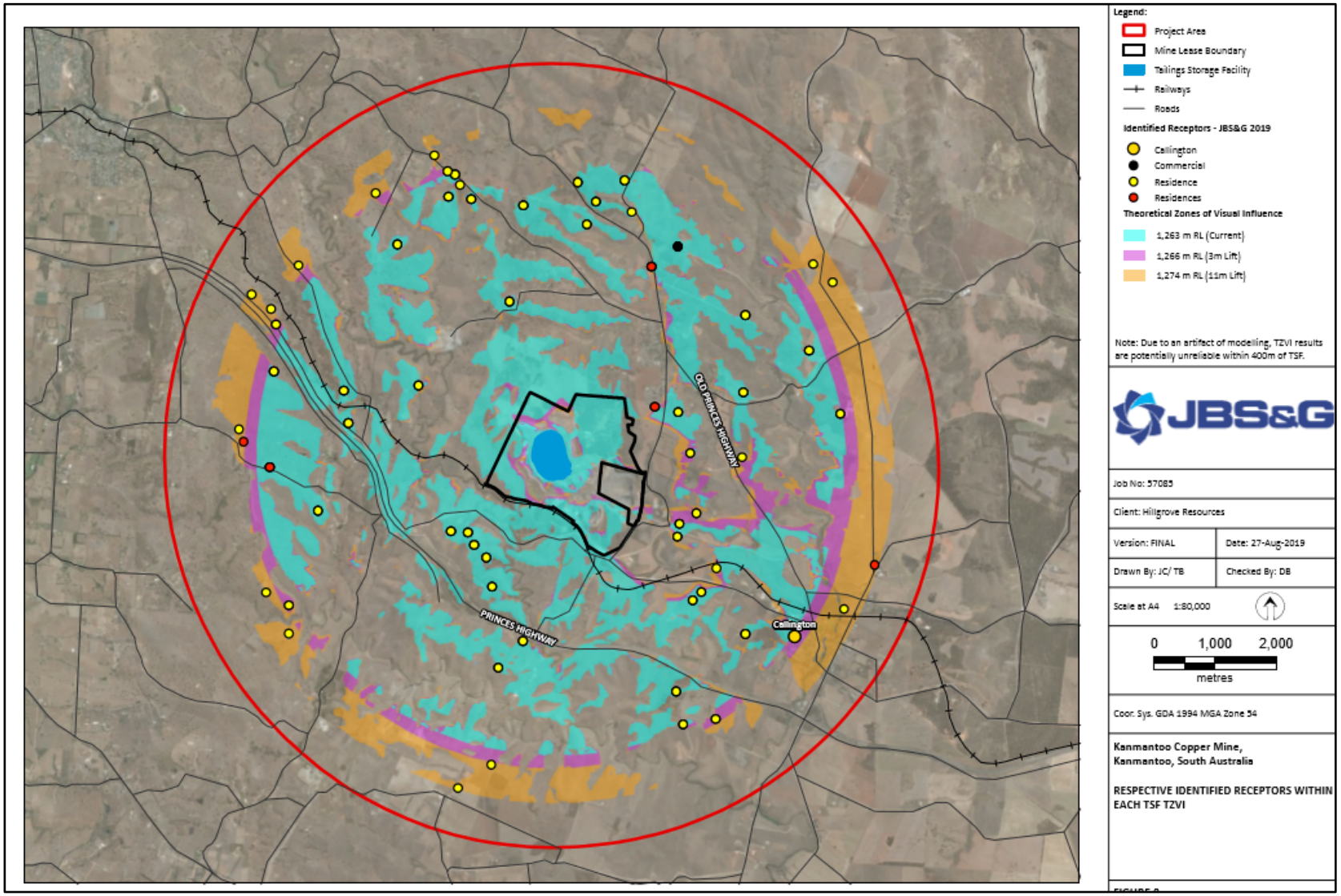


Figure 5-4 – Respective identified receptors within each TSF TZVI (JBS&G 2019a - Figure 8)

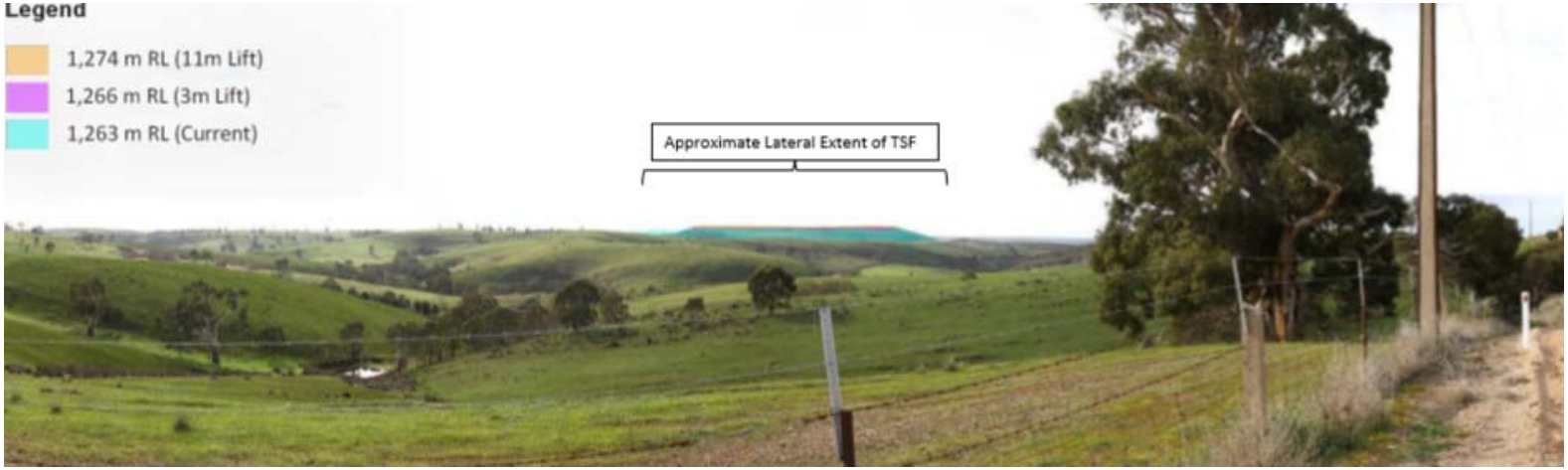


Figure 5-5 - Viewpoint 1 Photomontage Analysis: Petwood Road, Petwood, looking east (VP1)

Figure 5-6 - Viewpoint 2 Photomontage Analysis: Old Princes Highway, Kanmantoo, looking west north west (VP2)

Figure 5-7 - Viewpoint 3 Photomontage Analysis: Ironstone Range Road, Petwood, looking south east (VP3)

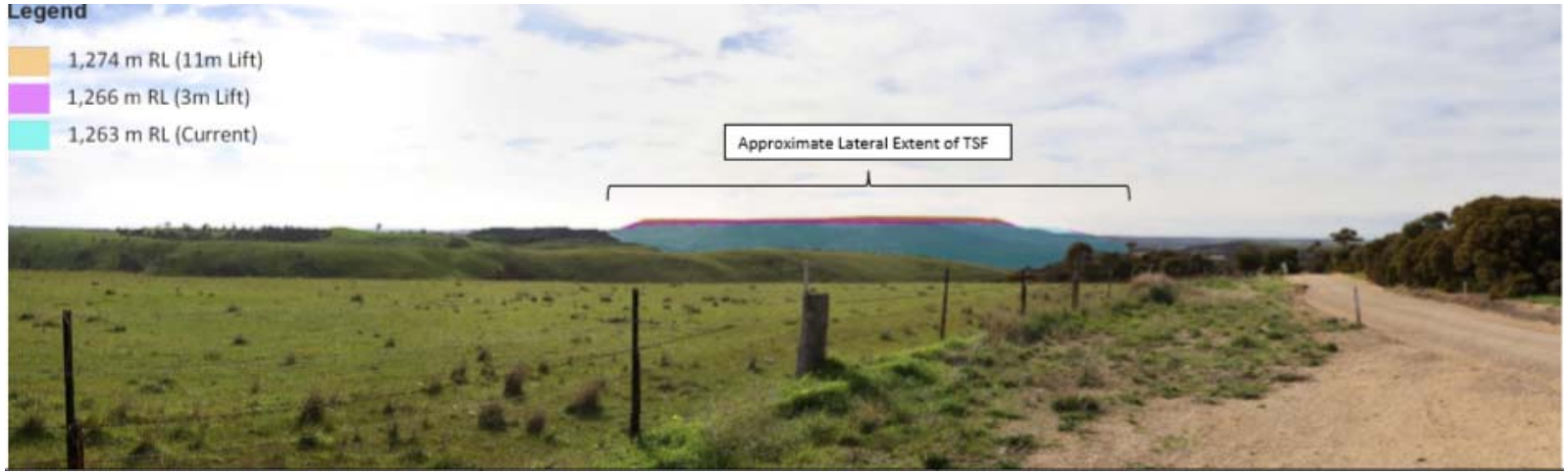


Figure 5-8 - Viewpoint 4 Photomontage Analysis: Back Callington Road, Petwood, looking north east (VP4)

Table 5-3 – Summary impact assessment of new or different activities

Outcome	Potential New /Different Impact	Impact event analysis			Potential impact assessment verification and comment	Additional control strategies	Uncertainties in Impact Event assessment or control strategies
		Source	Pathway	Receptor outside ML area			
Outcome 1b: No adverse impacts to adjacent public roads, railway, and adjacent land use outside the ML area.	I53 - Underground workings impacts Giant Pit stability (Section 5.2.3.1)	Underground workings	Land	Surface water, groundwater, ecology, land	This impact is not verified as a fundamental engineering control will remove the pathway. The underground workings will not affect the overall stability of the open pit as there will be an adequate crown pillar retained between the base of the open pit and the underground stopes and the FoS modelled for the underground workings is >2.8.	Fundamental design control = Retention of crown pillar between underground workings and open pit floor.	No uncertainties identified.
	I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability (Section 5.2.3.4)	IWL (TSF)	Land / water	Surface water, groundwater, ecology, land	There is potential for this impact to occur. PSM stability assessment concluded the borrow area will not affect TSF stability and will remain stable for operations and in perpetuity post-closure.	Re-batter borrow area slopes to <20° and rehabilitated in accordance with IWL closure requirements (Section 3.13.4.3)	No uncertainties identified as modelling based on monitoring and observation of the IWL over the life of the operation.
	I57 - Siltation of water control structures as a result of sedimentation from IWL post-closure results in overtopping during flood events and impact to surrounding land uses, including adjacent rail infrastructure (Section 5.2.3.5)	IWL (TSF)	Land Water	Surface water, groundwater, ecology, land, existing users, surrounding infrastructure	This impact has been modelled to not occur as a result of reasonable flooding events. Landloch modelling over 300 year period identifies sediment from IWL will be retained within existing capacity of surface water structures. Approximately 36,639m^3 of sediment will be deposited into the RWS over the 300 year period. This equates to ~30% of the RWS's capacity. Even with 125,000m^3 capacity of the RWS reduced by up to 60,000m^3, the remaining RWS capacity is sufficient to contain a 72hr, 1:100 AEP storm event. The northern water control structures were similarly modelled to have sufficient capacity.	No additional controls required	No uncertainties identified as modelling was conducted using site material inputs and based on the existing landform plus the proposed additional 11m lift.
Outcome 2: The current disturbed areas are stabilised to prevent sediment from leaving the lease area.	I55 - Additional lift on TSF impacts erosional forces and increases erosion, hence sediment from IWL landform (Section 5.2.3.3)	IWL (TSF)	Land / water	Surface water, groundwater, ecology, land	This impact is not verified as modelling indicates that this will not occur. Landloch modelling over 300 year period identifies erosion will not result in gullies and will not expose PAF in the long term.	No additional controls required	No uncertainties identified as modelling was conducted using site material inputs and based on the existing landform plus the proposed additional 11m lift.
Outcome 2: The current disturbed areas are stabilised to prevent sediment from leaving the lease area.	Refer to I56 in Outcome 1b	IWL (TSF)	Land / water	Surface water, groundwater, ecology, land	Refer to I56 in Outcome 1b	Refer to I56 in Outcome 1b	Refer to I56 in Outcome 1b

Outcome	Potential New /Different Impact	Impact event analysis			Potential impact assessment verification and comment	Additional control strategies	Uncertainties in Impact Event assessment or control strategies
		Source	Pathway	Receptor outside ML area			
Outcome 5: No adverse impact to the quality and quantity of surface water caused by mining operations to water dependent ecosystems to existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions	I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability (Section 5.2.3.2)	IWL (TSF)	Land / water	Surface water, groundwater, ecology, land	There is potential for this impact to occur. PSM stability assessment concluded the IWL has FoS greater than the minimum FoS recommended in ANCOLD (2012) for all embankments with the exception of the batter adjacent to the RWS. For this section, PSM concluded the FoS safety is expected to be higher than modelled due to the 3D effects.	Monitoring of pore pressure and embankment stability (refer to Section 6.3.2). In the event that leading indicator criteria (Table 6-2) are triggered, the design engineers would conduct an investigation to identify potential causes and any applicable remedial actions. At amber trigger level, reporting frequency would increase to weekly and indicative response measures may include: - a reduction in the amount of water being deposited into the TSF, this achievable by a number of methods including, – a reduction in the rate of tailings deposition – a reduction in the tailings water content; - installation of dewatering wells; - a reduction in embankment rate construction; - use of reinforcement to strengthen the embankments. A red trigger level would result in reporting frequency to the design engineers increase to daily and may require the reduction or cessation of wet tailings deposition until such time as investigation has been completed and any applicable remedial actions implemented. It is expected that this possibility would most likely occur during construction of Stage 9. Currently Stage 9 is planned to receive OTD tailings and/or additional capacity for tailings from additional underground operations should the additional targets be converted. A suitable remedial measure under this scenario may be to place OTD tailings using dry stacking as this would place less reliance on the underdrainage system.	Post TSF lift embankment construction settlement is expected to be small due to rapid pore pressure dissipation. This needs to be confirmed. Maintaining the required pore pressures required for effective underdrainage and stability. Refer to Table 6-1.
Outcome 5: No adverse impact to the quality and quantity of surface water caused by mining operations to water dependent ecosystems to existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions	Refer to I55, I56 in Outcome 2	IWL (TSF)	Water	Surface water, groundwater, ecology, land, existing users	Refer to I55, I56 in Outcome 2	Refer to I55, I56 in Outcome 2	Refer to I55, I56 in Outcome 2
Outcome 5: No adverse impact to the quality and quantity of surface water caused by mining operations to water dependent ecosystems to existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions	I64 – Surface expression of groundwater results in contamination of local surface water	Natural groundwater	Water	Surface water	There is potential for this impact to occur. Assessment of this surface expression of groundwater identifies that this water is not TSF seepage, rather natural groundwater expressing at surface. The water ponds on the Old TSF which reduces the water quality. Hillgrove are and will continue to manage this water to ensure it does not leave the ML area.	Temporary containment in place. Design for the permanent northeaster sediment / evaporation dam to be built with sufficient capacity for the surface expression of groundwater flow rate, long term sediment and storm events. Monitoring of the structure as a surface water control structure will occur once constructed.	No uncertainties identified due to extensive assessment of this water.
Outcome 6: No stormwater contaminated as a result of mining operations is to leave the lease area or result in contamination of soil at closure within the lease area.	Refer to I54, I55, I56 in Outcome 2 and 5	IWL (TSF)	Water	Surface water, groundwater, ecology, land, existing users	Refer to I54, I55, I56 in Outcome 2 and 5	Refer to I54, I55, I56 in Outcome 2 and 5	Refer to I54, I55, I56 in Outcome 2 and 5

Outcome	Potential New /Different Impact	Impact event analysis			Potential impact assessment verification and comment	Additional control strategies	Uncertainties in Impact Event assessment or control strategies
		Source	Pathway	Receptor outside ML area			
Outcome 7: No water runoff from the lease results in flooding of adjacent areas, to an extent greater than that that could reasonably be expected to occur prior to mining operations being established on the lease.	Refer to I57 in Outcome 1b	IWL (TSF)	Land Water	Surface water, groundwater, ecology, land, existing users, surrounding infrastructure	Refer to I57 in Outcome 1b	No additional controls required	No uncertainties identified as modelling was conducted using site material inputs and based on the existing landform plus the proposed additional 11m lift.
Outcome 9: No adverse impact to the quality and quantity of groundwater caused by mining operations to water dependent ecosystems or existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions.	I58 - Underground operation results in change to water quantity available to surrounding users due to dewatering (Section 5.2.3.6)	Underground	Water	Water dependent ecosystems, existing users	This impact has been modelled to not occur based on existing groundwater user locations and the lack of groundwater dependant ecosystems. Groundwater level decrease as a result of underground dewatering are not predicted to impact further than 800m from Giant Pit and impacts will be less than 25m reduction in groundwater.	No additional controls proposed	Inherent modelling uncertainties have been reduced to the extent possible using site data from existing monitoring.
Outcome 9: No adverse impact to the quality and quantity of groundwater caused by mining operations to water dependent ecosystems or existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions.	I59 - Underground operation results in change to water quality available to surrounding users due to exposure of PAF material (Section 5.2.3.7)	Underground	Water	Water dependent ecosystems, existing users	This impact has been modelled to not occur. Pit lake water quality will not significantly decrease due to underground operation and pit will remain as groundwater sink in perpetuity, during operations and post-closure.	No additional controls proposed	Inherent modelling uncertainties have been reduced to the extent possible using site data from existing monitoring.
Outcome 9: No adverse impact to the quality and quantity of groundwater caused by mining operations to water dependent ecosystems or existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions.	I60 – Increased height of TSF results in seepage thereby influencing water quality and quantity available to surrounding users (Section 5.2.3.8)	TSF	Water	Water dependent ecosystems, existing users	There is potential for this impact to occur. The PSM assessment concluded seepage should not occur with the maintenance of the required pore pressure and decant pond size. Mining One identified that even in the unlikely event of a breach in the liner, contaminants of potential concern are unlikely to move any significant distance from the TSF and the majority would be contained within the open pit groundwater sink.	Monitoring of pore pressure and embankment stability (refer to Section 6.3.2)	Post TSF lift embankment construction settlement is expected to be small due to rapid pore pressure dissipation. This needs to be confirmed. Maintaining the required pore pressures required for effective underdrainage and stability. Refer to Table 6-1.
Outcome 10: Contaminated water within the pit does not alter groundwater systems outside the extent of mining operation.	I61 – Underground workings alter pit lake system in terms of ability to alter groundwater systems outside the extent of mining operation (Section 5.2.3.9)	Underground (pit lake)	Water	Water dependent ecosystems, existing users	This impact has been modelled to not occur. Pit lake water quality will not significantly decrease due to underground operation and pit will remain as groundwater sink in perpetuity, during operations and post-closure.	No additional controls proposed	Inherent modelling uncertainties have been reduced to the extent possible using site data from existing monitoring.

Outcome	Potential New /Different Impact	Impact event analysis			Potential impact assessment verification and comment	Additional control strategies	Uncertainties in Impact Event assessment or control strategies
		Source	Pathway	Receptor outside ML area			
Outcome 14: No contamination of natural water drainage systems, streams and creeks and no contamination beyond approved EPA limits for groundwater, land and soils occur onsite or offsite resulting from permanent disposal or temporary storage of the mine waste and tailings.	Refer to I54, I55, I56, I57, I60, I61 in Outcomes 6 and 7	Refer to I54, I55, I56, I57, I60, I61 in Outcomes 6 and 7					
Outcome 17: No adverse public health and/or nuisance impacts from airblast, flyrock and vibration caused by blasting.	I62 – Impact to public health and/or nuisance impacts from vibration caused by underground blasting (Section 5.2.3.10)	Underground	Air (vibration)	Sensitive receptors	There is potential for this impact to occur. All PPV readings predicted to be below the Hillgrove criteria for 95 % of blasts, which is well below the AS 2187.2 limit. Flyrock not applicable for underground mining.	Explosives management plan updated to include underground operations (Explosives management plan to be updated in response to regular non-compliance monitoring results.	A level of uncertainty is inherent in any modelling however this was based on existing blast data from Kanmantoo hence uncertainty would be low. Refer to Table 6-1
Outcome 31: The form, contrasting and reflective aspects of the mining operations will blend with the surrounding industrial landscape. **Completion Outcome 2** The external visual amenity of the site is comparable with the surrounding areas and in accordance with the reasonable expectations of relevant stakeholders including removal of all mine related infrastructure (unless otherwise approved by the Director of Mines in consultation with relevant stakeholders).	I63 – TSF lift results in increased visual impact (Section 5.2.3.11)	TSF / IWL	Air (visual)	Freeway users	There is potential for this impact to occur. JBS&G concluded the visual impact of the Stage 8 and 9 lift of 11m on the TSF: The increase in the TSF height is not expected to significantly alter the current landscape within proximity to the Kanmantoo Site, which is already dominated by extractive/ mining industry land use. Additionally, the report concluded the change to the current TSF height is not expected to significantly alter the character of the current landscape, bearing in mind that there is currently a TSF present and related mining activities in the area.	No additional controls required.	Modelling cannot account for visual amenity perception from individuals. Refer to Table 6-1
Completion Outcome 3 The risks to the health and safety of the public and fauna are as low as reasonably practical.	I53 - Underground workings impacts Giant Pit stability	Underground workings	Land	Surface water, groundwater, ecology, land	Refer to I53 in Outcome 1b	Refer to I53 in Outcome 1b	Refer to I53 in Outcome 1b

Outcome	Potential New /Different Impact	Impact event analysis			Potential impact assessment verification and comment	Additional control strategies	Uncertainties in Impact Event assessment or control strategies
		Source	Pathway	Receptor outside ML area			
Completion Outcome 3 The risks to the health and safety of the public and fauna are as low as reasonably practical.	I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability (Section 5.2.3.2)	IWL (TSF)	Land / water	Surface water, groundwater, ecology, land	Further assessment is required to validate this potential impact. PSM stability assessment concluded the IWL has FoS greater than the minimum FoS recommended in ANCOLD (2012) for all embankments with the exception of the batter adjacent to the RWS. For this section, PSM concluded the FoS safety is expected to be higher than modelled due to the 3D effects.	Closure stability assumptions to be confirmed with further assessment (refer to Section 6.2)	The application of desktop 3D factors to determine the post closure FoS for the IWL batter adjacent to the RWS. Refer to Table 6-1
Completion Outcome 3 The risks to the health and safety of the public and fauna are as low as reasonably practical.	I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability (Section 5.2.3.4)	IWL (TSF)	Land / water	Surface water, groundwater, ecology, land	There is potential for this impact to occur. PSM stability assessment concluded the borrow area will not affect TSF stability and will remain stable for operations and in perpetuity post-closure.	Re-batter borrow area slopes to <20° and rehabilitated in accordance with IWL closure requirements (Section 3.13.4.3)	No uncertainties identified as modelling based on monitoring and observation fo the IWL over the life of the operation.
Completion Outcome 4 No compromise of the quality and quantity of groundwater to existing users unless adequate alternate supplies are provided.	I58 - Underground operation results in change to water quantity or quality available to surrounding users due to dewatering (Section 5.2.3.6)	Underground	Water	Water dependent ecosystems, existing users	This impact has been modelled to not occur. Pit lake water quality will not significantly decrease due to underground operation and pit will remain as groundwater sink in perpetuity, during operations and post-closure. Groundwater levels will rise once dewatering has ceased and the open pit is modelled to remain a groundwater sink in perpetuity.	No additional controls proposed	Inherent modelling uncertainties have been reduced to the extent possible using site data from existing monitoring.
Completion Outcome 5 All mining waste and tailings left onsite are chemically and physically stable.	I53 - Underground workings impacts Giant Pit stability (Section 5.2.3.1)	Refer to Completion Outcome 3					
Completion Outcome 5 All mining waste and tailings left onsite are chemically and physically stable.	I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability (Section 5.2.3.2)	Refer to Completion Outcome 3					
Completion Outcome 5 All mining waste and tailings left onsite are chemically and physically stable.	I56 - Removal of material from IWL for construction of TSF lift reduces TSF eastern wall stability (Section 5.2.3.4)	Refer to Completion Outcome 3					

Outcome	Potential New /Different Impact	Impact event analysis			Potential impact assessment verification and comment	Additional control strategies	Uncertainties in Impact Event assessment or control strategies
		Source	Pathway	Receptor outside ML area			
Completion Outcome 5 All mining waste and tailings left onsite are chemically and physically stable.	I60 – Increased height of TSF results in seepage thereby influencing water quality and quantity available to surrounding users (Section 5.2.3.8)	TSF	Water	Water dependent ecosystems, existing users	There is potential for this impact to occur. The PSM assessment concluded seepage should not occur with the maintenance of the required pore pressure and decant pond size. Mining One identified that even in the unlikely event of a breach in the liner, contaminants of potential concern are unlikely to move any significant distance from the TSF and the majority would be contained within the open pit groundwater sink.	Monitoring of pore pressure and embankment stability (refer to Section 6.3.2)	Post TSF lift embankment construction settlement is expected to be small due to rapid pore pressure dissipation. This needs to be confirmed. Maintaining the required pore pressures required for effective underdrainage and stability. Refer to Table 6-1.
Completion Outcome 6 No compromise of the quality and quantity of surface water to existing users and water dependent ecosystems.	I55 - Additional lift on TSF impacts erosional forces and increases erosion, hence sediment from IWL landform (Section 5.2.3.3)	IWL (TSF)	Land / water	Surface water, groundwater, ecology, land	This impact is not verified as modelling indicates that this will not occur. Landloch modelling over 300 year period identifies erosion will not result in gullies and will not expose PAF in the long term.	No additional controls required	No uncertainties identified as modelling was conducted using site material inputs and based on the existing landform plus the proposed additional 11m lift.
Completion Outcome 7 The site is physically stable.	I57 - Siltation of water control structures as a result of sedimentation from IWL post-closure results in overtopping during flood events and impact to surrounding land uses, including adjacent rail infrastructure (Section 5.2.3.5)	IWL (TSF)	Land Water	Surface water, groundwater, ecology, land, existing users, surrounding infrastructure	This impact has been modelled to not occur as a result of reasonable flooding events. Landloch modelling over 300 year period identifies sediment from IWL will be retained within existing capacity of surface water structures. Approximately 36,639m^3 of sediment will be deposited into the RWS over the 300 year period. This equates to ~30% of the RWS's capacity. Even with 125,000m^3 capacity of the RWS reduced by up to 60,000m^3, the remaining RWS capacity is sufficient to contain a 72hr, 1:100 AEP storm event. The northern water control structures were similarly modelled to have sufficient capacity.	No additional controls required	No uncertainties identified as modelling was conducted using site material inputs and based on the existing landform plus the proposed additional 11m lift.
Completion Outcome 7 The site is physically stable.	I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability (Section 5.2.3.2)	Refer to Completion Outcome 5.					
Completion Outcome 7 The site is physically stable.	I55 - Additional lift on TSF impacts erosional forces and increases erosion, hence sediment from IWL landform (Section 5.2.3.3)	Refer to Completion Outcome 6.					

6.0 Environmental Strategies, Criteria and Monitoring

6.1 Control and management strategies

The existing control and management strategies are identified in Table 5-2. Additional control and management strategies are identified in Table 5-3.

6.2 Uncertainty assessment

All uncertainties identified in the 2016 PEPR and further uncertainties arising from this PEPR are discussed in Table 6-1. Uncertainties included are either:

- uncertainties related to the assessment of a risk; or
- uncertainties relating to the future effectiveness of the proposed controls for new or different impacts.

Table 6-1 - Addressing Outcome Uncertainties

Relevant Outcome	Uncertainty	Commitments to Address Uncertainties	Where addressed in PEPR	Ongoing uncertainty?
Uncertainties identified in 2016 PEPR				
Closure Outcome 1: Ecosystem and landscape function is resilient, self-sustaining and indicating that an ecosystem and landscape function comparable to the surrounding areas will ultimately be achieved.	Sustainability of revegetated landforms.	Conduct planned ecosystem function analysis monitoring.	Addressed in NVMP (Appendix A).	No ongoing uncertainty.
		Including the locations of the additional monitoring sites (LFA report appended to Annual Compliance Report).	Since this requirement, multiple analogue sites for SEB were established in 2016 and reported in the MARCR. NVMP (Appendix A) identifies new LFA monitoring sites required given the change to SEB delivery – these will be reported in the MARCR as they are commenced.	LFA monitoring sites to address SEB delivery change – to be reported in MARCR as sites are established.
	Sustainability of revegetated landforms cont.	Including rehabilitation monitoring schedule to determine achievement of closure outcomes. complete	Refer to NVMP (Appendix A) and Table 6-2 and Table 6-3	No ongoing uncertainty.
	Post mining landuse and protection	Ongoing cover design refinements and confirmation studies	Section 3.13.4.3	No ongoing uncertainty.
		Erosion modelling for final landforms	Section 3.13.4.3	No ongoing uncertainty.
	Methodology, locations and schedule of progressive rehabilitation.	Provide a progressive rehabilitation plan/ schedule and detailed sequencing / methodology.	Figure 3-40	No ongoing uncertainty.

Relevant Outcome	Uncertainty	Commitments to Address Uncertainties	Where addressed in PEPR	Ongoing uncertainty?
Closure Outcome 2: The external visual amenity of the site is comparable with the surrounding areas and in accordance with the reasonable expectations of relevant stakeholders including removal of all mine related infrastructure (unless otherwise approved by the Director of Mines in consultation with relevant stakeholders).	Final impact on viewpoints.	Planned photo monitoring to check alignment with NVMP (Appendix A) and ongoing community consultation/ familiarisation (annually and on completion).	Section 2.4.3 and Section 5.2.3.11	Certain aspects of the model aim to quantify variables that are subjective in nature. While the modelling aims to be highly conservative, these variables could change with differing interpretation. The visual impact assessment was presented at KCCCC with no feedback from the community.
	Methodology, locations and schedule of progressive rehabilitation	Provide a progressive rehabilitation plan/ schedule and detailed sequencing / methodology.	Schedule in Figure 3-40. Description in Section 3.13.5.	No ongoing uncertainty.
Uncertainties identified in this PEPR				

Relevant Outcome	Uncertainty	Commitments to Address Uncertainties	Where addressed in PEPR	Ongoing uncertainty?
Outcome 5: No adverse impact to the quality and quantity of surface water caused by mining operations to water dependent ecosystems to existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions. **Outcome 6:** No stormwater contaminated as a result of mining operations is to leave the lease area or result in contamination of soil at closure within the lease area. **Outcome 9:** No adverse impact to the quality and quantity of groundwater caused by mining operations to water dependent ecosystems or existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions. **Completion Outcome 5:** All mining waste and tailings left onsite are chemically and physically stable.	Maintaining the required pore pressures required for effective underdrainage and stability.	Pore pressure monitoring will be implemented for Stage 8 and 9 of the TSF.	Section 3.7.2, Section 5.2.3.2 and monitoring provided in Section 6.3.2.	Pore pressure monitoring will ensure no ongoing uncertainty.
	Post TSF lift embankment construction settlement is expected to be small due to rapid pore pressure dissipation. This needs to be confirmed.	Embankment settlement monitoring will be implemented for Stage 8 and 9 of the TSF.	Section 3.7.2, Section 5.2.3.2 and monitoring provided in Section 6.3.2.	Embankment settlement monitoring will ensure no ongoing uncertainty.
	Inherent uncertainties in modelling groundwater	A model calibration and uncertainty analysis were conducted by Mining One (2019a) and considered the conceptual model, available data and necessary predictions while focusing on quantifying and reducing predictive uncertainty. This process produced 150 alternative model parameter realisations that match observation data. Ongoing monitoring data, such as dewatering rates from the underground operation, will also be used to calibrate any future iterations of this model.	Groundwater monitoring provided in Section 6.3.2	Limited ongoing uncertainty.

Relevant Outcome	Uncertainty	Commitments to Address Uncertainties	Where addressed in PEPR	Ongoing uncertainty?
	The water balance is very sensitive to the seepage rate and therefore ongoing monitoring should be undertaken to continually verify this rate to detect any changes (e.g. seasonal).	Groundwater level monitoring in bore KMB20 is adjacent to the surface expression of groundwater and is used to indicate a change in water volumes likely to express at the surface.	Outcome 9 in Table 6-2, Section 6.3.2	Ongoing groundwater level monitoring in KMB20 will ensure no ongoing uncertainty.
Completion Outcome 3: The risks to the health and safety of the public and fauna are as low as reasonably practical.	The application of desktop 3D factors to determine the post closure FoS for the IWL batter adjacent to the RWS.	Analysis as recommended by PSM will be conducted prior to closure of the IWL to confirm this FoS. This assessment will be completed prior to the final earthworks to close the TSF. Results will be reported in the relevant MARCR.	Section 3.7.2.3 and Section 3.13.4.3	Will remain an ongoing uncertainty until the further analysis is conducted prior to final earthworks.
Outcome 17: No adverse public health and/or nuisance impacts from airblast, flyrock and vibration caused by blasting.	A level of uncertainty is inherent in any modelling however this was based on existing blast data from Kanmantoo hence uncertainty would be low.	Ongoing PPV monitoring and reporting and ongoing community consultation.	Section 5.2.3.10	The low level of uncertainty will be addressed through the blast monitoring.
	Effectiveness of Explosives Management Plan implementation.	Ongoing PPV monitoring and update of the Explosives Management Plan in the event of regular non-compliance.	Section 5.2.3.10	The low level of uncertainty will be addressed through the blast monitoring.

Relevant Outcome	Uncertainty	Commitments to Address Uncertainties	Where addressed in PEPR	Ongoing uncertainty?
Outcome 31: The form, contrasting and reflective aspects of the mining operations will blend with the surrounding industrial landscape. **Completion Outcome 2:** The external visual amenity of the site is comparable with the surrounding areas and in accordance with the reasonable expectations of relevant stakeholders including removal of all mine related infrastructure (unless otherwise approved by the Director of Mines in consultation with relevant stakeholders).	Certain aspects of the model aim to quantify variables that are subjective in nature. While the modelling aims to be highly conservative, these variables could change with differing interpretation.	Ongoing visual impact photo monitoring and ongoing community consultation/ familiarisation (annually and on completion).	Section 2.4.3 and Section 5.2.3.11	There will always remain a small level of uncertainty as to individual reactions to visual intrusion. This low level uncertainty is reduced as the visual impact assessment was presented at KCCCC with no feedback from the community.

6.3 Measurement Criteria

6.3.1 Introduction

Measurement criteria include what, how, where and when the monitoring will be undertaken along with what is considered achievement of the outcomes and any data (baseline background, or control data) which may be used as a comparison for monitoring purposes. Measurement criteria, and their relevant outcomes, may be applicable to one or more mine phases, i.e., construction, operation, closure and post-closure until relinquishment of mine tenure. The applicable phase(s) are specified in the frequency for each measurement criteria. These measurement criteria tables form the operator compliance monitoring plan, identifying who is responsible for measuring/monitoring, record keeping and the how often the results are reported to management and any external parties, including the community.

Additionally, if specified in the lease/licence conditions or if there is a high level of reliance on control strategies to achieve an environmental outcome, a 'leading indicator criteria' has been included, giving time to act to ensure that the environmental outcome can still be achieved. Leading indicators are not required for all outcomes, and are not 'compliance criteria' under the *Mining Act 1971*.

Where potential impacts have been verified, any additional monitoring is identified in the measurement criteria tables, otherwise the monitoring reflects that currently conducted at Kanmantoo Copper Mine with no amendment to avoid inconsistency.

6.3.2 Operational Measurement Criteria

The measurement criteria and associated leading indicator criteria for the operational phase and to meet the operational outcomes (including the period post-active closure until site relinquishment) are presented in Table 6-2.

6.3.3 Completion Measurement Criteria

The measurement criteria for the completion phase and to meet the completion outcomes are presented in Table 6-3. There are no leading indicator criteria applicable to the completion outcomes as these generally represent a one-time requirement to provide evidence that the outcome has been met prior to lease relinquishment.

Table 6-2 – Operational Measurement Criteria

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Outcome 1a: Maintain a buffer zone of 10 m from the lease boundary with no workings* within that zone.								
Land use – proximity to ML boundary and impacts on adjacent public roads, railway, and adjacent land use. New potential impact = I56 Monitoring not changed.	Photo monitoring – visual evidence of workings.	Monitoring sites along ML boundary (Figure 6-1): 1. Sites B1 (railway embankment south of RSW) and B2 (southern boundary south of Emily Star) along southern ML boundary (adjacent to process plant and associated infrastructure). 2. Site B3 along eastern ML boundary (mine road preceding Neutrog Factory, adjacent to O'Neil/Nugent zone).	Annually until all rehabilitation has been completed	Location of lease boundary	No leading indicator criteria required	No workings within 10 m of ML boundary (i.e., no workings within buffer zone).	Environment Manager	Annually in the MARCR
Outcome 1b: No adverse impacts to adjacent public roads, railway, and adjacent land use outside the ML area. **Outcome 2:** The current disturbed areas are stabilised to prevent sediment from leaving the lease area.								
Land use – impacts to adjacent land use, erosion control. New potential impact = I56Monitoring not changed.	Photo monitoring – visual evidence of sediment leaving the area.	Photo monitoring: P19 and P17 in Figure 6-2	Annually until all rehabilitation has been completed	None required	No leading indicator criteria required	Photo monitoring identifies that discharge points from the lease area are free of significant sediment.	Environment Manager	Annually in the MARCR
Outcome 3: Existing soil quality and quantity is maintained. (also refer to Outcome 8)								
Land use – soil quality; surface water – soil contamination No verified new or different potential impacts. Monitoring not changed.	Soil sampling and analysis: • Metals - Al, As, Cd, Cr, Cu, Fe, Mn, Hg, Ni, Pb, Zn. • Nutrients. • Hydrocarbons. Analysis will be conducted by an external/independent laboratory and the results will be accurate to standard detection limits. Baseline sampling effort will be reflected in closure sampling effort (i.e., a similar number of samples will be taken).	Topsoil stockpiles (see Figure 6-1)	Annually	Average baseline taken prior to disturbance (Coffey 2010b (included in 2011 MARCR)	Photo monitoring – visual evidence of vegetation health (if vegetation present on topsoil stockpiles) conducted annually will show vegetation (if present) is healthy.	Topsoil quality in terms of the soil sampling parameters are not statistically significantly different from baseline to ensure existing soil quality is maintained.	Environment Manager	Annually in MARCR

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Land use – soil quality; surface water – soil contamination No verified new or different potential impacts. Monitoring not changed.	Soil sampling and analysis: • Metals - Al, As, Cd, Cr, Cu, Fe, Mn, Hg, Ni, Pb, Zn. • Nutrients. • Hydrocarbons. Analysis will be conducted by an external/independent laboratory and the results will be accurate to standard detection limits.	Footprint of HGO infrastructure areas and control sites (exact sites to be determined by contamination consultant).	Once prior to final rehabilitation of infrastructure areas	Control sample areas selected by independent suitably qualified expert that are representative of soil that is not disturbed or contaminated by HGO mining operations which are to be sampled during the contamination assessment Soil contamination monitoring control data Guidelines for the assessment and remediation of site contamination (EPA, 2018)	No leading indicator criteria required	No contamination as defined by NEPM standards for Residential Health and Interim Urban Ecological investigation or a statistically significant difference in a contaminant from control sites to ensure existing soil quality is maintained	Environment Manager	MARCR
Land use – soil quantity No verified new or different potential impacts. Monitoring not changed.	Review of records – topsoil stripping from disturbance areas	Areas disturbed (i.e., project footprint see Figure 3-1).	Annually until no more disturbance activities	Ground disturbance certificates	No leading indicator criteria required	All available topsoil (depth ranges from 0 to 150 mm) is stripped and stockpiled as part of land disturbance to ensure existing soil quantity is maintained.	Environment Manager	Internally reported, any non-compliance with guidelines reported in MARCR
Land use – soil quantity No verified new or different potential impacts. Monitoring not changed.	Survey – topsoil stockpiles volume	Topsoil stockpiles (see Figure 6-1)	Annually until all topsoil has been placed as required for closure.	Annual topsoil volume survey data	Photo monitoring – visual evidence of erosion conducted annually of selected stockpiles will show no signs of erosion (e.g., rills, gullies)	Volume stockpiled is only reducing as soil is removed for rehabilitation works to ensure existing soil quantity is maintained.	Environment Manager	Annually in MARCR
Outcome 4: Fuel and liquid chemical storage is adequately bunded to capture spillage and to prevent the migration or infiltration of any spillage or leakage to the surrounding environment in conformance with relevant Environment and Protection Authority guidelines.								
Land use – fuel and chemicals No verified new or different potential impacts. Monitoring not changed.	Visual inspections of fuel and liquid chemical storage areas for integrity and spillages.	Fuel and chemical storage areas	Annually until fuel and liquid chemical storage areas are removed or transferred	EPA bunding and spill management (2016) Inspection records of fuel and liquid chemical storage areas	No leading indicator criteria required	Fuel and liquid chemical storage areas constructed and maintained in accordance with EPA guidelines to prevent the migration or infiltration of any spillage or leakage to the surrounding environment.	Processing Manager Mining Manager	Internally reported, any non-compliance with guidelines reported in MARCR
Outcome 5: No adverse impact to the quality and quantity of surface water caused by mining operations to water dependent ecosystems or to existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions Also refer to Outcomes 6 and 8								

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Surface water – water quality New/ different potential impacts: I54, 56, 64 No change to monitoring required (Section 5.2.3.3)	Water sampling and analysis: • pH, conductivity, TSS. • Hydrocarbons. Analysis will be conducted by an external/independent laboratory and the results will be accurate to standard detection limits. Water level will also be recorded.	Surface water monitoring sites (Figure 6-2): • Drainage lines near ML boundary (SW1 and SW2). • Northeastern sediment/ evaporation dam (once constructed)	SW1 and SW2 opportunistically during/after rainfall events that generate stream flow. Northeastern sediment/ evaporation dam annually.	GMMP (Appendix M)	Photomonitoring of surface water structure integrity (monitoring for Outcome 7) provides the leading indicator for this outcome.	Results not to exceed the relevant water quality criteria as defined in the SA EPA EPP (water quality)[6]: pH 6.5 to 9; turbidity 1-50NTU; hydrocarbons 0mg/L and EC not to exceed the range 100 to 5,000µS/cm.(to ensure no adverse impact to the quality of surface water as a result of mining operations.	Environment Manager	Results reported annually in the MARCR including metals suite analysis as data
I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability	Pore pressure in the TSF below the Stage 8 and 9 embankment will be measured using electrical sensors such as vibrating wire piezometers with automated dataloggers.	Figure 6-3 Three sensors will be placed directly below the Stage 8 embankment at 5m	Continuous until construction of Stage 8 and 9 embankments are completed	Initial readings prior to tailings deposition	Amber trigger level: Water level above RL1240m Red trigger level: Water level above RL1248m	No adverse impact to the quality and quantity of surface water due to geotechnical instability of the TSF Stage 8 and 9 lifts evidenced by pore pressures reflecting initial readings or as advised by technical experts.	Processing Manager	Internally reported, any non-compliance with guidelines reported in MARCR During construction the continuously read piezometer reading should be reviewed by HGO's geotechnical engineer on a daily basis, as construction passes by each of the piezometer location; to look for increases in pressure directly under the embankment. The readings shall be passed to the design engineer on a frequency in accordance with the Operations Manual (depending on what trigger level is activated). On a quarterly basis HGO shall pass on the readings to the design engineers for their quarterly and annual operations compliance reviews. Externally annually in the MARCR

[6] As the ANZG (2018) guidelines do not yet provide physical/chemical stressor default guidelines values (DGVs) for the relevant drainage division in which the site is located, reference is still made to the use of the regional DGVs provided in the ANZECC & ARMCANZ 2000 guidelines (in this case the DGVs developed for lowland rivers in south central Australia)

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability cont.…	Pore pressure in the tailings will be measured using electrical sensors such as vibrating wire piezometers with automated dataloggers to measure pressures during operations and to record the expected falling pressures after tailings deposition ceases.	Figure 6-3 Three locations will have sensors placed at 10m and 20m depth mid-section between the embankment and decant pond	Continuous up to 6 years post operations unless steady state is achieved earlier	Baseline = Pore pressure readings taken in 2018 (this being an equivalent perched water table within the TSF of RL1240m)	Amber trigger level: Water level above RL1240m Red trigger level: Water level above RL1248m	No adverse impact to the quality and quantity of surface water due to geotechnical instability of the TSF Stage 8 and 9 lifts evidenced by pore pressures trending towards zero or having achieved steady state as the TSF drains once tailings deposition ceases.	Processing Manager	Internally reported, any non-compliance with guidelines reported in MARCR The readings shall be passed to the design engineers on a frequency in accordance with the Operations Manual (depending on what trigger level is activated). After tailings deposition ceases the design engineers shall review and report on an annual basis.
	Embankment settlement monitoring using survey methods such as traditional survey or GNSS differential GPS	Figure 6-3 3 x embankment crest locations	Monthly during operations and up to 5 years post operations unless zero movement is achieved earlier	Baseline from first installation survey	Amber trigger level: settlement greater than 10mm/day but less than 100mm in total OR less than 10mm/day but greater than 100mm in total. Red trigger level: settlement greater than 10mm/day OR greater than 100mm in total.	No adverse impact to the quality and quantity of surface water due to geotechnical instability of the TSF Stage 8 and 9 lifts evidenced by zero change in RL.	Processing Manager	Internally reported, any non-compliance with guidelines reported in MARCR The readings shall be passed to the design engineer on a frequency in accordance with the Operations Manual (depending on what trigger level is activated). After tailings deposition ceases the design engineers shall review and report on a annual basis.
	Store and Release cover settlement monitoring using survey methods such as traditional survey or GNSS differential GPS	Figure 6-3 3 locations evenly spaced diagonally (east to west) across the final TSF store and release cover	6 monthly for two years and annually for following 3 years	Baseline from first installation survey	After tailings deposition ceases and new monitor points are installed PSM to review and advise if more than 700mm of settlement occurs in the central monitor location.	No adverse impact to the quality and quantity of surface water due to geotechnical instability of the TSF Stage 8 and 9 lifts evidenced by settlements remaining within expected design settlement analyses	Processing Manager	Internally reported, any non-compliance with guidelines reported in MARCR The readings shall be passed to the design engineer on a frequency in accordance with the Operations Manual (depending on what trigger level is activated).

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability cont….	TSF underdrainage outflow to RWS via flowmeter records.	Underdrainage outflow pipe to RWS	Monthly during operations		Amber trigger level: <2.6ML/d Red trigger level: <1.0ML/d	No adverse impact to the quality and quantity of surface water due no risk to stability from inadequate drainage of the TSF	Processing Manager	Internally reported, any non-compliance with guidelines reported in MARCR HGO shall pass on the readings to the design engineers for an annual compliance review.
Additional monitoring included based on updated information	Freeboard of RWS will be visually measured against side markers	RWS	Monthly for the first 6 months, subject to review, for the period from cessation of tailings deposition until steady state flow is achieved.	0.5m freeboard required to contain a 72 hour, 1:100 AEP storm event	RWS freeboard reduced to 0.7m will trigger pumping to the open pit.	No adverse impact to the quality and quantity of surface water due to overflow from the RWS for the duration of TSF drainage post-closure	Site Operations Manager	Internally reported, any non-compliance with guidelines reported in MARCR
Outcome 6: No stormwater contaminated as a result of mining operations is to leave the lease area or result in contamination of soil at closure within the lease area.								
Surface water – stormwater contamination of soil New/ different potential impacts: I54, 56 New monitoring location added.	Sediment sampling and analysis: • Metals - Al, As, Cd, Cr, Cu, Fe, Mn, Hg, Ni, Pb, Zn. • Nutrients. • Hydrocarbons. Analysis will be conducted by an external/independent laboratory and the results will be accurate to standard detection limits.	Sediment monitoring locations (Figure 6-2).	Annually	Control data is ongoing sediment monitoring results	Water sampling and analysis for the following: • pH, conductivity, turbidity, TSS. • Metals: Al, As, Ba, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Hg, Ni, Se, Zn (filtered and unfiltered) (selected samples). • Major ions: Ca, Mg, SO4 (selected samples). • Alkalinity, DOC, nutrients (selected samples). • Nutrients and hydrocarbons (selected samples). • Water depth. Triggers action if discharge occurs and samples are inconsistent with background concentrations of receiving waters (as determined by the surface water quality monitoring).	Sediment quality in terms of the sediment sampling parameters are not statistically significantly different from baseline to ensure no sediment is contaminated as a result of the mining operations.	Environment Manager	Externally annually in the MARCR
I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability	Refer to Outcome 5 for monitoring							
Outcome 7: No water runoff from the lease results in flooding of adjacent areas, to an extent greater than that that could reasonably be expected to occur prior to mining operations being established on the lease.								

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Surface water – erosion, flooding New / different potential impacts: I64 No change to monitoring required	Photo monitoring – visual evidence of erosion, integrity and effectiveness of structure.	Locations P16 to P19: selected surface water management structures (Figure 6-2). The northeastern sediment / evaporation pond will be added once constructed.	Opportunistically during/after a significant rainfall event or quarterly if no rain.		Weekly visual inspection of the design freeboard in the TSF return water storage facility identifies that freeboard is maintained below 300 mm and a freeboard of 0.5 m is maintained for the process water dam and 0.3m in the northeastern sediment / evaporation pond (once constructed).	No water runoff from the lease results in flooding of adjacent areas, to an extent greater than that that could reasonably be expected to occur prior to mining operations being established on the lease through maintenance of the water control structures as per design to ensure structures operate effectively during/after rainfall.	Environment Manager	Externally annually in the MARCR
Outcome 8: No contamination and/or pollution of natural water drainage systems, streams and rivers, land and soils occurs either on or off site is caused by waste products and hazardous materials used in mine operations.								
No verified new or different potential impacts. Monitoring not changed.	Refer to Outcome 5 for monitoring							
Outcome 9: No adverse impact to the quality and quantity of groundwater caused by mining operations to water dependent ecosystems or existing users unless adequate alternate supplies are provided in accordance with Condition 18 of the lease conditions.								
Groundwater - supply New potential impact = I60. Monitoring not changed.	All active Hillgrove monitoring wells monitored for water level (as m bgl and m AHD) measured using either calibrated pressure transducer loggers and/or manually with a calibrated water level probe to an accuracy of +/- 0.02 m indicate no exceedance of predicted maximum drawdown	Groundwater monitoring bores (Figure 6-4)	Hillgrove wells: Quarterly during operations Biannually for 6 years post cessation of tailings deposition Landholder wells: Biannually during operations Or as otherwise updated by the GMMP and agreed with DEM	Previous monitoring depths Baseline groundwater depths	Annual compliance report identifies significant decrease in groundwater at third party users bores.	No adverse impact to the quality and quantity of groundwater caused by mining operations to water dependent ecosystems or existing users validated by no significant statistical change against statistical baseline (refer to GMMP Appendix M)	Environment Manager	Externally annually in the MARCR
Groundwater quality	Pore pressure as per I54 in Outcome 5 Groundwater quality in Outcome 10							

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
I60 – Increased height of TSF results in seepage thereby influencing water quality and quantity available to surrounding users	Supernatant pond size measured by standard survey methods	Decant pond on TSF	Monthly during operations		Monthly survey indicates supernatant pond extends beyond 100m from decant	Supernatant pond does not exceed 100m from the decant during operations so as to not compromise TSF pore pressure thereby ensuring no adverse impact to quality of groundwater to water dependent ecosystems or existing users as a result of TSF seepage.	Processing Manager	Internally monthly, externally annually in the MARCR
Outcome 10: Contaminated water within the pit does not alter groundwater systems outside the extent of mining operation.								
Groundwater - quality No verified new or different potential impacts. No change to monitoring required	Water sampling and analysis: • pH, conductivity (in situ parameters). • Metals: Al, As, Be, Ba, Cd, Co, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Se, V, Zn. • Major ions: Ca, Mg, Na, K, Cl, SO4, CO3, HCO3. • Nutrients for KMB020, KMB022 and KMB023 only. Analysis will be conducted by an external/independent laboratory and the results will be accurate to standard detection limits.	Pit sumps, all Hillgrove monitoring wells, landholder wells and production wells including KMB011 and KBM012 and KMB020 to KMB025; replacement bore for KBM009 (KBM028); and 'upstream' water quality bore KMB031. See Figure 6-4.	Hillgrove wells: In situ parameters = quarterly during operations, annually for 6 years post cessation of tailings deposition Laboratory analysis = annually during operations, annually for 6 years post cessation of tailings deposition Landholder wells: In situ parameters = biannually during operation Laboratory analysis = annually during operations Or as otherwise updated by the GMMP and agreed with DEM	Ongoing monitoring data	No leading indicator criteria required	Water quality (for metals) does not exceed SA EPA Environment Protection Policy requirements or existing baseline conditions whichever is higher as shown in the adopted criteria given in the GMMP (Appendix M) to ensure pit water is not contaminating groundwater systems outside the ML extent.	Environment Manager	Externally annually in the MARCR
Outcome 11: No demolition, industrial or solid domestic (other than treated sewage) wastes are to be disposed of within the lease.								
Waste management No verified new or different potential impacts. Monitoring not changed.	Record review – demolition, industrial or solid domestic waste disposal records/waste register.	Site wide	Annually until relinquishment	Waste disposal report	No leading indicator criteria required	All waste has been transported off lease and appropriately disposed (by reputable contractor).	Environment Manager	Externally annually in the MARCR
Outcome 12: No contamination and/or pollution of groundwater occurs either on or off site is caused by waste products and hazardous materials used in mine operations.								

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Hazardous materials - groundwater quality No verified new or different potential impacts. Monitoring not changed.	Refer to Outcome 9 and 10 Monitoring							
Outcome 13: The Emily Star pit and the O'Neil/Nugent zone will be backfilled with waste rock to the extent that it is technically feasible. **Outcome 13b:** The O'Neil/ Nugent pit void on ML6436 will be backfilled with waste rock and rehabilitated so suitable for future industrial use.								
Backfill of pits No verified new or different potential impacts.	Backfill reports have been provided in the MARCRs. No further backfill planned hence no further monitoring required. Refer to completion criteria.							
Outcome 14: No contamination of natural water drainage systems, streams and creeks and no contamination beyond approved EPA limits for groundwater, land and soils occur onsite or offsite resulting from permanent disposal or temporary storage of the mine waste and tailings.								
Groundwater - quality New / different potential impacts: I54, I55, I56, I57, I60, I61	Refer to Outcome 9 Monitoring							
TSF construction and operation	Independent verification that Stage 8 and 9 lifts have been constructed in accordance with the approved design presented in and operated in accordance with the Tailings Operating Manual	TSF Stage 8 and 9 lifts	Annually	Approved design Tailings Operating Manual Annual TSF compliance report	Monthly record review of inspection records of construction and operation by the Processing Manager identify the construction and operation is in accordance with TSF Operations Manual (Appendix I).	Certification by a suitable independent professional to demonstrate that the TSF Stage 8 and 9 lifts have been constructed in accordance with the approved design (Appendix H) and the Tailings Operating Manual (Appendix I) to ensure no discharges from the TSF.	Processing Manager.	Summary reported annually in the MARCR
Amended TSF cover design	Soil moisture monitoring using the stations installed as detailed in Section 3.13.4.3	Four locations on IWL (refer to Figure 3-38)	Continuous for at least 5 years post placement of the final top IWL cover		Significant infiltration of wetting front recorded below cover depth.	Soil moisture infiltration is restricted to the 1m NAF cover layer thereby providing evidence that the store and release cover is effective and will avoid discharges from the TSF.	Environment Manager	Externally annually in MARCR

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
I54 - Additional lift on TSF impacts TSF / IWL geotechnical stability I60 – Increased height of TSF results in seepage thereby influencing water quality and quantity available to surrounding users	Refer to pore pressure monitoring in Outcome 5							
Outcome 15: No adverse public health and nuisance impacts to local residents from air emissions, dust and odour generated by mining operations.								
Air quality – dust, human health No verified new or different potential impacts. Monitoring not changed.	Dust measurement – Continuous PM10 dust concentration monitoring (including both ambient and mine related dust) with Thermo Scientific Model 5014i BAM samplers at monitoring sites (SR01, SR06 and HV1) as per method and accuracy specified in Australian Standards.	Continuous samplers at (Figure 6-5): • HV1. • SR01. • SR06.	Continuous sampling – Continuous as a 24-hour average of measurements (midnight to midnight) taken at intervals of not more than 10 minutes.	Air Quality EPP	Trigger and Response Plan (TARP) as regularly updated to reflect operational conditions.	No adverse public health and nuisance impacts to local residents evidenced by continuous PM10 dust concentration monitoring (including both ambient and mine related dust) with Thermo Scientific Model 5014i BAM samplers at monitoring sites (SR1, SR06 and HV1)(see Figure 6-5) demonstrates compliance outside ML with Air EPP of PM10 <50ug/m^3/day (as a 24-hour average of measurements (midnight to midnight) taken at intervals of not more than 10 minutes) with the exception of non-mining related exceedances as verified by DEM	Environment Manager	Externally annually in MARCR

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Air quality – dust, amenity No verified new or different potential impacts. Monitoring not changed.	Dust measurement – TSP (including both ambient and mine related dust) leaving the site monitored with Thermo Scientific Model 5014i BAM samplers at monitoring sites (SR01, SR06 and HV1) as per method and accuracy specified in Australian Standards.	Continuous samplers at (Figure 6-5): • HV1. • SR01. • SR06.	Continuous sampling – Continuous as a 24-hour average of measurements (midnight to midnight) taken at intervals of not more than 10 minutes.	Air Quality EPP	Trigger and Response Plan (TARP) as regularly updated to reflect operational conditions.	No adverse public health and nuisance impacts to local residents evidenced by TSP not exceeding average of 120µg/m^3 for a 24 period (midnight to midnight) and an average of 90µg/m^3 for any 12 month period with the exception of non-mining related exceedances as verified by DEM (see Figure 6-5).	Environment Manager	Externally annually in MARCR
Air quality – odour No verified new or different potential impacts. Monitoring not changed.	Odour measurement - odour concentration (odour units) method and accuracy in accordance with AS/NZS 4323.3.2001.	At sensitive receptors (Figure 6-6).	On complaint	Air Quality EPP	No leading indicator criteria	No adverse public health and nuisance impacts to local residents evidenced by no exceedance of EPA Standards (2 odour units).	Environment Manager	Externally annually in MARCR
Outcome 16: No public nuisance impacts from noise emanating from the operating site. Noise must at all times comply with the relevant environment protection policy under the *Environment Protection Act* (1993).								
Noise No verified new or different potential impacts. Monitoring not changed.	Noise measurement – sound level in dB(A) measured by attended noise monitoring, +/- 1 dBA	At selected sensitive receptors (Figure 6-6): · Receiver 1. · Receiver 4. · Receiver 7.	24 hour period, quarterly and as required by complaint.	Noise EPP	Trigger and Response Plan (TARP) as regularly updated to reflect operational conditions.	No public nuisance as a result of noise evidenced by no exceedance of EPA noise limits of 50 dB(A) during the day and <40 dB(A) at night. maximum instantaneous (Lmax) noise levels of 60 dB(A) during the night (10 pm to 7 am) (rural receptor).	Environment Manager	Externally annually in MARCR
Outcome 17: No adverse public health and/or nuisance impacts from airblast, flyrock and vibration caused by blasting.								

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Blasting – airblast, vibration Different potential impact: I62 Monitoring not changed	Vibration and overpressure measurement method and accuracy in accordance with AS2187.2.	At nearest sensitive residential receptor (Receiver 4 and Neutrog and Kanmantoo township (Garnet Rd) (Figure 6-6).	All blasts		Monthly record review of video footage of blasts and post-blast inspections by the Mining Manager demonstrates each blast has been undertaken in accordance with AS 2187.2–2006 (explosives).	No adverse public health and/or nuisance impacts caused by blasting evidenced by results of vibration and overpressure monitoring shows vibration and overpressure levels comply with AS 2187.2 (5mm/s for 95% of blasts per rolling year or a maximum of 10 mm/s at monitoring sites specified in Figure 6-6), 115 dBL for 95% of blasts per rolling year or a maximum of 120 dB and a maximum of 125dB and 25mm/s at the Neutrog Facility.	Mining Manager	Externally annually in MARCR
Outcome 18: All clearance of native vegetation is authorised under appropriate legislation and no permanent loss of abundance or diversity on or off the lease due to operations.								
Native vegetation No verified new or different potential impacts. Monitoring not changed.	Record review - clearance records and maps (GIS database) of cleared areas.	Clearance areas (Figure 3-1).	Annually until no further vegetation clearance	Clearance / disturbance forms Approved area of disturbance in MLP		No unapproved areas of Iron grass grassland or *E. odorata* open woodland communities are cleared as part of mining operations in accordance with approved NVMP (Appendix A).	Environment Manager	Externally annually in MARCR
Native vegetation No verified new or different potential impacts. Monitoring not changed.	Survey – LFA monitoring of remnant vegetation and rehabilitated areas.	Remnant vegetation and rehabilitated areas within the ML area and associated analogue sites (Figure 6-7).	Annually until 5 years after each specific area was rehabilitated	NVMP (Appendix A).	Annual photomonitoring verifies no significant mine related change (as determined by ecological consultant) in remnant vegetation (not cleared for mining).	No permanent loss of abundance or diversity reflected in annual LFA monitoring results.	Environment Manager	Externally annually in MARCR
Outcome 19: No uncontrolled fires caused by mining operations effect remnant vegetation on or off the mine site.								

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Fire – native vegetation No verified new or different potential impacts. Monitoring not changed.	Photo monitoring and survey conducted by a technical specialist – flora abundance, health and diversity.	Quadrat monitoring sites Q1 to Q3 in remnant vegetation (Figure 6-1).	Annually until relinquishment	Annual survey reports	No leading indicator criteria	No significant uncontrolled fire related change as determined by ecological consultant in remnant vegetation (not cleared for mining) resulting from uncontrolled fires caused by mining operations.	Environment Manager	Externally annually in MARCR
Outcome 20: No introduction of new weeds and plant pathogens, nor increase in abundance of existing weed species in the lease area and adjacent areas caused by mining operations.								
Weeds No verified new or different potential impacts. Monitoring not changed.	Flora survey – weed density, weed species and pathogens. Methods include survey as described above and targeted inspections of high risk areas (e.g., disturbed ground).	ML with focus on areas susceptible to weeds such as recently disturbed areas and areas near permanent water.	Annually until relinquishment	Annual survey reports	No leading indicator criteria	No significant increase in weeds or plant pathogens and no introduction of new declared weeds in Iron Grass Grassland and *E. odorata* open woodland communities that can be reasonably attributed to mining operations (as determined by ecological consultant).	Environment Manager	Externally annually in MARCR
Outcome 21: No net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas.								
Fauna No verified new or different potential impacts. Monitoring not changed.	Fauna survey conducted by technical specialist – abundance and diversity.	ML and adjacent areas.	Annually until relinquishment	Annual survey reports	No leading indicator criteria	No net adverse impacts on native fauna abundance or diversity as determined by ecological consultant that can be reasonably attributed to mining operations.	Environment Manager	Externally annually in MARCR
Outcome 22: No introduction of new pests (including feral animals), nor increase in abundance of existing pest species in the lease area and adjacent areas caused by mining operations.								

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Fauna – pests No verified new or different potential impacts. Monitoring not changed.	Fauna survey conducted by technical specialist – abundance and diversity.	ML and adjacent areas.	Annually until relinquishment	Annual survey reports	No leading indicator criteria	No significant increase in abundance of pest (feral) species and no introduction of new pest species that can be reasonably attributed to mining operations (as determined by flora and fauna consultant) when compared to baseline (Appendix 5A and 5B of 2016 PEPR).	Environment Manager	Externally annually in MARCR
Outcome 23: Operate a community engagement plan to the satisfaction of the Director of Mines which ensures effective communication and exchange of information between the operator, Hillgrove and their stakeholders (including but not limited to landowners, Callington/Kanmantoo communities or individuals).								
Community No verified new or different potential impacts. Monitoring not changed.	Record review – KCCCC meeting minutes and the community action plan	Entire site.	Quarterly	Community Engagement Plan	No leading indicator criteria	KCCCC meeting minutes and the community action plan provide evidence of compliance with community engagement plan and effective communication.	Environment Manager	Externally annually in MARCR
Outcome 24: Any complaints received from public recorded and addressed in manner and form specified by the Director of Mines.								
Complaints No verified new or different potential impacts. Monitoring not changed.	Record review - complaints register.	Entire site.	As complaints are received		No leading indicator criteria	All complaints received from public recorded and addressed as required by Director of Mines.	Environment Manager	Externally annually in MARCR
Outcome 25: No public injuries or deaths will result from unauthorised entry to the site that could have been reasonably prevented.								
Site access No verified new or different potential impacts. Monitoring not changed.	Record review – incident reports of unauthorised access to site resulting in public injury or deaths.	Entire site.	As incident occurs		Record review of incident reports of unauthorised access to site by the General Manager identifies there has been no unauthorised site access.	Incident report investigation shows injury could not have been reasonably prevented by Hillgrove.	General Manager	Internal and externally to SafeWork SA as required
Outcome 26: No disturbance to Indigenous artefacts or sites of significance unless prior approval under the relevant legislation is obtained (note: no known sites exist within the ML area).								

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Potential Indigenous sites No verified new or different potential impacts. Monitoring not changed.	Review of records – incident reports of discovery of Indigenous site.	ML area.	As sites are identified		No leading indicator criteria	Records to show if an Indigenous site is discovered, and in each instance Hillgrove will stop works and follow appropriate procedures, seeking appropriate approval to disturb under the Aboriginal Heritage Act.	Environment Manager	Externally annually in MARCR
Outcome 27: No disturbance to non-Indigenous artefacts or sites of significance unless prior approval under the relevant legislation is obtained.								
Non-Indigenous cultural heritage No verified new or different potential impacts. Monitoring not changed.	Not relevant as there are no non-Indigenous heritage or sites present on the ML area that have legislative protection.							
Outcome 28: Visual impact of the process plant from the South Eastern Freeway is minimised to the satisfaction of the Director of Mines.								
Visual amenity No verified new or different potential impacts. Monitoring not changed.	Photo monitoring – visibility of process plant.	View from South Eastern Freeway (Site P12 in Figure 6-1, see also Appendix B.	Annually until processing plant removed or transferred to a third party		No leading indicator criteria	Visual impact of the process plant from the South Eastern Highway is limited to a level that satisfies the Director of Mines.	Environment Manager	Externally annually in MARCR
Outcome 29: No unauthorised damage to adjacent public or private infrastructure (e.g., roads, power supplies).								

New or amended impact	What will be measured and form (method)	Location	Frequency	Control / baseline data	Leading Indicator Criteria	Outcome Achievement	Responsibility	Reporting
Infrastructure damage No verified new or different potential impacts. Monitoring not changed.	Record review – incident and investigation reports of damage.	Public and private infrastructure in the vicinity of the site	On report of damage		Record review of consultation records with appropriate infrastructure stakeholders (e.g., District Council of Mount Barker, Murray Bridge Council, DTEI and Transport SA) by the Environment Manager verifies consultation has occurred in the event of infrastructure damage. Annual photomonitoring at sites adjacent to the ML (Figure 6-1): • P1 - Mine Road (at main entry) • P2 - Junction of Mine Road and Back Callington Road (at the southeastern corner of the ML) • P3 - Railway line at site of culvert (southwestern edge of ML) reviewed by Environmental Manager for visual evidence of mine related impacts verify no evidence of mine related impacts to adjacent public infrastructure.	Records to show that any reports of unauthorised damage to public or private infrastructure are investigated and show that Hillgrove is not responsible.	Environment Manager	Externally annually in MARCR
Outcome 30: Traffic movements, noise, dust and/or dragout to and from the mine site cause no adverse public impacts.								
Traffic No verified new or different potential impacts. Monitoring not changed.	Record review – concentrate shipments recorded via dockets over the weighbridge.	Weighbridge	Per movement			Review shows heavy vehicle movements within modelled range of up to 28 movements per day to cause no adverse public impact.	Processing Manager	Internally
	Refer to air quality, noise and complaint monitoring							
Outcome 31: The form, contrasting and reflective aspects of the mining operations will blend with the surrounding industrial landscape.								
Visual amenity Different potential impact: I63 Monitoring not changed.	Refer to monitoring for Outcome 28							

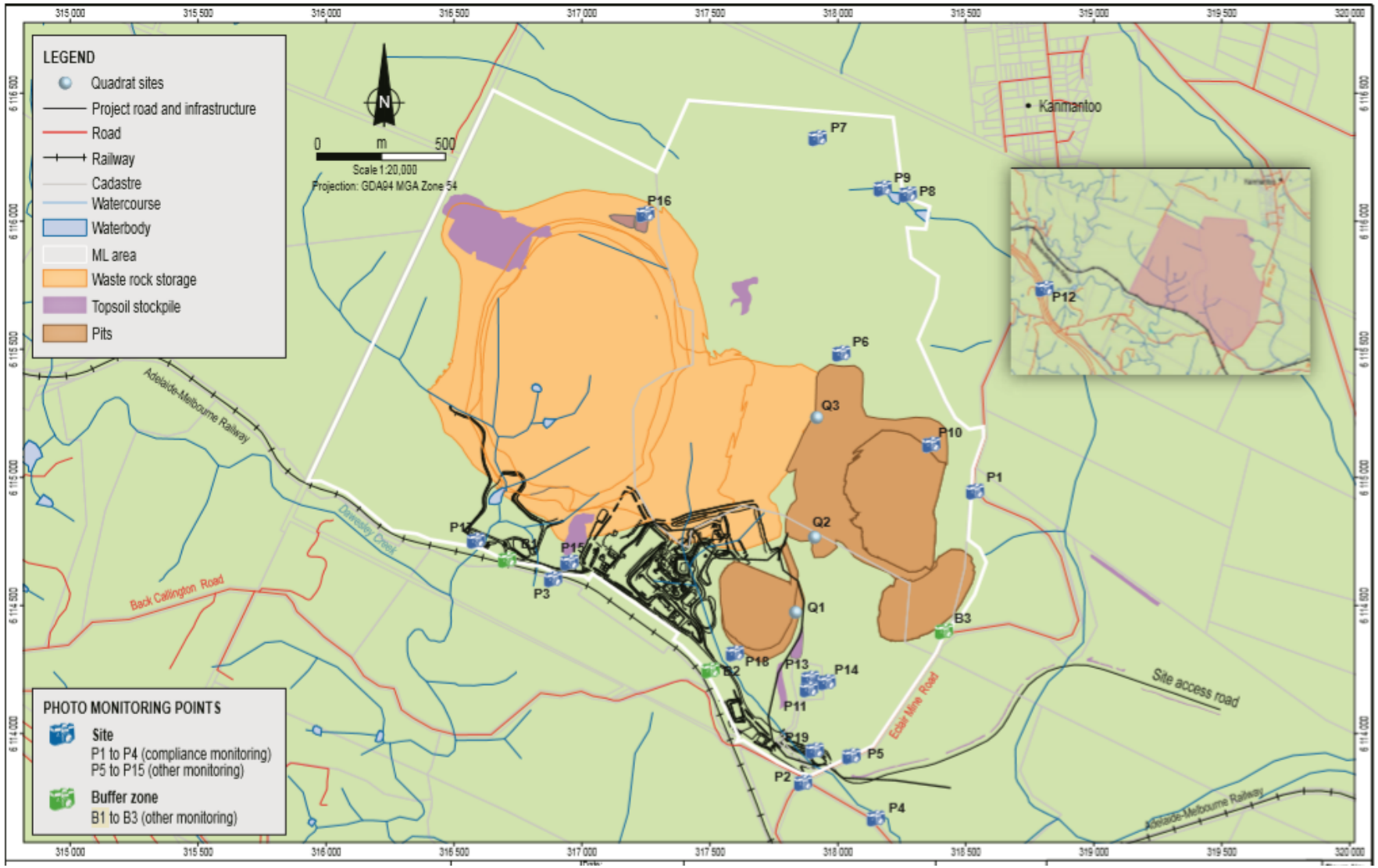


Figure 6-1 – Photo monitoring and vegetation quadrat survey locations

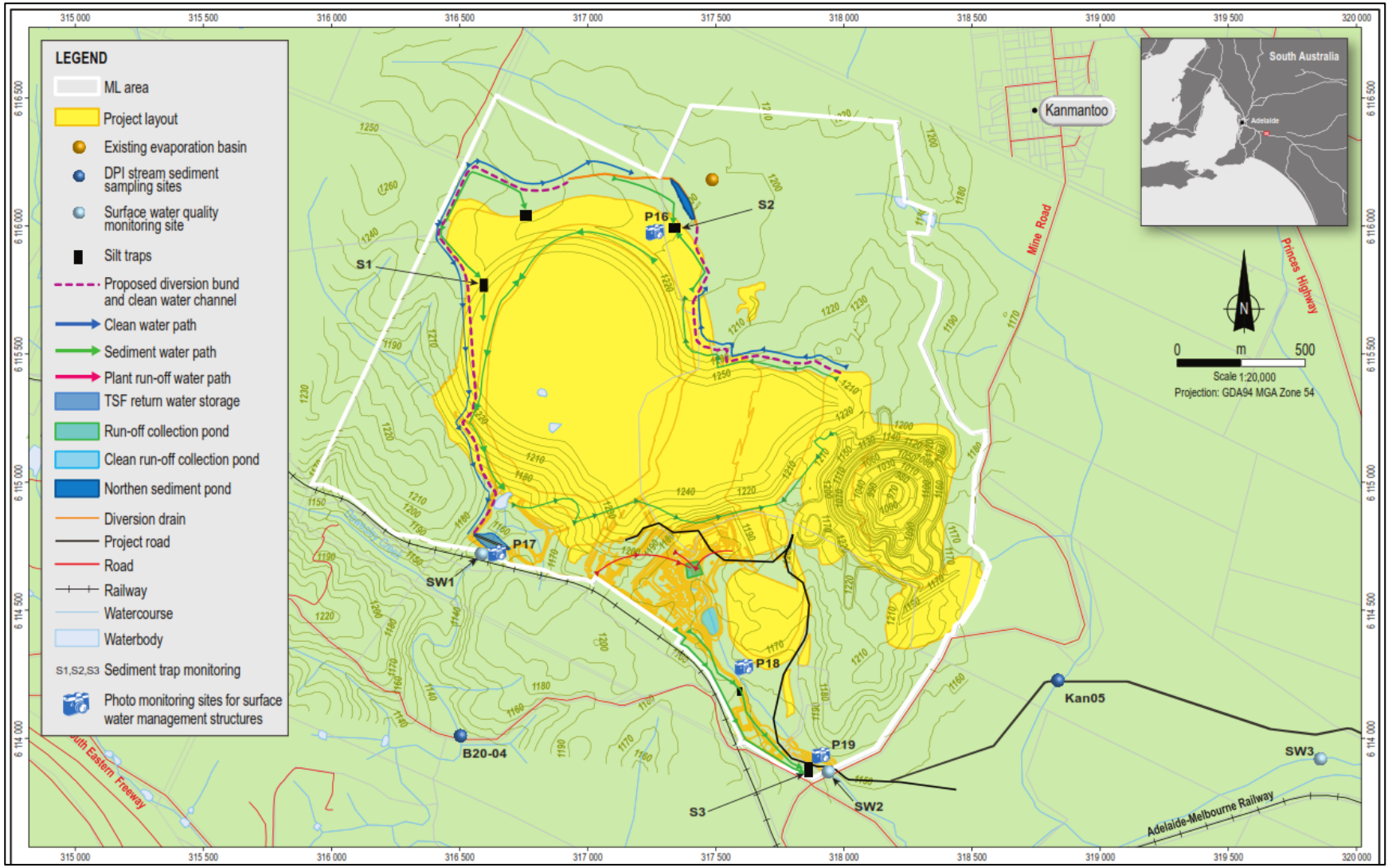


Figure 6-2 – Surface water and sediment monitoring locations

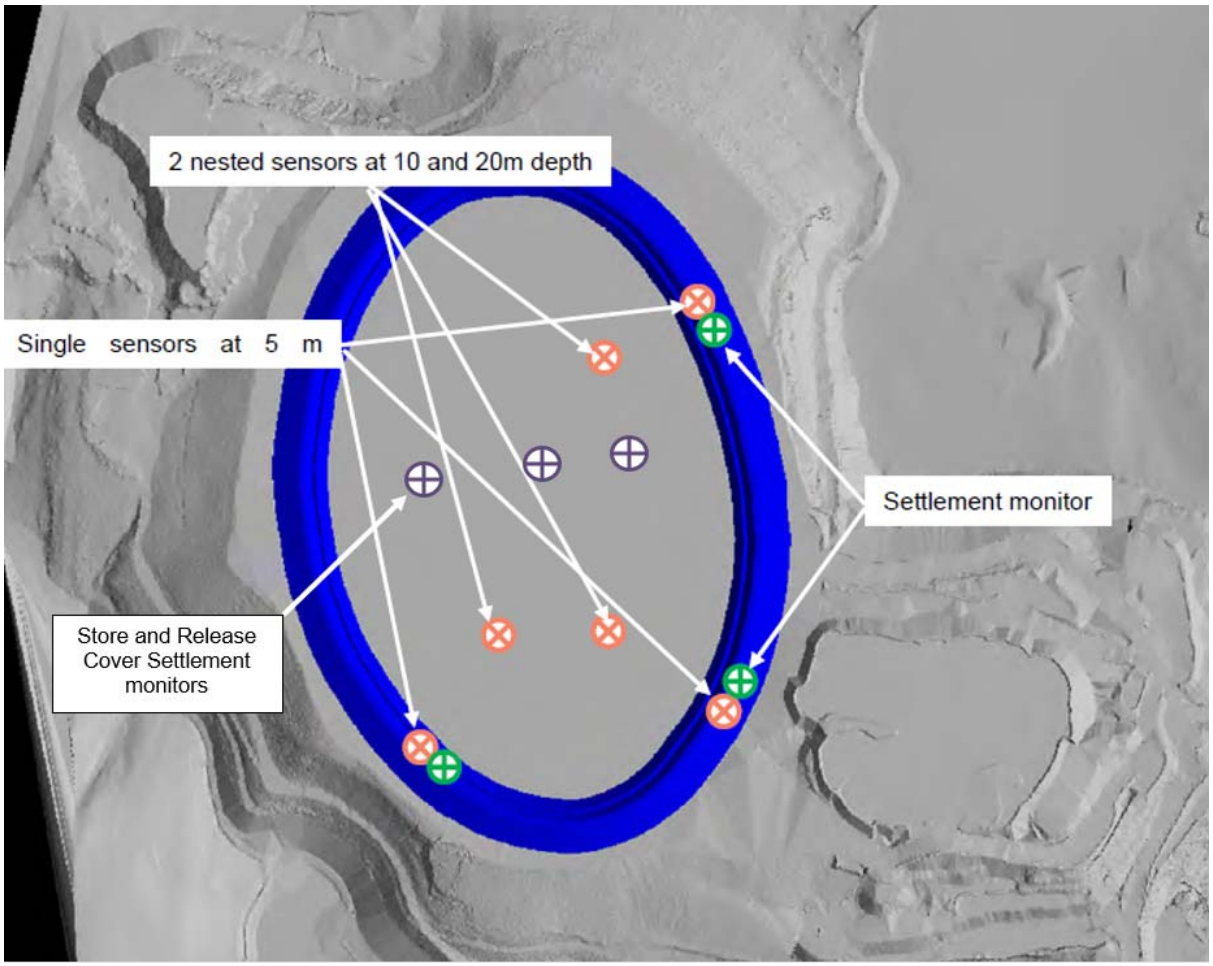


Figure 6-3 – Indicative TSF stability and store and release cover settlement monitoring locations

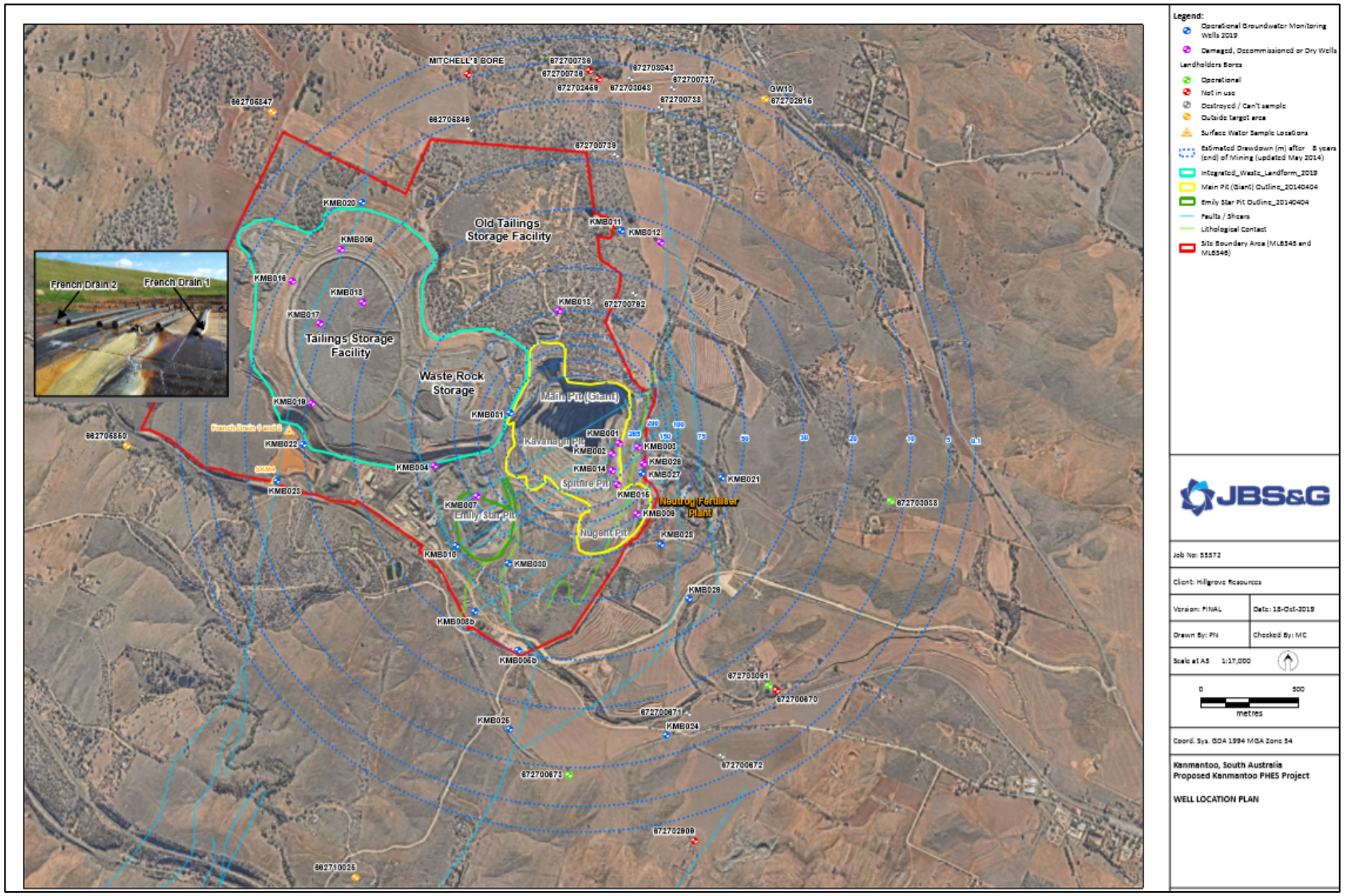


Figure 6-4 – Groundwater monitoring locations (JBS&G 2019b)

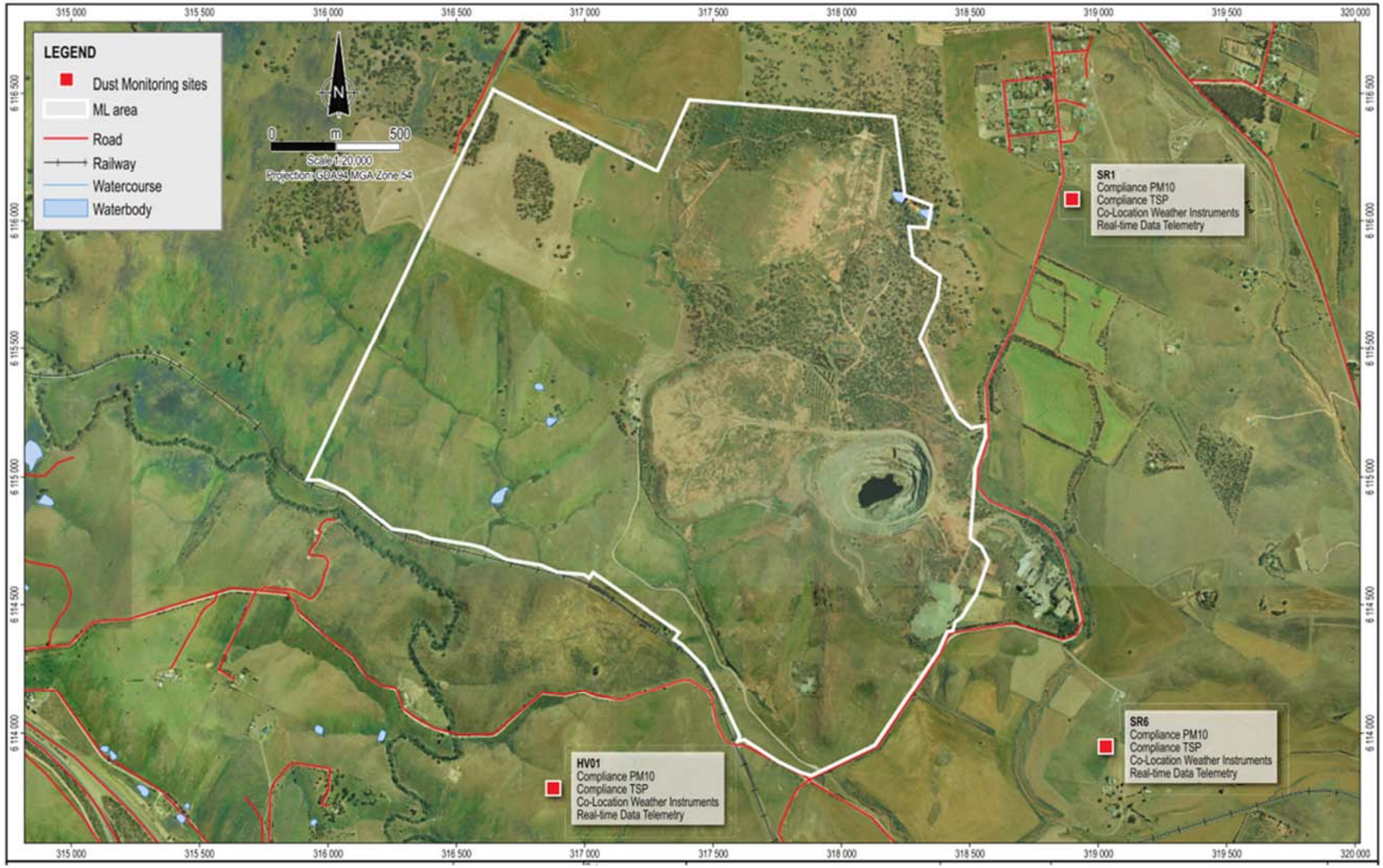


Figure 6-5 – Dust monitoring locations

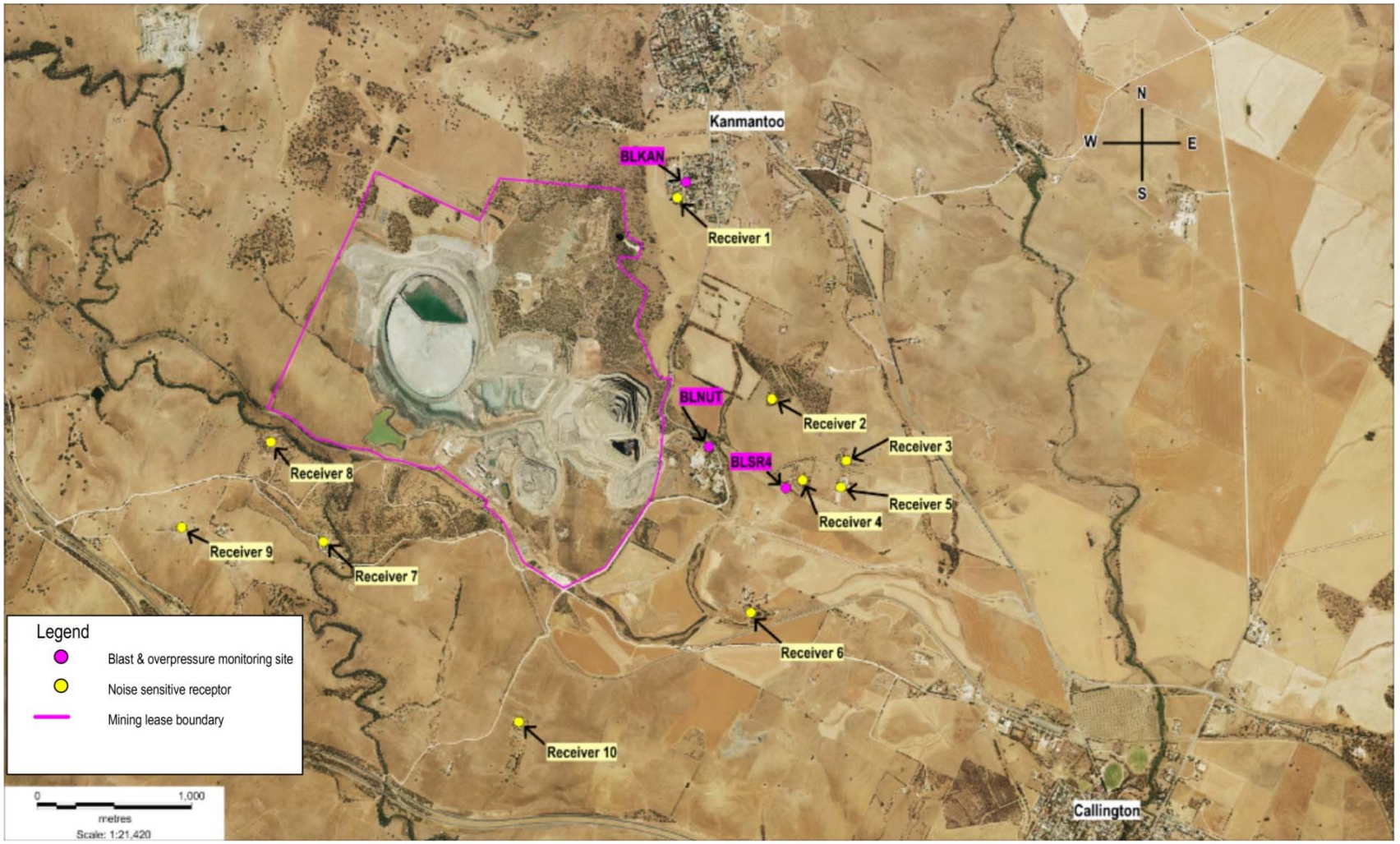


Figure 6-6 – Noise, Vibration, Overpressure and sensitive receptors monitoring locations

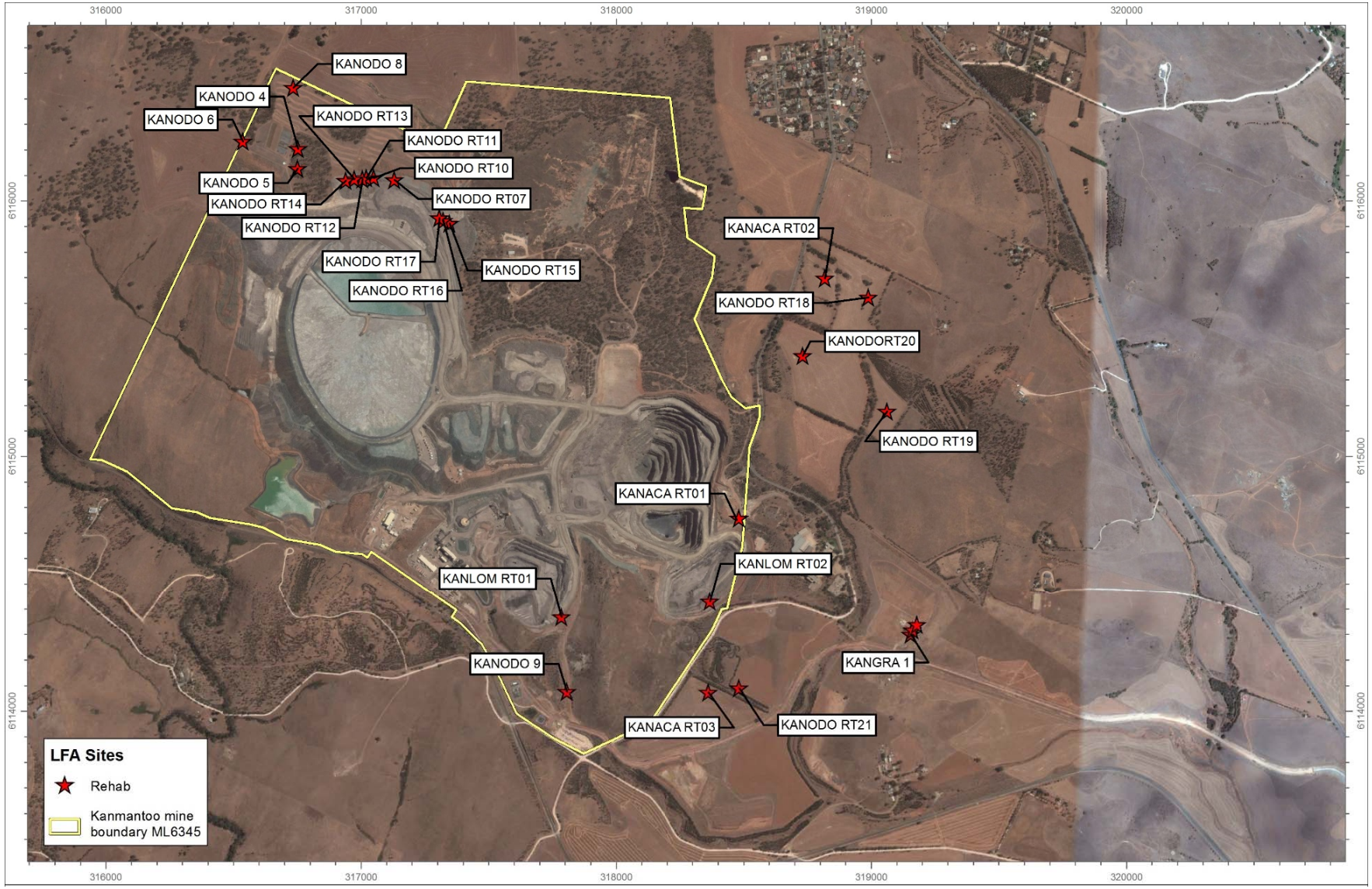


Figure 6-7 – 2019 EBS LFA monitoring locations

Table 6-3 – Mine Completion Measurement Criteria

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 1 Ecosystem and landscape function is resilient, self-sustaining and indicating that an ecosystem and landscape function comparable to the surrounding areas will ultimately be achieved.	Infrastructure Other disturbed areas	Independent suitably qualified expert verifies soil contamination assessment results within the footprint of removed infrastructure areas. Soils will be analysed for metals (Al, As, Cd, Cr, Cu, Fe, Mn, Hg, Ni, Pb, Zn), nutrients and hydrocarbons. Should soils be identified to be impacted (i.e., beyond 2 standard deviations of representative control sample) the independent expert will verify the effectiveness of mitigation (removal, treatment or encapsulation)	Applicable to areas where infrastructure has been removed (as opposed to infrastructure remaining and being transferred to third parties) Footprint of Hillgrove infrastructure areas including magazine Footprint of other disturbed areas: SPA, monitoring locations, and laydown area	Once prior to final rehabilitation of infrastructure areas	Control sample areas selected by independent suitably qualified expert that are representative of soil that is not disturbed or contaminated by Hillgrove mining operations which are to be sampled during the contamination assessment Soil contamination monitoring control data Guidelines for the assessment and remediation of site contamination (EPA, 2018)	The soil survey assessment expert report verifies soils in the identified disturbed areas have a quality within 2 standard deviations of representative control sample defined in Table 6-2 OR Where soil quality is measured as greater than 2 standard deviations from the representative control soil sample, the expert report will verify that the impacted soil has been removed, treated or encapsulated to a level similar to control site to provide for ecosystem and landscape function in these areas.

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 1 …continued.	All domains rehabilitated with native vegetation	A suitably qualified expert will, through LFA monitoring, verify completion of rehabilitation of disturbance areas & infrastructure footprints in accordance with PEPR and associated NVMP requirements	ML area – all areas rehabilitated with native vegetation	Annual LFA monitoring (refer to Table 6-2) incorporated into final verification within 12 months of surrender application	LFA monitoring of rehabilitation areas and analogues (refer to Table 6-2) - summary report Approved PEPR and associated NVMP	Suitably qualified expert provides a report verifying, through assessment of annual LFA monitoring, that over a monitoring period of at least 5 years, the rehabilitation presents a trend of continual improvement in landscape function and perennial plant cover relative to regional conditions, to indicate the ecosystem and landscape function is resilient and self-sustaining and is or will be comparable to surrounding areas.
	Native woodlands Native grasslands	A suitably qualified expert will, through review of the LFA monitoring, verify biodiversity has not reduced in these domains	LFA monitoring locations in native woodlands and native grasslands domain (see Figure 6-7)	Annual LFA monitoring (refer to Table 6-2) incorporated into final verification within 12 months of surrender application	LFA monitoring in relevant domains (refer to Table 6-2) Approved PEPR and associated NVMP	Suitably qualified expert provides a report verifying, through assessment of annual LFA monitoring, that biodiversity has not reduced in these domains, thereby indicating the ecosystem function is resilient and self-sustaining and is or will be comparable to surrounding areas.

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 2 The external visual amenity of the site is comparable with the surrounding areas and in accordance with the reasonable expectations of relevant stakeholders including removal of all mine related infrastructure (unless otherwise approved by the Director of Mines in consultation with relevant stakeholders).	All	Independent expert will verify, through review of closure and rehabilitation records, that closure and rehabilitation have been conducted in accordance with the approved PEPR, which is prepared in consultation with stakeholders to address their expectations, and the resultant visual amenity is comparable with surrounds.	ML areas viewed from photo monitoring viewpoints VP1 to VP 4 (Figure 6-1)	Once, within 12 months of surrender application	Approved PEPR Closure records (including NAF cover placement, topsoil placement and revegetation) Ongoing photo monitoring from viewpoints 1 to 4 (Figure 6-1)	Independent expert report verifies, through review of closure and rehabilitation records and photo monitoring, that closure and rehabilitation have been conducted in accordance with the approved PEPR, thereby in accordance with reasonable expectations of relevant stakeholders and the resultant visual amenity is comparable with surrounds.
	Infrastructure Other disturbance areas	Where infrastructure has been transferred to a third party, the presence of documentation in the form of transfer or sale documentation, of transfer of any infrastructure to third parties, along with all associated liability and approval of the Director of Mines. Where the transferred infrastructure is to be retained on site, documentation will provide evidence that the retention is compliant with Council zoning.	Any infrastructure transferred to a third party	Once, on transfer of infrastructure	Transfer documentation	Provide evidence of records in the form of legal transfer or sale documentation, of transfer of any infrastructure to third parties and approved from the Director of Mines for any infrastructure to be retained. Where the transferred infrastructure is to be retained on site, the retention is compliant with Council zoning.

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 3 The risks to the health and safety of the public and fauna are as low as reasonably practical.	Open pit (Main Pit)	An independent suitably qualified person will verify through site visit and inspection that the abandonment bund (or other appropriate site security engineering controls) are implemented in accordance the approved PEPR	Open pit	Once within 12 months prior to relinquishment	Approved PEPR (Section3.13.4.1) WA Guidelines for Safety Bund Walls around Abandoned open pit mines (DIR, 1997) or equivalent as agreed by Director of Mines	Verification by an independent suitably qualified person that the abandonment bund (or other appropriate site security engineering controls) have been implemented as required by the PEPR (Section 3.13.4.1) to meet the requirements of the most recent WA guidelines for abandonment bunds (or equivalent standard as agreed by the Director of Mines) to prevent unauthorised public access to the open pit to ensure the risk to the health and safety of the public is as low as reasonably practical
	Open pits (backfilled)	Verification by a suitably qualified geotechnical expert that the Emily Star pit and the Nugent/O'Neil zone are backfilled and represent a geotechnically stable surface	Emily Star pit and Nugent/O'Neil zone	Once, within 12 months of surrender application	Backfill reports: 1. Nugent Pit Backfill Report (2016)[7] 2. Nugent Pit Upper Level Backfill and Rehabilitation Report (2018)[8] Emily Star Pit Backfill and Remediation Design Report (2018)[9]	Suitably qualified geotechnical expert report verifies that the Emily Star pit and the Nugent/O'Neil zone are backfilled and represent a geotechnically stable surface to ensure the risk to the health and safety of the public is as low as reasonably practical

[7] Hillgrove Resources (2016) Nugent Pit Backfill Report, Prepared by Bruce Hutchison, Principal Engineer, Hillgrove Resources (Kanmantoo Copper Mine), September 2016
[8] Hillgrove Resources (2018) Nugent Pit Upper Level Backfill and Rehabilitation Report, Prepared by Bruce Hutchison, Principal Engineer, Hillgrove Resources (Kanmantoo Copper Mine), November 2018
[9] Hillgrove Resources (2018) Emily Star Pit Backfill and Remediation Design Report, Prepared by Bruce Hutchison, Principal Engineer, Hillgrove Resources (Kanmantoo Copper Mine), November 2018

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 3 The risks to the health and safety of the public and fauna are as low as reasonably practical. *continued*	Infrastructure	Transfer of infrastructure – refer to Completion Outcome 2				
	Infrastructure Other disturbance areas	Verification by photo evidence that all above ground infrastructure has been removed from the ML area in accordance with the requirements of the approved Kanmantoo Copper Mine PEPR	All infrastructure areas where infrastructure has not been transferred to a third party	Once, on removal of above ground infrastructure	Pre-removal photographs Post-removal photographs Approved PEPR (Section 3.13.4.4 and 3.13.4.11)	Verification by photo evidence that all above ground infrastructure not transferred to a third party has been removed from the ML area in accordance with the requirements of the approved PEPR and no longer poses risk to public health and safety.
	Infrastructure Other disturbance areas	Verification by photo evidence that all below ground infrastructure such as foundations, slabs and footings has been removed from the ML area in accordance with the requirements of the approved Kanmantoo Copper Mine PEPR OR Verification by survey that at least 1m of NAF material has been placed over below ground infrastructure such as foundations, slabs and footings	All infrastructure areas where infrastructure has not been transferred to a third party	Once, on removal or covering of below ground infrastructure	Pre-and post -removal photographs Approved PEPR (Section 3.13.4.4 and 3.13.4.11) OR Survey of NAF thickness Approved PEPR (Section 3.13.4.4 and 3.13.4.11)	Verification by photo evidence that all above ground infrastructure not transferred to a third party has been removed from the ML area or appropriately covered with 1m NAF waste rock in accordance with the requirements of the approved PEPR (Section Section 3.13.4.4 and 3.13.4.11) and no longer poses risk to public health and safety.

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 3 The risks to the health and safety of the public and fauna are as low as reasonably practical. *continued*	Other disturbance areas	Verification by photo evidence that all HGO exploration costeans, sumps or drill holes have been backfilled.	Any Hillgrove exploration costeans or sumps in the ML area	Once on completion of active closure	Pre-removal photographs Post-removal photographs DSD (2012) M21 Guidelines for mineral exploration: Mineral Exploration Drill holes — General specifications for construction and backfilling	Verification by photo evidence that all HGO exploration costeans, sumps or drill holes in the ML area have been backfilled in accordance with the requirements of M21 Guidelines for mineral exploration: Mineral Exploration Drill holes — General specifications for construction and backfilling (2012) (or equivalent) and no longer poses risk to public health and safety.
	Surface water structures	In the event that the surface water structures are not transferred to a third party, photo evidence of the implementation of means of egress from the RWS and removal of the HDPE liner from the clean water runoff pond to provide for egress	RWS Clean water runoff pond	Once, on transfer of infrastructure	Pre and post implementation photographs	Verification by photo evidence that the HDPE liner from the clean water runoff pond has been removed and that a means of egress has been implemented to the TSF return water pond such that there is no significant risk to public health and public or fauna safety.
	RWS	Evidence of a land management agreement attached to the land title, transferring any liability associated with the RWS to the land owner	RWS	Once, on sale of land or within 12 months of surrender application (whichever occurs earlier)	Land management agreement	A land management agreement is attached to the land title transferring all liability of the RWS to the land holder.
	IWL	Refer to Completion Outcome 5				

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 4 No compromise of the quality and quantity of groundwater to existing users unless adequate alternate supplies are provided.	Open pit Underground	Verification by a suitably qualified expert of groundwater monitoring and pit lake water level that the pit lake is not acting contrary to the pit lake modelling.	Main Pit	Once within 12 months prior to surrender application	Groundwater monitoring (Table 6-2) Pit lake model (Mining One 2019a) (PEPR Appendix E). Pit lake water level – visual inspection	A report by a suitably qualified expert verifies, through assessment of groundwater monitoring data and pit lake water level in comparison to the groundwater model, that the pit lake not acting contrary to the model predictions and hence can be reasonably expected to present no compromise of the quality and quantity of groundwater to existing users unless adequate alternate supplies has been provided in a supply method agreed with the affected user.
	IWL	Refer to Completion Outcome 5				
Completion Outcome 5 All mining waste and tailings left onsite are chemically and physically stable.	Open pits (void)	Refer to Completion Outcome 3 for physical stability Refer to Completion Outcome 4 for chemical stability				
	IWL	Review by a suitably qualified independent expert of construction records for the IWL against the approved PEPR design (reinforced in the erosion modelling) for physical stability	IWL	Once on completion of IWL	PEPR IWL design (Section 3.13.4.3) which reflects the independent erosion simulation model (Landloch, 2019) and design engineer construction reports	A report by a suitably qualified independent expert verifies the IWL has been constructed in accordance with the approved PEPR design for long term landform physical stability

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 5 All mining waste and tailings left onsite are chemically and physically stable. *Continued…*	IWL	Review by a suitably qualified independent expert of construction records of the IWL cover against the approved PEPR design for geochemical stability and the performance monitoring results of the IWL with respect to the cover operating as designed	IWL	Once within 12 months prior to surrender application	PEPR IWL cover design (Section 3.13.4.3) Construction reports for the IWL (IWL construction report #1, #2 and #3 2015-2016) and any other available reports as per Section Section 3.13.4.3. IWL Soil moisture monitoring – refer to Section 3.13.4.3 and Table 6-2	A report by a suitably qualified independent expert verifies the IWL cover has been constructed in accordance with the approved PEPR design (Section 3.13.4.3) and is performing as per design for long term landform geochemical stability as evidenced by soil moisture monitoring (Section 3.13.4.3 and Table 6-2)
	IWL	Review by a suitably qualified independent expert of IWL PAF and NAF placement construction reports against approved PEPR design for geochemical stability	IWL inclusive of TSF	Once on completion of IWL	PEPR IWL design and TSF cover design (Sections 3.7 and 3.13.4.3) Construction reports for the IWL (IWL construction report #1, #2 and #3 2015-2016) and any other available reports as per Section 3.13.4.3.	A report by a suitably qualified independent expert verifies IWL PAF and NAF has been placed as per PEPR requirements through assessment of placement construction reports, hence provide for long term landform chemical stability

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 6 No compromise of the quality and quantity of surface water to existing users and water dependent ecosystems.	IWL	Suitably qualified expert assessment of all previous annual surface water monitoring data measured at drainage lines (SW1 and SW2) and analysed at NATA certified laboratory for pH, and key indicator metals and nutrients (i.e., Cu, Fe, Ammonia as N, N (NOX), P)	SW1 and SW2 (refer to Figure 6-2)	Once within 12 months prior to surrender application	Opportunistic (during surface water flow events) surface water monitoring incorporated into final verification once prior to relinquishment GMMP	Suitably qualified expert assessment of all previous annual monitoring data verifies that surface water monitoring at drainage lines (SW1 and SW2) meets the guidelines as accepted in the GMMP, other than as a result of those events which could not be reasonably prevented by HGO, i.e., relating to high intensity rainfall events and first flush.
Completion Outcome 7 The site is physically stable.	Open Pits	Refer to Completion Outcome 3 for physical stability				
	IWL	Refer to Completion Outcome 5 for physical stability				

Completion Outcome	Applicable Domain(s)	What will be measured and form (method)	Location	Frequency	Control / baseline data	Outcome Achievement
Completion Outcome 8 A Mine Completion Report prepared in consultation with the landowner and in accordance with guidelines approved by the Director of Mines, which demonstrates achievement of the closure criteria as specified in the current PEPR has been provided to the Minister prior to lease relinquishment.	All	Records of submission to the Minister of a Mine Completion Report prepared in consultation with the landowner and in accordance with guidelines approved by the Director of Mines, which demonstrates achievement of the closure criteria as specified in the current PEPR.	ML area	Once, as part of the surrender application	PEPR mine completion commitments (Section 3.13)	Records provide evidence that a Mine Completion Report prepared in consultation with the landowner and in accordance with guidelines approved by the Director of Mines, which demonstrates achievement of the closure criteria as specified in the current PEPR has been provided to the Minister prior to lease relinquishment.

6.4 Operator Compliance Monitoring Plan

Hillgrove will continue to implement a comprehensive monitoring and reporting program for the operation. The primary objectives of the environmental and social monitoring program are as follows.

- Measure the achievement of each outcome and the effectiveness of each strategy.
- Detect and measure trends or environmental/social changes and enable analysis of their causes.
- Confirm environmental and social impacts of specific activities and identify unforeseen effects and the need for additional management measures.

Compliance monitoring is conducted to assess compliance with the lease conditions and in particular compliance against the assessment criteria for each environmental and social outcome. Leading indicator monitoring is also required by the lease conditions for certain aspects and is conducted to provide early warnings that a control measure is failing and that the achievement of a particular outcome may be at risk. If a leading indicator is not achieved immediate action is taken to investigate the issue and develop a course of action to address it. This is the responsibility of the Environment Manager, who will be supported by the General Manager and the other members of the management team.

The operational compliance monitoring program is summarised in Table 6-2, inclusive of leading indicator monitoring. The completion compliance monitoring program is presented in Table 6-3.

7.0 Operator Capability

7.1 Commitment and Leadership

Hillgrove is committed to continuing to achieve best practice outcomes through:

- high operating standards in all aspects of its activities to minimise environmental impact and prevent environmental harm;
- communication and consultation with all stakeholders;
- employee awareness of sound environmental practice as part of day-to-day activities;
- continuous improvement through measurement of environmental performance;
- regular audits and review of policies, systems and procedures; and
- compliance with applicable legislation.

This commitment is captured in Hillgrove's sustainability policy (Figure 7-1). Compliance with the policy is emphasised in the company's induction program. The commitment is also demonstrated through the company's corporate governance principles.

Hillgrove recognises that all activities impact on the environment. Since it is not possible to eliminate all impacts, Hillgrove's policy is to engineer and conduct operations with the objective of achieving and exceeding compliance so that adverse effects on the environment are minimised and benefits are maximised.

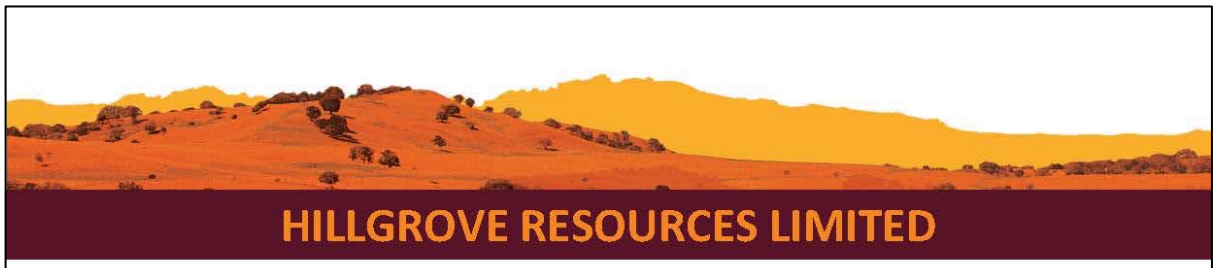
Hillgrove's Kanmantoo operation has adopted the sustainability policy by developing site-specific procedures and documentation that support the implementation of the policy in the form of an integrated management system (IMS).

7.2 Integrated Management System

Hillgrove have an integrated management system (IMS) to assist with managing the safety and environmental risks associated with the Kanmantoo Copper Mines. This system assists Hillgrove in tracking compliance and licence requirements and ensuring that review occur in a systematic and timetabled manner. It assists in managing the records associated with its quality, heath, safety and environmental responsibilities in an accessible and easily understood way and help Hillgrove in demonstrating compliance with appropriate management system standards and corporate requirements.

7.3 Management Structure

The Kanmantoo Copper Mines management team is led by the General Manager. The General Manager has overall responsibility for the site and oversees the mining operation. The General Manager is supported by a management team (Figure 7-2).



HILLGROVE RESOURCES LIMITED

SUSTAINABILITY POLICY

Our Vision — "To operate in an environmentally safe and sustainable manner with minimal impact to the community"

Hillgrove Resources is committed to effectively minimising the environmental and community impacts of our activities to provide a sustainable environmental future for communities surrounding our sites, even after our operations cease.

Through the acceptance of individual Environmental responsibility, promotion of an impact aware culture, effective leadership and the implementation, maintenance and continual improvement of our Integrated Risk Management System, we will ensure:

- Integration of environmental and rehabilitation processes into exploration, mine planning, mining and metallurgical activities
- Identified impacts are eliminated or minimised as far as reasonably practicable
- Contributions from all workers and key stakeholders towards the improvement of environmental management will be encouraged and respected
- Active consultation with the community about the company's activities
- Opportunities are identified for the efficient use of energy and water, waste minimisation and reduction of the Company's environmental footprint
- A focus on the conservation of biodiversity and integrated approaches to land use planning
- Effective rehabilitation of sites or areas disturbed by company activities to comply with the applicable Environmental Management Plan
- Companies providing contract services to Hillgrove manage their environment and community impacts in alignment with this policy
- Appropriate resources are provided to achieve a systematic, effective approach to environmental management
- All officers, management and workers understand their environmental roles and responsibilities and demonstrate commitment to them
- Environmental management systems and procedures are regularly evaluated for effectiveness and continually improved
- Compliance with environmental legislation, codes of practice and approvals

Lachlan Wallace
Chief Executive Officer and Managing Director
12 August 2019

Figure 7-1 – Hillgrove Sustainability Policy

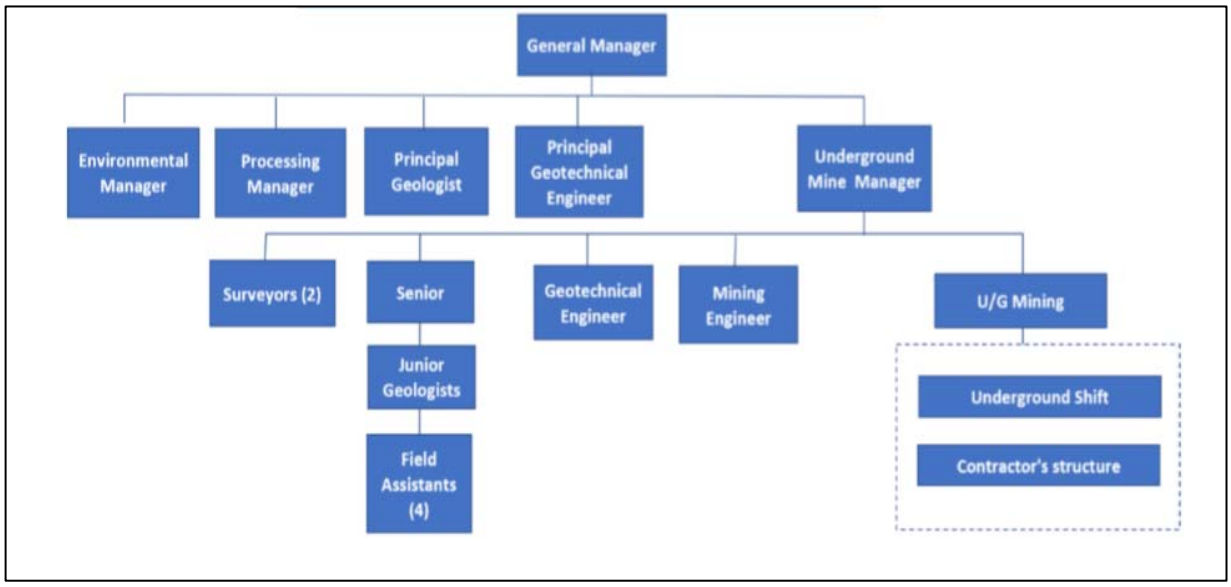


Figure 7-2 – Kanmantoo Copper Mine Proposed Organisational Chart

7.4 Policies and Objectives

Management of Hillgrove's Kanmantoo operation is governed by the performance objectives set out in the company's sustainability policy, PEPR and management plans. Both the policy and management plans provide objectives for sustainable development and sound environmental stewardship.

Hillgrove will continue to comply with all applicable environmental laws, regulations and approvals as set out in Section 1.4. Hillgrove will also continue to educate their employees and contractors about environmental matters and associated responsibilities to ensure employees and contractors have the appropriate degree of awareness, environmental skills and training.

7.5 Organisation and Resources

The site General Manager is responsible for ensuring that all project activities are conducted in full compliance with statutory regulations and are consistent with Hillgrove's sustainability policy, management plans and systems. In addition, all Hillgrove and contractor personnel are responsible for the environmental performance of their activities and complying with the relevant environmental management procedures.

The General Manager ensures sufficient resources are allocated to implement and maintain the environmental policy during the Kanmantoo Copper Mine operation.

The General Manager will continue to be assisted by the management team as appropriate and based on their respective responsibilities, to:

- ensure that the environmental and community relations aspects of Hillgrove's sustainability policy, systems and management measures are implemented uniformly, and are revised and maintained as required (all managers responsible);
- implement the environmental management plan;
- ensure that contractors fulfil their contractual obligations (relevant manager that contractor reports to);
- implement induction procedures and appropriate training;

- ensure compliance with licence and lease conditions, environmental management system and company policy via the establishment and maintenance of appropriate reporting systems and databases;
- continue to implement the mine closure and completion plan;
- provide advice as required to other project personnel; and
- liaise with stakeholders.

7.6 Communication

The General Manager (or their delegate) will continue to ensure that the project's risk register requirements, and policies and procedures to meet these requirements, are communicated to all employees, contractors and visitors. Communication will continue to be achieved by various means including inductions, training, and the safety, health and environment (SHE) committee, in accordance with the Hillgrove's sustainability policy.

7.6.1 Inductions

Following appointment, each employee and contractor undergoes a formal site induction to ensure that they have the appropriate knowledge concerning health, safety, environment and community relation procedures.

7.6.2 Training

In addition to general inductions, ongoing reinforcement is provided through specific work area inductions and weekly 'tool box' meetings, where health and safety, environmental and community relations issues that may arise from time to time are discussed, including changes to policies and procedures.

7.6.3 Safety, Health and Environment Committee

Hillgrove have a Safety, Health and Environment committee, formed from representatives from across the site. The committee assists with internal communication and encouraging fellow workers to adopt safe work practices, follow environmental requirements and identify when activities may cause community concern.

7.6.4 Ongoing Community Consultation

Hillgrove's community consultation program is ongoing and will continue through the life of the project to ensure due consideration of all project-related opportunities and concerns. Details about the program are provided in Section 4.0.

7.7 Risk and Impact Evaluation and Management

It is necessary to anticipate, prevent and mitigate environmental risks and impacts to protect the environment. Hillgrove will continue to undertake risk assessments in order to:

- Anticipate, prevent and mitigate environmental risks and impacts.
- Minimise loss in all areas of the organisation.
- Improve the quality of decision-making within the organisation.

Appropriate controls are in place at the operation for each risk, based on the following hierarchy of controls.

- Eliminate.
- Substitute.
- Engineer.
- Isolate.
- Administration.

- Protection.

The site maintains a detailed risk register that document risks and risk action plans and includes detail on the control measures, responsibilities for management and implementation.

7.8 Planning

7.8.1 Environmental Management Plan

A risk-based environmental management plan (EMP) has been implemented at the operation to:

- document project commitments and impact mitigation requirements;
- document conditions of approval resulting from the environmental approval process and requirements of the *Mining Act 1971* including the lease conditions and other relevant legislation; and
- provide the basis for the development of environmental guidelines and work procedures to be prepared by the construction contractor.

The EMP is based on the environmental and social objectives in the approved PEPR and is be monitored and evaluated against key environmental performance standards to ensure environmental compliance.

7.8.2 Emergency Response Plan

Hillgrove implements an Emergency Response Plan that establishes specific actions to manage significant events such as fires, car accidents, chemical or oil spills, tailings spills or concentrate spillage. This document will be updated to include the underground operation.

All incidents, both minor and major, are recorded in an incident register that forms part of the IMS documentation.

No ambulance will be kept on site as an ambulance service and fully-equipped hospital with on-call doctor for emergencies are nearby at Mt Barker. A first aid room is provided in the administration building and first aid boxes are kept in the workshops, crusher control and mill control buildings, laboratory, and in vehicles. A qualified safety officer is also employed on site to coordinate emergencies.

A fire trailer is located on site to provide fire protection. Fire hydrants with hose reels are located in the workshop and administration areas, concentrate shed, and fuel storage area. Portable fire extinguishers are fitted on all buildings, the fuelling station, plant areas and all vehicles. Smoke detectors are located in all transportable buildings, control rooms and switch rooms.

7.9 Implementation, Recording and Monitoring

7.9.1 Recording

Hillgrove will establish and maintain an auditable record system that will include the following documentation.

- Approved Program for Environmental Protection and Rehabilitation (PEPR).
- Environmental management plans.
- Monitoring results.
- Environmental monitoring reports.
- Audit reports.
- Incident register.
- Complaints register.
- Risk register.

7.9.2 Monitoring

Section 1.1 provides the monitoring program for the mine. Detailed procedures for monitoring form part of the EMP.

7.9.3 Inspections

Hillgrove regularly conducts inspections of operational and progressive closure activities to ensure that environmental management plans are correctly implemented. The frequency of inspection depends on the potential risk associated with the activity. Inspections are undertaken by Hillgrove's Environment Manager.

7.10 Audit and Review

7.10.1 Audits

Internal audits are conducted or arranged by Hillgrove to ensure the integrated management system is correctly implemented and management plans are effective in managing the potential environmental impacts of the project. Audits are undertaken during operations and following a major environmental incident.

7.10.2 Management Review

Any environmental procedures found to be deficient as a result of an audit or investigation after an environmental incident is revised and the EMP updated to reflect the new procedures.

Reviews of the overall effectiveness of the environmental portion of the IMS are undertaken by senior management to ensure continual improvement, sustainability and effectiveness.

7.10.3 Non-compliances

If any non-compliances with the Mining Act occur Hillgrove will verbally notify the Director of Mines within 24 hours, after it first becomes aware of the non-compliance. A written report will be provided within three days of such time period as approved by the Director of Mines.

7.11 Previous Experience of Operator

The Hillgrove Kanmantoo Copper Mine team has proven their experience since the commencement of the operation and are appropriately qualified to manage the construction and operation of the project. Similarly the major contractors that Hillgrove have employed on the project all have established reputations and appropriate experience.

Hillgrove use, and will continue to use, contractors with extensive industry experience in the specific area of employ. Contractors are selected using the EHS system compliance and management as key selection criteria, including an audit of contractor systems.

Selection of the underground mining contractor will be conducted in a similar manner, with assessment of the contractor covering technical aspects, cost and EHS system compliance. Once on site, the contractors will be required to be compliant with all Hillgrove EHS system requirements.

8.0 Lease Conditions

Hillgrove will comply with all tenement conditions until relinquishment of those tenements. A number of the tenement conditions have been translated into outcomes to be achieved and are presented in Table 5-1.

The remainder of the tenement conditions are presented in Table 8-1.

Table 8-1 – Remaining tenement conditions

Tenement and Condition Number	Tenement Condition	Response
ML6436 Schedule 1 Condition 1 ML6345 Schedule 1 Condition 1	Mining operations authorised by this lease must only be for the recovery of metallic mineral ores (copper, silver & gold) and garnet from the area of the Lease Additional test in ML6436: as outlined in the mining lease proposal document dated 4 April 2014 and subsequent response document dated 27 May 2014.	Noted And as amended in subsequent approved PEPRs.
ML6436 Schedule 1 Condition 2 ML6345 Schedule 1 Condition 8	The Tenement Holder agrees to the approved PEPR (section 70B(5)) and the Compliance report (regulation 86) and any reportable incident reports (Regulation 87) being made available for public inspection. ML6345 wording: The Lessee agrees to the approved MARP (PEPR) being made available for public inspection	Agreed. PEPRs are available on the DEM website
ML6436 Schedule 1 Condition 3 ML6345 Schedule 1 Condition 13	The Lessee must, prior to commencing operations under this Lease and for the duration of the lease maintain public liability insurance to cover all operations under the Lease (including sudden and accidental pollution) in the name of the Lessee for a sum not less than $50 million or such greater sum as specified by the Director of Mines, and make such amendments to the terms and conditions of the insurance as the Director of Mines may require. A copy of the cover note of certificate of currency for the insurance must be provided to the Director or Mines upon request. If requested by the Director of Mines, the Lessee must engage an independent and reputable risk assessor to prepare a risk assessment report detailing the public liability risks arising out of the conduct of operations of the Lease, and recommending the level of amount of public liability cover (in respect of any occurrence) that should be effected and maintained by the Lessee. In preparing the risk assessment report, the assessor must consult with the landowner and the Director of Mines. In specifying the level of insurance required, the Director of Mines accepts no liability for the completeness, adequacy of the sum insured the limit of liability, the scoped coverage, the conditions or exclusions of the insurance in respect of how the Lessee may or may not respond to any loss, damage or liability.	Noted and public liability insurance held.

Tenement and Condition Number	Tenement Condition	Response
ML6436 Schedule 1 Condition 4 ML6345 Schedule 1 Condition 16	In requesting a review of the bond required under the Mining Act 1971 the Minister may request that written quotes from an independent third party approved by the Minister are obtained by the Tenement Holder for the cost of rehabilitating the site to the requirements specified in the approved Program under Regulation 65(2).	Noted. Refer to Section 3.13.9 for the rehabilitation liability estimate and bond.
ML6436 Schedule 1 Condition 5 ML6345 Schedule 1 Condition 16	The Tenement Holder must meet all the charges and costs in obtaining and maintaining the Bond.	
ML6345 Schedule 1 Condition 2	The Lessee understands and accepts the pursuant to Section 80(2) of the Mining Act, 1971, the rights granted by this lease are modified by, and are subject to, the terms of the Consent Agreement between Hillgrove Resources Ltd and Hillgrove Copper Pty Ltd made on 20 February 2009 ("the Consent Agreement") annexed to this lease.	Noted.
ML6345 Schedule 1 Condition 3	The Lessee must not commence or undertake any mining operations on the land until a Mining and Rehabilitation Program (MARP (PEPR)) has been approved by the Minister and a bond has been paid in accordance with Section 62 of the Mining Act, 1971.	The operation did not commence until the original MARP was approved.
ML6345 Schedule 1 Condition 4	The Lessee must prepare a MARP (PEPR) that complies with the requirements of guidelines approved by the Director of Mines and include environmental outcomes and criteria that are developed in consultation with relevant stakeholders	Original MARP was prepared and has been superseded by subsequent PEPRs.
ML6345 Schedule 1 Condition 5	The criteria included in the MARP (PEPR) must demonstrate clear and unambiguous achievement of the environmental and mine closure outcomes specified in schedule 2 by: • Including the specific parameters to be measured and monitored by the Lessee • Specifying the locations that the parameters will be measured, or how these locations will be determined • Clearly stating the acceptable values for demonstrating achievement of the outcome , with consideration of any inherent errors of measurement • Specifying the frequency of monitoring by the Lessee • Identifying what background or control data are to be used or specify how it will be acquired (if necessary).	Original MARP was prepared to meet these specifications and has been superseded by subsequent PEPRs. Section 1.1 provides the monitoring implemented to demonstrate achievement of outcomes.

Tenement and Condition Number	Tenement Condition	Response
ML6345 Schedule 1 Condition 6	The Lessee must implement and comply with the approved MARP (PEPR).	Original MARP superseded by subsequent PEPRs. Annual compliance reports (MARCR) submitted to DEM to provide evidence of compliance with approved PEPR.
ML6345 Schedule 1 Condition 7	The Lessee must review the MARP (PEPR) on request of the Director of Mines within a time specified in the request and submit the revised MARP for approval to the Director of Mines.	Noted.
ML6345 Schedule 1 Condition 9	The lessee must keep accurate records of the quantity, value, manner of deposition and costs associated with selling all minerals mined, and whenever required to do so, submit the records for inspection by any person authorised by the Director of Mines. This clause is to be taken as a notice by the Director of Mines in accordance with Section 77 of the Act.	Noted.
ML6345 Schedule 1 Condition 10	The Lessee must demonstrate upon request and to the Director of Mines, the Lessee's capability and competence to comply with the requirements of the Mining Act, 1971, the conditions of this Lease and the MARP (PEPR).	Noted.
ML6345 Schedule 1 Condition 11	The Lessee must provide to the Director of Mines a Compliance Report on operations carried out on the Lease and compliance with the approved PEPR. The Compliance Report must be submitted every year, within 2 months after the anniversary of the date the Lease was granted, or at some time agreed with the Director of Mines in accordance with guidelines approved by the Director of Mines. The Lessee agrees to the Compliance Report being made available for public inspection.	Annual compliance reports (MARCR) submitted to DEM to provide evidence of compliance with approved PEPR.
ML6345 Schedule 1 Condition 12	The Lessee must, if requested by the Director of Mines, undertake an independent audit of achievement of the environmental outcomes in the PEPR, by an independent expert approved by the Director of Mines and submit the audit to the Director. The audit will be made available to the public, in a manner and form as determined by the Director of Mines.	Noted.

Tenement and Condition Number	Tenement Condition	Response
ML6345 Schedule 1 Condition 13	At least 3 months prior to Lease relinquishment or expiry, the Lessee must provide to the Minister a Mine Completion Report prepared in consultation with the landowner and in accordance with guidelines approved by the Director of Mines, which demonstrates achievement of the closure criteria as specified in the current PEPR.	Noted.
ML6345 Schedule 1 Condition 15	The Lessee must report any non-compliance with the Act, these conditions and approved MARP (PEPR) to the Director of Mines. A verbal notification must be provided within 24 hours, after the Lessee becomes aware of the non-compliance. A written report must be provided within 3 days of such time period as approved by the Director of Mines.	Noted.

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