FINGERBOARDS MINERAL SANDS PROJECT

DRAFT MINE REHABILITATION PLAN

under the Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019

KALBAR

QUALITY INFORMATION

Document	Draft Mine Rehabilitation Plan – Fingerboards Mineral Sands
Ref	
Date	~~July 2020~~ March 2021

REVISION HISTORY

Revision	Revision Date	Prepared by	Checked	Authorized
0	01/02/2019	LC		
1	05/04/2019	MBS		V.Hugo, Kalbar
2	08/07/2019	LC		V.Hugo, Kalbar
3	02/12/2019	ST		V.Hugo, Kalbar
4	15/05/2020	LC		V.Hugo, Kalbar
5	26/07/2020	LC	CC/VH	V.Hugo, Kalbar
6	24/03/21 (to address the changed tailings strategy (use of centrifuges) and correct editorial errors).	LF	LC/SW	L.Fallaw, Kalbar

REHABILITATION PLAN CHECKLIST

	Rehabilitation Plan Checklist	Y/N/ NA	Page number	Comments
1.	Has the RP been endorsed by the site manager or appropriate senior company representative?	Y	iii	
2.	Has a cover page been included at the front of the RP?	Y	Cover	
3.	Project summary Does the project summary contain an overview of the operations including land ownership, tenure, history and current status, proposed date of closure, major mine components and contain supporting maps and plans?	Y	Section 2	Proposed date of closure is not specified, as project has not yet been approved. The anticipated date of project completion is at the end of Operational Year 20 (notionally in 2042).
4.	Legislative context Does the RP contain a list of all State and Commonwealth legislation relevant to the operation and guideline, standards and codes of practice used in the development of the RP?	Y	Section 3 Table 3-1	
5.	Rehabilitation and closure obligations and commitments Does the RP include a comprehensive register of all legally binding rehabilitation and closure related obligations, conditions and commitments?	Y	Attachment A	Additional statutory obligations will be added to register as project permitting progresses
6.	Environmental setting, knowledge base and gap analysis Does the RP provide a detailed description of the local and regional environmental setting and include all environmental data relevant to rehabilitation planning? Does the RP list key rehabilitation and closure data for each domain and identify knowledge gaps and describe how they will be addressed?	Y Y	Section 5.1 Section 9.6	Description of local and regional environmental context is a brief summary, rather than a detailed description, as it was judged unnecessary to repeat information presented in the EES (to which the RP is an attachment).
7.	Stakeholder identification and community engagement Does the RP detail the stakeholder engagement process, identify all stakeholders impacted by and likely to impact rehabilitation and closure and refer to the community engagement plan?	Y	Section 4	
8.	Post closure land use Does the RP clearly state a post closure land use and detail how it was determined and a timeframe for refining post closure land use?	Y	Section 6.1	

	Rehabilitation Plan Checklist	Y/N/ NA	Page number	Comments
9.	Identification of Rehabilitation Issues and Risk Assessment Does the RP identify and detail all rehabilitation and closure issues and include a risk assessment methodology and register, identifying how risks will be managed?	Y	Section 8	See also Risk Management Plan (Appendix B of Fingerboards work plan)
10.	Closure Objectives Does the RP list closure objectives for the site with at least the minimum requirements for a safe, stable, non-polluting site capable of sustaining an agreed post-mining land use?	Y	Section 6.2	
11.	Closure criteria Have SMART closure criteria linked to the site's closure objectives been developed, and does the RP provide detailed information on how the criteria were developed?	Y	Section 7	
12.	Closure strategy, implementation and scheduling Does the RP detail what and how rehabilitation and closure tasks will be implemented for each domain with a supporting timeframe and take into account unplanned and temporary closure scenarios? Are progressive and final rehabilitation milestones clearly outlined?	Y	Section 9.5	
13.	Monitoring framework Does the RP detail the monitoring methodology, is the methodology scientifically robust, are there supporting timeframes for the monitoring program and triggers identified for when monitoring data exceeds desired criteria	Y	Section 10	
14.	Financial provisioning Has the RP considered all rehabilitation and closure costs, is a methodology for rehabilitation liability self-assessment and financial provisioning included?	Y	Section 12	
15.	Management of rehabilitation and closure knowledge Does the RP describe all the systems and processes in place to store and manage rehabilitation and closure related data?	Y	Section 13	

CORPORATE ENDORSEMENT

I hereby certify that to the best of my knowledge the information within this Rehabilitation Plan and checklist is correct and verifiable.

Name: ____

Position: ____

Signed: ____

Date: ____

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1 INTRODUCTION

1.1 Purpose and scope

The purpose of this document is to present a conceptual framework describing how land used for the proposed Kalbar Resources Limited (Kalbar) Fingerboards Mineral Sands Project (the project) will be rehabilitated so as to deliver a safe, stable, non-polluting site with no unacceptable liability to the state, community or environment at project completion. This plan:

- describes the post-mining land uses envisaged following project completion;
- describes the rehabilitation and closure outcomes which Kalbar seeks to achieve;
- proposes a set of metrics by which attainment of rehabilitation outcomes would be assessed;
- identifies the key risks that could affect delivery of closure objectives; and
- describes how Kalbar propose to avoid or mitigate rehabilitation and closure risks.

This mine Draft Rehabilitation Plan (RP) is part of the overarching Fingerboards environmental management framework, which is described in more detail in the Fingerboards work plan. This plan does not present detailed rehabilitation or closure procedures, however it provides an overview of the elements of Kalbar's environmental management system relevant to mine rehabilitation and closure and references key procedures and other management system components that will implemented to support rehabilitation activities.

The rehabilitation and closure activities described in this RP are not limited to activities in the post-closure phase of the project. Successful rehabilitation and closure requires planning and action throughout the life of the project and this whole-of-life approach is reflected in this plan.

The RP is a living document and requires regular review and updating to ensure it is effective, consistent with operational practices (as documented in approved operational procedures), and aligned with community expectations. This draft rehabilitation plan was prepared in conjunction with the Fingerboards project Environment Effects Statement (EES) submission. No environmental or planning approvals had been issued for the mining and related activities proposed in connection with the project. A revised version of this plan will be prepared after the completion of the EES process, assuming that the Minister's assessment at the conclusion of the EES process determines that the project would have an acceptable level of environmental effect. The next version of this plan will reflect advice contained in the Minister's assessment report.

Kalbar will submit an updated rehabilitation plan for government review at least every three years after the commencement of operations. Any significant changes to the scale or character of the mining operation would also require submission of a revised closure plan. Closure cost provisioning will be reviewed internally on an annual basis.

The plan has been prepared in accordance with requirements of the *Mineral Resources (Sustainable Development) Act 1990* (MRSDA) and the associated the *Mineral Resources (Sustainable Development) (Mineral Industries) Regulations* 2019. Because those legal instruments relate to activities on land covered by mining tenure – but not to other land – this plan addresses rehabilitation only on those parts of the project that are – or will be – on mining tenure. Some project elements (for example, some ancillary linear infrastructure) will not be on mining tenure. Rehabilitation of project components on land not under mining tenure will be described in other applicable project documentation, for example, documents prepared as part of any planning scheme amendments.

The RP has been developed in accordance with guidelines issued by the Department of Jobs, Precincts and Regions (DJPR) on *Rehabilitation plans and other environmental aspects of work plans.* The RP also takes into account the DJPR's *Preparation of Work Plans and Work Plan Variations: Guideline for mining projects* (January 2019).

The target audience for this plan includes:

- Kalbar employees and contractors, who will be responsible for implementing the rehabilitation plan.
- Owners (including Traditional Owners) and occupiers of land within and near to the proposed project, whose use and enjoyment of land may be affected by rehabilitation and closure decisions.
- The broader East Gippsland community.
- Regulatory bodies, including (but not limited to) the DEDJTR-ERR, the East Gippsland Catchment Management Authority (EGCMA), the Environment Protection Authority (EPA), the Department of Environment, Land, Water and Planning (DELWP) and the Department of the Environment and Energy (DotEE).

This document focusses on the identification and management of risks related to mine rehabilitation and closure. It has been drafted to provide management information in an accessible way. Readers interested in more technical aspects of mine rehabilitation and closure should consult the technical references listed in Section 15.

1.2 Rehabilitation goals and principles

1.2.1 Rehabilitation goals

The EES scoping requirements set out the following draft evaluation objective for closure:

- To establish safe progressive rehabilitation and post-closure stable rehabilitated landforms capable of supporting native ecosystems and/or productive agriculture that will enable long-term sustainable use of the project area.

1.2.2 Rehabilitation principles

While focussing on the rehabilitation goal above, will adhere to the following principles:

- Consideration of mine closure and rehabilitation should be integral to all phases of mine planning, development and operations.
- Decisions on post-closure land uses and completion criteria should be informed by stakeholder views and based on verifiable, valid scientific information.
- Multiple and sequential land uses that support long term, sustainable (and self-sustaining) beneficial uses of the land should be actively encouraged.
- A risk-based approach will be used in the development of closure and rehabilitation strategies and in defining rehabilitation priorities.
- Rehabilitation should be implemented progressively and tracked using valid, measureable criteria.
- Rehabilitation performance and provisioning will be reviewed / audited on a regular basis to assess compliance with regulatory requirements and progress towards the outcomes agreed with stakeholders. Results of periodic reviews / audits will be made publicly available.

Kalbar's approach to mine site rehabilitation and closure aims to manage land within the project area in a way that maintains or improves current land capability so that after mining the land can be used for a range of beneficial uses. A further aim of the rehabilitation approaches outlined in this plan is to ensure that conditions on the project do not adversely affect the environmental values or the use and enjoyment of surrounding land or watercourses during or after the active life of the mine. It is recognised that the above goals need to endure over long timeframes post closure.

1.2.3 Related management plans and supporting documentation

This plan is one of a suite of management plans developed under the Fingerboards Environmental Management Framework (EMF). Other management plans and sub-plans included in the EMF that have direct relevance to mine closure and rehabilitation matters include:

- Risk Management Plan.
- Environmental Management Plan.
- Community Engagement Plan.
- Radiation Management Plan.
- Radioactive Waste Management Plan.
- Cultural Heritage Management Plan.
- Water Risk ~~Management~~ Treatment Plan.
- Air Quality (Dust) Risk Treatment Plan.
- Biodiversity Risk Treatment Plan.
- Noise Risk Treatment Plan.
- Ground Control Management Plan

The various management plans are, in turn, supported by a range of management tools (checklists, registers, work instructions). Management tools relevant to this rehabilitation plan include, but are not limited to:

- Community complaints handling procedure and database.
- Materials inventory (for tracking quantities and movement of topsoils and overburden.
- Land access and clearing procedure.
- Rehabilitation procedure: materials placement.
- Checklist for soil erosion observations.
- Weed identification guide.
- Revegetation procedure: native vegetation.
- Revegetation procedure: pasture.
- Rehabilitation monitoring procedure (including vegetation health monitoring procedure).
- Surface water and groundwater monitoring procedures.
- Performance and compliance monitoring procedures and templates.
- Environmental incident reporting procedure and templates.
- Rehabilitation expenditure forms.
- Procedure for review of rehabilitation provisioning.
- Procedures for decommissioning of plant and infrastructure.
- Radiation monitoring plan.

- Air quality monitoring and reporting plan.

This plan describes closure and rehabilitation objectives, identifies key risks and the strategies proposed for managing these and proposes targets for assessing attainment of the closure and rehabilitation outcomes. The plan does not include detailed procedures for various components of the mine rehabilitation program. Information on how rehabilitation tasks will be performed, monitored and reported is addressed in a series of operational procedures, including (but not limited to) the procedures listed above. The operational procedures are currently under development and will be finalised prior to construction. Revisions to the RP will be made to maintain consistency with the EMF and associated management plans.

2 PROJECT OVERVIEW

This section provides a description of the project, including the location, existing land tenure and uses, and related closure domains.

2.1 Location

The project is a greenfields project, meaning that no mining has previously occurred at the site. It is located near Glenaladale in the Shire of East Gippsland, approximately 25 km west of Bairnsdale, and 250 km east of Melbourne, Victoria (Figure 2-1). It is expected that the mining licence will be the same area as the project area described in this report. The area is predominantly grazing and timber plantation land, dissected by narrow deep gullies and intersected by state and local roads (Plate 2-1).

Plate 2-1: Aerial view of the project area from the Fingerboards intersection looking east towards the Mitchell River.

2.2 Proposed Mining Operations

The Key Characteristics of the project are summarised in Table 2-1 and the proposed project layout is shown in Figure 2-2.

The project proposes to mine mineral sands within the Glenaladale Deposit, a body of unconsolidated sediments which contains significant amounts of heavy minerals such as zircon, rutile, ilmenite and rare-earth bearing minerals (monazite and xenotime). Mineral rights to the deposit were acquired by Kalbar in 2013. Kalbar has since conducted extensive drilling and resource estimation to delineate a high value orebody containing 1.19 Bt of ore at 0.5% zircon, 1.4% titanium minerals and 0.05% rare earths. Kalbar plans to mine from areas of enriched grades, occurring close to the surface, producing 8 Mt of heavy mineral concentrate (HMC) from 170 Mt of ore for up to 20 years and cover an approximate area of 1,675 hectares (ha). This includes approximately two years for construction and commissioning. Final decommissioning and rehabilitation plus post-mining rehabilitation performance monitoring is expected to take up to five years.

Post closure performance monitoring will continue until such time as all completion criteria are met and final lease relinquishment achieved.

Table 2-1~~2-1~~: Key characteristics of the Fingerboards Mineral Sands Project

Item	Description
Project location	East Gippsland Shire, Victoria. The associated infrastructure extends to the Wellington Shire.
Project footprint	Approximately 1,675 ha. About 1,350 ha will be disturbed within the project area.
Mining method	Open cut dry mining using conventional earthmoving equipment i.e. scrapers, excavators, trucks, conveyors and stackers, and tractor scoops for topsoil removal. Mine void location will be progressive and will be backfilled for rehabilitation with tailings and overburden as it advances.
Mining production	An estimated 170 Mt of ore will be extracted to produce approximately 8 Mt of HMC. Following construction and commissioning, a gradual ramp up of production is proposed, initially commencing at 500 tph. At peak production, up to two mining units, operating in different areas of the project area, will be used to extract the ore. The second MUP is expected to start operating about 12 months after mine start up, but this could be delayed, pending marketing conditions.
Mine life	Up to 20 years (including up to a two-year construction and commissioning period). Production at full capacity is expected to take place for 15 years. Final closure may require an additional five years of management to ensure closure objectives are met.
Rehabilitation	Progressive rehabilitation, starting when overburden and topsoil are replaced behind the mine void.
Mine void dimensions / footprint	The total maximum area of mining disturbance at any time is expected to be 360 ha. Topsoil stripping and placement will be completed within a buffer time frame of six months to manage the seasonal nature of the activity. The mine void will average 29 m deep. The maximum depth is around 45 m. All mining will occur above the natural watertable. The wall angle of the mine void will be approximately 40 degrees.
Mine materials	During peak production the aim will be to minimise stockpiling and rehandling. The majority of overburden will be directly returned to areas undergoing backfilling and rehabilitation behind the active mining area. Ahead of the active mining are, clearing of vegetation and stripping of topsoil and overburden will be occurring. Noise bunds made of overburden (2.5 to 10 m in height) will be constructed to protect sensitive receptors. The noise bunds will be temporary and will follow the active mining area. Visual bunds (2.5 to 4 m high) built with overburden material will be placed in strategic locations along Bairnsdale-Dargo Road and Fernbank-Glenaladale Road and local residences to protect visual amenity. These bunds will be temporary in nature as the active mining areas move and sites are rehabilitated.
Processing rate	Capacity to treat 1,500 tph of slurried ore at the wet concentrator plant (WCP) at peak production, which equates to 12 Mtpa of ore.
Feed-rate	Expected maximum combined feed-rate of the ore to the two MUPs is 1,500 tph. Each MUP will have a capacity to treat up to 1,000 tph. Ore may be stockpiled and blended to provide suitable feed for the MUPs and ultimately the WCP. This is to manage levels of clay and economic minerals in the feed.
Operating hours	24 hours a day, seven days a week, 365 days a year.

Mining will be conducted using conventional dry mining earthmoving equipment. Mining is proposed to be conducted 24 hours/day and 365 days/year, subject to any requirements or conditions to avoid or mitigate any potential impacts on local amenity caused by noise, dust, etc. The proposed mine pit will have an average depth of approximately 29 metres and a maximum depth of approximately 45 m. The mine void location will move over the life of the mine. The void will be progressively backfilled with tailings, overburden and topsoil as it advances. A simplified schematic of the mining and mineral processing process is provided in Figure 2-3.

The ore will be fed into the mining unit plants (MUPs) for slurrying and pumping to the WCP. There, the slurried ore will undergo onsite processing to produce heavy mineral concentrate (HMC), which will then be separated using wet high intensity magnets (WHIMS) to produce a magnetic and non-magnetic concentrate. The concentrates will be stockpiled at a loading facility adjacent to the WCP before being transported to port via road, rail or a combination of both.

Prior to upgrading of the Avon River rail bridge, approximately half of the concentrates will be transported in bulk by road from the mine site to Port Anthony or the adjacent Barry Beach Marine Terminal. Twenty B-double trips from the mine to the port will be required, and 20 trips from the port back to the mine each day.

The remaining concentrates will be transported in containers from the project area to the existing rail siding in Maryvale. Current capacity constraints at the Maryvale siding allow for only 50% of concentrate to be transported by rail. Twenty B-double trips will be needed from the mine to the Maryvale rail siding and 20 trips from the rail siding back to the mine each day. Containerised concentrate will be taken by rail from the Maryvale rail siding to the Port of Melbourne. Rail transport will occur overnight due to capacity restraints on the metropolitan rail network.

Once Now with the completion of the Avon River rail bridge has been upgraded (expected by 2021), material will be transported to , all B-doubles associated with product transport will be re-routed to either the proposed purpose-built Fernbank East rail siding south of the project area (preferred option), or to the existing Bairnsdale rail siding. Transport of concentrates to Maryvale and Port Anthony/Barry Beach Marine Terminal would cease once either of these two options has been adopted.

The option to use the existing Bairnsdale rail siding would involve 40 return B-double trips per day via Bairnsdale-Dargo Road, Lindenow-Glenaladale Road, Princes Highway, Racecourse Road, Forge Creek Road and Bosworth Road.

The option to construct the Fernbank East rail siding would involve 40 return B-double trips per day travelling via a sealed private haulage road within the infrastructure corridor from the mine site to the rail siding. This is the preferred approach for the transport of concentrate once the Avon River rail bridge has been upgraded..

Under any transport scenario, the concentrates will be exported for secondary processing in mineral separation plants in Asia.

Overburden and tailings (non-economic sand, silts and clay) from the mining and processing will ultimately be returned to the mining void as part of the rehabilitation process. Approximately 96% of the ore will be returned to the mine void in a continuous rehabilitation process. Coarse sand tailings will initially be deposited into Perry Gully. After approximately four months, when the mine void has enough capacity, coarse sand tailings will be deposited into the mining void. an off-path area until sufficient space is available to allow tailings to be placed directly into the mine void. These tailings will be covered with constructed subsoil and topsoil prior to rehabilitation.

Fines tailings are generated from the desliming stage, separate to the coarse sand tailings. The fine tailings are dewatered by means of solid bowl centrifuges located within a building near the mine void to produce a damp cake. Two centrifuge buildings are proposed, each one serving an active mining area and MUP. The cake will be stockpiled at the centrifuge plant and from there trucked to the mine void, where it will be dumped with overburden before placing a final subsoil rehabilitation layer.

, equivalent to about 23% of the ore tonnage, will initially be deposited into a constructed temporary tailings storage facility (TSF) on the future mine path. As mined out areas of the void become available, the fines tailings will be deposited into the mine void, along with the coarse tailings. Areas backfilled with fine tailings will be covered with overburden as required, graded to a stable profile, covered with subsoil blend, and then capped with topsoil. The backfilled ground will be revegetated so that the land can be returned to its pre-mining land use or to other agreed land uses, including native vegetation. The total amount of land under disturbance at any one time is approximately 360 ha and Table 2-2 outlines how this is made up.

The mine void will be progressively backfilled with coarse sand tailings, fines tailings cake and overburden (Table 4-2) before the proposed mining licence area is reprofiled and revegetated and the land returned to pre-mining land use and capability, or other agreed post-mining land use.

Table 2-22-2: Expected total maximum area of mining disturbance at any time

Operational domain	Nature of disturbance	Area, ha
Mining excavations	Topsoil strip	35
	Overburden strip	23
	Ore and pit mining void floor	18
	Coarse sand tailings and fines tailings cell construction (in mine void)	19
	Overburden placement	5
	Topsoil placement	35
	Mining (on path) Sub-total	135
Tailings storage facilities	Fines tailings storage facility (includes embankments)	90
Centrifuge facilities	Centrifuge buildings and associated infrastructure	15
Off-path topsoil storage (from mining excavation)	Topsoil stockpiles	45
	Off Path Sub-total	13560
Water storage and industrial infrastructure	Infrastructure Sub-total	90
	TOTAL	360285

Approximately 3 GL of water will be required on an annual basis for processing, dust suppression and rehabilitation. Water for the project will be sourced from surface water (winterfill from the Mitchell River) and groundwater from the Latrobe Group Aquifer (from a borefield south of the project area).

The power demand for the MUPs, and WCP and centrifuge plants is estimated at 149,000 kVA on average. It will be sourced from the 66 kV network. An infrastructure corridor outside of the mining lease, containing a haulage road to the proposed rail siding, 66 kV and 22 kV powerlines and a groundwater pipeline from the borefield, will be constructed from the WCP to the railway line south of the project area, as shown in Figure 2-4.

Figure 2-5 shows the location and regional setting of the service corridors and product transport route outside of the mining lease area.

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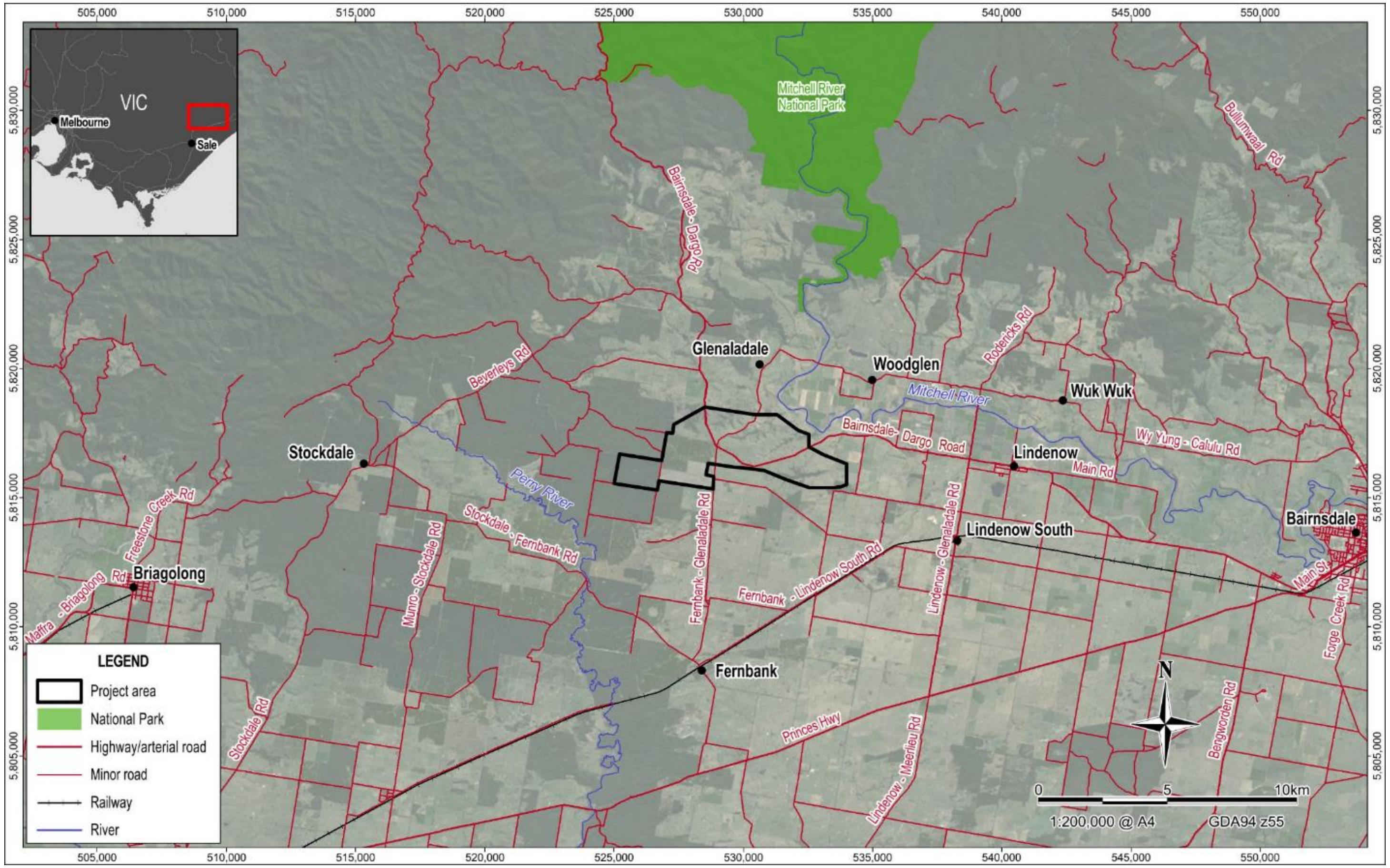
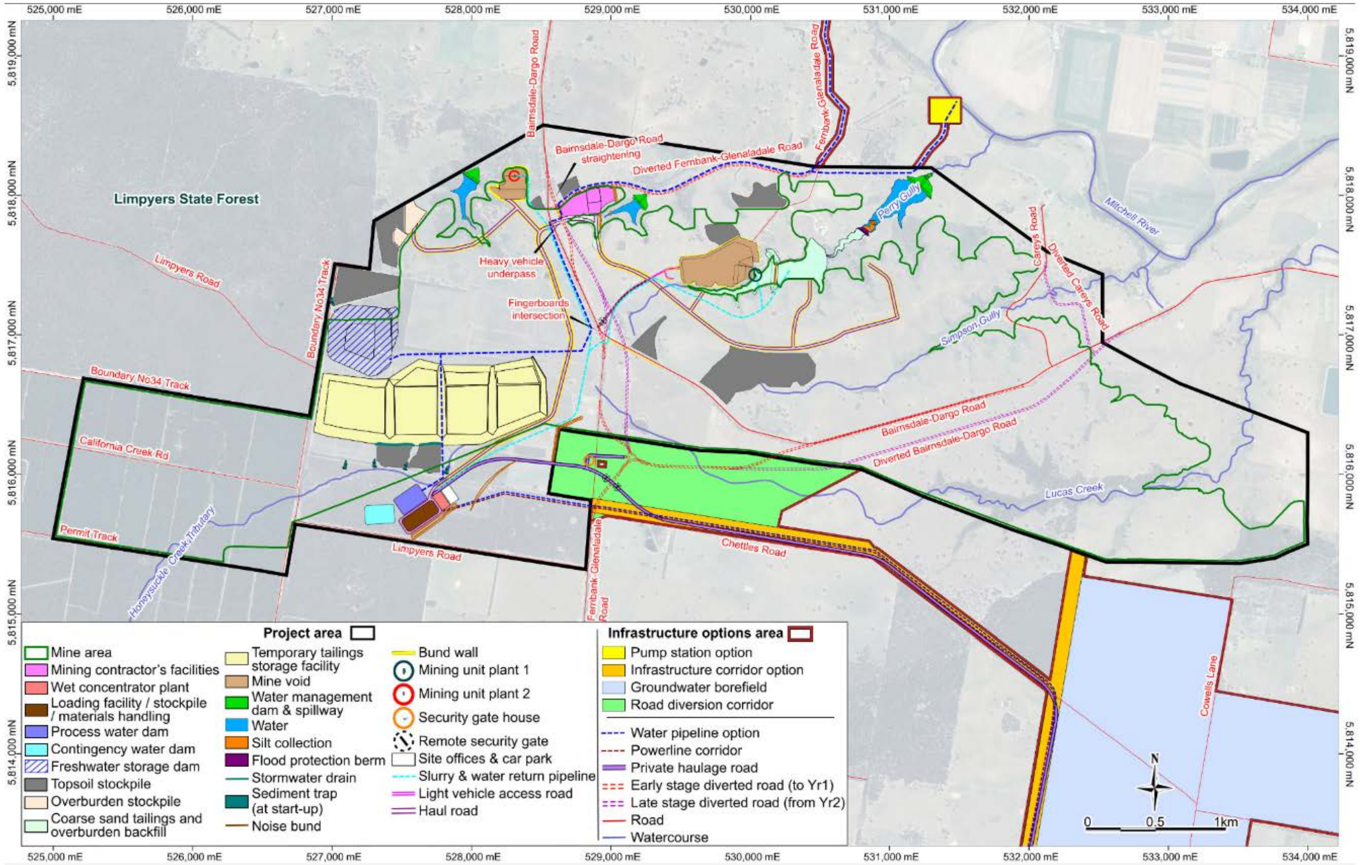


Figure 2-1: Location plan of the Fingerboards project area.


525,000 mE
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531,000 mE
532,000 mE
533,000 mE
534,000 mE
5,819,000 mN
5,818,000 mN
5,817,000 mN
5,816,000 mN
5,815,000 mN
5,814,000 mN
Limpyers State Forest
Limpyers Road
Boundary No34 Track
California Creek Rd
Permit Track
Honeysuckle Creek Tributary
Bairnsdale-Dargo Road
Bairnsdale-Dargo Road straightening
Diverted Fernbank-Glenaladale Road
Fernbank-Glenaladale Road
Heavy vehicle underpass
Fingerboards intersection
Perry Gully
Mitchell River
Careys Road
Diverted Careys Road
Simpson Gully
Diverted Bairnsdale-Dargo Road
Lucas Creek
Chettles Road
Cowells Lane
Project area
Mine area
Mining contractor's facilities
Wet concentrator plant
Loading facility / stockpile / materials handling
Process water dam
Contingency water dam
Freshwater storage dam
Topsoil stockpile
Overburden stockpile
Coarse sand tailings and overburden backfill
Temporary tailings storage facility
Mine void
Water management dam & spillway
Water
Silt collection
Flood protection berm
Stormwater drain
Sediment trap (at start-up)
Noise bund
Bund wall
Mining unit plant 1
Mining unit plant 2
Security gate house
Remote security gate
Site offices & car park
Slurry & water return pipeline
Light vehicle access road
Haul road
Infrastructure options area
Pump station option
Infrastructure corridor option
Groundwater borefield
Road diversion corridor
Water pipeline option
Powerline corridor
Private haulage road
Early stage diverted road (to Yr1)
Late stage diverted road (from Yr2)
Road
Watercourse
N
0
0.5
1km

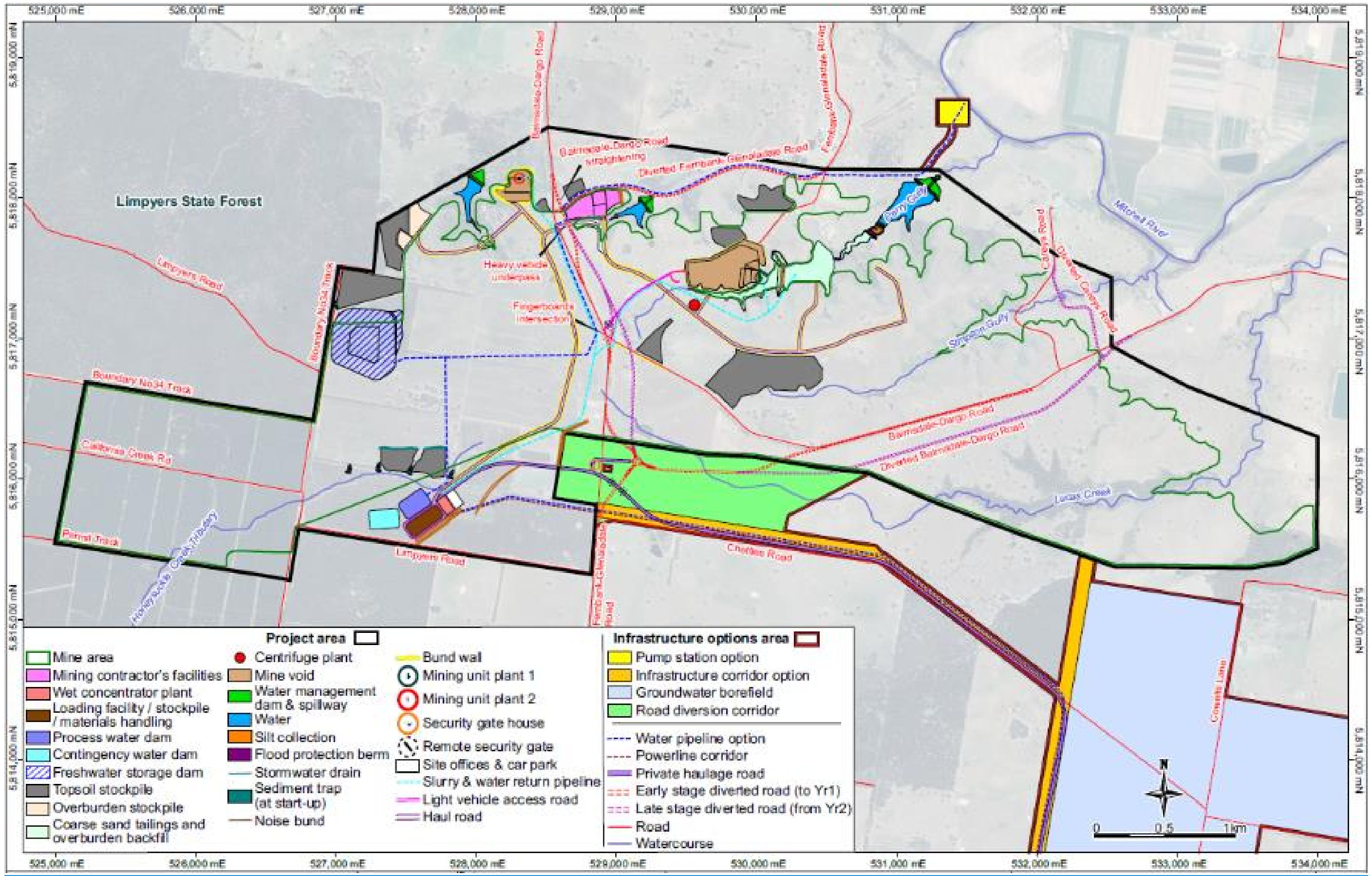
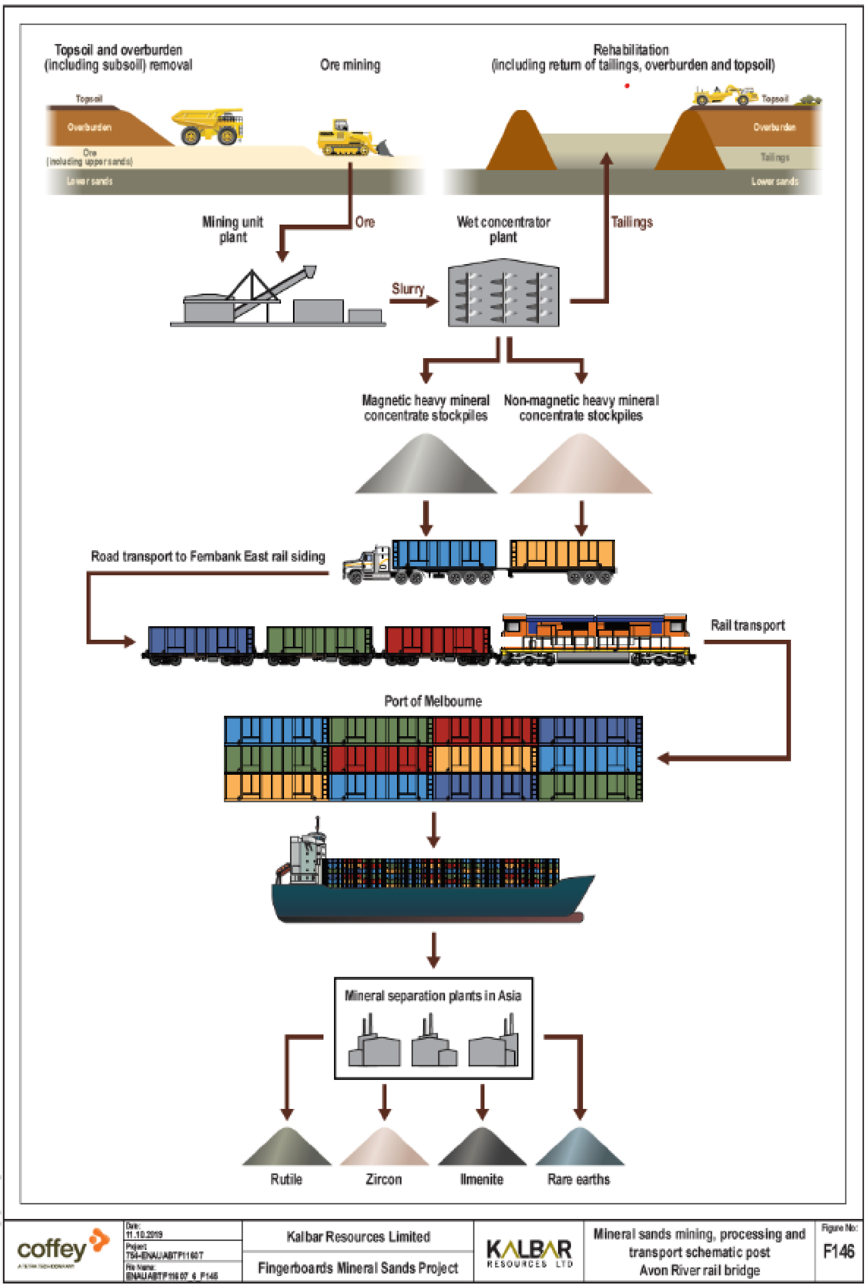


Figure 2-2: General arrangement layout (at mining start up – Year 1 composite).


Topsoil and overburden (including subsoil) removal
Ore mining
Rehabilitation (including return of tailings, overburden and topsoil)
Topsoil
Overburden
Lower sands
Tailings
Mining unit plant
Ore
Wet concentrator plant
Tailings
Slurry
Magnetic heavy mineral concentrate stockpiles
Non-magnetic heavy mineral concentrate stockpiles
Road transport to Fernbank East rail siding
Rail transport
Port of Melbourne
Mineral separation plants in Asia
Rutile
Zircon
Ilmenite
Rare earths
coffey
Date: 11.10.2019
Kalbar Resources Limited
Fingerboards Mineral Sands Project
KALBAR RESOURCES LTD
Mineral sands mining, processing and transport schematic post Avon River rail bridge
Figure No: F146

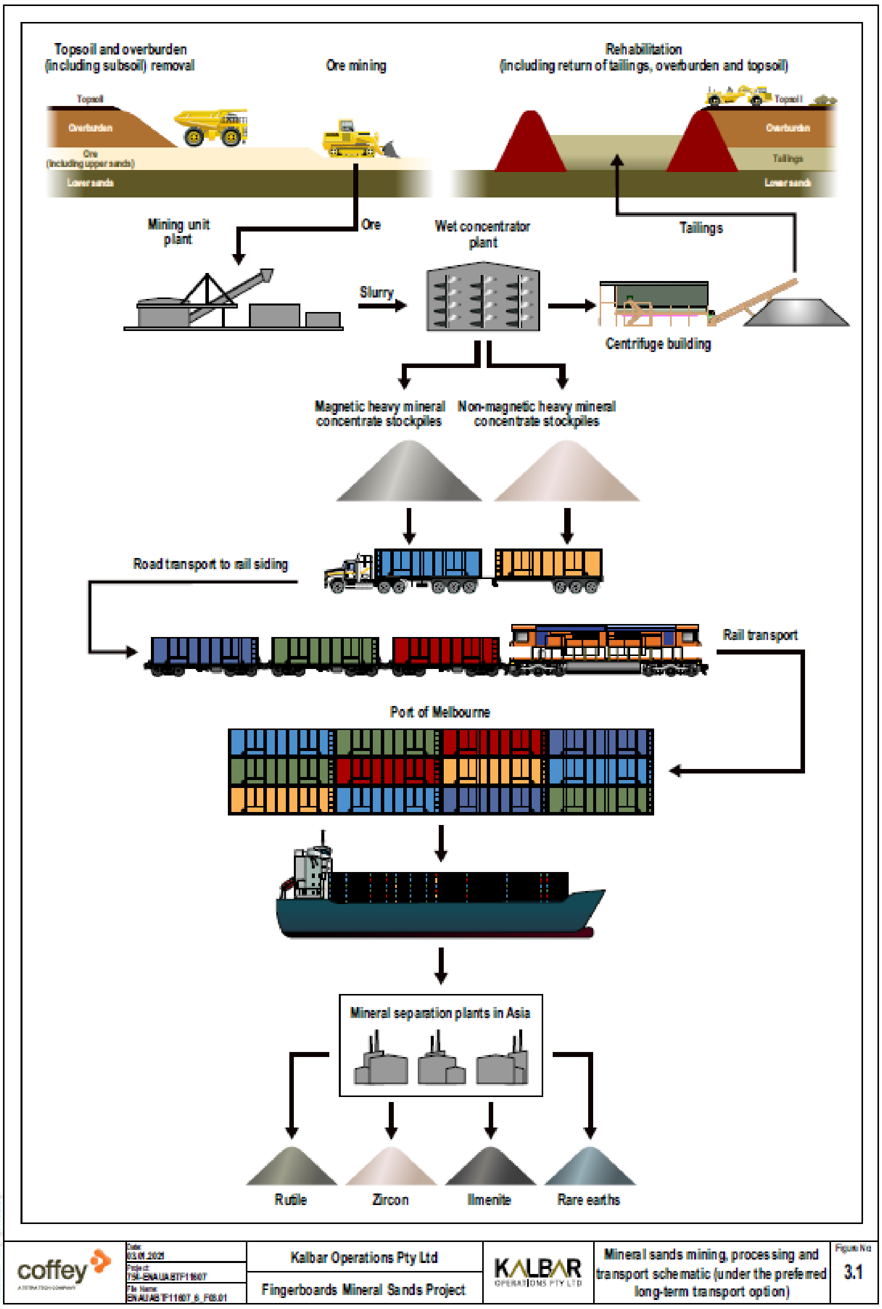
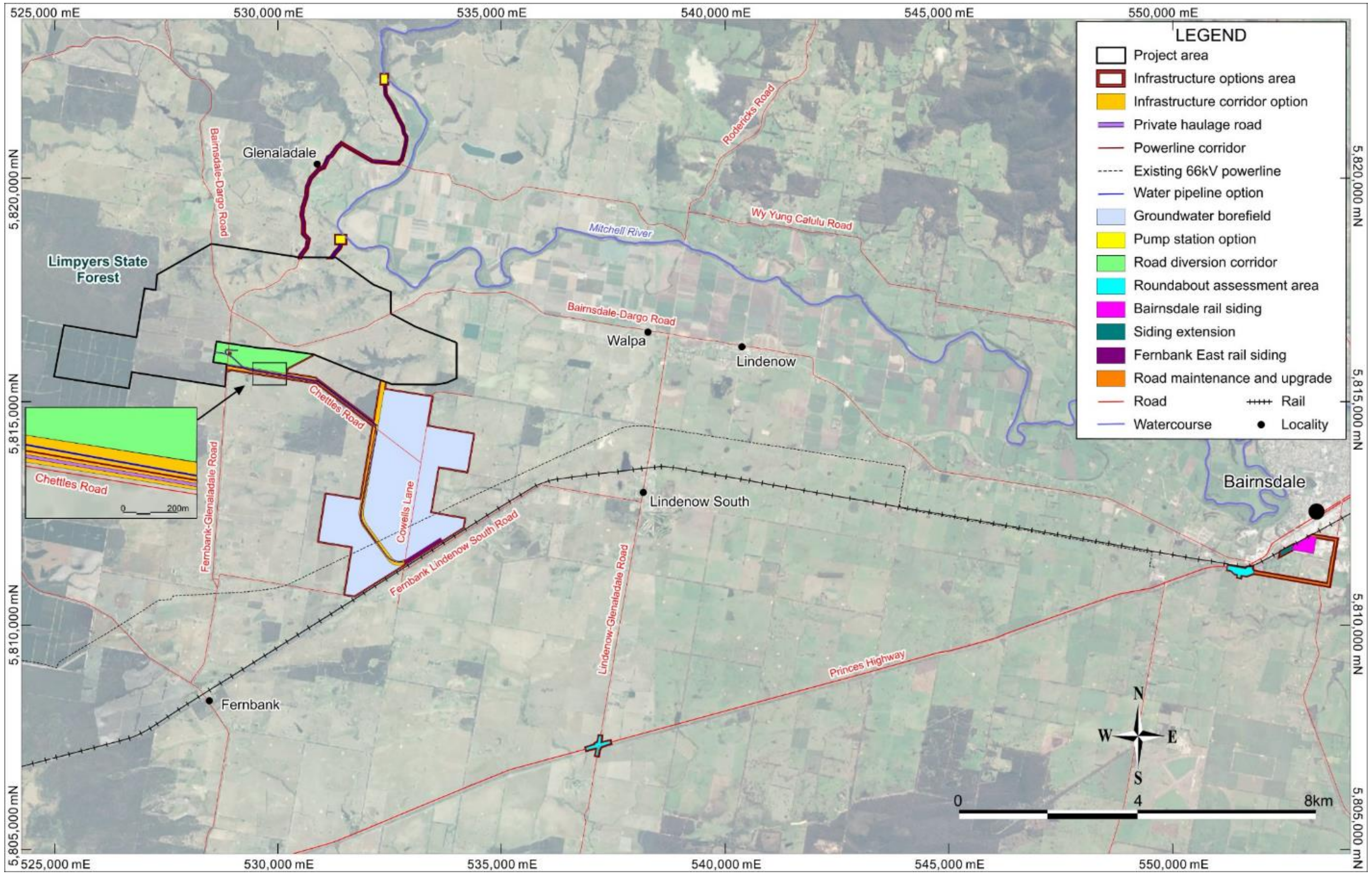


Figure 2-3: Mining and mineral processing schematic.



LEGEND
Project area
Infrastructure options area
Infrastructure corridor option
Private haulage road
Powerline corridor
Existing 66kV powerline
Water pipeline option
Groundwater borefield
Pump station option
Road diversion corridor
Roundabout assessment area
Bairnsdale rail siding
Siding extension
Fernbank East rail siding
Road maintenance and upgrade
Road
Rail
Watercourse
Locality
525,000 mE
530,000 mE
535,000 mE
540,000 mE
545,000 mE
550,000 mE
5,820,000 mN
5,815,000 mN
5,810,000 mN
5,805,000 mN
Glenaladale
Limpyers State Forest
Walpa
Lindenow
Lindenow South
Bairnsdale
Fernbank
Mitchell River
Bairnsdale-Dargo Road
Wy Yung Calulu Road
Rodericks Road
Chettles Road
Cowells Lane
Fernbank Lindenow South Road
Fernbank-Glenaladale Road
Lindenow-Glenaladale Road
Princes Highway
0
200m
4
8km
N
S
E
W

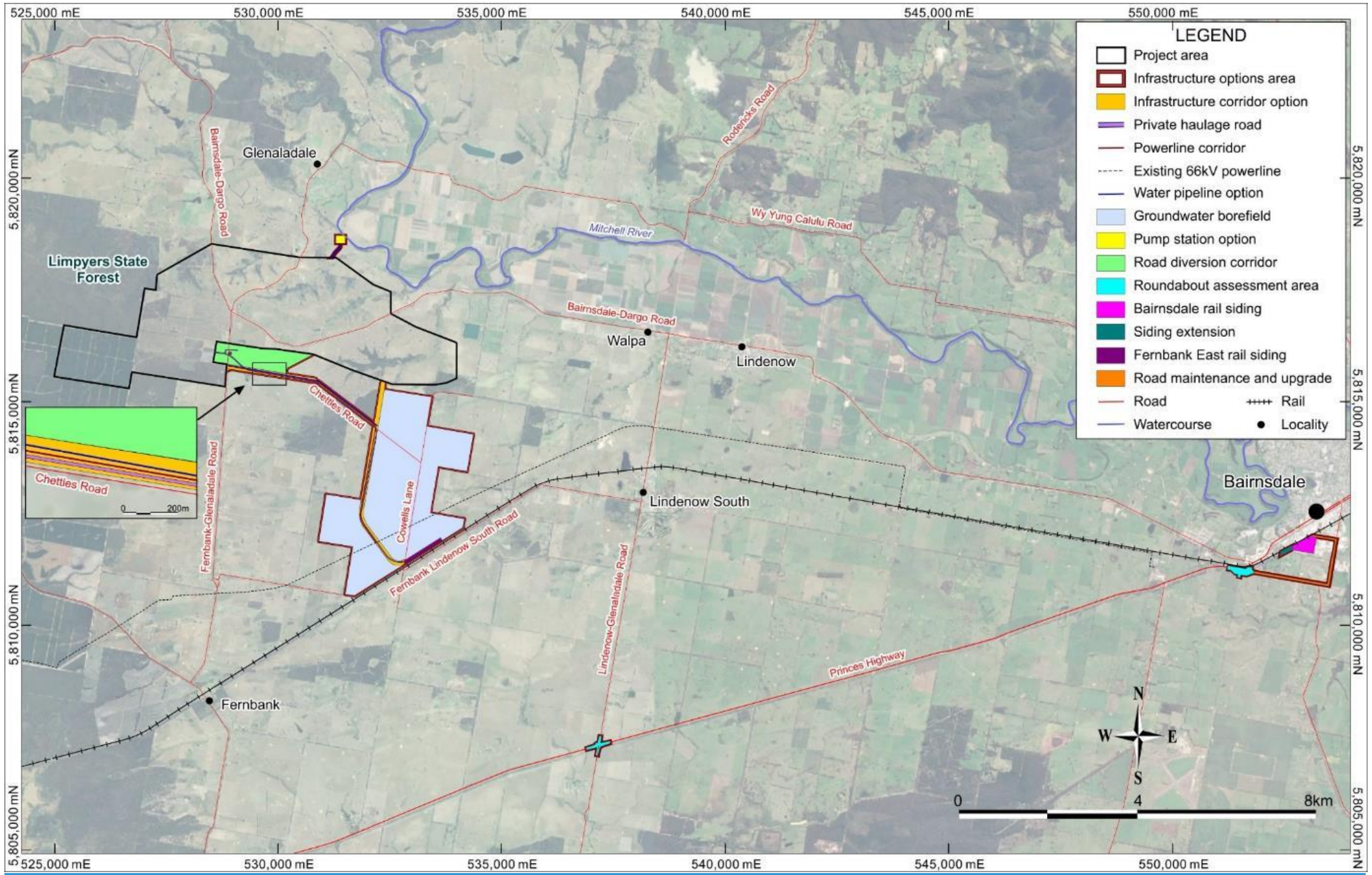
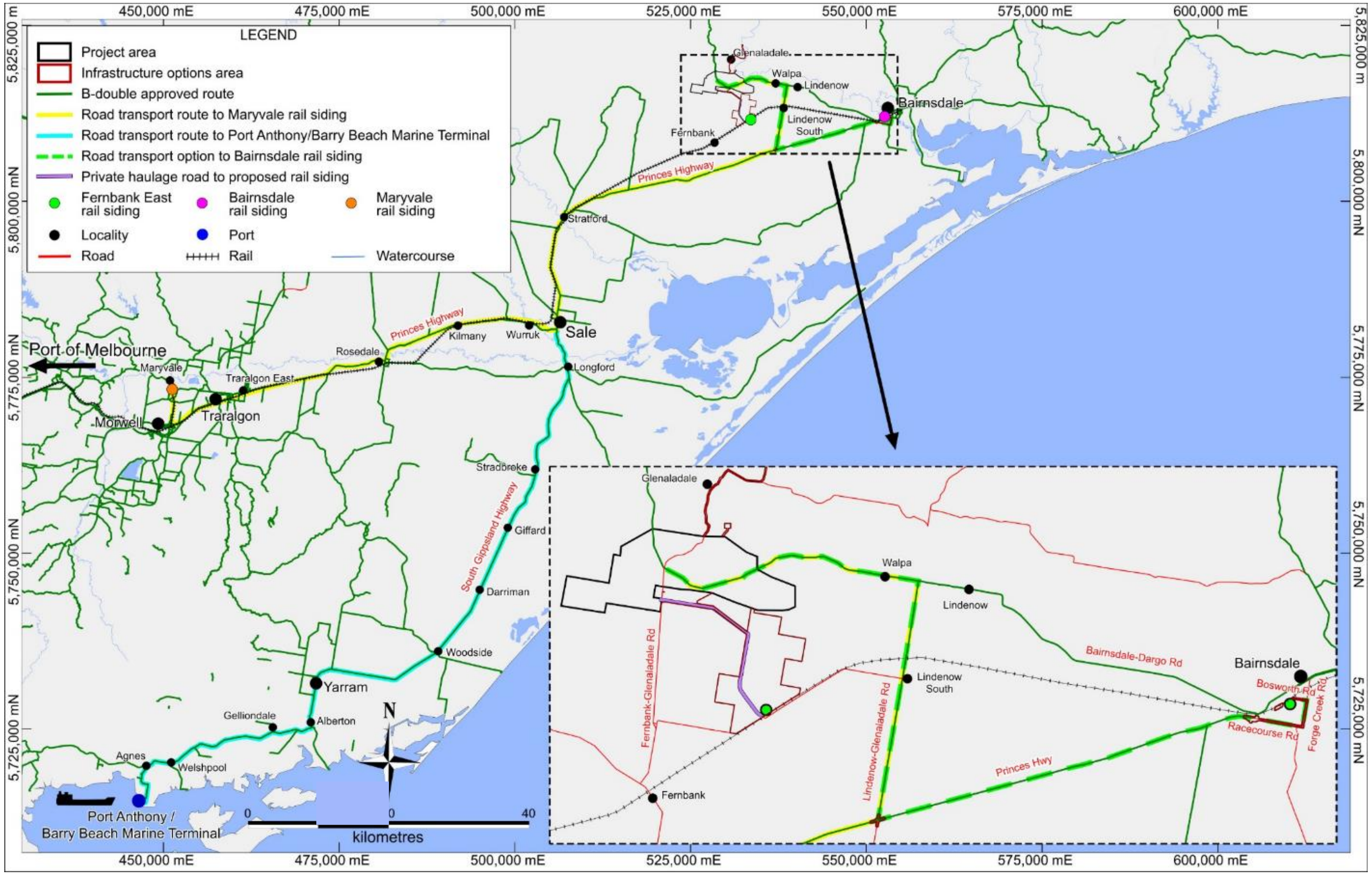


Figure 2-4: Water pipeline routes, power line routes and infrastructure location outside the project area.


LEGEND
Project area
Infrastructure options area
B-double approved route
Road transport route to Maryvale rail siding
Road transport route to Port Anthony/Barry Beach Marine Terminal
Road transport option to Bairnsdale rail siding
Private haulage road to proposed rail siding
Fernbank East rail siding
Bairnsdale rail siding
Maryvale rail siding
Locality
Port
Road
Rail
Watercourse
450,000 mE
475,000 mE
500,000 mE
525,000 mE
550,000 mE
575,000 mE
600,000 mE
5,825,000 mN
5,800,000 mN
5,775,000 mN
5,750,000 mN
5,725,000 mN
Port of Melbourne
Maryvale
Traralgon East
Morwell
Traralgon
Rosedale
Kilmany
Wurruk
Sale
Princes Highway
Longford
Stratford
Fernbank
Glenaladale
Walpa
Lindenow
Lindenow South
Bairnsdale
Stradbroke
Giffard
South Gippsland Highway
Darriman
Woodside
Yarram
Gelliondale
Alberton
Agnes
Welshpool
Port Anthony / Barry Beach Marine Terminal
N
0
40
kilometres
Bairnsdale-Dargo Rd
Fernbank-Glenaladale Rd
Lindenow-Glenaladale Rd
Princes Hwy
Bosworth Rd
Forge Creek Rd
Racecourse Rd

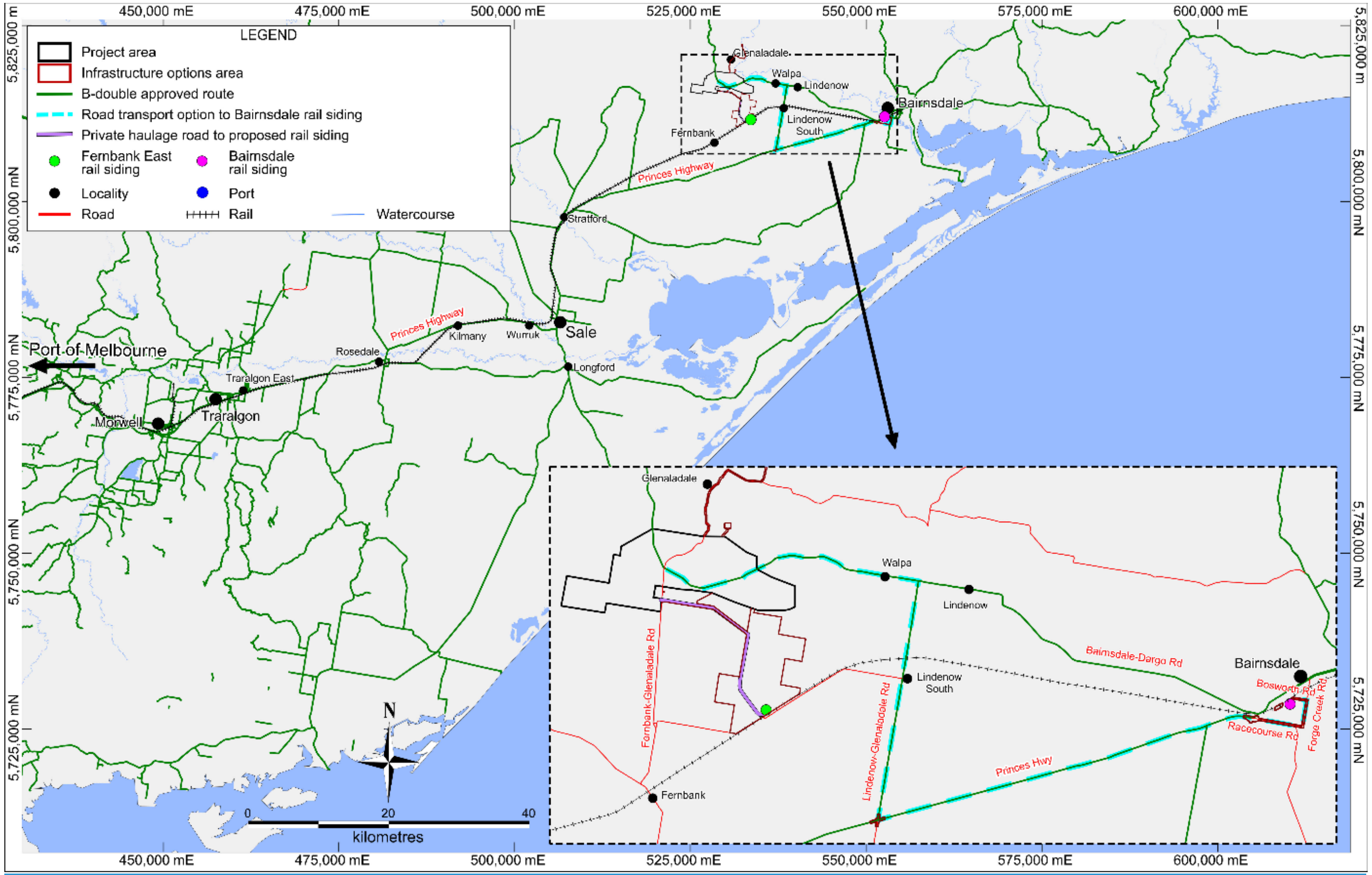


Figure 2-5: Proposed transport routes (regional scale).

2.3 Existing land tenure and land use

There are 19 landholders in the Project area (Table 2-3). All of the land on which the project would be operated (with the exception of temporary road relocations and rail infrastructure and associated loading facilities used for product transport) is freehold land. Future land ownership is currently subject to on-going negotiation between Kalbar and the existing owners.

Table 2-32-3: Land holdings within the project area (Hamilton SierraCon, 2020)

Landholding	Land within the project area (ha)	Proportion of project area	Primary land use
1	264	16.8%	Grazing
2	234.5	14.9%	Grazing
3	218.2	13.9%	Blue gum plantation
4	188.9	12.0%	Pine plantation
5	176	11.2%	Grazing
6	123.6	7.9%	Grazing
7	105.7	6.7%	Grazing
8	70.1	4.5%	Grazing
9	53.3	3.4%	Roads
10	21.6	1.4%	Grazing
11	21.6	1.4%	Grazing
12	12.7	0.8%	Blue gum plantation
13	10.8	0.7%	Grazing
14	7.1	0.5%	Grazing
15	6	0.4%	Grazing
16	5.9	0.4%	Grazing
17	2.3	0.1%	Grazing
18	0.5	0.0%	Grazing
19	46.1	2.9%	Other

*grazing and road reserve areas include areas of remnant vegetation; "grazing" includes lifestyle blocks.

With the exception of land use for plantation timber and remnant vegetation, virtually the whole of the project area is zoned for farming (Figure 2-6). As a result, land uses in the project area are predominantly comprised of dryland agricultural grazing land (sheep and beef) (approximately 913 ha) and forestry plantations (approximately 429 ha of blue gum and radiata pine) with lesser extents of remnant native vegetation, vegetable production and broad acre cropping. Agricultural enterprises are operated both on a full-time basis by owner-occupiers (with some use of contractors for silage/hay making, fencing, farm dam earthworks, fertiliser spreading and weed control), and also for part-time agricultural operations and lifestyle properties. Landholders have advised that there is little roadside movement of livestock and only infrequent transport of farm machinery across the proposed project area (Hamilton SierraCon, 2020).

Areas of remnant native vegetation occur along gullies, creeks and roadside reserves (Figure 2-8).

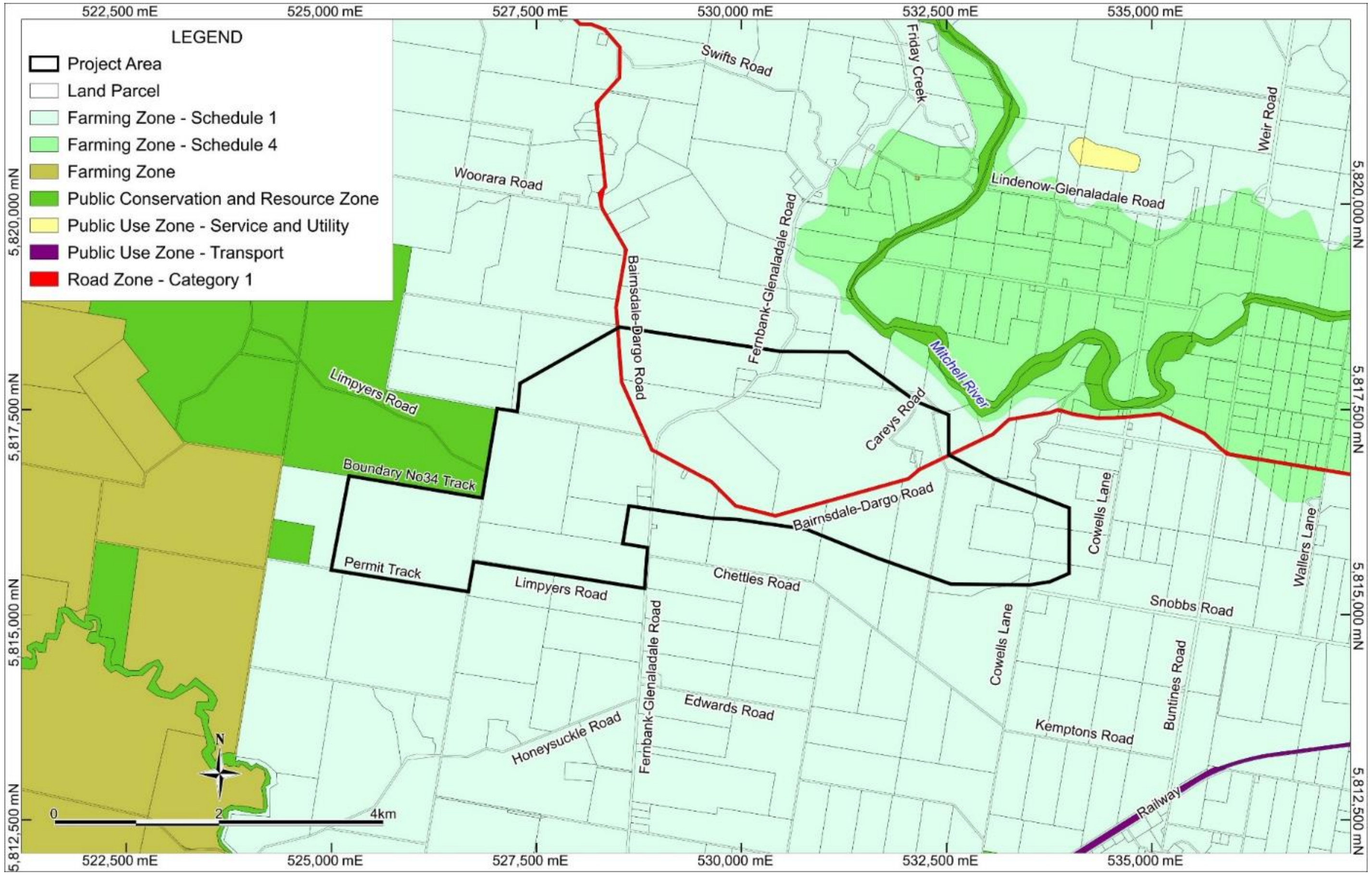


Figure 2-6: East Gippsland planning scheme zones.

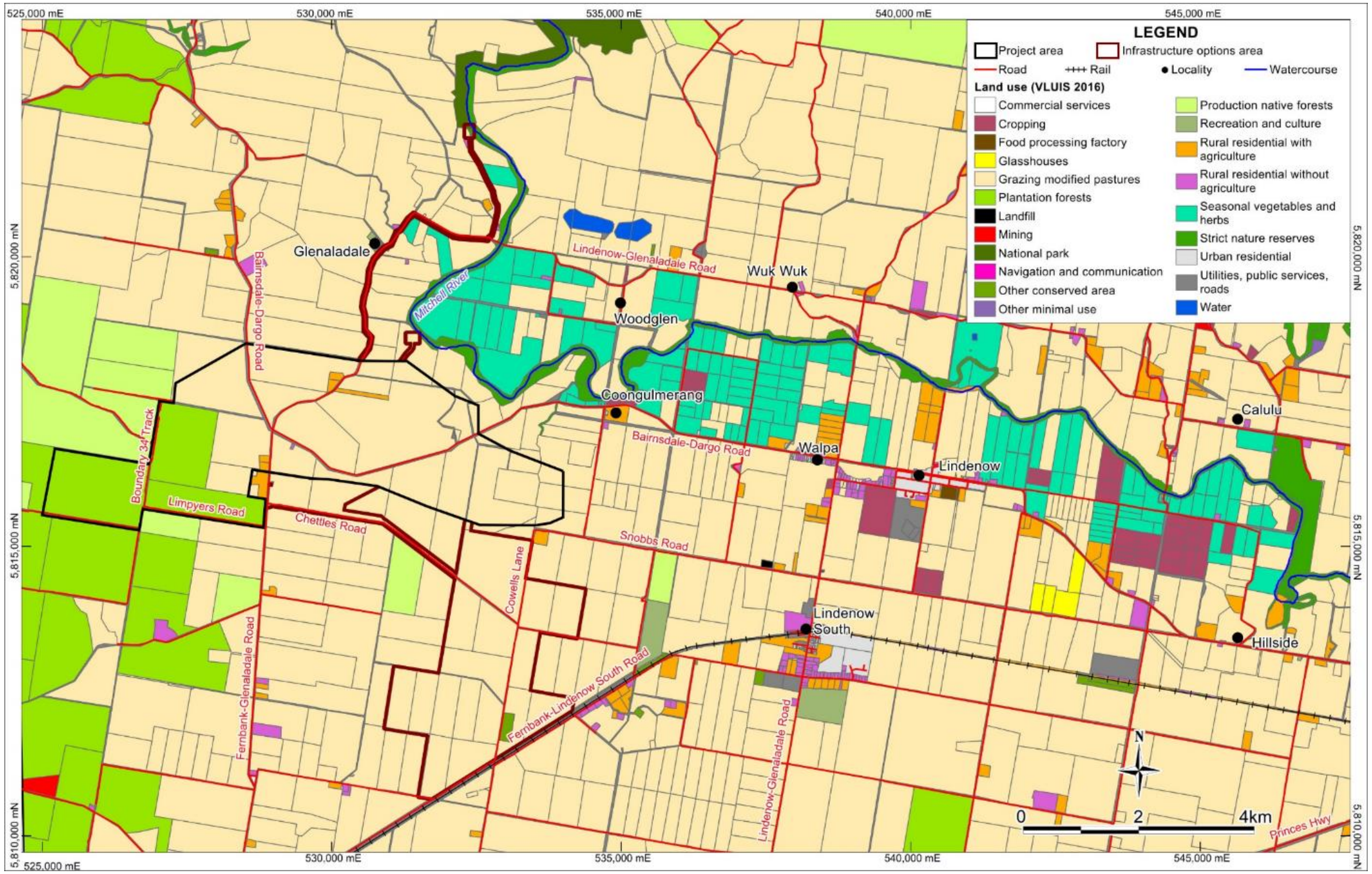


Figure 2-7: Current land uses at and near the Fingerboards sites

Figure 2-8: Vegetation protection overlay (VP01) areas along road verges near project area.

2.4 Mine closure operational definitions

The Commonwealth Department of Industry and Tourism and Resources (DITR, 2006a) recommends the following terms. Table 2-4 lists these for clarity of the terms throughout the report.

Table 2-42-4: Fingerboards operational definitions.

Domain Code	Domain name	Description/example
1	Mining excavations	Active and completed mining cells/blocks, tailings emplacements, and areas cleared in advance of mining.
2	Tailings storage facilitiesdisposal area	Initial tailings storage facility (TSF). Located outside of the mining excavation initially, but wWithin the mining excavation as the operation progresses
3	Water storage	Freshwater storages, process water dam, contingency water storage, sediment detention basins, drainage infrastructure.
4	Industrial infrastructure areas	Ore processing plant and associated facilities, run of mine ore stockpiles (ROM) and product stockpiles, product loadout, materials handling area, pipelines, powerlines, light vehicle roads, mine haul roads, site access roads, administration buildings, laboratory and ancillary buildings, hardstand and laydown areas, carpark, electrical substation.

3 REGULATORY FRAMEWORK FOR MINE REHABILITATION AND CLOSURE

Australian State and Territory Governments (and in some cases local government) are largely responsible for the regulation and management of mine rehabilitation and closure requirements for the mining industry (ANZMEC and MCA, 2000). This section details the relevant national, state and local legal requirements pertaining to the operation and closure of the project.

3.1.1 *Mineral Resources (Sustainable Development) Act* 1990

The principal legislation governing the mining industry in Victoria is the *Mineral Resources (Sustainable Development) Act 1990* (MRSDA) and the associated Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019 (Regulations). The Minister for Resources (Victorian Government) and the Earth Resources Regulation (ERR) Branch of the Department of Jobs, Precincts and Regions (DJPR) are responsible for the administration of the MRSDA and Regulations.

The MRSDA establishes a legal framework aimed at ensuring that land which has been mined is rehabilitated. Before a proponent is granted consent to conduct mining activities it must submit a work plan (including a rehabilitation plan),along with other required information, including – but not limited to –a a risk management plan and a community engagement plan) to ERR for its review and approval. The rehabilitation plan must be approved before mining can commence.

The MRSDA act requires

- A rehabilitation plan be prepared that considers any special characteristics of the land, the surrounding environment, land stability, agreed end uses, and the potential for long-term degradation of the environment. The plan must also include proposals for the progressive rehabilitation, stabilisation and revegetation of extraction areas, waste disposal areas, stockpiles areas, dams and other land affected by the operation. Landscaping to minimise visual impacts and details of final rehabilitation and closure of the site must also be included.
- A rehabilitation bond to be lodged by the proponent to cover rehabilitation costs should the operator default on its obligations to complete rehabilitation. The method used to calculate the bond needs to be approved by the Victorian Minister for Resources. Compensation agreements with landholders, severance or redundancy payments to employees or contractors, and shire rates, royalties or taxes do not form part of the bond.

Regulation 43, in Division 6 of the MRSD Regulations sets out a number of specific requirements for rehabilitation plans. Rehabilitation plans must include:

(a) a description of proposed land uses for the affected land after it has been rehabilitated, taking into account community views expressed during consultation; and

(b) proposed land forms that will be achieved to complete rehabilitation. The final land forms must be

- safe, stable and sustainable; and
- capable of supporting the proposed land uses

(c) objectives for each rehabilitation domain

(d) criteria for measuring whether the objectives have been met;

(e) a description of, and schedule for, rehabilitation milestones; and

(f) an identification and assessment of relevant risks that the rehabilitated land may pose to the environment, any member of the public or to land, property or infrastructure in the vicinity of the rehabilitated land. The assessment of risks must describe

- the type, likelihood and consequence of the risks;
- the activities required to manage the risks;

- the projected costs to manage the risks; and
- other matters that may be relevant to risks arising from the rehabilitated land.

This draft rehabilitation plan does not present projected closure cost information or rehabilitation milestones.

3.1.2 Other legislation

Some other state and federal legislation can influence mine rehabilitation design, planning and implementation even though the other legislation may not explicitly refer to mine rehabilitation or closure. Key examples are summarised in Table 3-1.

Table 3-13-1: Other legislation potentially relevant to mine rehabilitation and closure

Legislation	Administering authority	Applicability to mine rehabilitation & closure
Environment Effects Act 1978	Department of Environment Land Water and Planning (DELWP)	Provides legal framework for the assessment of potential environmental impacts of proposed development; allows government to impose specific requirement for the assessment of particular elements of a proposed development, including (in the case of the Fingerboards project) mine rehabilitation and closure.
Environment Protection Act 1970	Environment Protection Authority	Sets out requirements for pollution prevention; established via the State Environmental Protection Policies framework.
Catchment and Land Protection Act 1994	East Gippsland Catchment Management Authority (EGCMA), DELWP	Provides for integrated management and protection of catchments, and community participation in the management of land and water resources.
Water Act 1989	DELWP, EGCMA	Provides formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses and the protection of catchment conditions.
Planning and Environment Act 1987	DELWP; East Gippsland Shire Council (EGSC)	Provides for the establishment (through local government) of local planning policies and overlays to control development and protect wetlands, other biodiversity assets, and hertage places and objects.
Flora and Fauna Guarantee Act 1988	DELWP	Provides for the protection of threatened species and communities and for the management of potentially threatening processes, including through land management co-operative agreements under the *Conservation, Forests and Lands Act 1987.*
Environment Protection and Biodiversity Conservation Act 1999	Department of the Environment and Energy (Cwth)	Provides a legislative and policy framework for the protection matters of national environmental significance, including protected flora and fauna and wetlands of international significance, such as the Gippsland Lakes. Also regulates activities deemed to constitute a 'nuclear action'.
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) - Legislative framework	Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) (Cwth) Department of Health (VIC) Provides a legislative and policy framework for the management of radiation protection and nuclear safety.	Relevant to operations and unplanned closure (if any HMC stockpiles remain), however is not relevant to planned closure as HMC stockpiles will be absent and mining residues are very low activity and will be covered.
Occupational Health and Safety Act 2004 (Vic) and associated Occupational Health and Safety Regulations 2007	Worksafe Victoria	Apply to all workplace activities and management systems both during the rehabilitation process and up to the closure of the project.
Aboriginal Heritage Act 2006	Aboriginal Victoria	Requires the preparation of a Cultural Heritage Management Plan for any areas of cultural heritage sensitivity that may be impacted by mining. Rehabilitation specific requirements may relate to how artefacts discovered during mine development are managed.

3.1.3 Environmental Effects Statement Relevance

The scoping requirements document prepared to guide the development of the Fingerboards Environment Effects Statement included a range of matters relevant to mine rehabilitation planning, design and implementation (Table 3-2).

Table 3-2~~3-2~~: EES scoping requirements relevant to Fingerboards mine rehabilitation

Rehabilitation / closure aspect	Matters to be addressed in Fingerboards EES
Draft Evaluation Objective	• To establish safe progressive rehabilitation and post-closure stable rehabilitated landforms capable of supporting native ecosystems and/or productive agriculture that will enable long-term sustainable use of the project area.
Characterisation of pre-mining environment	• Describe the existing topography, soil profiles, drainage, plant-soil-water interactions and vegetation cover within the project area, in particular in the proposed mine footprint over the proposed mine life. • Describe current agricultural and horticultural practices in the project area, including key factors influencing sustainable cropping and outputs. • Characterise the relevant physical and chemical properties of overburden and topsoil materials to be used in rehabilitation.
Closure design; impact mitigation	The EES should include a rehabilitation framework which provides information on the following matters: • Planning for progressive rehabilitation and mine closure. • Proposed storage and management of stockpiled topsoil and subsoils. • Design criteria relating to landform and soil profile reconstruction. • Representative geotechnical cross-sections of rehabilitated areas. • Proposed management of surface water and groundwater flows, including flood risks. • Consideration of restoring natural drainage and restoration of disturbed waterways. • Principles of establishing sustainable vegetation cover, including consideration of habitat suitable for listed threatened species and communities or potential for productive land uses. • Consideration of landscape and visual values from the Mitchell River National Park vantage points and tourist tracks. • Proposed fire management measures.
Risk and impact assessment	• Assess best practice methods for storage and management of stockpiled topsoil and subsoils, restoring soil profiles, drainage and productivity, as well as landscape rehabilitation in the context of back-filling of the mine voids and decommissioning of other earth structures. • Assess levels of certainty of successful outcomes from the proposed design and mitigation measures and consequential performance management measures. • Assess potential risks from radiation on the environment, biodiversity values and human health.
Performance management	• Outline and evaluate the proposed performance requirements for rehabilitation, including monitoring and auditing of performance. • Propose criteria to ensure rehabilitation is appropriate for the intended end land-use (agricultural and native areas) and does not result in long term degradation. • Consider: soil profile characteristics (physical/chemical), horizon depths, maximum slope geometry, factor of safety, plant-soil-water interactions for targeted vegetation communities. • Prepare a draft mine rehabilitation plan with strategies for progressive rehabilitation, appropriate design criteria, completion criteria/monitoring methodologies and contingency measures for unplanned/ forced closure.

The EES scoping requirements also set out draft evaluation objectives in the related areas of biodiversity, water, amenity and environmental quality, social, land use and infrastructure, and landscape and visual. These objectives have several common elements which are addressed within the draft rehabilitation plan (RP).

The EES scoping requirements specifically required the EES to address the following issues:

- Changes to topography, soil profiles, surface water flow, hydrology and drainage and vegetation cover.
- Potential impacts of mining activities on agriculture, forestry and tourism associated with the Mitchell River National Park.
- Adequacy of overburden and soil resources for the rehabilitation of the project area (to ensure the post-mining topography can be reconfigured to pre-mining topography, or as close as practical to enable productive land-uses to be re-instated).
- Proposed design criteria required to avoid long term landform degradation (slope geometry, soil profile characteristics (physical/chemical) and surface drainage / erosion mitigation).
- Management of dispersive soils to prevent long-term degradation of the rehabilitated landform.

These issues have been considered through a range of technical studies (notably, Landloch, 2020, 2020b and 2020c; EHP, 2020; Katestone, 2020; Hamilton SierraCon, 2020; Matrix Planning, 2020; Mining One, 2020; Water Technology, 2020a; Water Technology, 2020b) and the results of those studies have informed the development of this plan. Specific technical references are cited throughout this plan.

Characterisation of the pre-mining environment is described in the Fingerboards EES and supporting technical reports. A brief overview of key aspects of the pre-mining environment is presented in the Fingerboards work plan, a draft of which is appended to the EES. A summary of the pre-mining environment, pertinent to closure and rehabilitation is provided in Section 5 of this report.

Stakeholder engagement is discussed in Section 4. An outline of the proposed changes to land use over the period of mine construction, operation, rehabilitation, decommissioning and post-closure is provided in Section 6.1.

Section 8 of this rehabilitation plan builds on the impact identification and risk assessment conducted as part of the Fingerboards EES. Rehabilitation and closure design and the framework proposed by Kalbar for managing rehabilitation performance are addressed in this plan (Section 9). An overview of the rehabilitation framework for the project is presented in Chapter 11 of the EES.

3.1.4 Guidelines and other non-statutory instruments

Rehabilitation methodologies utilised for this project are guided by several documents that have been produced by the Commonwealth and Victorian Governments, industry organisations and independent bodies. Several of the documents are outlined below in Table 3-3, along with a summary of their relevance to rehabilitation.

Table 3-33-3: Summary of the relevant guidelines – mine rehabilitation and closure

Document	Purpose	Relevance to Fingerboards rehabilitation
Commonwealth		
Mine Rehabilitation - Leading Practice Sustainable Development Program for the Mining Industry. Department of Foreign Affairs and Trade, 2016a.	A handbook to address mine rehabilitation in the context of the 'Leading Practice Sustainable Development (LPSD) Program'	Outlines the key principles and procedures now recognised as leading practice for planning, implementing and monitoring rehabilitation. Detailed case studies of various mine rehabilitation methods are given.
Mine Closure - Leading Practice Sustainable Development Program for the Mining Industry, Department of Foreign Affairs and Trade 2016b.	A handbook to address mine closure in the context of the 'Leading Practice Sustainable Development (LPSD) Program'. Sets a broad standard for the process of mine closure and rehabilitation across Australia for industry, state, and local governments.	Presents overall concepts and the general processes involved in planning and implementing mine closure programs. Case studies of various mine closures and rehabilitation methods are given.
Victoria		
rehabilitation plan Guideline for the Mining Industry, Department of Economic Development, Jobs, Transport and Resources, Earth Resources Regulation Branch 2017	To assist operators of mining industries to prepare a rehabilitation plan To complement the current statutory requirements for a rehabilitation plan to include closure as an integral part of operations development and planning	Provides information on the preparation and submission of rehabilitation plans; includes a rehabilitation plan Checklist
Minerals Guidelines and Codes of Practice: Rehabilitation - Guidelines for Environmental Management in Exploration and Mining, Earth Resources Regulation (DEDJTR) 2014	To provide assistance to mining licensees in Victoria in the areas of: • rehabilitation of mineral exploration sites and drill holes • rehabilitation and environmental aspects of mining and extractive work plans	Presents technical information for management of various mining operations and types of overburden and tailings. Also provides guidance on other environmental aspects that should be included in the Work Plan such as; flora and fauna, noise and vibration, water storage, erosion and runoff and management of hazardous materials.
Guidance Material for the Assessment of Geotechnical Risks in Open Pit Mines and Quarries, Earth Resources Regulation (DEDJTR) 2015	To assist mine and quarry owners in Victoria in: • understanding risk concepts;	Provides the technical information required for the work plan and on geotechnical risks (including during rehabilitation) and how to reduce them.

Document	Purpose	Relevance to Fingerboards rehabilitation
	• identifying geotechnical risks associated with mine and quarry developments; • developing assessments of the scale of the perceived risks; and • developing control measures to reduce risks to a level that is as low as practically possible.	
~~Technical Guideline – Design and Management of Tailings Storage Facilities, Earth Resources Regulation (DEDJTR) 2017~~	~~Guideline for preparing a Mining Work Plan and to assist in the safe and effective design, construction, operation and decommissioning of large TSF structures.~~	~~Covers decommissioning and closure of large TSF's, including a description of what information must be included in a TSF Closure Plan.~~
Other/non-government		
Strategic Framework for Mine Closure, Australian and New Zealand Minerals and Energy Council Minerals Council of Australia 2000	To provide a broadly consistent framework for mine closure across Australian including: • involving stakeholders; • operating in a cost-effective and timely manner; • remaining financially sound; • establishing a set of indicators to demonstrate the successful completion of the closure process; and • final decision making on closure.	General rehabilitation requirements for all operators across Australia Potential scenarios and examples are given for various pathways of site closure Common problems and legislation that may be involved.
Guidelines on the Consequence Categories for Dams (October 2012) Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure (May 2012) Regulation and Practice for the Environmental Management of Dams in Australia (June 2014) ANCOLD	This series of documents covers the environmental management, design, construction and closure of large dams To raise awareness of significant environmental matters to be considered by all dam owners/operators.	Applicable for water or tailings dams with the potential to cause loss of life or significant environmental or physical damage through operation or failure Technical working groups report on a range of environmental issues that dam owners/ operators need to be aware of in all dam projects in a clear and simple format.

4 STAKEHOLDER ENGAGEMENT AND COMMUNICATION

4.1 Linkage of rehabilitation plan to Community Engagement Plan

Kalbar has prepared, and is implementing, a comprehensive community engagement plan (CEP) for the project. In the course of activities conducted under the CEP, information and viewpoints provided by stakeholders will be established to inform planning and design for decommissioning, rehabilitation and eventual closure of the project .

The current version of the Community Engagement Plan has been developed in accordance with the *Community Engagement Guidelines for Mining and Mineral Exploration in Victoria* (DJPR, 2019) and with the *EES Consultation Plan Advisory Note: Preparing an EES consultation Plan, November 2018* (DELWP, 2018). Kalbar's stakeholder consultation since 2016 has been conducted under the *Fingerboards Mineral Sands Project – EES Consultation Plan*, which was last revised and updated in May 2020.

The development of the Fingerboards project has include engagement with stakeholders on a wide variety of matters, which included rehabilitation and closure including consideration of final landforms, land use, soils management and vegetation cover (Table 4-1). Concerns about rehabilitation were noted and responded to at community consultation sessions (eg. Community sessions held in Lindenow on 17th July, 2018 and 15th May, 2019). In addition, community consultation, including matters related to rehabilitation and closure, were conducted by independent specialists, as part of the following specialist studies:

- Socioeconomic Impact Assessment Study (Coffey, 2020).
- Horticultural Impact Assessment (RMCG, 2020).
- Agricultural Impact Assessment (Hamilton SierraCon, 2020).

The following principles, which are included in the Community Engagement Plan developed for the assessment phase of the project, are also relevant to the Mine rehabilitation plan. Kalbar will:

- Demonstrate a commitment to actively engaging with all community and stakeholder interests at all stages of development.
- Promote inclusiveness by encouraging and supporting a diverse representation of community participation in consultation.
- Clearly communicate the purpose of consultation activities.
- Foster mutual respect by recognising and responding to the rights, values and interests of all stakeholders.
- Show transparency by documenting community issues and input in a timely, open and effective manner.
- Clearly document and share information on how stakeholder feedback contributes to the assessment process.

Kalbar is committed to the following stakeholder engagement activities:

- Establish an Environment Review Committee (section 9.2) and Community Reference Group (Section 14) to providea point of liaison and communication with the local community and government stakeholders. Section 9.2 for details of the Environment Review Committee.
- Holding meetings with directly affected landholders and other key stakeholders prior to commencement of rehabilitation to determine the preferred final land use.

- Engaging with all relevant stakeholders (for example, landholders and local council) prior to the removal of project infrastructure, such as fencing, groundwater bores, haul roads and powerlines, to determine whether these assets could be used in the future (subject to regulatory approval).
- Consulting with landholders, Traditional Owners and community groups such as Wildlife Victoria to determine preferred vegetation for rehabilitation of the site to ensure compatibility with future stocking requirements.
- Communicating regularly with stakeholders through media releases and advertisements in local newspapers and project updates through the email database.
- Providing to stakeholders annual environmental and rehabilitation performance reports in plain language with information in an accessible format. These reports would be made available through the project and Kalbar's website.
- Conducting and reporting on post-closure monitoring for at least five years after project completion, unless otherwise agreed with Earth Resources Regulation and other stakeholders.

4.2 Stakeholder engagement processes

- The general steps adopted by Kalbar in developing a stakeholder engagement process were:
- Stakeholder identification.
- Stakeholder analysis. Identification of appropriate consultation methods and activities.
- Establishment of systems for recording, monitoring and reporting on consultation activities.
- ~~Stakeholder Identification and analysis.~~

Stakeholders encompass the following categories:

- Communities in and surrounding the project area location, such as neighbouring properties ('Communities of place').
- Communities of similar practice, such as local community groups, sports groups, residents' associations, service clubs, farmers' groups, rate payers' associations, local businesses, sports clubs, tourist or seasonal groups and other groups (Communities of interest').
- Communities that have a special or legal interest in the land, such as Indigenous communities or some environmental groups ('Communities of standing').
- Primary stakeholders are considered those who have the potential to be directly impacted by the project (irrespective of their level of interest or involvement in – or influence over – the project).
- Secondary stakeholders are defined as those who are unlikely to be impacted by project implementation, but who nonetheless have an interest in the project.

4.2.1 Stakeholder Consultation Activities and FIndings

The Fingerboards Community Engagement Plan includes detailed information on the stakeholder engagement process including methods of consultation and records of consultation undertaken. Kalbar maintains a detailed register of responses to issues raised by various stakeholders and these are available to ERR on request. Timeframes for further consultation and engagement, including on matters relating to mine rehabilitation and closure are provided in the Community Engagement Plan.

Apart from technical discussions with the Technical Reference Group (established as part of the Environment Effects Statement process), Kalbar has conducted general community consultation and discussions with individual landholders on the matter of land rehabilitation separate to other environmental aspects of the project. Sessions with significance to the rehabilitation plan are summarised in Table 4-1.

Table 4-14-1: Community Consultation on Rehabilitation and Closure

Date	Relevent Area Represented	Attendees	Feedback type
20/09/2017	General	50	Drop in session for one on one with staff and specialists
17/04/2018	Cultural Heritage, Traffic	30	Drop in session for one on one with staff and specialists
17/07/2018	Biodiversity, socioeconomic, agriculture, air quality	80	Presentation from specialists plus facilitated Q&A
11/09/2018	Traffic and Transport, General	25	Drop in session for one on one with staff and specialists
15/05/2019	Water, rehabilitation, Humen Health	approx 50	Presentation from specialists plus facilitated Q&A
20/06/2019	Visual and Landscap, Socioeconomic	approx 50	Presentation from specialists plus facilitated Q&A
22/08/2019	Grassy Woodland Restoriation	130	Presentation from specialists plus facilitated Q&A
29/10/2019	Horticulture	140	Presentation from specialists plus facilitated Q&A

The approach to engage the community and other stakeholders during the EES process focused initially on raising awareness about the project and EES process while developing a preliminary understanding of community and stakeholder concerns, including in relation to rehabilitation and closure. Several groups of stakeholders were consulted about rehabilitation, decommissioning and closure activities as part of the engagement for the project (see Section 11.8: Closure risks). Comments were provided by potentially affected landowners and residents within, adjacent to and near the project area, local communities, special interest groups, and business and interest groups.

Forums for engagement included meetings with landholders, government agencies and the community, as well as a community survey and the release of frequently asked questions and information bulletins on the project website. Meetings with landholders have continued through the project with 32 of these meetings dated and tabled. The meetings include 3 meetings with representative aboriginal bodies. The 32 relevent landholder meetings are subset of the 277 stakeholder engagements tabled and dated in the Fingerboards Community Engagement Register.

As the EES process progressed, the focus of community and stakeholder engagement shifted to providing information and seeking input on the technical studies being conducted for the EES. Workshops and drop-in community sessions were held, as well as meetings with landholders and government agencies, industry briefings with local businesses, regular updates of the project website and distribution of project bulletins and information sheets. Kalbar representatives also attended several East Gippsland regional community events.

Stakeholders who specifically mentioned rehabilitation and closure are listed and their concerns detailed in Table 4-2.

Table 4-24-2: Stakeholder consultation relating to rehabilitation and closure

Stakeholder group	Issues raised in consultation to date
Directly affected landowners: landholders and residents within the project area	Land stability post rehabilitation. Uneven subsidence of land post rehabilitation. Increased tunnel erosion. Difficult terrain to rehabiliate. How will monitoring by itself be effective. Who will assess and act on the monitoring? What if a landowner is not satisfied with the rehab?
Nearby landowners: landholders and residents adjacent to and near the project area	Concern about voids or dumps left post mining. Ensurances Assurances that rehab will be effective. Who will assess the rehab at handover. Farming of the land after mining will not be achievable.
Local communities: community members within the local communities of Glenaladale, Lindenow, Fernbank, Lindenow South, Walpa and Flaggy Creek	Rehab within 5 years of mining is unrealistic. Rehab will not be a priority for the company. Rehab bonds are not adequate. What will happen if Kalbar goes into administration or sell the mine to another company.
Special interest groups: East Gippsland Landcare Network; Mine-Free Glenaladale; East Gippsland Community Action Group; Gippsland Environment Group; Greening Australia	According to Australia Institute, few mines are closed in Victoria. Inadequacies in rehabilitation will take years to uncover. Kalbar does not have a demonstrated track record in rehabilitation.
Business Groups: Bairnsdale Chamber of Commerce; Business and Tourism East Gippsland; Agribusiness Gippsland; Irrigators Association; Committee for Gippsland East**;** Gippsland Marketing Inc.	Listed rehabilitation as a concern.
Industry Groups: Minerals Council of Australia; Victorian Farmers Federation; East Gippsland Food Cluster	Listed rehabilitation as a concern.
Media: ABC Gippsland; Weekly Times; *Bairnsdale Advertiser/EG News;* Nine News; *Gippsland Times*; *Stock and Land*	Questions about landform and rehabilitation.

Potential issues raised from these stakeholders related to the proposed rehabilitation approach, land stability and erosion, relinquishment and closure criteria, monitoring plans, the final landform, post-mining land use (specifically, return to productive grazing land), risks to achieving effective rehabilitation, and financing post-closure activities. The key concern from community members was that rehabilitation of the project area will be unsuccessful and previous land uses will not be able to be reinstated, including agriculture and native vegetation. These issues have been considered in the development of the closure strategy.

5 ENVIRONMENTAL SETTING AND KNOWLEDGE BASE

Comprehensive baseline environmental characterisation of the Fingerboards site and surrounding receiving environments is presented in the Fingerboards Environment Effects Statement (EES) and associated technical appendices. This section provides a brief overview of salient baseline information and serves as the basis for identifying key knowledge gaps relevant to mine rehabilitation and closure outcomes. Knowledge gaps are addressed in more detail in Section 9.6.

5.1 Summary of relevant baseline information

5.1.1 Climate

Climatic conditions are an important consideration for any closure strategy as rainfall patterns and evaporation rates determine the amount of water available for vegetation. As a baseline study, this also is a key metric for comparison with climate change conditions through the life of mine.

The long-term average annual rainfall is 700mm and ranges from 350mm to 1190 mm (Landloch 2020a). Average monthly rainfall in the project area is approximately 50 to 65 mm with high rainfall events (75 mm or more over 24 hours). The East Gippsland region has the greatest frequency of such high rainfall events in Victoria. This variability gives rise to periods of little rainfall and drought conditions as well as floods. Evaporation of water off the land (evaporation rates) is greater than rainfall for most of the year in this area, except in May, June and July. This gap between rainfall and evaporation rates (Figure 5-1) is the greatest in summer and leads to vegetation experiencing water stress.

Climate change projections for the area indicate a 2.3% lower rainfall total in year 15 of the mine and the decrease in runoff is higher due to the lower rainfall totals and increased evaporation potential decreasing soil moisture content. Thus, more water is infiltrated into the ground in any given rainfall event under climate change conditions. Under average conditions the climate scenario produces 4% less runoff over historical conditions, decreasing to 12% reduction over historical conditions in a dry (10^{th} percentile) year(EMM,2020a).

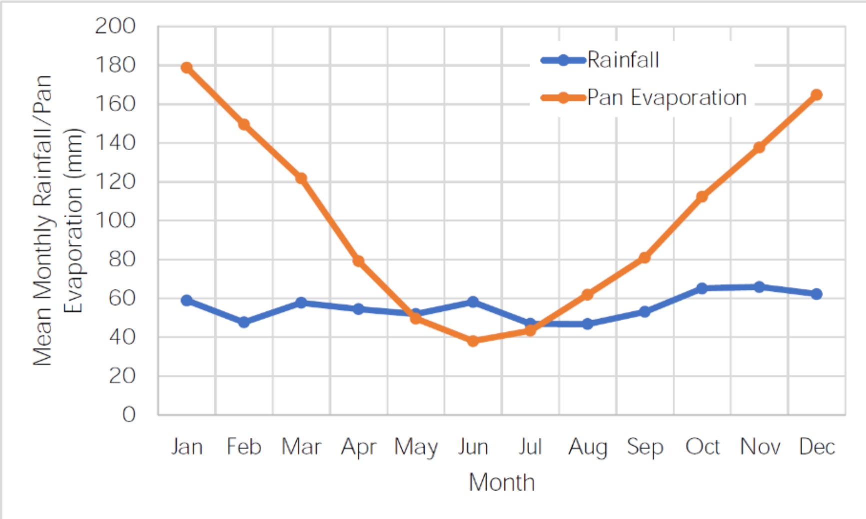


Figure 5-1: Long Term Monthly Climate Averages (source: Landloch 2020a)

5.1.2 Landforms and hydrology

Landforms, in particular the slope angles or steepness of the ground, influence both soils and the way in which water moves around an area (the hydrology). Both these factors are important for determining appropriate closure activities.

The general project locality lies on the southern flank of the Great Dividing Range. This part of the Gippsland region is characterised by high elevation and high relief mountains and foothills, and a flatter coastal plain. The coastal plain comprises terrestrial and marine deposits overlying bedrock..

At the project site, the physiography is characterised by elevated plains reaching elevations of 130 m AHD, with incised gullies bordering the Mitchell River Valley, which has a typically surface elevation around 35 m AHD adjacent to the project site.

There are four main geomorphic units in the project area (Plate 5-1):

- Plateau: The upper planar surface of the project area, which has a low gradient.
- Swales: Broad flow paths draining the plateau, which are important drainage pathways for runoff from the plateau to the flow channels.
- Valley slopes: The steeper outer faces of the plateau that adjoin the flow channels.
- Flow channels: Ephemeral drainage lines that convey surface runoff across the area.

Plate 5-1: View of plateau in Fingerboards area showing geomorphic units.

The Fingerboards project area falls within the south-central region of both the West and East Gippsland Catchment Management Authority (CMA) areas. The catchments are drained by a series of generally southward-flowing rivers from incised valleys in the exposed and elevated bedrock of the Great Dividing Range, across the coastal plain and out to the Tasman Sea and/or to the Gippsland Lakes system. Surface runoff from the Fingerboards project site reports to tributaries of the Perry and Mitchell Rivers, which in turn flow to the Gippsland Lakes system.

The largest part of the contributing surface water catchment within the Fingerboards project area is characterised by plateau landforms. The swales are a minor contributor to surface water runoff.

Extensive clearing of trees and regular grazing in the project area since European settlement has altered the hydrology of the site, increasing surface runoff from rainfall events and reducing plant water use. This has led to increased storm flows in streams, with higher peak flows and shorter flow durations. Clearing and grazing have most likely also contributed to increased deep drainage, which in turn increases the potential for tunnel erosion.

The occurrence of accelerated tunnel erosion is uncommon within the project area (Figure 5-2). However, one location in the project area is an obvious intake area for surface runoff. This location is a small quarry that has been loosely filled and is associated with a large tunnel discharging into an adjacent channel (Landloch, 2020a). Water that has ponded in the loosely filled quarry would have moved laterally and exited through the channel bank.

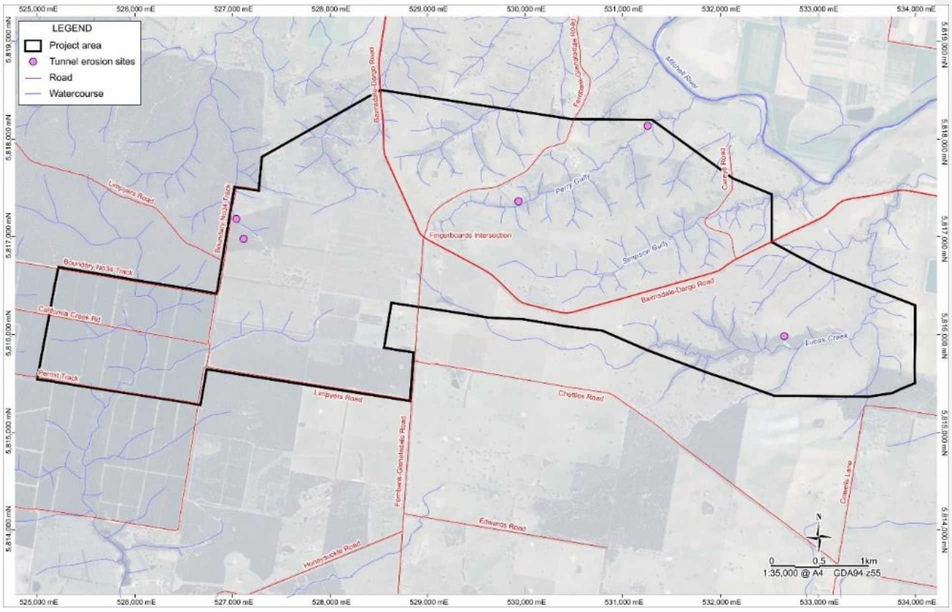


Figure 5-2: Map of project area showing locations of known tunnel erosion sites.

5.1.3 Surface water quality (After Coffey,2020b)

The major downstream water receptors from the project area are the Mitchell River to the east and the Perry River to the south west. Both these rivers flow into the Ramsar listed Gippsland Lakes. Understanding baseline water flows is therefore critical to developing rehabilitation plans which protect these receptors.

The quality of surface water in both the Mitchell River and the disconnected pools of water across the project area are fresh. The Mitchell River typically has total dissolved solids (TDS) concentrations below 60 mg/L. Surface water samples collected from ponded water in drainage lines across the project area displayed higher salinity readings (27 to 166 mg/L TDS), which is most likely the result of evaporative concentration occurring in the stagnant pools of water. There some uncertainty about the quality of flowing water within the project area as only three samples have been collected due to the prevailing dry conditions during the period of base line surveys.

Most surface water tested during baseline studies in the project area contained concentrations of dissolved oxygen ranging from 3.0 to 11.5 mg/L, which reflects the oxidising conditions that would typically be expected for most fresh surface water bodies. Negative redox potential values were recorded at Honeysuckle Creek and Moilun Creek during a monitoring event in June 2017 indicate that reducing conditions might occasionally occur. Reducing conditions are likely to indicate decomposition of organic matter within these stagnant water bodies.

Surface water pH values (between 5.84 and 7.57) were within the expected range for recent rainfall runoff.

Turbidity levels vary in local surface waters, ranging from 0 to 157 NTU. This reflects the variable sediment loads within local waterways. During future rainfall events, turbidity is expected to include values above the values measured so far, as sampling to date was mostly conducted outside periods of intense rainfall. Turbidity values measured in the Mitchell River during baseline studies for the Fingerboards project ranged from 0 to 4.8 NTU.

Major ion chemistry in the Mitchell River is dominated by sodium, magnesium, chloride and bicarbonate, which is characteristic of rainfall runoff that has been subject to geochemical processes within the catchment, such as interactions with soil carbon and mineral dissolution.

Detectable concentrations of a number of metals were reported for the Mitchell River and surface water across the project area. A summary of metal species with reported concentrations above the analytical limits of reporting is presented in Table 5-1. ANZECC water quality 95% protection level trigger values are provided for comparison. The 95th% trigger values are typically applied to ecosystems that could be classified as 'slightly to moderately disturbed'. Both total and dissolved ('filtered') metal concentrations during the first baseline monitoring round, but only dissolved concentrations were measured in subsequent rounds. Surface water samples collected from pools of ponded water across the project area generally contained concentrations of total and dissolved metals that were higher than the concentrations reported in the Mitchell River.

Table 5-15-1: Metals and metalloids in surface water

Parameter	**Range: Mitchell River**		**ANZECC 95th percentile ecosystem protection guideline (mg/L)**	**Range: Fingerboards project area**	
	Total (mg/L)	**Filtered (mg/L)**		**Total (mg/L)**	**Filtered (mg/L)**
Aluminium	0.02 to 0.12	<0.01	0.055	0.07 to 32.8	0.04 to 0.58
Arsenic	<0.001	<0.001	0.013	<0.001 to 0.023	<0.001 to 0.008
Barium	0.006 to 0.011	0.004 to 0.005	--	0.007 to 0.122	0.002 to 0.067
Boron	<0.05	<0.05	0.37	<0.05 to 0.16	-
Chromium	<0.001	<0.001	0.001	<0.001 to 0.056	<0.001
Copper	<0.001	<0.001	0.0014	<0.001 to 0.019	<0.001 to 0.001
Iron	0.11 to 0.36	0.07 to 0.14	--	0.08 to 53.9	0.47 to 1.38
Lead	<0.001	<0.001	0.0034	<0.001 to 0.019	<0.001
Manganese	0.004 to 0.021	0.001 to 0.01	1.9	0.004 to 2.36	0.002 to 1.93
Nickel	<0.001	<0.001	0.011	<0.001 to 0.015	<0.001
Strontium	0.021 to 0.034	0.023 to 0.037	--	0.015 to 0.126	0.002 to 0.097
Zinc	<0.005 to 0.007*	<0.005 to 0.007	0.008	<0.005 to 0.109	<0.005 to 0.008

** – Dissolved ('filtered') metal value adopted for total metals where total (unfiltered) analysis was not performed; ANZECC guideline values are for As V and for Cr VI. A dash (--) means no guideline value has been published.*

5.1.4 Groundwater (After Coffey,2020b)

Groundwater can be interconnected with surface water and also supports certain ecosystems that are dependent upon them for water. The watertable beneath the project area and the Glenaladale mineral sands deposit is contained within the upper part of a geological unit called The Coongulmerang Formation.

Groundwater levels in the Coongulmerang Formation aquifer relative to the Australian Height Datum (AHD) ranged from 45 to 70 m AHD in the western part of the project area falling to the northeast towards the Mitchell River where levels were generally between 27 and 28 m AHD. On a regional basis, the groundwater gradient is steep to the north of the project area, due to the steep topography, and becomes flatter in the coastal plain to the southeast. The dominant regional groundwater flow direction is generally from the northwest to the southeast, mostly discharging to the lower lying alluvium floodplain system near the current coastline.

No part of the proposed mine pit is planned to intersect the groundwater table. The shallowest depth from the pit floor to the water table is approximately 30m.

5.1.5 Groundwater quality (After Coffey,2020b)

Groundwater in the project area does not extend up to the Haunted Hill Formation. In the Coongulmerang and lower Formations, it is fresh to brackish (with no discernible pattern in salinity across the project area), and slightly to moderately acidic, with low dissolved oxygen concentrations. Nitrogen, primarily in the form of nitrate, and phosphorus were detected at all groundwater monitoring locations and are common groundwater contaminants associated with the agriculture industry. No pesticides or herbicides were detected in the groundwater sampling.

Baseline monitoring and analysis of groundwater quality has shown that groundwater salinity within the Coongulmerang Formation aquifer ranges from fresh with dissolved solids of 125 mg/L in well MW01to brackish with dissolved solids of 2,666 mg/L. in well MW04 (Table 5-2 and Figure 5-3). The variation in groundwater salinity does not follow a discernible spatial pattern. Field measured groundwater pH ranged between 4.55 and 7.42, but were mostly in the range from pH 5 to pH 6, indicating slightly acidic groundwater conditions. Groundwater is generally oxidising, with positive redox potential values and dissolved oxygen concentrations generally above 1.0 mg/L. Groundwater in the vicinity of Mitchell River typically contains less dissolved oxygen.

Major ions

Major ions chemistry in groundwater underlying the project area is dominated by sodium and chloride, with lesser amounts of sulfate (SO_4), magnesium (Mg) and bicarbonate (HCO3) ions. Groundwater within the underlying Boisdale aquifer is also sodium-chloride type and does not appear distinctly different from that of the Coongulmerang Formation.

Nitrogen has been detected, primarily in the form of nitrate, at all groundwater monitoring locations. Concentrations ranged from below detection up to 2.82 mg/L (well MW01). Phosphorus was also present at elevated concentrations (<0.01 to 3.54 mg/L). Both phosphorus and nitrate are a common groundwater contaminants associated with the agricultural industry.

Groundwater within the Coongulmerang Formation is characterised by concentrations of dissolved metals that are higher than commonly encountered in similar (but un- mineralised) formations (i.e., aluminium, arsenic, nickel, iron, cadmium, copper, strontium and zinc)

No pesticides or herbicides have been detected in baseline groundwater monitoring conducted at the Fingerboards site to date.

Table 5-25-2: Groundwater quality (Coongulmerang Formation) in Fingerboards project area

Well ID	Date Measured	Dissolved Oxygen (mg/L)	Field EC (µS/cm)	Total Dissolved Solids (mg/L)	Redox Potential (mV)	pH	Temperature (°C)
MW01	22/06/2017	4.81	193	125	153	6.21	15.39
	30/10/2017	5.08	246	160	*710*	6	18.2
	22/01/2018	5.80	239	155	*764.4*	5.88	22.42
	4/04/2018	6.14	231	150	*837*	5.87	17.35
MW02	21/06/2017	1.86	1,162	755	-65.3	7.42	17.3
	31/10/2017	0.23	1,219	792	115	7.08	17.29
	23/01/2018	1.04	1,209	786	264.8	6.4	20.27
	-	-	-	-	-	-	-
MW03	21/06/2017	0.72	366	238	145.3	5.46	16.95
	30/10/2017	0.38	445	289	*704*	5.25	17.8
	23/01/2018	0.25	362	235	*466.8*	4.69	18.53
	4/04/2018	0.07	382	248	*635.7*	4.55	18.45
MW04	21/06/2017	0.94	3,400	2,210	69.9	5.36	16.85
	30/10/2017	1.1	3,985	2,590	*732*	4.6	18.1
	23/01/2018	0.41	3,775	2,454	*967.9*	5.15	19.14
	4/04/2018	0.14	4,102	2,666	*518.8*	5.23	19.31
MW06	21/06/2017	2.8	700	455	154.5	6.36	16.83
	31/10/2017	0.6	1,447	941	*713.0*	5.93	25.1
	24/01/2018	1.09	1,928	1,253	*703.7*	5.71	19.22
	3/04/2018	3.65	2,157	1,402	*997.8*	5.57	20.8
MW07	21/06/2017	4.09	1,212	788	190.11	5.57	15.64
	31/10/2017	2.62	1,563	1,016	*724*	5.18	17.69
	22/01/2018	4.39	1,624	1,056	*903*	5.14	22.69
	3/04/2018	5.23	1,556	1,011	*718.4*	5.1	19.24
MW08	22/06/2017	0.5	327	213	4.8	6.5	16.8
	31/10/2017	1.14	813	528	*576*	5.9	17.19
	22/01/2018	1.03	1,088	707	*833*	5.7	20.1
	3/04/2018	4.12	1,137	739	*663.7*	5.62	20.53

Data from Coffey (2020b)

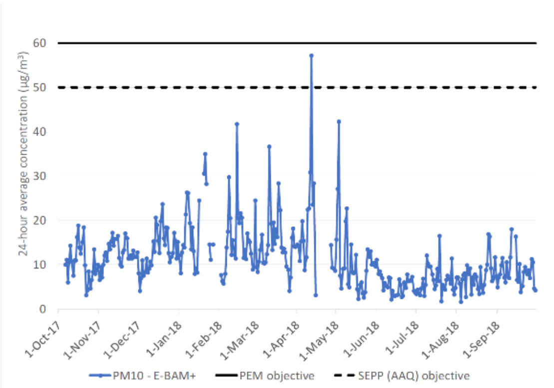
Figure 5-3: Water quality monitoring locations.

5.1.6 Air quality (After Katestone,2020)

Rehabilitation activities including landform contouring, ripping, topsoil return, seeding and incomplete rehabilitation areas are potential dust generating activities.Victorian EPA requires that dust emission from any project activity (construction, operations, rehabilitation) is monitored taking into account ambient dust levels. Hence baseline levels of ambient dust levels are relevant to rehabiliation and closure.

A Level 1 Air Quality Assessment was conducted to include 12 months of ambient monitoring data and 12 months of meteorological data at the Project site. The air quality assessment investigated the potential for the project to affect air quality during construction, operations and decommissioning (and therefore closure).

Background air quality in the Fingerboards project area is generally good (annual average PM2.5 dust concentrations below 8 µg/m^3 and annual average PM10 dust concentrations was 11.35 µg/m^3), (Figure 5-4).



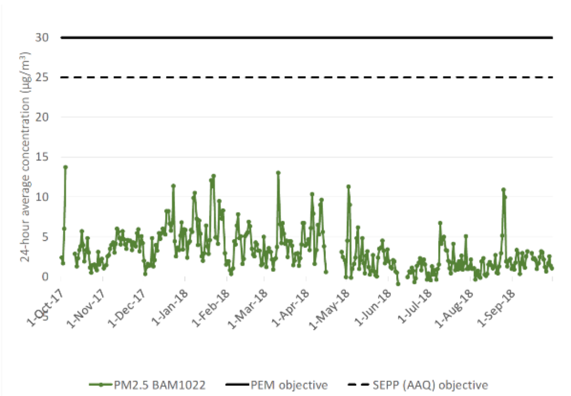


Figure 5-4: Baseline levels of airborne particulates near project area (top PM10; bottom PM2.5) (Katestone, 2020).

Concentrations of respirable crystalline silica (existing predominantly as α-quartz, with traces of cristobalite) were measured as part of the base line study. Whilst there is not a full year of data over which to calculate an annual average, the average of the datasets collected to date is well below the

PEM's annual average air quality design criterion. Concentrations of metals in air are also typically low (Table 5-3).

Dust deposition monitoring has been conducted at the Fingerboards site since July 2017. The maximum measurement of total insoluble solids recorded between September 2017 and July 2018 (53.3 mg/m^2/day) is well below the guideline for monthly average dust deposition of 120 mg/m^2/day.

Table 5-35-3: Summary of ambient heavy metal concentrations

Parameter	Max	90th percentile	70th percentile	Average	Annual average air quality design criteria (ug/m^3)	% of criteria
Arsenic	0.008	0.003	0.001	0.001	0.003	31%
Cadmium	0.0003	0.0002	0.0002	0.0002	0.0033	6%
Cobalt	0.001	0.001	0.001	0.001	0.0017	44%
Chromium III[1]	0.029	0.009	0.002	0.004	0.041	10%
Copper	0.002	0.002	0.002	0.001	1	0.1%
Iron	0.25	0.16	0.11	0.085	n/a[2]	n/a
Manganese	0.009	0.004	0.002	0.002	0.25	1%
Molybdenum	0.004	0.003	0.002	0.002	3	0.1%
Nickel	0.006	0.002	0.001	0.002	0.059	2%
Lead	0.020	0.002	0.002	0.002	n/a[2]	n/a
Antimony	0.024	0.005	0.002	0.003	0.5	1%
Selenium	0.004	0.003	0.002	0.002	0.2	1%
Tin	0.010	0.009	0.004	0.005	2	0.2%
Thorium	0.003	0.003	0.003	0.003	ALARA	n/a
Titanium	0.020	0.006	0.002	0.002	5	0.0%
Uranium	0.003	0.003	0.002	0.002	0.2	1%
Vanadium	0.007	0.001	0.001	0.001	2	0.04%
Tungsten	0.023	0.007	0.005	0.006	5	0.1%
Zinc	1.5	0.027	0.015	0.059	2	3%
Zinc oxide	2.6	0.11	0.029	0.171	2	9%

Table note:

1 Chromium is measured. Kalbar have advised all chromium in extracted materials and soils is expected to be Cr III so their quality criteria for Cr III has been used here.

2 Iron and lead not assessed individually as TCEQ ESLs state must meet NAAQS

5.1.7 Vegetation, flora and fauna habitats

Much of the flora and consequently fauna in the project area will be heavily impacted but re-established progressively through the minelife and during closure. Knowledge of baseline biodiversity is essential to monitor rehabilitation success.

The biodiversity of the project area were assessed by EHP (EHP, 2020) as part of the EES. The project area is typical of many agricultural areas within the East Gippsland region, with large areas of improved pastures and derived native grasslands, scattered patches of remnant vegetation and regrowth from past clearing.

Approximately 90% of the project area contains vegetation that has been modified or disturbed, 30% of which is a timber plantation in the western section of the project area. The timber plantation supports scattered native trees and vegetation classified as remnant patches of Lowland Herb-rich Forest, Plains Grassy Woodland, Aquatic Herbland and Plains Grassy Wetland. This vegetation is largely retained along forestry tracks and in areas where forestry planting has been constrained. The scattered trees and remnant patches provide some level of connectivity within a landscape dominated by monoculture plantings and highly modified by plantation activities. No conservation significant species have been recorded within these areas (EHP, 2020).

The remaining approximately 10% of the project area supports native vegetation, which is concentrated around roadsides and in gullies. Native vegetation includes areas of Plains Grassy Forest (Ecological Vegetation Class 151), Plains Grassy Woodland (Ecological Vegetation Class 55) and Valley Grassy Forest (Ecological Vegetation Class 47). Remnant trees in the project area include *Eucalyptus tereticornis* subsp. *mediana* (Gippsland red gum), *E. polyanthus* (red box) and *E. globoidea* (white stringybark).

No nationally significant fauna species were found in the project area during the biodiversity baseline assessment (EHP, 2020), although Australian grayling (*Prototroctes maraena*, listed as Vulnerable) were found in the Mitchell River as part of this assessment. EHP (2020) field surveys recorded one State significant species within the project area, the Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris*).

Ephemeral drainage lines within the project area are known to support several conservation significant species, including Slender Wire-lily (27 plants), Blue Matrush (three plants), Sandfly Zieria (three plants) and Yellow-bellied Sheathtail Bat. Scattered farm dams and soaks occur across the project area. However, they represent only a very small proportion of habitats present and mostly support non-native vegetation.

The road reserves of Fernbank-Glenaladale Road and Bairnsdale-Dargo Road support scattered native trees and linear tracts of Plains Grassy Woodland (8.76 ha), Plains Grassy Forest (4.27 ha) and Lowland Forest (1.00 ha). High quality patches of this vegetation correspond with ecological communities listed under the Environment Protection and Biodiversity Conservation Act 1999 and Flora and Fauna Guarantee Act 1988 and these areas are also known to support the significant flora species such as Slender Wire-lily (six plants). Vegetated road reserves within the project area provide habitat connectivity within a highly fragmented landscape.

5.1.8 Materials characteristics: soils

An understanding of the existing soils, subsoils and overburden characteristics is critical to the understanding of both landform stability and productivity. It is expected that the soils will be used for rehabilitation and post-mining landuse, therefore the nature of the soils will inform rehabilitation plans in terms of the need for soil conditioning, levels of fertilising and residual post-mining capability.

An investigation of soils was conducted in the project area, with two soil types being recorded as occurring, with broadly similar physical characteristics and fertility (Landloch, 2020d):

- Texture-contrast soils (sodosols) with an acid, sandy A horizon overlying a high clay, sodic B horizon overlying gravel. These soils are largely associated with the plateau tops in the project area. The sodosols in the project area are susceptible to tunnel erosion as they are strongly layered and have dispersive B horizons.
- Sandy soils (podosols) of reasonably uniform texture throughout the profile, acid pH, and almost all non-sodic, overlying coffee rock and/or gravel, These soils are largely associated with slopes adjoining the plateau tops in the project area.
- Shallow sandy soils overlying gravel are commonly associated with creek/valley floor locations and are largely formed by fluvial processes.

Surface soils in the project area have several inherent limitations to plant growth, including strongly acidic pH and high levels of exchangeable aluminium; a moderate tendency to hardsetting and/or dispersion; low water holding capacity; deficiency in some trace elements (chiefly boron and copper) and variable deficiencies in potassium and phosphorus.

Subsoils in the project area are generally of poor quality for agriculture and other uses, being either deep sands with low fertility and water-holding capacity, or sodic clays which are prone to dispersion and hardsetting.

Overburden in the project area is made up of the Haunted Hills Formation, which is a fluvial deposit comprising two distinct units: a lower gravel unit, and an upper clay and sandy clay unit. Material properties that are of concern in both the gravel and sand/clay units include a high percentage of exchangeable magnesium (approximately 65 to 72%) and sodium (approximately 20 to 24%), and a low calcium to magnesium ratio (0.1). These properties have the potential to cause clay dispersion and render the subsoils / overburden susceptible to tunnel erosion. The salinity level of the overburden (0.31 to 0.44 decisiemens per metre) is low: release of saline seepage or leachate is unlikely.

According to Landloch (2020c), analysis of wastes and overburden do not indicate sufficient concentrations of sulfide to cause acid mine drainage (AMD). This is substantiated by the findings of EGI (2020). For the HHF clay/sand, measured Total S was 200 mg/kg, very much lower than the levels of 3,500 and 5,555 mg/kg of Total S typically adopted as a cut-off to identify potential acid forming materials (Australian Govt 2016). As well, pH levels in the samples tested were close to, or slightly above neutral, evidence that little acidification has occurred in the past. A geochemistry study by EGI (2020) concluded that “the risk in relation to occurrence of acid sulfate soil will also be low”.

5.1.9 Materials characteristics: mining residues

An understanding of the characteristics of the mining residues (tailings) is critical to rehabilitation plans and the nature of these tailings will determine important factors such as: water retention of residues; levels of heavy metals; the leachability of these metals from the residues; and the potential of the residues to form acid mine drainage (EGI,2020).

An investigation of mining residues (tailings) produced by the project was conducted by Kalbar as part of its metallurgical test program and also assessed by Landloch in 2020 (Landloch, 2020b). Mining residues consist of two streams of tailings; fines and coarse tailings. Fine tailings consist of tailings finer than 38 µm: that is, of a texture similar to a sandy clayey silt. Because of its fine particle size, this material has been identified as having potential to increase the water storage capacity of reconstituted soils (Landloch, 2020b).

The coarse sand tailings stream is essentially a fine sand and as would be expected of a sand, has low salinity and fertility. The salinity level of both the coarse sand tailings (0.03 decisiemens per metre) and fines tailings (0.09 dS/m) is low and will not generate saline seepage or leachate.

The mineral composition of the fine tailings is dominated by quartz, mica and kaolinite (a clay mineral), with trace amounts of rutile and other titanium oxides (Table 5-4 5-4). Sulphide concentrations in the sand tailings and fines tailings contain insufficient concentrations of sulfide to cause acid mine drainage.

Table 5-45-4: Mineral composition of fine tailings (by X-ray diffraction)

Mineral	Abundance (range), %
Quartz	40.5 - 47
Mica	24.8 - 28
Kaolinite	20.7 - 25
Rutile / anatase	1 – 1.2
Other and non-diffracting	0 – 10.9

Source: Bureau Veritas (2017)

Total and water-leachable metals in fine and coarse tailings are typically low (Table 5-5). None of the total metals concentrations determined in representative fine or coarse tailings samples exceeded health-based investigation levels for soils in areas used for residential purposes (National Environmental Protection Measure, Guideline on Investigation Levels for Soil and Groundwater, 2013). Water leachable concentrations of metals measured in samples of fine and coarse sand tailings all met ANZECC water quality criteria for protection of freshwater aquatic ecosystems (95th percent ecosystem protection level), with the single possible exception of one result for leachable copper in a test conducted on a sample of fine tailings. All the total and leachable metals test results satisfied EPA waste classification criteria for industrial waste (EPA, 2009).

5.1.10 Radiation monitoring and assessment

Baseline radiation monitoring of the following environment features were conducted as part of the EES assessment:

- Air – radon monitoring within the project area and the broader region (as far as Bairnsdale);
- Groundwater from the monitoring bores shown in Figure 5-3;
- Surface water; and
- Soils from within and adjacent to the project area.

The radionuclide content of surface soils in the project area and south of Bairnsdale–Dargo Road was found to fall within or below the global average radionuclide content of surface soils for uranium, thorium and potassium (K) 40. This result indicates soils in this area do not have elevated levels of these radionuclides.

The radionuclide content of surface soils in the project area north of Bairnsdale–Dargo Road is substantially elevated compared to the global average radionuclide content of surface soils for both uranium and thorium. The elevated levels in this part of the project area are due to the orebody occurring at, or closer to, the ground surface.

The average absorbed dose rates measured in the project area are consistent with background terrestrial radiation levels encountered in Australia.

Radiation monitoring will continue prior to, during and post operations to determine that post mining radiation levels are lower than or match the pre-mining baseline levels.

An assessment of the radiological impacts of the proposed mining and processing operations within the project area was carried out by SGS (2020). The main heavy mineral constituents of mineral sands are the titanium-bearing minerals, predominately ilmenite, but also rutile and leucoxene, as well as zircon, and the rare earth bearing minerals monazite and xenotime. Uranium and thorium are also present in these minerals, predominantly associated with the zircon and rare earth products. Consequently, the mining and processing of heavy mineral ores can have the potential to cause elevated radiation exposures of both workers and the public during operations, and from the management of waste and non-economic minerals arising from production.

Most uranium and thorium bearing minerals will be removed as part of the HMC, with only trace amounts in the tailings returned to the mine pit for disposal, comparable to some of the topsoil in the project area. Furthermore, rehabilitation of the pit area after disposal will mean that the overburden and subsoil cover will lead to further attenuation of the gamma radiation field. As a consequence, the external radiation dose at the surface will not be significantly different to the ambient background radiation levels in the region. SGS (2020) concluded that there will not be any significant long-term impact on radioactivity levels in groundwater arising from mining, mineral processing and the disposal of tailings and other waste. Measured radiation in the fine and sand tailings are well below 1 Bq/g. As such, the SGS report concludes that the fine and sand tailings do not constitute radioactive waste material.

Table 5-5~~5-5~~: Total and leachable metals / metalloids in fine and coarse tailings (from EGI, 2020).

Metal / metalloid	LoR, mg/L	Leachable metal, mg/L		ASLP0 (EPA waste classification criteria), mg/L	ANZECC 95% ecosystem protection, mg/L	LoR, mg/kg	Total metal, mg/kg		TC0 (EPA waste classification criteria), mg/kg	NEPM HIL-A, mg/kg
		Fine tailings	Coarse tailings				Fine tails	Coarse tails		
Aluminium	0.1	<0.001 (0.003)	<0.001	--	0.055*		4,500	260	--	--
Antimony	0.001	<0.001	<0.001	1	--	0.5	<0.5	<0.5	75	--
Arsenic	0.05	0.009 (0.005)	0.005 (0.003)	0.35	0.013**		35	4.4	500	100
Beryllium	0.01	<0.0005	<0.0005	1	--***	0.5	<0.5	<0.5	100	60
Bismuth	0.001	<0.001 (0.001)	<0.001	--	--	1	<1	<1	100	--
Boron	0.02	<0.02	<0.02	15	0.37	1	<1	<1	15,000	4500
Cadmium	0.0001	<0.0001	<0.0001	0.1	0.0002	0.1	<0.1	<0.1	100	20
Chromium**	0.005	<0.005 (NT)	<0.005 (NT)	2.5	0.001		81	10	500	100
Copper	0.001	**0.002** (<0.001)	<0.001	100	0.0014		17	1.8	5,000	6000
Fluoride	0.1	0.3 (NT)	<0.1 (NT)	75	--	--	NT	NT	10,000	--
Lead	0.001	<0.001	<0.001	0.5	0.0034		10	1.9	1,500	300
Mercury	0.00005	<0.00005	<0.00005	0.05	0.0006				75	40
Molybdenum	0.001	0.003	<0.001	2.5	--				1,000	--
Nickel	0.001	<0.001	<0.001	1	0.011				3,000	400
Selenium	0.001	<0.001	<0.001	0.5	0.011	0.1	0.3	<0.1	50	200
Silver	0.001	<0.001	<0.001	5	0.00005	0.1	0.1	<0.1	180	--
Sulfate	1	<1 (NT)	<1 (NT)	--	--	100	100	<100	--	--
Manganese	0.005	<0.005	<0.005	--	1.9		23	6	--	--
Thallium	0.001	<0.001	<0.001	--	--	0.5	<0.5	<0.5	--	--
Thorium	0.0005	0.0017 (0.0012)	0.0008 (<0.0005)	--	--		9.8	1	--	--
Uranium	0.0005	0.0005 (<0.0005)	<0.0005	--	--		3	0.4	--	--
Zinc	0.001	0.002 (<0.001)	0.003 (<0.001)	150	0.006		16	2.3	35,000	7400

* Applies to freshwater with pH > 6.5. Not defined for waters with pH <6.5. ** ANZECC criterion for As V; EPA criteria for chromium are for Cr VI – sample results are for total Cr.
*** A dash (--) means no criterion or guideline value has been defined; 'NT' means samples were not re-tested after 3 days settling time. ASLP values in parentheses are for test conducted after allowing extracted samples to settle for 3 days (to allow settling of colloidal materials). If no values appear in parentheses, the 3-day test result was the same as the original test result conducted immediately after sample extraction.

5.1.11 Social and cultural values

The project locality lies within Kurnai or Gunai/Ganai ('the Gunaikurnai') People's territory, an area of East Gippsland between Wilson's Promontory and the New South Wales border (ALA, 2020). The project area is located within the traditional territory of the Brabralung people, one of five clans of the Gunaikurnai (ALA, 2020). Today the Gunaikurnai people are represented by the Gunaikurnai Land and Waters Aboriginal Corporation.

The majority of land within the Gippsland region is public land occupied by state forests and national, coastal and marine parks (EGCMA, 2013 and WGCMA, 2012). The bulk of private land within the region has been cleared for agriculture and is used for grazing, dairy, meat production, forestry and irrigated horticulture. Land capability in the region is variable with the most productive land located on the Mitchell River floodplain, river terraces and gullies (Hamilton SierraCon, 2020). The Lindenow flats of the Mitchell River are a high-value irrigated vegetable production area.

The Mitchell River National Park is located approximately 10 km north of the project area. The Gippsland Lakes system, a Ramsar listed wetland, is located approximately 28 km southeast of the project area. These natural assets draw tourists to the area for a range of outdoor activities such as bushwalking, cycling, boating and scenic drives. Retirees are also being increasingly attracted to the area due to the proximity of these natural assets and scenic landscape.

There are nine settlements and towns within a 10-km radius of the project area. Each of these has a distinct identity. Some residents have a strong family history of farming in the local area and others have moved to the area more recently for lifestyle reasons. The bulk of residents live in owner occupier households on rural residential living and farming properties.

The Gippsland region has a number of areas with a high level of socioeconomic disadvantage, characterised by lower levels of income, lower educational attainment, employment in unskilled occupations and dwellings without motor vehicles. The local government areas nearest to the Fingerboards project, the Shires of Wellington and East Gippsland have Socio Economic Indices for Areas (SEIFA) scores of 974.1 and 958.2, respectively, which is slightly below the national average score of 1,000 and indicative of a slight to moderate levels of socioeconomic disadvantage, relative to other local level government areas in Australia.

The main sources of employment in the East Gippsland Shire in 2016 were aged care residential services (4.8%), supermarket and grocery stores (3.2%) and primary education (3.1%) (ABS, 2016). East Gippsland's fishing industry is a major employer. Other notable sources of employment include the vegetable industry and tourism sector (Hamilton SierraCon, 2020). In 2016, the top employers by industry in Wellington Shire were dairy cattle farming (5.9%), hospitals (5.4%) and primary education (3.0%) (ABS, 2016). Top employers in the shire include RAAF Base East Sale, ExxonMobil (through its Esso/BHP joint venture), Murray Goulburn and Fulham Prison. Employment opportunities at RAAF Base East Sale have increased in recent years with the expansion of the base.

In 2016, the proportion of the labour force looking for work in both the East Gippsland Shire (6.4%) and Wellington Shire (6.2%) was consistent with the Victorian average (6.6%), yet lower than the regional average (7.4%) (ABS, 2016). Managers, technicians, trades workers, and professionals were the main occupation types in the two shires, in line with the Victorian trend (ABS, 2016).

5.1.12 Public Health (After Coffey,2020a)

Health statistics may become a valuable baseline to review any possible impacts that rehabilitation and closure activities may be claimed to have on public health.

The top causes of death in both East Gippsland and Wellington shires are malignant cancers, followed by cardiovascular disease. As outlined in Table 5.8, the percentage of people reporting high blood pressure in East Gippsland and Wellington shires is higher than the state average, as are alcohol related deaths per 10,000 of the population. Life expectancy levels across the two shires are slightly lower than the Victorian average.

Across East Gippsland and Wellington shires, people reporting asthma is 2-3% higher than it is for Victoria, while the percentage of people reporting type 2 diabetes is higher in Wellington Shire (6.6%) compared to East Gippsland Shire (3.8%) and Victoria (5.0%).

6 POST-CLOSURE LAND USES AND OBJECTIVES.

This Section identifies post-mining land use(s) for the project and sets out the closure objectives required to facilitate those land use(s).

6.1 Proposed post-mining land uses

The post-closure land uses proposed in this rehabilitation plan were determined by taking into account:

1. The existing land uses.
2. Views expressed by stakeholders during consultation
3. Compliance with legal and policy requirements.
4. Likely success of achieving closure objectives (technical risk), having regard to biophysical conditions at the site.

Stakeholder consultation including the opinion of landholders produced a clear interest in returning the original character and function of the landform especially with respect to farming. This consideration led to six proposed closure land use zones (and Figure 6-1 to Figure 6-6). seeking to largely reinstate pre-mining beneficial uses, but with consideration given to biophysical attributes of the rehabilitated land profile and an increase in the proportion of land allocated to the rehabilitation of native vegetation. Amenity plantings to enhance aesthetics and landscape values are planned, particularly along public boundaries and road reserves.

The most significant proposed change in land use is the removal of blue gum and pine plantations in the southwestern portion of the project area and their replacement with approximately 200 ha of native grassy woodland. The focus of revegetation in this area will be on species that comprise the 'Gippsland Red Gum Grassy Woodland and Associated Native Grassland' ecological community. This vegetation community is listed as threatened under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

The proposed post-closure land uses within the mine operations areas do not currently target new or novel agricultural, industrial, commercial or recreational uses, although this could potentially change depending on ongoing stakeholder consultation

Trees and/or shrubs will be established in all zones. Tree seed or seedlings will be, as much as possible, provenance material sourced from within, or close to, the project area. Flora species selected to revegetate rehabilitated areas will provide habitat for listed threatened species known to occur or that have the potential to occur within the project area. Other factors which influence successful revegetation include soil properties, drainage, aspect and landform.

Zones A and B are currently subject to grazing and correlate to plateau top and swales. These will be largely returned to similar vegetation with the intent of achieving grazing animal productivity equivalent to, or better than, current levels. Tree density, particularly in Zone B, will be increased from the current density to reduce deep drainage, reduce potential of seepage flows, and increase erosional stability.

Zones C and D will be revegetated with tree and shrub species consistent with local native vegetation communities. Grazing will be excluded from these zones.

Zones E and F will also be revegetated with species broadly consistent with appropriate local native vegetation communities.

Table 6-16-1: Post-closure land use zones

Zone code	Zone name	Zone area (ha) (%)	Final land use	Description/example
A	Plateau grazing	696 (55%)	Grazing	Large area of open woodland, native and improved pasture on broad undulating plateau top. Typical gradients, horizontal to 1:10
B	Swales and plateau edges	116 (9%)	Grazing/native vegetation	Relatively small area bordering plateau slopes where gradients begin to increase and runoff flows concentrate prior to discharge onto plateau slopes, supporting native trees and shrubs and native and exotic grasses. Typical gradients , 1:12 to 1:5
C	Valley slopes	208 (17%)	Native vegetation	Native vegetation (trees, shrubs, groundcover species and exotic and native grasses) on more steeply sloping plateau edges. Typical gradients, 1:8 to 1:3
D	Channels	32 (2%)	Riparian areas and associated waterways	Riparian zones and their associated channels (waterways) (whether existing or re-established), vegetated with native riparian and/or aquatic plant species Typical gradient along channel, 1:50 to 1:1
E	Native grass woodland	205 (16%)	Native vegetation	Native grass woodland in western part of project area broadly consistent with EVC 55 (Plains Grassy Woodland), EVC 47 (Valley Grassy Forest), and EVC 877 (Lowland Herb-rich Forest). Located on plateau landform. Typical gradients, Horizontal to 1:10
F	Road Verge	33 (3%)	Road verge. Predominantly native vegetation	Verges of realigned public roads vegetated with predominantly native grass with low-density trees and shrubs. Typical gradients, Horizontal to 1:10

Agreements for land located within the mining licence are proposed to be individually negotiated with landowners in accordance with the requirements of the *Mineral Resources (Sustainable Development) Act 1990* (Sections 85 and 87). The act sets statutory compensation requirements and will take into account (but not be limited to) the following:

- Land-use post mining (in most cases this is expected to reflect the pre-mining land-use);
- Changes to landform (eg slope contours) aligned with the post mining land-use;
- Agreed vegetation planting aligned with the post mining land-use;
- Hand-back criteria (eg, productivity, weed density, soil condition) aligned with the post mining land-use;
- Replacement or repair/maintenance of any infrastructure (eg. roads, fences, dams) located on the leased land;
- Changes to land access (eg. access roads, gates) post mining;
- Possible agistment of livestock on alternative properties during the leasing period;
- Ongoing compensation or rehabilitation obligations if land does not meet agreed hand-back criteria.

Agreements for land located outside of the mining licence will be negotiated with landowners on the following basis:

- Registered easements for specific infrastructure or utility requirements (eg. Rail siding, power lines, private haul road);
- Compensation for loss of land related to these easements, including solatium (compensation for non-financial disadvantage), if required;
- Agreed land-use post mining and the need for easements (in most cases this is expected to reflect the pre-mining land-use);
- All other factors listed above.

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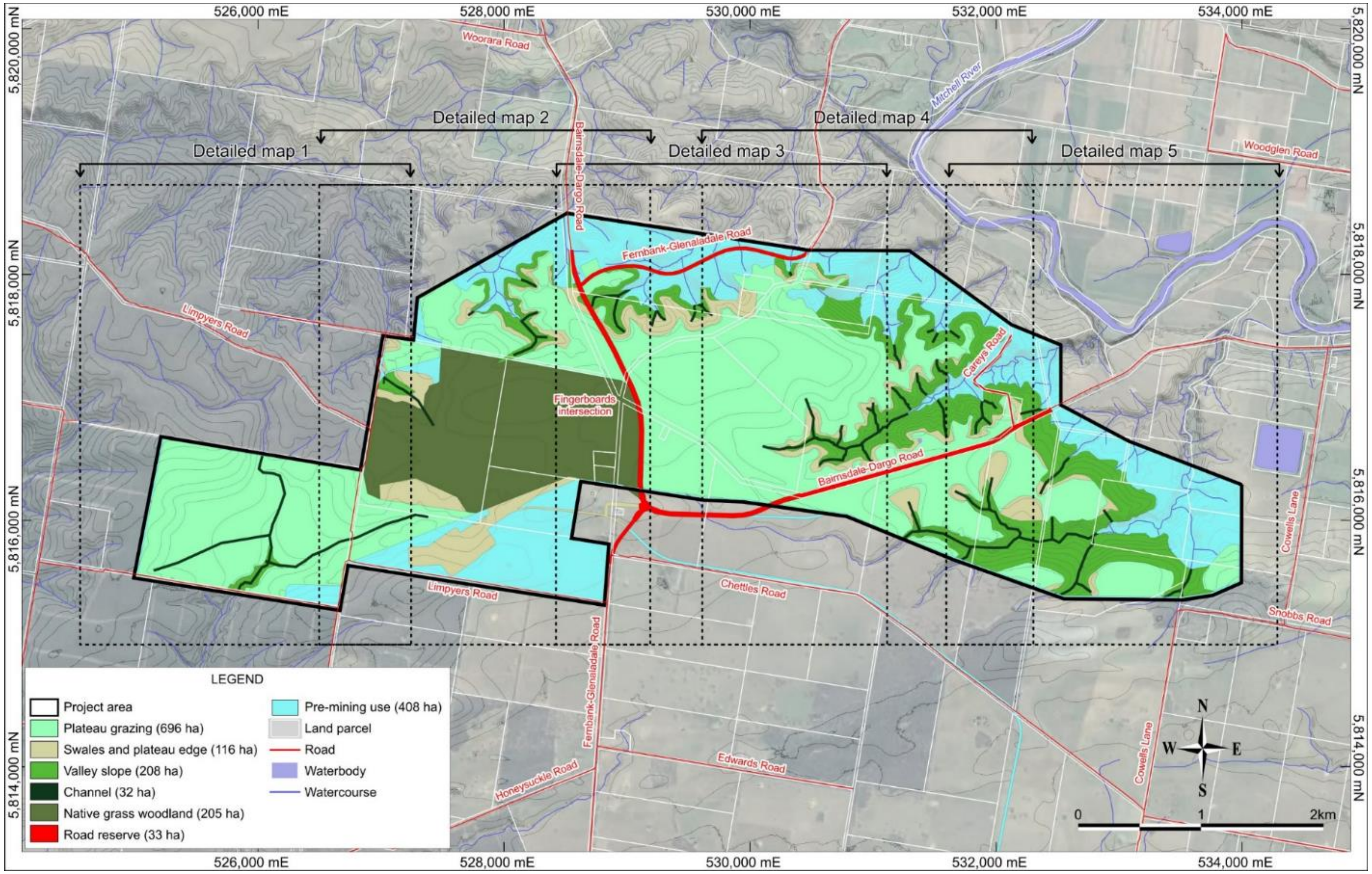


Figure 6-1: Proposed post-closure land uses within the project area (existing land parcels delineated with white lines).

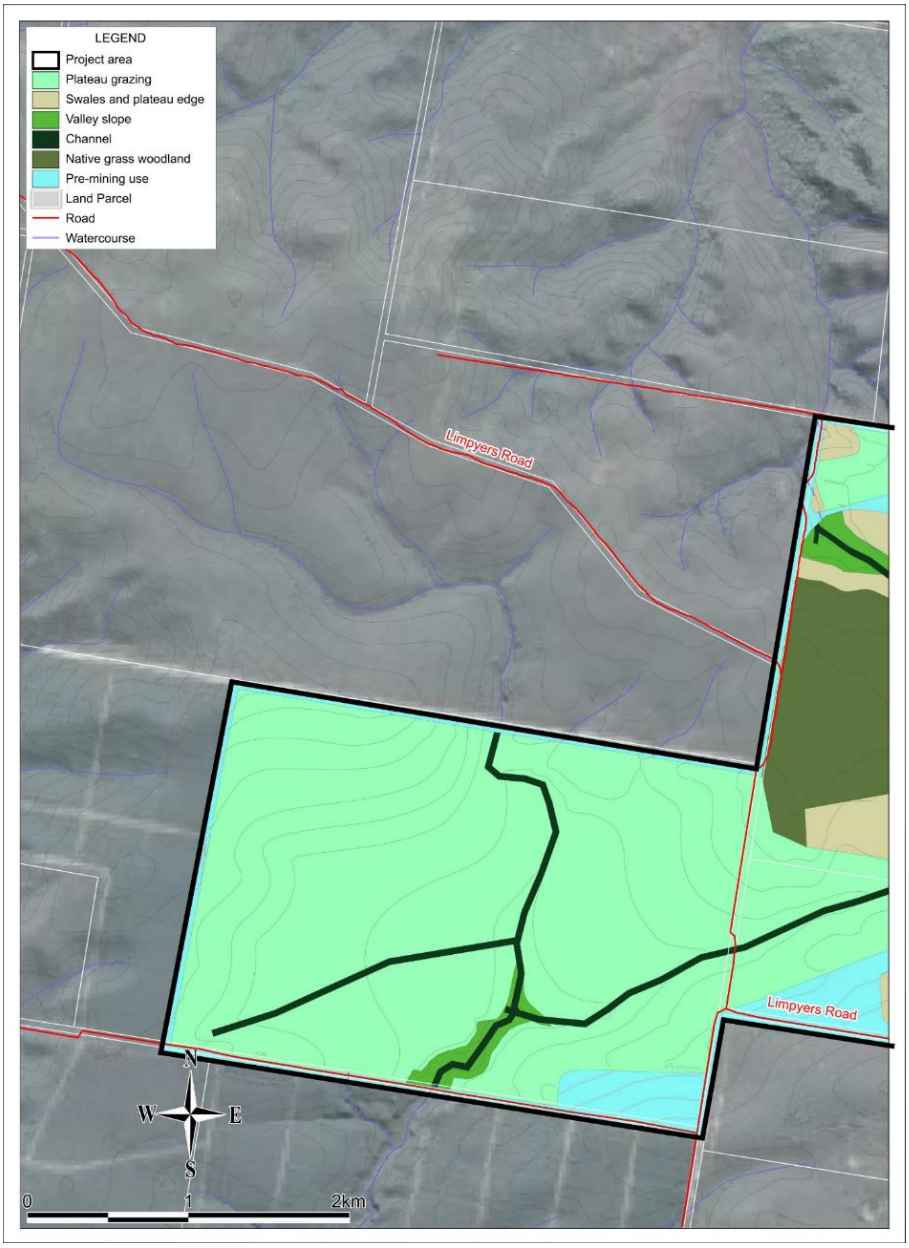


Figure 6-2: Proposed post-closure land uses within the project area Detail 1

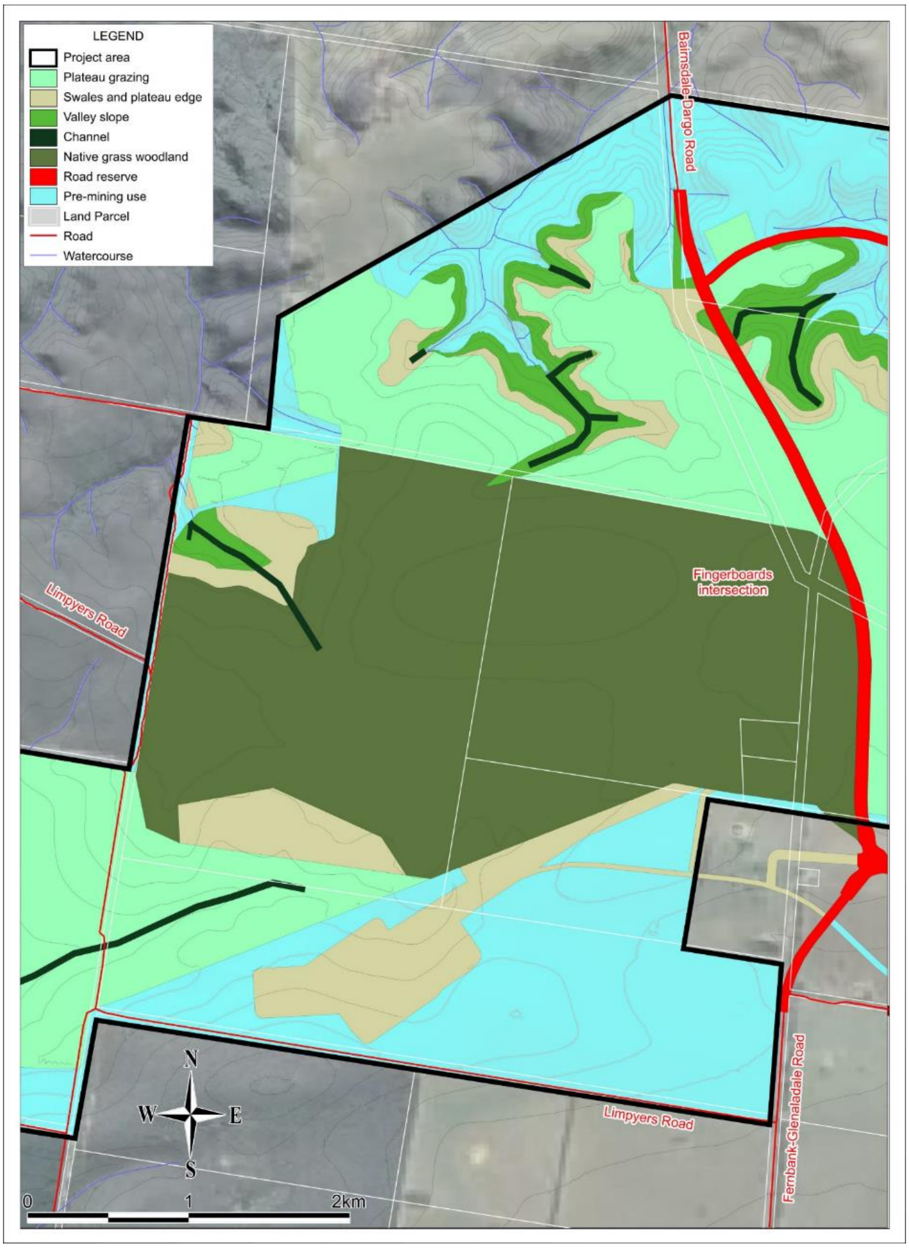


Figure 6-3: Proposed post-closure land uses within the project area Detail 2

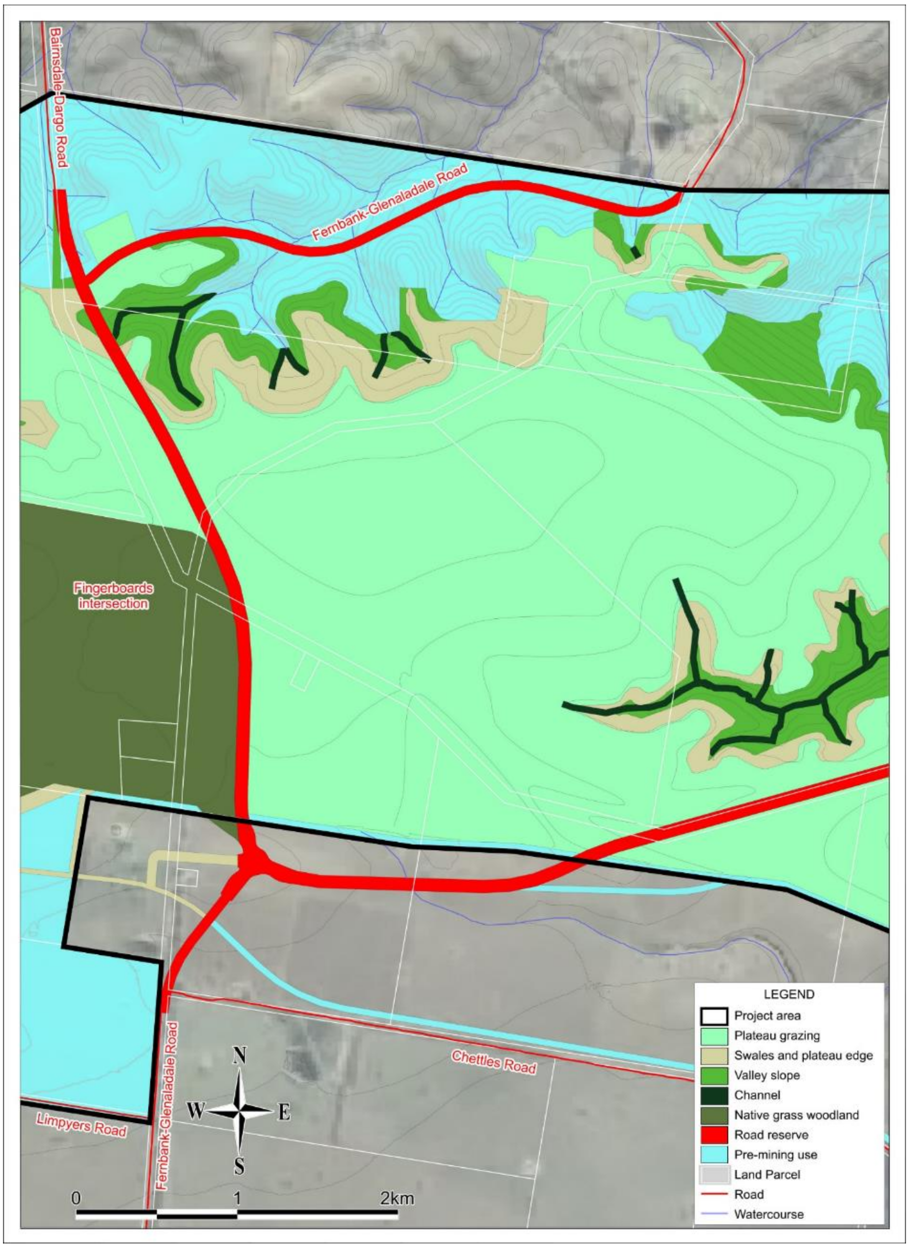


Figure 6-4: Proposed post-closure land uses within the project area Detail 3

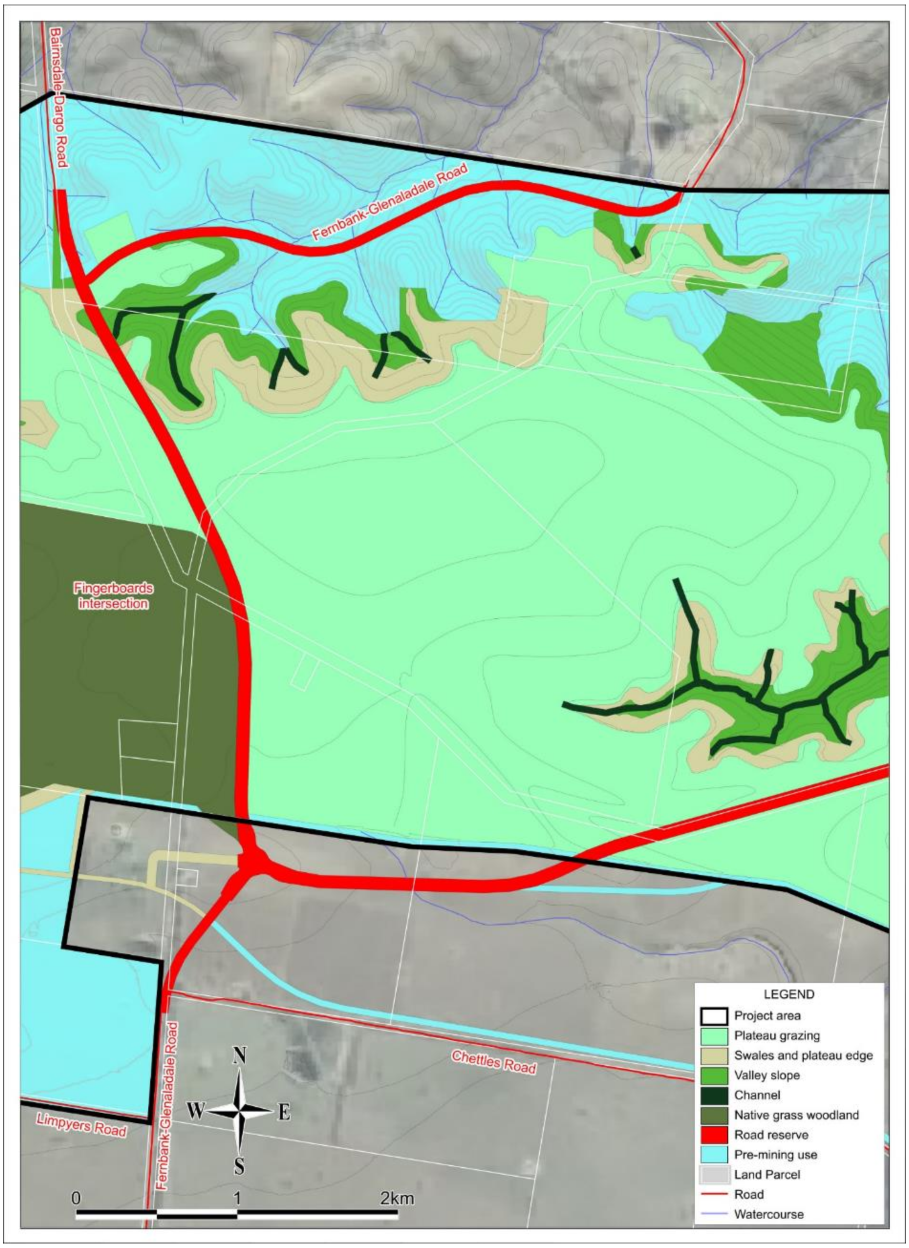


Figure 6-5: Proposed post-closure land uses within the project area Detail 4

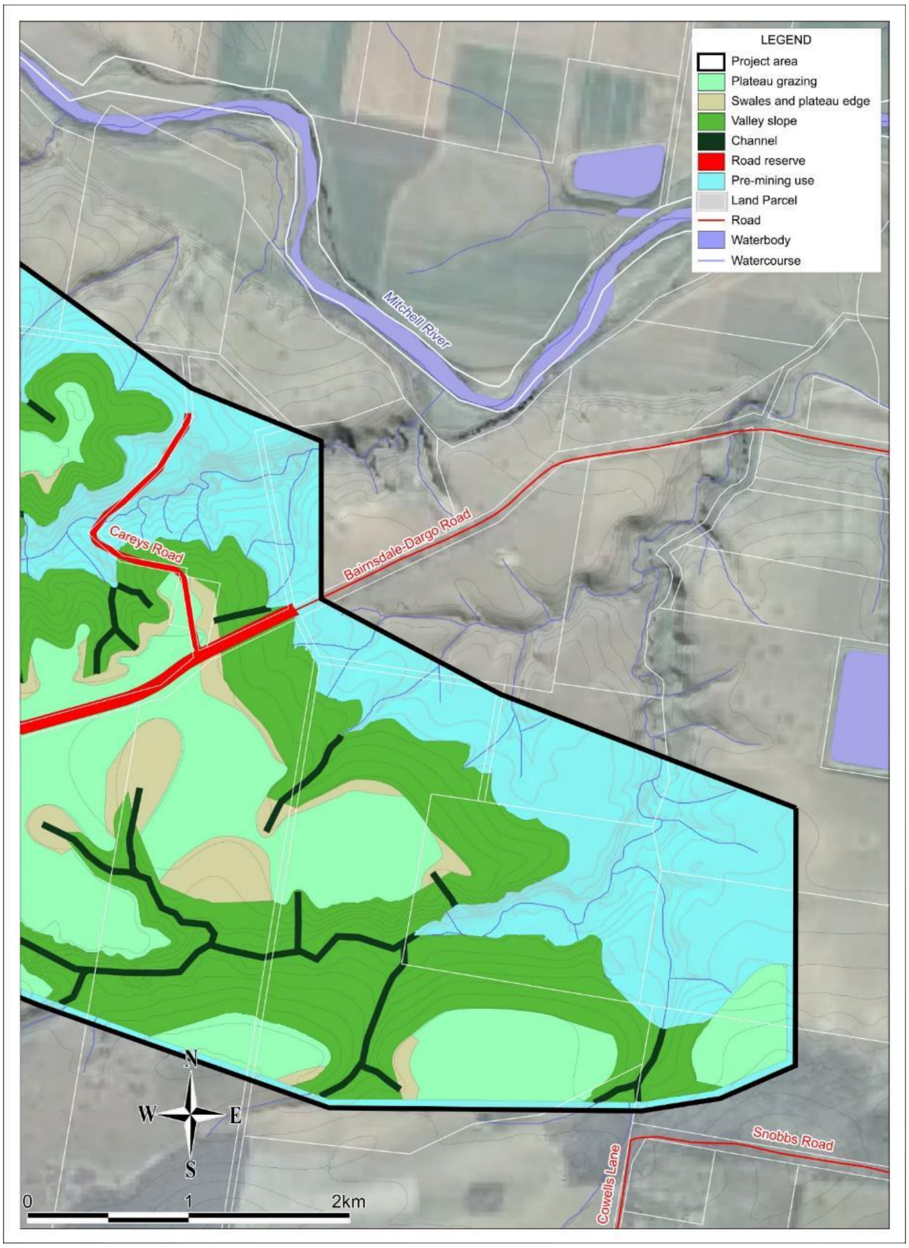


Figure 6-6: Proposed post-closure land uses within the project area Detail 5

6.2 Closure and rehabilitation objectives

The EES scoping requirements set out the following draft evaluation objective for closure applicable to the aspect of rehabiitation:

- *Rehabilitation:* To establish safe progressive rehabilitation and post-closure stable rehabilitated landforms capable of supporting native ecosystems and/or productive agriculture that will enable long-term sustainable use of the project area.

The EES scoping requirements also set out other draft evaluation objectives that are relevant for closure to the following aspects:

- *Biodiversity:* To avoid or minimise potential adverse effects on native vegetation, listed threatened and migratory species and ecological communities, and habitat for these species, as well as address offset requirements for residual environmental effects consistent with state and Commonwealth policies.
- *Water,* catchment values and hydrology: To minimise effects on water resources and on beneficial and licensed uses of surface water, groundwater and related catchment values (including the Gippsland Lakes Ramsar site) over the short and long-term.
- *Amenity and environmental quality:* To protect the health and wellbeing of residents and local communities, and minimise effects on air quality, noise and the social amenity of the area, having regard to relevant limits, targets or standards.
- *Social, land use and infrastructure:* To minimise potential adverse social and land use effects, including on, agriculture (such as dairy irrigated horticulture and grazing), forestry, tourism industries and transport infrastructure.
- *Landscape and visual:* To avoid adverse effects on the landscape and recreational values of the Mitchell River National Park and minimise visual effects on the open space areas.

7 CLOSURE CRITERIA

Closure of the project is ultimately intended to establish the objective “To establish safe progressive rehabilitation and post-closure stable rehabilitated landforms capable of supporting native ecosystems and/or productive agriculture that will enable long-term sustainable use of the project”. In meeting this ultimate aim and the EES objectives, specific closure criteria have been developed.

Each closure criteria may apply to one of more of the project rehabilitation and closure objectives. This information is tabled in Table 7-1 along with the measurement tool and timeframe that will be the method to indicate satisfaction of closure obectives.

Table 7-17-1: Provisional rehabilitation and closure criteria

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Rehabilitation Social, land use and infrastructure Landscape and visual	A	• Previously disturbed areas are rehabilitated to establish a modified environment receptive to vegetation regrowth and recovery over time and which where possible, blends with the surrounding landscape.	• Land capability equivalent or better than pre-mining condition. • Compliance with agreed post mining land use plan.	• Pasture conditions (biomass, dry matter productivity) observed to be acceptable, using data from enclosures and species balance surveys prior to mining.	• Annual surveys of rehabilitated areas from commencement of mining operations to assess progress against criteria. • Compliance audits conducted with five years after completion of rehabilitation activities. • Monitoring to continue until closure criteria met and land returned to landowners.
Rehabilitation	B, C, D, E, F	• Landscape function and vegetation, for areas rehabilitated to a natural ecosystem land use, is resilient, self-sustaining, and comparable to surrounding area (or to agreed analogue system).	• Species richness / diversity values at 70% or more of reference sites. • Percentage vegetation cover. • Vegetation community structure / density of particular life forms. • Vegetation health.	• For native revegetation areas, perennial plant species and groundcover density demonstrate development trends along desired trajectory based on pre-mining surveys and comparable reference sites.	• Annual surveys of rehabilitated areas from commencement of mining operations to assess progress against criteria. • Compliance audits conducted within five years after completion of rehabilitation activities.

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Rehabilitation Social, land use and infrastructure	A, B, C, E, F	• Most appropriate material mix (topsoils, overburden, tailings) are used in the upper layers (~ 1 m) of post mining landforms. Soil properties support desired surface stability and vegetation growth, productivity and resilience, according to zone requirements.	• Land capability equivalent or better than pre-mining condition. • Areas rehabilitated to a grazing land use are resilient, self-sustaining, and comparable to the surrounding undisturbed area.	• Pasture biomass/dry matter productivity measured at rehabilitation monitoring sites equal to, or greater than that measured at reference sites.	• Annual surveys of rehabilitated areas from commencement of mining operations to assess performance of materials against vegetation criteria.
Rehabilitation Social, land use and infrastructure	A	• See above.	• Major macronutrient (N, P, K, and organic C) concentrations in root zone (0 to 600 mm) are equal to, or greater than, those measured at comparable reference sites, and indicate that the soil is capable of sustaining required groundcover levels.	• Soil monitoring against pre-mining data and reference sites.	• Twice yearly surveys of rehabilitated areas from commencement of mining operations to assess soil macronutrients in soils.
Rehabilitation Biodiversity	A, B, C, E, F	• Declared or controlled weed species are identified and controlled.	• Weed diversity does not exceed 110% of baseline survey results. • Weed abundance is comparable to reference sites. • Vegetation in grazing zones (A) is dominated by pasture grass and legume species suitable for grazing.	• Pre-mining flora and vegetation surveys and surveys of adjacent non mining area reference sites.	• Annual surveys post-commencement of rehabilitation activities in an area. • Monitoring to continue until closure criteria met and land returned to landowners.

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Rehabilitation Amenity and environmental quality	All	• Air emissions are controlled during rehabilitation and post closure.	• Air emissions meet PEM requirements for PM_{10}, $PM_{2.5}$, respirable silica and heavy metals.	• Air quality monitoring as per EPA requirements.	• Ongoing monthly monitoring from EES approval.
Rehabilitation Biodiversity Water, catchment values and hydrology	All	• No contaminated water is released from site.	• Surface and groundwater quality reflect original (pre-mining) baseline chemistry.	• Comparison against baseline monitoring data.	• Quarterly monitoring of surface and groundwater sites during operational phase of mining: frequency of ongoing post-closure monitoring to be reviewed in final rehabilitation plan.
Rehabilitation	A	• Adequate dewatering of fine and sand tailings areas.	• Tailings areas are sufficiently dewatered to be geotechnically stable.	• Tailings areas are greater than 70% solids and consolidated.	• On-going three monthly monitoring during operations.

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Rehabilitation Biodiversity Water, catchment values and hydrology	All	• Landform designs to achieve appropriate landform erosion rates.	• No evidence of uncontrolled subsidence or displacement of rehabilitated mine landform surfaces. • Land surface configuration complies with the final landform design including maximum allowed slope angles. • No erosion features incompatible with safe use of the land for agreed post-closure uses: • In areas of natural vegetation, density of rills / gullies and rate of sediment discharge does not exceed that on agreed reference sites. • On agricultural land, erosion features greater than 300 mm deep occupy less than 0.5% of the rehabilitated surface; no gullies greater than 500 mm deep.	• As built surveys and elevation data recorded and used for comparisons. • Visual observation of water ponding and flow paths following rainfall events.	• Twice yearly, with additional inspections following significant storm events (greater than 1 in 10-year event).

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Rehabilitation	All	• Identification and re-shaping of all potentially geotechnically unstable mine waste landforms, embankment structures, or roads.	• Any remaining mine voids or engineered slopes to satisfy relevant requirements of the Occupational Health and Safety Act and associated regulations and will comply with static and dynamic stability criteria defined the project's Ground Control Management Plan. • Ground movements do not result in loss of infrastructure (roads, pipelines) functionality. • Drainage structures (e.g., drop structures) are designed by certified engineer and demonstrated to be stable.	• Results of slope displacement monitoring and road pillar deformation monitoring during and after backfilling. • Results of daily planned, routine visual observations for deformation in road pavements. • Geotechnical monitoring of landforms and structures from completion of landform formation post mining activity. Use of drone aerial photographs and Lidar data to monitor changes. • Inspections show that channel linings, surface armour, engineered drop structures, etc. are in place and functioning.	• Quarterly internal, review of slope stability information, pavement deformation data and other geotechnical monitoring data. • Annual independent review of geotechnical monitoring data.
Rehabilitation	C, D, E	• Implementation of a post mining land use plan which includes discouragement of livestock grazing on newly created (geomorphologically fragile) landforms, flow lines and riparian areas.	• Livestock excluded from geomorphologically fragile areas until closure of areas achieved.	• Livestock access into these areas controlled and monitored.	• Ongoing monitoring from commencement of rehabilitation.

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Rehabilitation	C, D, E	• Develop vegetation cover to minimise erosion.	• Groundcover density achieves and maintains at least 70% of perennial surface cover. • Litter density is comparable with reference sites.	• For native revegetation areas, perennial plant species and groundcover density demonstrate development trends along desired trajectory based on pre-mining surveys and comparable reference sites.	• Annual surveys of rehabilitated areas from commencement of mining operations to assess progress against criteria. • Final compliance audits conducted within five years after completion of rehabilitation activities.
Rehabilitation Biodiversity Water, catchment values and hydrology	C, D	• Design and construction of post mining landforms such that post closure hydrological patterns resemble the pre-mining environment.	• Waterways are kept geotechnically, hydrologically and erosionally stable and are adequately vegetated.	• Inspections using AusRivAs (or an agreed equivalent) to assess the stability, vegetation health and flow regimes of waterways within and adjacent to the project area.	• Twice yearly from start of rehabilitation associated with a waterway.
Rehabilitation Water, catchment values and hydrology	C, D	• As above.	• Surface flows from project area reflect flow patterns of the pre-mining environment.	• Comparison against baseline monitoring data and EES surface water flow modelling.	• Annual monitoring for five years post closure of surface and groundwater sites.

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Rehabilitation Biodiversity Water, catchment values and hydrology	A	• ~~Dewatering of tailings areas prevents groundwater mounding outside of project area.~~ • Management of the return of materials (tailings, overburden) prevents the creation of perched water tables close to the surface.	• During active mining operations, mounding of groundwater is contained below the tailings layers within the rehabilitated landform and within the project area. • At the time of site revegetation, groundwater levels do not extend into the plant root zone (except in low lying areas where pre-mining watertable levels are naturally shallow).	• Monitoring of groundwater levels within and surrounding the project area.	• Quarterly monitoring groundwater levels from authorisation of the EES. • Annually for five years post closure of surface and groundwater sites.
Rehabilitation Biodiversity Water, catchment values and hydrology	All	• Post closure, no contaminated water from the project area enters the surrounding natural environment.	• Surface and groundwater levels and quality reflect original (pre-mining) baseline chemistry.	• Comparison against baseline monitoring data.	• Annual monitoring for five years post closure of surface and groundwater sites.
Rehabilitation Amenity and environmental quality	All	• Rehabilitation to ensure that radiation dose at surface and radon levels in atmosphere is less than or equal to baseline levels found within the project area.	• Average surface radiation levels across site do not exceed background (baseline) for surface radiation levels, radon levels or activity levels with water.	• Radiation surveys at project completion demonstrates that pre-mining background (baseline) levels achieved.	• Annually for the first two years of rehabilitation and then every three years if radiation levels are found to be below baseline levels. • Every three months for surface and groundwater monitoring of radiation levels to account for seasonal variation.

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Rehabilitation	All	• Operational hazardous materials management practices, such as bunding, etc. to be employed during closure process. • See also decommissioning and removal of site infrastructure below.	• Concentration of metals and hydrocarbons in soils to depth of at least 2 m do not exceed average pre-mining concentrations. • All hazardous structures removed from the area or remaining structures made safe; no open voids remain at project completion. • Any remaining toxic materials will be appropriately removed, contained or remediated and do not exceed SEPP guidelines at closure or thereafter.	• Site contamination assessment at project completion.	• At rehabilitation completion.
Social, land use and infrastructure Landscape and visual	All	• Infrastructure will be decommissioned and removed, unless means of legal ownership transfer documentation has been agreed with stakeholders.	• All industrial structures and visually obtrusive elements have been removed from the site unless legal documentation regarding transfer of ownership.	• Decommissioning completion report and regulator site inspection.	• At the completion of mining and processing operations.

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Landscape and visual	All	• Removal of any remaining stockpiles, visual or noise bunds as part of closure plan. • Rehabilitated landform will closely resemble the existing natural landform. Once vegetation is established, the rehabilitated areas are expected to be visually indistinct from surrounding unmined areas.	• Scale and form of remaining mine landforms in respect of surrounding landscape to be audited by an independent suitably qualified person. Audit report included in site relinquishment report.	• Photographic records: comparison with pre-mining landscape.	• At rehabilitation completion.
Rehabilitation Biodiversity Water, catchment values and hydrology Amenity and environmental quality Social, land use and infrastructure Landscape and visual	All	• Application of current mining industry rehabilitation techniques suitable to the site conditions and constraints of the post-mining environment. • Effective resourcing of annual update to Closure Cost Estimate. • Establishment of a cross functional closure planning KPI for the mine site. • Effective resourcing of Triannual rehabilitation plan update. • Effective resourcing of post-closure management and preparation of the final Relinquishment Report.	• Closure planning KPIs and targets are met on an annual basis. • Financial provisioning for mine rehabilitation is adequate for remaining closure works (including post-closure monitoring and maintenance). • Legal transfer of liability for any ongoing maintenance works including if required any Trust Fund arrangements.	• Annual review of rehabilitation and closure provisioning; three yearly independent audit of closure provisioning. • Acceptance of relinquishment by regulators or landowners based on agreed closure criteria.	• From commencement of operations.

Evaluation objective Aspect/s addressed	Zone	Closure Target	Closure Criteria	Measurement tool (data or observations that will be used)	Timeframes (frequency of measurements)
Rehabilitation Biodiversity Water, catchment values and hydrology Amenity and environmental quality Social, land use and infrastructure Landscape and visual	All	• Effective community and stakeholder consultation throughout the project life to ensure that all opinions/requests/commitments/legal liabilities are recorded and responded to.	• Closure planning recognised as a Corporate KPI until final lease relinquishment. • Financial provisioning for mine rehabilitation is adequately covers any remaining external land owner compensation claims. • Inclusion of the detailed stakeholder consultation register within the Final Relinquishment Report.	• Implementation of the stakeholder consultation plan throughout project life. • Continuous up-dating of stake holder consultation register.	• From EES onwards.
Rehabilitation Biodiversity Water, catchment values and hydrology Amenity and environmental quality Social, land use and infrastructure Landscape and visual	All	• Implementation of the stakeholder consultation plan throughout project life.	• Legal transfer of liability for any ongoing maintenance works including if required any Trust Fund arrangements. • Earth Resource Regulation acceptance of Final rehabilitation plan and application for surrender of mining lease. • Legal acceptance by post mining landowners.	• Continuous updating of stakeholder consultation register.	• From EES onwards.

8 IDENTIFICATION OF REHABILITATION AND CLOSURE RISKS

Kalbar has interpreted 'risk' to mean those factors that could affect the reliable attainment of agreed rehabilitation outcomes or objectives.

This section has focussed on the key risks and mitigations relevant to mine rehabilitation and closure. The complete risk assessment of the construction , operation, and closure of the project is provided in the Draft Work Plan and associated Risk Management Plan. Appendix A of this document provides a summary of risks and mitigation measures relevant to mine rehabilitation.

8.1 Key project rehabilitation and closure risks

Key issues and potential impacts have been identified that relate to the risk of not achieving successful closure of the project, including the risk of not meeting one or more of the closure targets. Issues and impacts have been identified and assessed through ongoing stakeholder engagement, specialist studies, other investigations and field trials.

This section is focused on key issues and impacts that affect closure success. Other issues and potential impacts that are not critical to closure success, but are still relevant to decommissioning and rehabilitation activities more generally and to the closure phase of the project are addressed in detail in the Draft Work Plan.

Key issues and potential impacts that could influence the successful closure of the project relate to:

- The presence of any contamination in soils used for rehabilitation, including from hazardous materials, or the presence of radionuclides or heavy metals in the post-mining landform.
- Erosion (loss) of soils from surface flows of runoff water on the post-mining landform.
- Failure of vegetation to establish on the post-mining landform and/or poor growth of vegetation once established.
- Geotechnical issues including:
  - Collapse or deformation of mined slopes
  - Collapse or deformation of road pillars
  - Liquefaction
- Rehabilitation and closure execution risks
  - Dust
  - Bushfire
  - Radiation exposure during decommisssioning

Key socioeconomic impacts during mine closure relate to the loss of income and employment. As the project transitions from operation to closure, opportunities associated with the supply goods and services to the project and employment will decline. Unplanned closure would result in the loss of employment and income for businesses supplying goods and services to the project. This may occur temporarily or permanently. Socioeconomic issues and potential impacts are discussed in detail in Socioeconomic impact assessment chapter of the EES.

8.1.1 Soil contamination

8.1.1.1 Hazardous materials

Soils could become contaminated over the life of the project through accidental leaks or spills of hazardous materials such as diesel, oil, hydraulic fluids and chemicals. Contaminated soils will affect the ability of vegetation of establish on the final landform. Measures will be implemented throughout the project to prevent leaks or spills from occurring and to effectively clean up any contaminated soils should an accidental release occur. Any unexpected or previously unknown areas of contaminated soils encountered during rehabilitation, decommissioning and closure will be remediated so as not to adversely affect plant establishment.

8.1.1.2 Radionuclides and heavy metals in post-mining landform

The radionuclide content of surface soils south of Bairnsdale–Dargo Road fall within or below the global average radionuclide content of surface soils for uranium, thorium and potassium. This result indicates soils in this area do not have elevated levels of these radionuclides. The radioactivity in the coarse and fine tailings are similarly low levels. Following mining of the ore and rehabilitation, the levels of radioactivity of the ground surface will be less than pre-mining levels.

For the material to be returned to the mine void, the uranium activity concentrations range from 0.12~~0~~ to 0.18 Bq/g. This range is generally lower than the radioactive concentration of uranium in surface soils north of Bairnsdale–Dargo Road of 0.08 to 0.66 Bq/~~k~~g. The thorium activity concentrations in the material to be returned to the mine void range from 0.28 to 0.40 Bq/~~k~~g. These levels are generally lower than the radioactive concentration of thorium in surface soils north of Bairnsdale–Dargo Road of 0.12 to 1.23 Bq/~~k~~g, which is due to the presence of subcropping ore. [1]

Testing samples of materials to be used in rehabilitation found low levels of all heavy metals in coarse sand tailings, which is consistent with a material largely, if not completely, composed of quartz grains. Low levels of metals were found in fines tailings, except for arsenic. Fines tailings had a concentration of arsenic of 45 mg/kg, which is within the soil background range of 1 to 50 mg/kg reported by the National Environment Protection Council's Guideline on the Investigation Levels for Soil and Groundwater. The concentration of arsenic in fines tailings was above the ecological investigation level of 20 mg/kg, but below the health investigation level of 100 to 200 mg/kg reported in the same guideline.

Fines tailings, which will be in the form of a centrifuge cake, will be ~~either buried (encapsulated) or mixed with~~placed together with overburden in the mine voids ~~or sand tailings to form subsoils,~~ significantly reducing the average concentration of arsenic in such mixes. ~~Encapsulated fines tailings will be covered by at least 3 m of overburden, manufactured subsoil and topsoil.~~

8.1.2 Erosion of soils

Erosion, of either surface soils or subsurface soils (tunnel erosion) can cause significant loss of soils from an area, create land instability (including through tunnel erosion) and lead to increased turbidity and sediment entering waterways. The factors affecting erosion risk have been considered in the design and planning of the final landform and the preparation of the closure strategy.

8.1.2.1 Surface erosion

The valley slopes and flow channels in the project area have the most potential for erosion compared to the plateau and swales. The key risk factors for the valley slopes are their relatively steep gradients and occurrence of grazing, which reduces surface vegetation cover and disturbs surface soil. Undercutting at the bottom of valley slopes is also a potential issue in some areas. The key risk factors for flow channels are the infrequent but large flows, lack of riparian vegetation, and disturbance caused by grazing to soils and vegetation cover.

Erosion leads to soil loss with the rate of loss determined by the erosive strength (erosivity) of rainfall events (high intensity rainfall is generally more erosive), the stability of soils (erodibility), and the steepness and length of slope and vegetation cover. Farming activities, such as mechanical ploughing on the contour of a slope, can also affect the amount of soil lost within an area.

~~1~~

The overall plateau dimensions and distances that drainage (surface water) will move through the various flow channels will be similar to the pre-mining landform. Careful design of the landform will ensure that the gradients constructed will not exceed the gradient of the correlated lcation in the pre-mining landform.

The post-closure land use zone with highest gradient (and highest associated erosion risk) is Zone C (valley slopes). Gradients in this zone are planned to be largely the same or less steep than those currently present, reducing the erosion risk relative to existing conditions. Erosion resistance will be increased in Zone C relative to pre-mining levels of surface cover through including rock into the surface soil, excluding stock and using higher densities of trees and shrubs. The higher vegetation densities provide a range of benefits such as increased root mass in the soil, higher rates of infiltration of runoff water, reduced rates of seepage through valley slopes, and accumulation of surface leaf litter.

Rehabilitated Channels (Zone D) will be designed to be less prone to erosion by the design of drainage paths as broader, U-shaped features. They will also be protected from erosion by inclusion of gravel and boulders into the stream bed, early establishment of revegetation, and widening of the valley floor in the design process. In addition a revegetation programme for revegetation of all gullies downstream of mining activities will be commenced at the first autumn or winter after environmental approval.

The Revised Universal Soil Loss Equation (RUSLE) (Renard et al, 1997) is well supported by research and is used widely across Australia for assessment and management of erosion. It has been used for this project to provide an objective argument that the rehabilitation program planned will provide the same or greater landform erosional stability after mine closure.

The equation is:

$$A = R \cdot K \cdot L \cdot S \cdot C \cdot P$$

where A is the average annual soil loss (in t/ha/year), R is the average annual rainfall erosivity factor, K is the soil erodibility factor, L is the slope length factor, S is the slope steepness factor, C is the cover management factor and P is the support practice factor.

Broadly, for pre- and post-mining landforms, R (rainfall erosivity factor) will be unchanged (or at least, not changed by mining) and K (soil erodibility factor) will be largely unchanged as the same topsoil layer will still be present on the soil. Within the RUSLE, the practice factor P is largely used to describe effects of tillage on the contour, so is not relevant to minesite rehabilitation.

That leaves factors L (slope length factor), S (slope steepness factor), and C (cover management factor) that may be altered by mining and rehabilitation.

As discussed above, it is planned to increase surface cover and rock in the soil (thereby reducing the factor, C) in the valley slope areas of Zone C where the erosion risk is highest.

Consequently, that leaves the LS factor combination as an indicator of potential changes in erosion potential due to changes in landform from pre- to post-mining. Mapping of LS factor[7] distribution on pre- and post-mining landforms shows that the post- mining landform will not result in any increases in LS in the steeper areas of highest erosion potential (Figures Figure 8-1 to Figure 8-4). Consequently, the assessment (based on well- established and accepted methodology) demonstrates no increase in erosion risk due to the contours of the proposed final rehabilitated landform.

Given that the project area (including the highest risk Valley Slope zone) is currently largely stable, it can be concluded that the planned changes in landform, vegetation, and surface management will all deliver increases in the erosion stability of the area.

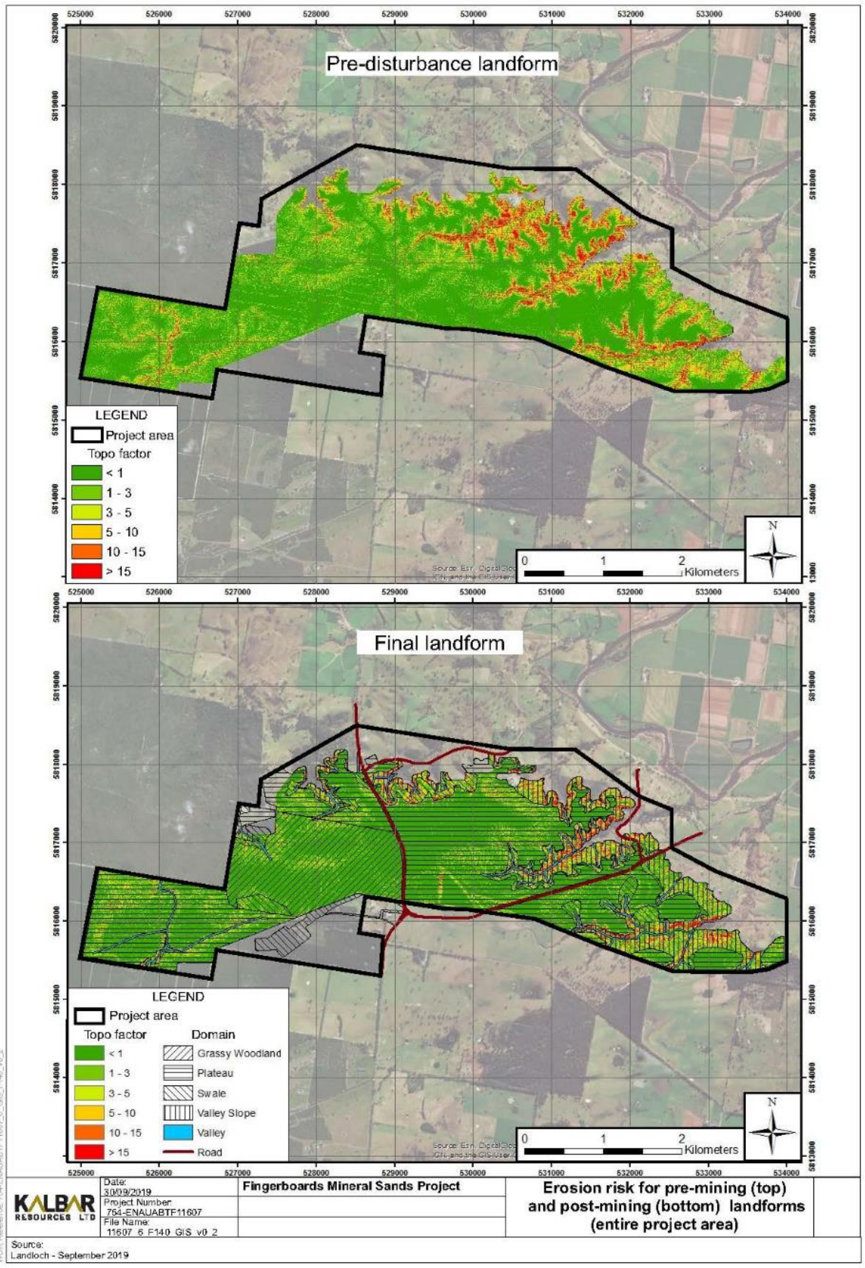


Figure 8-1: Before and After Erosion Risk – Overview.

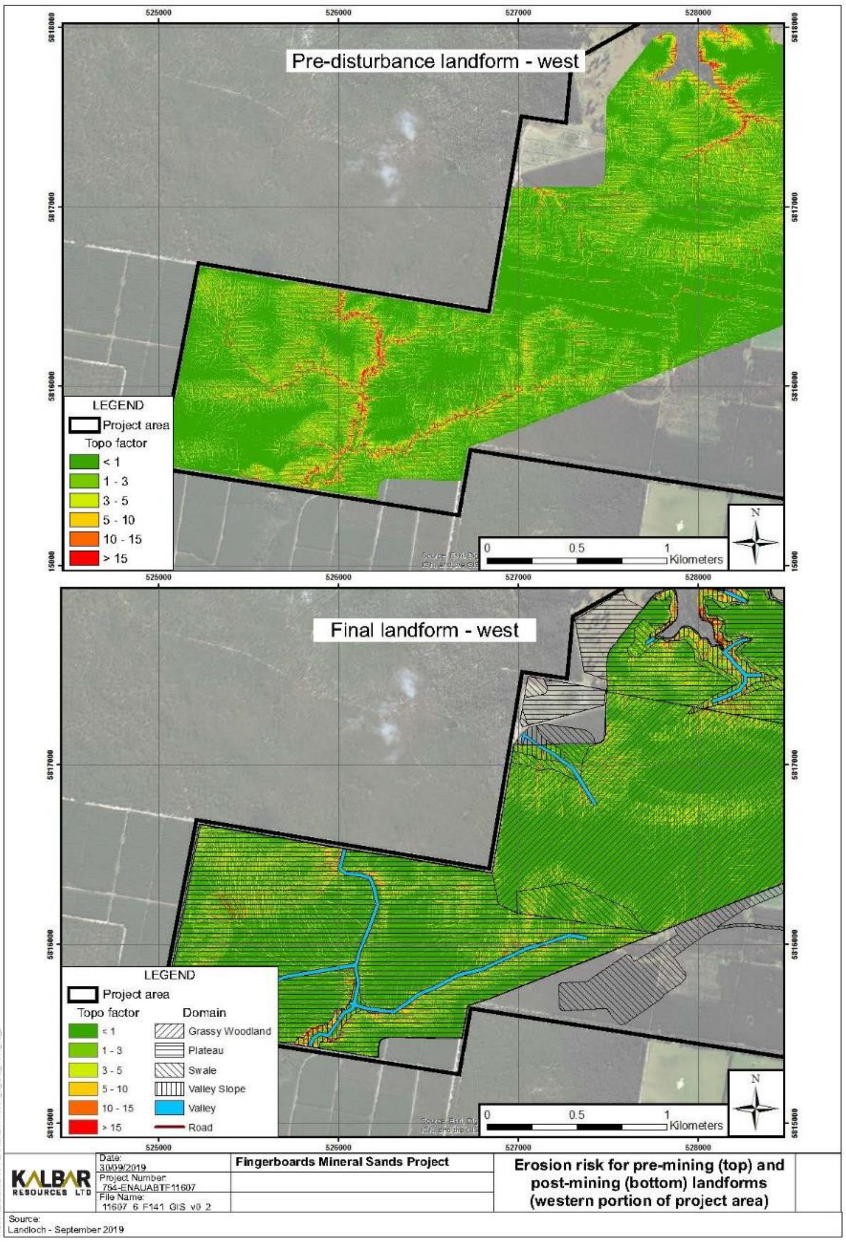


Figure 8-2: Before and After Erosion Risk – West.

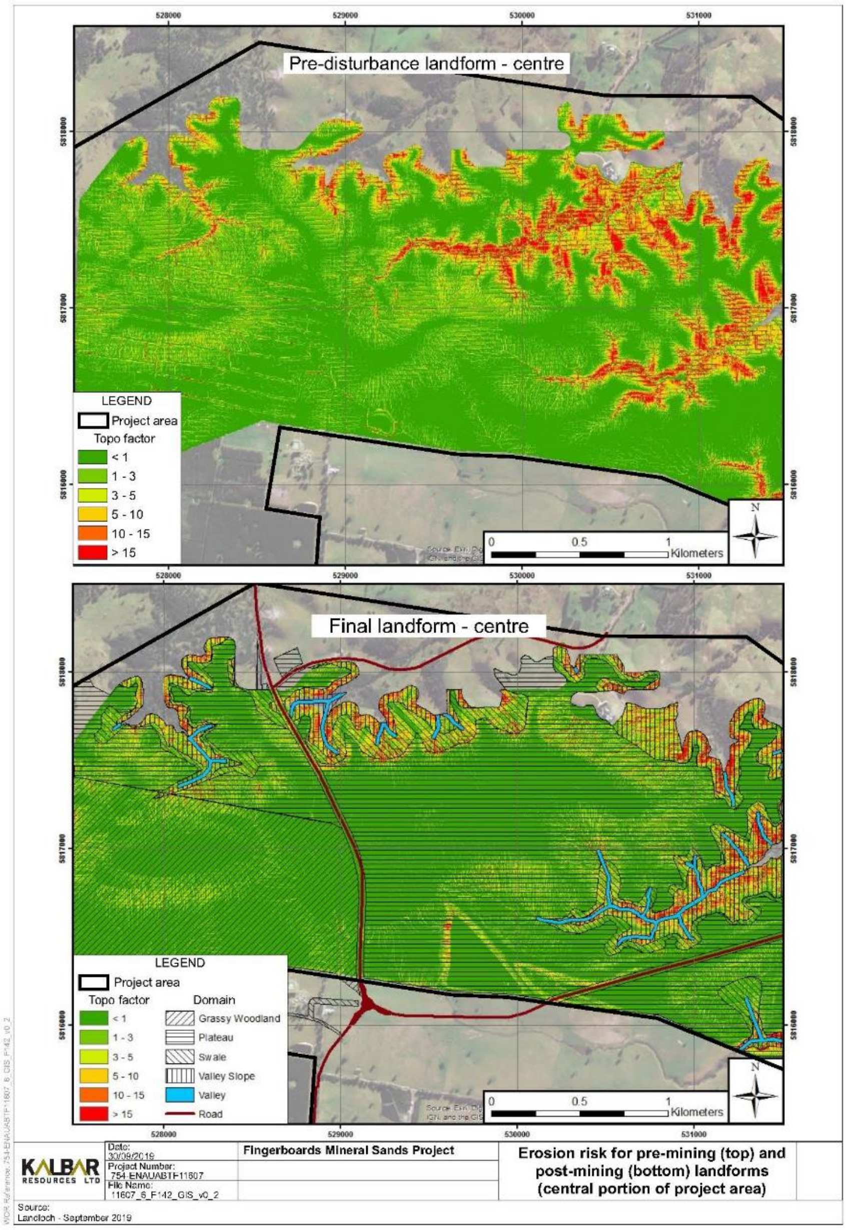


Figure 8-3: Before and After Erosion Risk – Centre

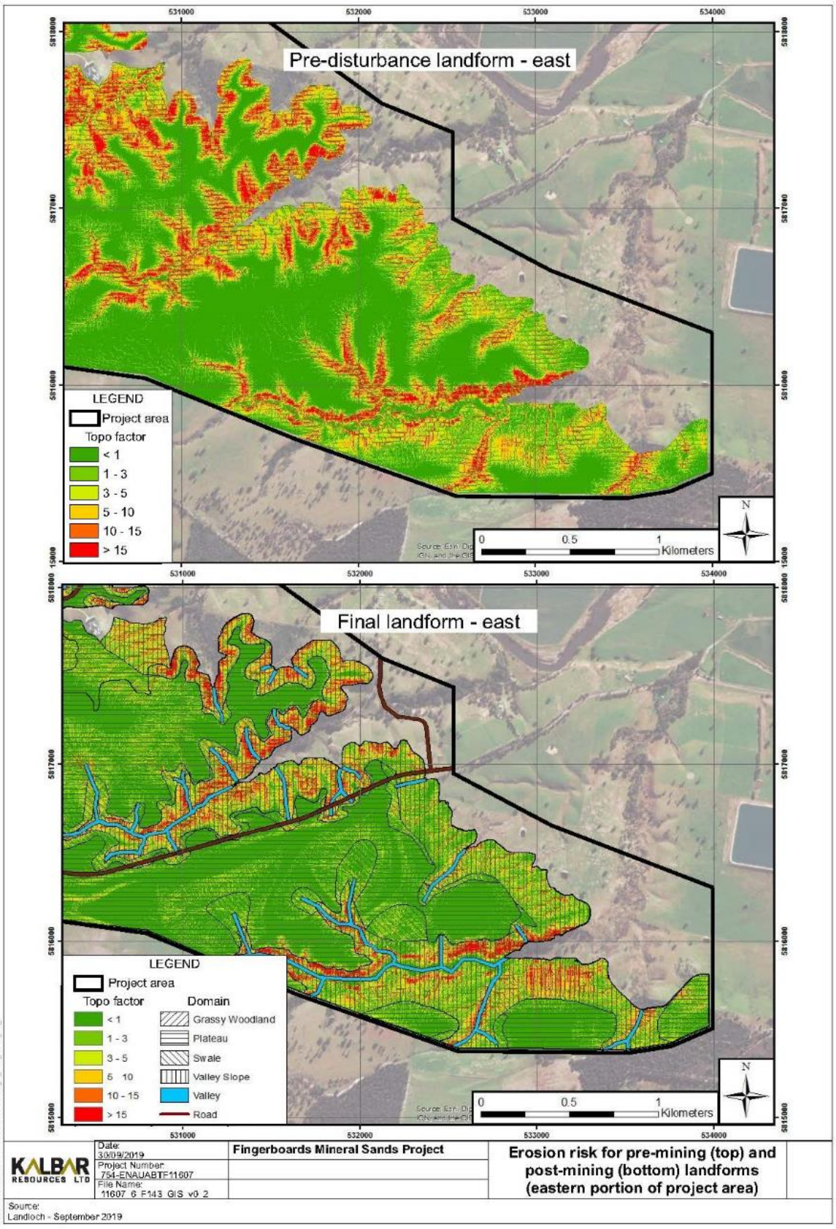


Figure 8-4: Before and After Erosion Risk – East

8.1.2.2 Tunnel erosion

The types of soils present in the project area, and the gradient of slopes in the areas in which they occur, generally do not favour the development of tunnel erosion. The sodosols are most likely to be susceptible to this type of erosion as they are strongly layered, and with unstable subsurface components. The layered surfaces provide a way for seepage flows to move through the subsurface. Sodosols mostly occur on the low-gradient plateau top, reducing the risk of tunnel erosion occurring. The podosol soil type that dominant areas with higher gradients have a low risk of tunnel erosion as they are not strongly layered and are largely sandy soils.

Tunnel erosion requires a point in the landscape at which a relatively large volume of water enters the soil. Soil profiles and the revegetation planned for each post-closure land use zone in the post-mining landform aim to maximise water use through increasing surface vegetation cover, tree densities and the overall ability of the soil to store water. Tunnel erosion also requires a soil layer that will be readily moved in the seepage flow. Potentially dispersive (unstable) soils (such as overburden ~~or fines tailings~~) placed as part of a constructed subsoil will be treated with gypsum or equivalent. Treatment will be over a thickness of at least 500 mm and will reduce exchangeable sodium and magnesium to levels that reduce the dispersive risk.

A 300 mm topsoil layer will be placed over the manufactured subsoil will provide a total effective depth for plant roots of at least 800 mm. Topsoil and subsoil will be ripped (mechanically broken up) to remove any pronounced layering to eliminate the interface along which water can move. Revegetation will minimise the volume of seepage flows that reaches valley slopes and channels through increasing the density of deep-rooted species (trees and shrubs) to minimise the potential for seepage flows to exit in such areas.

8.1.3 Poor or failed vegetation establishment or growth

Successful rehabilitation relies heavily on vegetation becoming established, and continuing to grow, in the planned densities and species mix.

Poor establishment and performance of areas of rehabilitated pasture may lead to diminished use and value as grazing land. Prolonged dry conditions with evaporation of water occurring at higher rates than incoming rainfall will reduce soil moisture and adversely affect pasture establishment and productivity. Selection of pasture mixes will be critical in maximising pasture productivity.

Failure or poor performance of revegetation can occur due to several factors as described below.

8.1.3.1 Poor viability of seed

Plant seeds will be collected locally to provide material for use in revegetation of areas to be returned to native vegetation. The viability of such locally-collected seed can vary due to factors such as the how and when (time of year) it is collected. Some areas of the final landform will be seeded directly with locally collected seed. The seed will be tested for viability prior to use.

8.1.3.2 Delayed or failed establishment of vegetation from seed

Delayed establishment of vegetation from seed may occur due to prolonged dry conditions or a drought. Seed will remain viable in the soil and will establish once rainfall occurs. Delayed establishment typically has no significant impact on rehabilitation outcomes where surface erosion (by water or wind) is not a significant risk.

Establishment failure typically occurs when a rainfall event triggers germination, but subsequent prolonged dry conditions result in death of the germinated plants. In such cases, reapplication of seed at a later date (when suitable rainfall is considered more likely to occur) will resolve the issue with no significant damage or site deterioration due to delayed vegetation establishment. Establishment failure can also occur due to predation of seeds and/or young seedlings by insects.

In areas where the risk of erosion (by water and/or wind) is higher, hydroseeding (applying seed with a tackifier, which is a chemical compound used to increase stickiness) can be used to stabilise the soil surface and minimise erosion. Hydromulches can also be used to prevent erosion and retain ~~rainfall~~ moisture longer so it becomes more available to germinating seeds. In some cases, supplemental irrigation can be provided.

8.1.3.3 Poor growth due to unsuitable soil chemistry or physical parameters

Soils in the project area provide low to moderate productivity for grazing and are generally unsuitable for many other agricultural uses. The soils have several inherent limitations to plant growth, including acidity, sodicity, low water holding capacity, and deficiencies in phosphorus, potassium, boron and copper (refer to Section 11.3.3).

Most of these limitations can be addressed using established soil management and agronomic approaches. These include adding fertilisers to address nutrient and mineral deficiencies and lime and gypsum to address pH and potential cation imbalances (imbalances in the ratio of cations, such as calcium, magnesium, sodium and potassium, which can result in soil structural problems). Where available, organic material can be incorporated to increase soil organic matter and provide nutrients in more slowly-available forms.

If the soil has not been managed to ensure a suitable growing environment for revegetation, then the chances of failure are increased. The growing medium must be relatively free of weeds and have a suitable water holding capacity and fertility for the proposed revegetation. Mixing of topsoil with other soil substrates that contain undesirable chemical or physical properties may result in unfavourable conditions that hinder seed germination and plant growth.

The suitability of topsoil for revegetation will be maximised where required by spreading ameliorants such as lime, organic mulches, and fertilisers on these soils prior to stripping. Surface grasses will be retained and mixed in with topsoil during the stripping process. A manufactured subsoil will be used to augment topsoil to provide a more productive medium for plant growth in rehabilitated landforms. The subsoil will be a mixture of overburden ~~and~~ or coarse sand ~~or~~ with fines tailings, at a ratio to be determined. This may also include organic amendments. Specific mixtures will aim to increase the water and nutrient holding capacity and decrease hardsetting tendency of the subsoil.

8.1.3.4 Grazing and damage by pests, livestock and native animals

Vegetation in rehabilitated areas will also certainly require protection from grazing pests, livestock and native animals. The level of protection needed will be assessed in each area and suitable measures applied once revegetation works have commenced. The strategies adopted in each location, and over time, will be flexible enough to adapt to the presence of different animals, fluctuating populations and variations in weather from year to year.

8.1.3.5 Restriction of deep drainage

Deep drainage may be restricted due to hardsetting of backfilled fines tailings. This has the potential to affect deep rooted perennial pastures, trees and shrubs by creating waterlogged soils and perched watertables within the soil profile.

8.1.4 Geotechnical risks

Geotechnical risks including instability, deformation and liquefaction of the rehabilitated landform has the potential to impact on human safety, and the surrounding environment and infrastructure. Disturbing the landform through removing topsoil, overburden and the target ore, followed by the placement of tailings, overburden and topsoil back into the mined areas will need to be managed to ensure these risks are reduced as far as practicable.

The geotechnical risks described below relate to both operation and closure phases of the project, as both phases will take place concurrently and affect one another. Actions taken during operations, such as mining within acceptable slope tolerances and monitoring surface water ponding, will impact on the geotechnical stability of the final rehabilitated landform.

8.1.4.1 Collapse or deformation of mined slope

The collapse or deformation of a mined slope during operation or closure could occur due to several factors including inadequate mined slope design, slope not mined to design, slope being steepened or undercut by surface water, water infiltration from perched watertables or surface water changes to groundwater pressure unknown, weaker or variable ground conditions, or an earthquake. If a mined slope was to collapse completely or partially, or deform, adjacent to an existing road or a private property, it could impact on the road or private property, as well as on human safety and the surrounding environment.

8.1.4.2 Collapse or deformation of road pillar

The collapse or deformation of a road pillar, either completely or partially during operation or closure could occur due to inadequate road pillar design, the road pillar is not constructed to design, the road pillar is steepened or undercut by surface water, water infiltration from perched water tables or surface water changes groundwater pressure, unknown, weaker or variable ground conditions, or an earthquake. If a road pillar was to collapse completely or partially, or deform, adjacent to an existing road or a private property, it could impact on the road or private property, as well as on human safety and the surrounding environment.

Other than earthquake, the remaining factors are all avoidable by management measures and geotechnical drilling and evaluation. Kalbar has already commenced geotechnical testwork and studies in road pillar construction.

8.1.4.3 Liquefaction

Liquefaction, whereby ~~the landform~~ a granular material (such as soil or tailings) loses its strength and stiffness due to a sudden change in stress conditions~~an earthquake~~ is a risk to the stability of the rehabilitated landform, including mined slopes and road pillars, particularly if the tailings returned to the mine void are not adequately dried and confined. If liquefaction occurred, it could potentially impact human health and safety, as well as the surrounding environment and infrastructure.

The likelihood of liquefaction occurring is rare, however the consequences in some circumstance are extreme or major. ~~Tailings will be dried and covered by overburden to confine them.~~ If liquefaction was to occur, the stability of the landform does not depend on the strength of the tailings and the overburden encapsulating the tailings would allow the landform to remain stable. Accordingly, receptors outside the pit void (for example, public infrastructure or watercourses) are unlikely to be at risk of significant impact.

8.1.4.4 Differential Settlement of Landform

Differential settlement of the reconstructed landform following construction and rehabilitation could create areas of ponding or diversion and concentration of overland flow. S~~and tailings s~~ettlement of backfilled tailings will be largely complete before local overburden placement ends. ~~The material with the highest potential for post rehabilitation settlement is the fine tailings however, settling of fine tailings will be largely completed due to the time delay between tailing completion and topsoil placement.~~ Fines tailings will have minimal settlement risk as the tailings have been dewatered to a stable cake before placement into the mine void.

Nonetheless, as it is essential that surface runoff on the final landform drains evenly, with no areas of ponding and minimal diversion and concentration of flow at any point, initial rehabilitation works should:

- Plan landforms with consideration of the as placed and final settlement of each component, the final landsurface will, on average, be approximately 1.3m higher than the original.

- Monitor surface elevation change for a minimum of 1 year following rehabilitation works; and
- Use the measured amount of settlement to adjust the settlement parameter and establish guidelines for material placement for future rehabilitation works.

~~Areas without fine tailings, especially road pillars, will undergo reduced post placement settlement. Landform placement design will require lower initial elevation of the landform in these areas.~~

8.1.5 Execution Risks

Rehabilitation activities can cause significant impact with subsqent exection risk if non compliant. The key risks of this type are considered dust generation, bush fire and handling of potentially dangerous substances during decommissioning.

~~Slower than expected consolidation of fine tailings could delay rehabilitation, but impacts would be modest. The inherent control is the use of assisted mechanical consolidation screw driven pontoon boats. This system makes the consolidation of fine tailngs considerably faster and more consistent by reducing the reliance on drying weather. Mineralogical studies show that the clays are kaolinitic and compose less than 25% of the snandy-clayey-silt. These studies, particle size analysis, and comparision to performance of close operational analogies all indicate that the Fingerboards fine tailings will respond well to assisted mechanical consolidation. Comparable operational analogues reach target consolidation in 4 to 6 weeks using the method and the upper end of this range has been used for setting of tailings storage areas.~~

8.2 Risk mitigation

Proposed mitigation to address the potential impacts listed in Section 8.1 relating to closure are set out below. Unique alphanumeric identifiers included in parentheses are derived from the mitigation register presented in the Draft Work Plan.

Contamination of soils

- Areas used for handling and/or storage of hazardous materials will be appropriately bunded and contain spill response equipment (RH17, TE41).
- Hazardous materials will be managed (including storage, handling, transport and disposal) in accordance with relevant Safety Data Sheets (RH18).
- Mobile plant and vehicles will be maintained regularly and in accordance with manufacturers specifications. Maintenance will include inspections for leaks and spills (RH19).
- If a leak or spill occurs, contaminated soil will be excavated and disposed of at a licensed facility (RH32).
- Personnel will be trained in management of hazardous materials and spill response procedures prior to commencement of work (RH20).
- Triple interceptor traps will be used to prevent releases of hazardous materials from bunded areas (RH31).
- Operation of the project in accordance with a management licence covering radiation safety-related aspects of the project in accordance with the provisions of the Radiation Regulations. The licence is likely to include compliance with the Radiation Protection Series No. 9 as a condition. This Code of Practice requires the development and implementation of a radiation management plan for all operation, which must be developed in accordance with the specific requirements of the Victorian Department of Health and Human Services and take into account any special conditions or exemptions from specific provisions of the Radiation Regulations that might apply to the project (RD05).

Erosion and increased turbidity and sediment deposition in waterways

- The mine void will be progressively backfilled and rehabilitated to minimise the area required for topsoil and overburden stockpiles (AQ07).
- Construction of stockpiles will be designed to avoid flow pathways to minimise erosion (RH04).
- Rocks will be included in rehabilitated channel beds to increase critical shear of the bed and resist initiation of scour, thereby increasing channel stability to storm flows and minimising erosion (RH06).
- Rehabilitation will be designed to ensure plateau tops are close to level and evenly distribute runoff to drainage paths (swales) discharging off the plateau to adjoining major flow channels. Swales will be designed to be broad, U-shaped, no steeper than current stable drainage paths, and consistent in shape with the most stable drainage paths currently present (RH07).
- Riparian vegetation will be established in rehabilitated flow channels to increase effective hydraulic roughness of the channels, thereby reducing flow velocities, increasing channel stability to storm flows and minimising erosion (RH08).
- High rates of vegetation establishment will be prioritised in rehabilitated flow channels (especially in the first three years of rehabilitation) to maximise surface cover and minimise erosion (RH09).
- Hydromulches or tackifiers will be used where appropriate to prevent erosion and ensure more effective use of incident rainfall by germinating seeds (RH11).

- Hydroseeding will be used in rehabilitation areas where appropriate to stabilise the soil surface and minimise erosion (RH12).
- Seeding times and rates will consider site/local experience to ensure maximum reliability of vegetation establishment. Seed will be re-applied in areas where rehabilitation performance does not meet established targets at a later date when suitable conditions, e.g. rainfall, are considered likely to occur (RH13).
- Stockpiles will be vegetated where appropriate to minimise erosion (RH22).
- Stockpile slope angles will be constructed as low as practicable and mulch materials and contour ripping will be strategically used to stabilise stockpiles, prevent runoff and minimise erosion (RH23).
- The density of deep-rooted trees and shrubs will be increased in areas at risk from tunnel erosion by minimising the volume of seepage flows reaching valley slopes and channels (RH24).
- Grazing will be excluded in rehabilitated flow channels to maintain sufficient levels of vegetation cover on the surface of the channel bed and prevent disturbance of soils by trampling by livestock, thereby increasing channel stability to storm flows and minimising erosion (RH25).
- Topsoil stockpiles scheduled to be in place for four months or longer (or for an unknown duration) will be restricted to a height of 2 m and treated with soil stabiliser, or revegetated immediately following their construction (RH26).
- Tree densities in areas planned for grazing land use, particularly in swale areas, will be increased to reduce deep drainage and seepage flows, and to maximise erosion stability (RH27).
- Gypsum or equivalent, will be applied in sufficient quantity over a depth of at least 500 mm to reduce exchangeable sodium and magnesium to acceptable levels (ESP <4 and Ca/Mg ratio >0.5) where material likely to disperse (such as Haunted Hills Formation overburden or fines tailings) is placed as part of a constructed subsoil (RH28).
- Revegetated areas will be fenced (electric fencing with multiple closely spaced tapes) to prevent damage by stock or kangaroos, where cost-effective to do so (RH29).
- Where practical, undisturbed water will be diverted around disturbance areas. (SW24)
- The design and placement of infrastructure in the project area will consider potential for flow accumulation and increased flood risk. (SW02)
- Erosion within gullies will be controlled using primary and secondary sediment traps constructed at appropriate sites. Catchment water onsite will be retained to approximately 10% annual-exceedance-probability. All site drains will be designed and profiled to reduce water flow velocity, to reduce erosion. (SW04)
- If required, bed instability will be addressed though appropriately designed grade controls, such as the use of rock chutes. (SW07)
- All stream bed instability areas will be inspected prior to, and annually during construction to ascertain a rate of movement and potential risks posed to mine infrastructure. (SW08)
- Surface water management infrastructure designed to capture run-off (and eroded sediments) will be maintained until such a time that vegetation is fully established and stabilising the landscape.(SW09)
- The fresh water storage, process water, contingency water and water management dams will have design storage allowance for a 1 in 100-year average-exceedance probability, 72-hour storm event. (SW11)

- The project will recover and reuse water where practicable (such as run-off from ore stockpiles and water recovered from in-pit tailings storage)~~and supernatant water from the TSF and tailings area within the mine void)~~ (SW23)
- Permanent and long-term drains and bund walls will be topsoiled and vegetated with suitable vegetation as soon as possible. (SW39)
- Appropriate outlet scour protection will be placed on all stormwater outlets, chutes, spillways and slope drains to dissipate flow energy and minimise risk of soil erosion.(SW30)
- Ephemeral drainage gullies will be revegetated in areas downstream of future mining activities prior to operations commencing (SW34)
- Appropriate erosion and sediment control strategies will be implemented to prevent gully erosion in areas adjoining the project footprint (TE23).
- No-go zones will be established around waterbodies adjoining the project footprint to prevent any disturbance to the biodiversity values present within these areas (TE24).
- Strategies to control sediment runoff (and reduce the potential for increased turbidity in downstream aquatic habitats) and reduce the potential for spills will be implemented during construction and operations (TE25).
- Management techniques, such as underdrains, sumps and water recovery pumps will be used to maximise the recovery of water in the mine void tailings containment cells. (GW15)

Poor or failed vegetation establishment or performance

- Progressive rehabilitation to return land to pre-mining or agreed land use capability and productivity (RH05, VL05).
- Management of grazing, as follows:
  - Larger plants that are less susceptible to grazing damage will be used in rehabilitation areas where possible (RH15).
  - Revegetation will be conducted over as large an area as possible at one time to spread potential impacts of animal grazing over larger areas (RH30).
  - Scheduling planting of tubestock to maximise initial growth, including in spring to take advantage of warmer growing conditions, or in autumn to take advantage of the wet winter (RH33).
  - Rehabilitated areas will be irrigated where required to promote satisfactory performance and vegetation establishment (RH14).
  - Guards will be placed on tubestock where required to prevent damage by rabbits, cockatoos and other pest animals (RH16).
  - Spreading seed to achieve a stem density significantly higher than the target to allow for losses due to animal damage and other causes, with thinning at a later date to achieve the target number of stems per hectare, particularly in areas where a higher (moderate) density of trees is proposed and where there is inclusion of understorey species (RH34).
  - Revegetated areas will be fenced (electric fencing with multiple closely spaced tapes) to prevent damage by stock or kangaroos, where cost-effective to do so (RH29).
- Seeding times and rates will consider site/local experience to ensure maximum reliability of vegetation establishment. Seed will be re-applied in areas where rehabilitation performance does

not meet established targets at a later date when suitable conditions, e.g., rainfall, are considered likely to occur (RH13).

- Rehabilitation activities will be timed in consultation with landholders and based on analysis of long-term rainfall patterns to maximise the rate of successful vegetation establishment and rehabilitation performance. (RH10)
- Hydromulches or tackifiers will be used where appropriate to prevent erosion and ensure more effective use of incident rainfall by germinating seeds (RH11).
- Site inductions will include information on the different soil types present across the project area and their corresponding management, including in relation to stockpiling (RH02).
- Where possible, ameliorants such as organic mulches and fertilisers will be spread on in-situ topsoils prior to stripping to increase soil fertility (RH21).
- Fines (centrifuge cake) will be blended with coarse sand tailings and placed so as to ensure any restrictions to drainage are far enough below the soil surface such that the growth of vegetation is unaffected ~~tailings will be placed at depth in the backfilled mine void to ensure any restrictions to drainage are far enough below the soil surface such that the growth of vegetation is unaffected~~ (RH03).
- Revegetation of mined areas will include planting of a range of locally occurring native shrubs, trees and groundcover plants in consultation with DELWP to recreate the target vegetation community. (TE11)
- Biosecurity procedures will be implemented to avoid introducing and spreading weeds, pests and diseases into the project area and surrounding areas. (TE45)
- Disturbed areas will be revegetated to increase habitat value and visual amenity while reducing the likelihood for establishment and proliferation of weeds. (TE46)
- Revegetation of mined areas will include management of weeds and pest animals. (TE47)
- Areas will be revegetated following the mine rehabilitation plan, to: Increase overall native vegetation cover in the project area. Increase native vegetation patch size (TE9)

Geotechnical

- Undertake rigorous geotechnical design methodology using all available information and account for variability and uncertainty (GEO01).
- Undertake slope stability and displacement monitoring of mine slopes adjacent to roads using one or a combination of:
  - Survey targets (prisms) located on mine slopes and read by a robotic total station (RTS) from various fixed survey pillars.
  - Radar, for safety-critical situations where a rapid response may be required (GEO02).
- Undertake daily visual assessments around mining areas near infrastructure, including checks for signs of deformation (e.g., cracks, compressional ridges), over steepening of slopes and poor management of surface water (e.g., pooling) (GEO03).
- Ensure that all mined slopes adjacent to infrastructure are surveyed and verify that they have been mined within acceptable tolerances of specified slope designs (GEO04).
- Incorporate surface water run-off controls into mine designs, including:
  - Prevent uncontrolled ponding of surface water from rainfall within the specified stand-off distance from slope crests. Controlled ponding and re-direction should be used where topography makes it difficult to re-direct water from areas and drains along edges of roads.

  - Prevent any surface water run-off over mine slopes with crest windrows, including no ponding behind the windrows.
  - For the 5 m berm in mine slopes, if necessary, collect any rainfall run-off and any seepage water in drains along the toes, and re-direct it down the slope via a lined drain to the pit floor. Review these water controls in the early stages of mining.
  - Manage water storage and ponding areas on the pit floor well away from slope toes, and away from areas that will form foundations for road pillars (GEO05).
- Undertake visual assessments of water controls on a regular basis, and after rainfall, to ensure that any ponding, seepage or run-off meets design specifications (GEO06).
- Account for earthquake motion (acceleration) in mine slope designs (GEO07).
- Undertake visual assessments of excavations for any variability of expected geological conditions, with particular focus on weaker than expected materials or features (GEO08).
- Ensure that excavation visual assessments are routinely completed by an experienced geologist or mining engineer with some geotechnical understanding (GEO09).
- Following an earthquake event, the following checks should be completed:
  - Visual assessment of mining areas and surrounds for evidence of slope instability or deformation, and any water interactions with slopes including seepage, liquefaction and infiltration into new cracks or depressions.
  - Visual assessment of roads adjacent to mining areas and roads on road pillars for evidence of cracking and subsidence. This could include a drive-along at a safe speed to check surfaces for serviceability.
  - Check all slope stability and deformation monitoring equipment to ensure it is still functioning (GEO10).
- Undertake deformation and settlement monitoring of mine slopes around mining operations and assess for horizontal strain and tilt at margins of existing roads, measured by strain gauges and tilt meters (GEO11).
- Undertake deformation and settlement monitoring of road pillars around mining operations and assess the following:
  - Horizontal strain and tilt on completed road pillars, measured by strain and tilt gauges; initially prior to formation of the roads to confirm that residual are below tolerances; and prior to filling the voids adjacent to the road pillar.
  - Settlement of constructed road, either by surveying and/or settlement plates (GEO12).
- Construct road pillars from Haunted Hills Formation gravel and/or coarse sand tailings (GEO13).
- Conduct initial trials during the early stages of building road pillars to verify construction methods and achieved densities (GEO14).
- Document, review and quality control the construction and monitoring of all road pillars, including:
  - Assessing the construction of road pillars against planned construction methods.
  - Trial various compaction method to document and assess for performance outcomes.
  - Formally review road pillar construction methods prior to constructing high road pillar, including specifications of Haunted Hills Formation gravel, sand tailings dewatering and compaction, any additives (e.g., fly ash), achieved strengths and deformation moduli and settlement times for each stage (GEO15).

- Where possible, exclusion zones will be put in place for the geotechnical risk zones (GRZ) around each mining area and public access will be limited in affected areas (GEO16).
- Place overburden and sand tailings on a sound, free-draining mine floor (GEO18).
- If excess materials are placed on natural surfaces, remove weak materials such as topsoil, alluvium, and dune sand prior to placement (GEO19).
- Construct slopes of landforms from Haunted Hills Formation gravel, particularly for slopes with a gradient of 1:3. For slopes of 1:4 or flatter, dewatered, stacked and compacted coarse sand tailings can be placed within the outer zone of the slope, with Haunted Hills Formation gravel forming an outer layer (GEO20).
- Place Haunted Hills Formation clay well within the landform (GEO21).
- The next lift of material on top of sand tailings will be constructed only when the deposited sand tailings have achieved a partially-dewatered state (i.e., such that rapid loading will not induce a pore pressure increase). (GEO22).
- Nominally compact Haunted Hills Formation gravel to minimise latent settlement of the landform that may affect the final landform profile (GEO23).
- Ensure surface water courses are directed away from the landform during construction and operation so rainfall does not pond or cause localised infiltration (GEO24).
- ~~Conduct geotechnical assessments of the tailings cell structures. This could be done during operations, to observe and test the tailings being produced (GEO25).~~

Rehabilitation and closure execution impacts

- Speed limits will be implemented and enforced on unsealed project roads to minimise dust generation. (AQ04)
- The mine void will be progressively backfilled and rehabilitated to minimise the area required for topsoil and overburden stockpiles . (AQ07)
- Certain activities will cease when real-time monitoring indicates that trigger level near key sensitive receptors have been reached. (AQ13)
- Certain activities will be scheduled to avoid excessive dust emissions during forecast adverse weather conditions. (AQ14)
- Dust generation will be managed in accordance with the air quality sub-plan. (AQ15)
- A principal contact person will be identified for community queries and follow a complaint response procedure (see Chapter 12: Environmental management framework for the detailed complaints procedure). Twenty-four hour contact details for relevant project personnel will be provided through letters and signage onsite. (AQ19)
- A bushfire management plan will be prepared and implemented that identifies measures for landscape, siting, design, defendable space, construction, water supply and access and includes site specific bushfire mitigation measures, awareness actions, preparedness levels and fire response procedures for the site. (BF01)
- Workers will be provided with training specific to their role on potential radiation risks and measures to be implemented to reduce or minimise radiation exposures. All training will be documented. (RD02)
- The project will be operated in accordance with a management licence covering radiation safety-related aspects of the project in accordance with the provisions of the Radiation Regulations. (RD05)

9 REHABILITATION AND CLOSURE IMPLEMENTATION

Rehabilitation will occur during operation of the mine (progressive rehabilitation), and after mining has ceased (and following the decommissioning and removal of infrastructure). This section describes the adaptive approach to closure that will be implemented throughout the mine life, rehabilitation methods, physical and chemical properties of materials used in rehabilitation, approach to management of surface water, and details of revegetation in each of the zones

9.1 Adaptive management

Rehabilitation activities will commence as early as the first year of mining and will continue for up to approximately five years following the cessation of mining operations and completion of decommissioning activities. Rehabilitation will therefore occur over a period of up to 25 years, with significant opportunities to review the approach over that timeframe. Rehabilitation, decommissioning and closure outcomes will also depend on actions and decisions made early in the mine life. The following activities have and will be undertaken to ensure that the rehabilitation approach is adapted and refined where necessary to achieve the required outcomes~~:~~:

- Fully integrating ongoing closure planning into life-of-mine planning.
- Providing adequate resources and materials (such as topsoil, capping material for landforms, seed and vegetative material) for successful progressive rehabilitation.
- Basing rehabilitation plans and activities on sound science by undertaking site-specific studies and research trials early on in the mine life.
- Regularly updating progressive rehabilitation strategies so they accurately reflect the annually updated life-of-mine planning and rehabilitation performance.
- Reviewing and incorporating research and monitoring results into rehabilitation procedures.

9.2 Environment review committee

The environment review committee will continue to operate during the rehabilitation, decommissioning and closure phases of the project. The committee is expected to include members drawn from a range of stakeholders including representatives from the local community, community groups, local and state government agencies and authorities, Indigenous groups and small businesses. The committee would be chaired by an independent stakeholder to promote openness and transparency. The role of the committee in the closure period would be to provide information and feedback to Kalbar on the rehabilitation process.

9.3 Rehabilitation process

Mining will be conducted on a progressive basis, with areas of topsoil, then overburden being removed prior to the removal of ore. Mined areas will be progressively backfilled with coarse sand tailings, overburden and fines tailings. Fines tailings will be ~~covered~~ placed together with overburden (including manufactured subsoil) and topsoil, and then rehabilitated. The time from overburden stripping to completion of rehabilitation seeding is likely to be between three to five years.

Two mine voids, of less than 100 ha total, are expected to be active at any one time. Progressive rehabilitation behind the active mining areas~~, tailings facilities~~ and other infrastructure will result in a maximum area of disturbance of about ~~360~~ 285 ha at any one time. On average, an area of about 80 ha is expected to be rehabilitated each year.~~ This area will vary as new fines tailings cells withhold areas for rehabilitation and completed fines tailings cells allow additional areas for rehabilitation. No tailings will remain at the surface of the final post-closure landform and tailings~~

will not be used in the construction of outer slopes of built landforms. Tailings will be in a dried or partly dried state prior to covering with overburden.

Project infrastructure, such as buildings, fencing, pipelines, powerlines, haul roads and other pavements, will be removed after discussion with all relevant stakeholders. Some infrastructure may be retained at the request of landholders, Southern Rural Water or East Gippsland Shire.

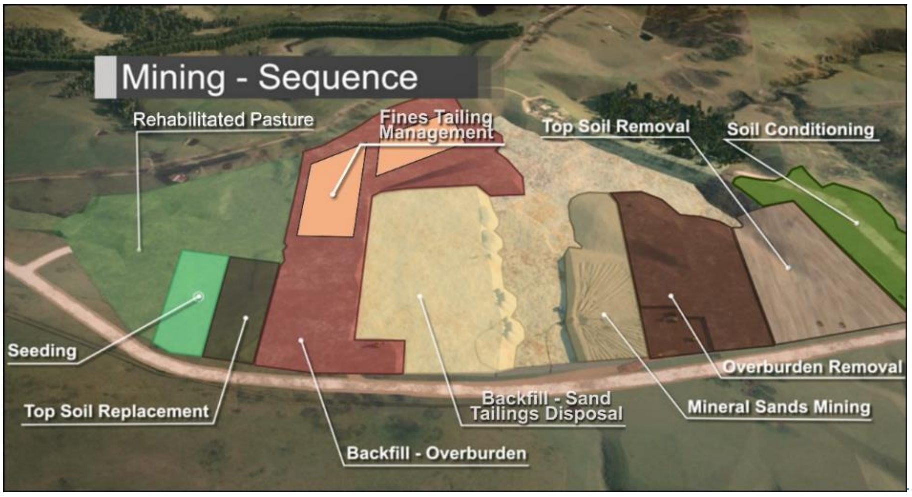
Prescriptions for these various phases of operations are provided below.

9.3.1 Progressive rehabilitation

The nature of mineral sand mining allows for effective progressive rehabilitation from Year 1 of operations. The intention is to restore the post mining landscape to a form approximating the pre-mining landform, using a profile built up with overburden, tailings material and recovered topsoil. Mining will be from a series of cells, with each ore mining location correlating to one Mining Unit Plant (MUP) location. Progressively during operations, each mined-out cell will be backfilled first with sand tailings and then overlain with overburden as it is stripped ahead of the advancing mining face (Figure 9-1). The plan for progressive rehabilitation includes:

- Applying gypsum and/or other soil amendments, as required to topsoil before it is removed ahead of mining.
- Allowing the deposited coarse and fine tailings material to consolidate and dry sufficiently to support earthmoving machinery.
- Placing overburden and fine tailings cake above the sand tailings.
- Manufacture, placement and blending of subsoil horizon above overburden.
- Replacing topsoil stripped from the area above the overburden.
- Establishing cover crops/pasture or native vegetation, consistent with post-mining land use agreements.

Details on the design of post mining landforms is provided in Section 9.4.4.3



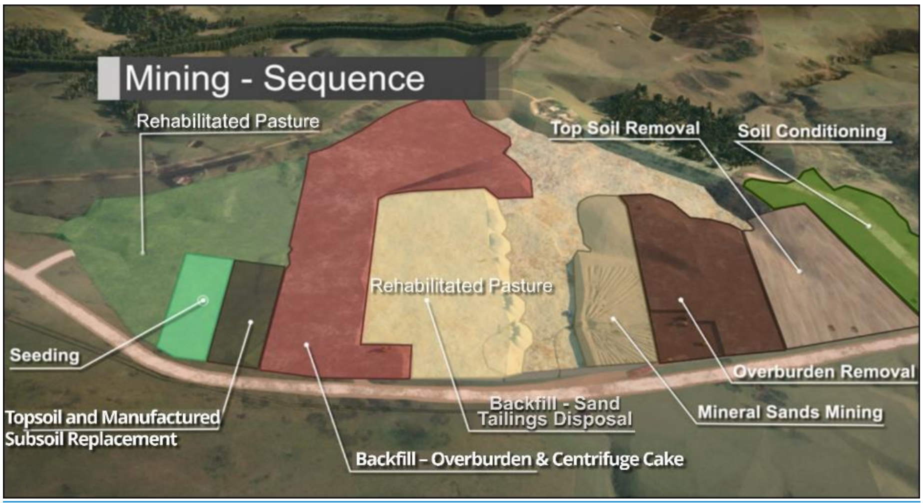


Figure 9-1: Progressive mining and rehabilitation sequence (mining takes place towards the right)

9.3.2 Topsoil Management

Prior to soil stripping, any tree vegetation would be cleared, but surface grass will be retained and mixed with the topsoil when it is stripped. Surface soils will be stripped to a depth of approximately 300 mm, as the B horizon soil is low in nutrients and organic matter as well as being higher in clays and gravels. Pre-mining soil seedbank sampling across all rehabilitation domains will help to characterise existing weed loads and inform soil management for rehabilitation. Where required and appropriate, ameliorants (such as lime, organic mulches, and fertilisers) will be spread on in-situ topsoils prior to stripping to improve the value of topsoil as a growth medium during rehabilitation. Whenever practical to do so, stripped topsoils will be placed directly on rehabilitation areas.

Ameliorant application rates may vary with final land use. Where returning to grazing, applications will aim to address current constraints to soil productivity, and where native vegetation is planned, soil preparation may need to consider the potentially lower levels of chemical fertility required.

In steeper areas soil management will include the incorporation of rock or gravel into the topsoil to increase erosion resistance and promote vegetation growth.

Where topsoil stockpiles are scheduled to be left in place for four months or longer, the stockpiles will be restricted to 2 m in height and constructed with the top parallel to the floor.

Long term topsoil stockpiles will be vegetated to stabilize the stockpile and protect against wind or water erosion. If necessary, additional stabilization in the form of hydromulch (or similar) will be provided. If the stockpile vegetation is dominated by weed species, then spraying to kill weeds and re-seeding with desired grass and legume species may be required.

9.3.3 Subsoils

Subsoils (the sub-surface soil below the topsoil) will be stripped and incorporated with the rest of the overburden. The subsoils are of poor quality for agriculture and other uses, being either deep sands with low fertility and water-holding capacity, or sodic clays prone to dispersion and hardsetting. A manufactured subsoil will be used to provide a more productive medium for plant growth in rehabilitated landforms.

The subsoil material will be composed of a combination of fines and coarse sand tailings, or overburden and coarse sand tailings, which will be mixed and ripped (mechanically broken up) to form a subsoil layer approximately 0.6 to 0.8 m thick with suitable permeability and water holding capacity. Trials are currently being conducted to determine optimal mixing ratios and rates of amendments (e.g., gypsum, fertilisers and organic material) to optimise performance of the manufactured subsoil, and the current plans for material placement will be revised as trial results become available. Findings to date indicate that a mixture of fines and coarse sand tailings will provide suitable properties for subsoil to be used as a growth medium. The specific mixture(s) adopted will aim to increase water and nutrient holding capacity of the subsoil and potentially greatly increase the resilience of vegetation established on the re-constructed soils.

Because it is planned to replace current subsoils with tailored mixtures that will not be dispersive, the soils to be replaced will be even less susceptible to hard setting and tunnel erosion development than the existing profiles.

9.3.4 Overburden

The material sitting over the target mineral sands (overburden) is made up of a geological structure called the Haunted Hills Formation. This formation was formed through fluvial processes (rivers and streams) and comprises two distinct parts: a lower gravel unit, and an upper clay and sandy clay unit.

Understanding the physical and chemical properties of the overburden material is important for rehabilitation as some properties of the overburden could affect rehabilitation success. Both the gravel and sand/clay units include a high percentage of exchangeable magnesium and sodium and a low calcium to magnesium ratio. These properties could cause clay dispersion, which could increase the risk of erosion. Clay dispersion occurs when excessive sodium is present: when water is added, the sodium attached to the clay forces the clay particles apart. This results in a cloud of clay forming around the aggregate. The fine clay particles that have dispersed clog small pores in the soil, degrade soil structure, and restrict root growth and water movement.

Gypsum, a soft sulfate mineral composed of calcium sulfate dihydrate, will be applied during rehabilitation to any overburden placed within the first metre of the rehabilitated profile. Gypsum contains approximately 23% calcium and 18% sulfur and is used to improve soil structure and reduce crusting in hard setting clayey soils.

Other properties of the overburden, such as salinity and sulphide concentrations, are sufficiently low so as to not generate saline seepage or leachate or acid mine drainage, respectively. No acid sulfate soils are present within the project area.

Excavating and depositing the overburden back into the mine void will increase the volume of the overburden by 1.22 times the undisturbed material at the time of placement. The volume increase is predicted to reduce quickly to 1.08 following consolidation of the material from self-weight and placement traffic. After consideration of the volume lost due to shipping out of HMC and the swell of the fine tailings, the net swell between original volume and the volume remaining after rehabilitation is 1.05 times. The difference is accommodated by a modest increase to the height of the final topography and the infilling of the Perry Gully area.

The upper clay and sandy clay units of the overburden in the natural form have the ability to impede the downward flow of groundwater with potential perching of water, however this is recognised as uncommon since only three boreholes of 380 recorded perched water within the Haunted Hill formation, and no instances of perched water were encountered within the Coongulmerang Formation across the project area. The layering within the natural Haunted Hill Formation will be dramatically reduced by the mixing during the mining and dumping process. Potential perching of water above buried fine tailings will be addressed by the discontinuity of fine tailings at cell margins and the retention of drainage structures at the low points in fine tailngs cells. In addition, the introduction of high water retention soils and use of larger trees in all zones of rehabilitation will absorb additional vadose water in the overburden profile including that above the fine tailings cells.

Tunnel erosion which may be related to perching of ground water, will be managed by the above methods controlling perching, and by surface drainage to ensure no excessive localised infiltration of water and by placing the clays away from slope edges (the distance to be determined by the slope gradient) (refer to Mining One Consulting, 2020).

9.3.5 Tailings

Coarse sand tailings and fines tailings have a high percentage of exchangeable sodium, which may lead to clay dispersion, and will be addressed through adding gypsum as needed. The salinity level of both the coarse sand tailings (0.03 dS/m) and fines tailings (0.09 dS/m) is sufficiently low such that the material will not generate saline seepage or leachate. Similarly, the coarse sand tailings and fines tailings contain insufficient concentrations of sulfide to cause acid mine drainage.

The geochemical properties of the fines tailings are within the limits of clean fill, as classified by the Industrial Waste Resource Guidelines – Soil Hazard Categorisation and Management, except for arsenic and chromium (EPA Victoria, 2009). The total arsenic and chromium concentration in fines tailings samples have been measured as 37 mg/kg and 86 mg/kg respectively. This is higher than the upper limits for clean fill of 20 mg/kg (arsenic) and 1 mg/kg (chromium), but well below the upper limits for Category C waste of 500 mg/kg (both). The total arsenic and chromium concentration from leach tests of fines tailings samples were less than 0.01 mg/L, which are well below the upper limits of 0.7 mg/L (arsenic) and 5 mg/l (chromium) for Category C waste. On the basis of both concentration in solids and leachate, the fines tailings cake can be considered Category C waste. and would not be considered material with potential for higher impact under the Technical Guideline – Design and Management of Tailing Storage Facilities (DEDJTR, 2017) indicating that aArsenic and chromium that are in fine tailings centrifuge cake are unlikely to be potential hazards in fines tailings that will require management during rehabilitation.

The geochemical properties of the coarse sand tailings are classified as clean fill under the Industrial Waste Resource Guidelines – Soil Hazard Categorisation and Management, except for chromium (EPA Victoria, 2009). The total chromium concentration in coarse sand tailings samples has been measured as 10 mg/kg. This is higher than the upper limit for clean fill of 1 mg/kg, but well below the upper limit for Category C waste of 500 mg/kg. The total chromium concentration from leach tests of coarse sand tailings samples was less than 0.005 mg/L, which is well below the upper limit of 5 mg/L for Category C waste. On the basis of both concentration in solids (1 mg/kg) and leachate, (less than 0.005 mg/L), the coarse sand tailings can be considered Category C waste and would not be considered material with potential for higher impact under the Technical Guideline – Design and Management of Tailing Storage Facilities (DEDJTR, 2017), indicating that Cchromium is unlikely to be a potential hazard in coarse sand tailings is unlikely to require special that will require management during rehabilitation.

In addition to overburden backfill, approximately 10 m of coarse tailings are expected to be placed over all areas, and up to 8 m of fines tailings will be placed at spaced locations during backfilling. The fines tailings material is prone to hardsetting when dried and is expected to restrict deep drainage. Fines tailings will be placed at a minimum depth of 3 m in the re-constructed profile so that any restrictions to drainage are not so close to the soil surface as to affect growth of grass or trees. Mixtures of fines tailings with other materials may be placed closer to the surface, provided they are of appropriate permeability.

The methods used to release water from the fines tailings is expected to increase the content of solids to approximately 73% (Osborne, 2019). Placement of the fines tailings will be within constructed cells, across approximately one third of the mine void, at an approximate thickness of 6.5 m. The fines tailings are anticipated to settle by about 1.45 m following the application of approximately 18.3 m of

~~overburden. Further detail on the settlement of replaced fines tailings and coarse sand tailings is provided in Section 11.6.2.4.~~

9.3.6 Material Balance

Only a small proportion (in the order of 1.3%) of the material disturbed (overburden and ore) for the project will be transported offsite as HMC and a shortfall in availability of bulk materials is unlikely. These materials will be used for reshaping of the final post-mining landform. Other than topsoil, which will be separately stripped and stockpiled for use in rehabilitation, the only material required for specific rehabilitation purposes is the cobbly or gravelly Haunted Hills Formation overburden, which will be used for erosion protection and in other applications where material with a high component of coarse particles is required. A high level, whole-of-project materials balance for the project has been developed (Table 9-1). A detailed materials balance will be developed once detailed mine design has been completed. (Table 9-1, Figure 9-2)

In the order of 8 million tonnes of HMC will be produced over the life of the project. The volume represented) by this material is more than compensated for by the slight swelling of mined material that occurs when it is excavated and then replaced. When swelling is taken into account and as the amount of material exported is small relative to the total amount of mined material, sufficient material will be available to reinstate the land surface to a configuration similar to the pre-mining surface, including sufficient coarse material to satisfy project requirements for erosion protection and other engineering applications requiring gravelly or rock fill.

Table 9-19-1: Life of mine materials balance

Material type	Mined material, m3	Required rehabilitation materials, m3
Topsoil (Surface to 0.3 m)	3535762	3535762
Overburden: Gravelly HHF	63930300	
Gravelly HHF: Road pillars		17798226
Gravelly HHF: Slope armouring		19690000
Gravelly HHF: Dam construction		993000
Gravelly HHF: Other void (bulk fill)		25449074
Subsoil and other overburden	162753402	
Surface profiling (above fine tailings)		22,558,111
Other void (bulk fill)		140195291
Ore	99933166	
Tailings		99933166
Total	**330152630**	**330152630**

Note: Volumes in table are shown as 'loose cubic metres', meaning that the swell factor has already been taken into account.

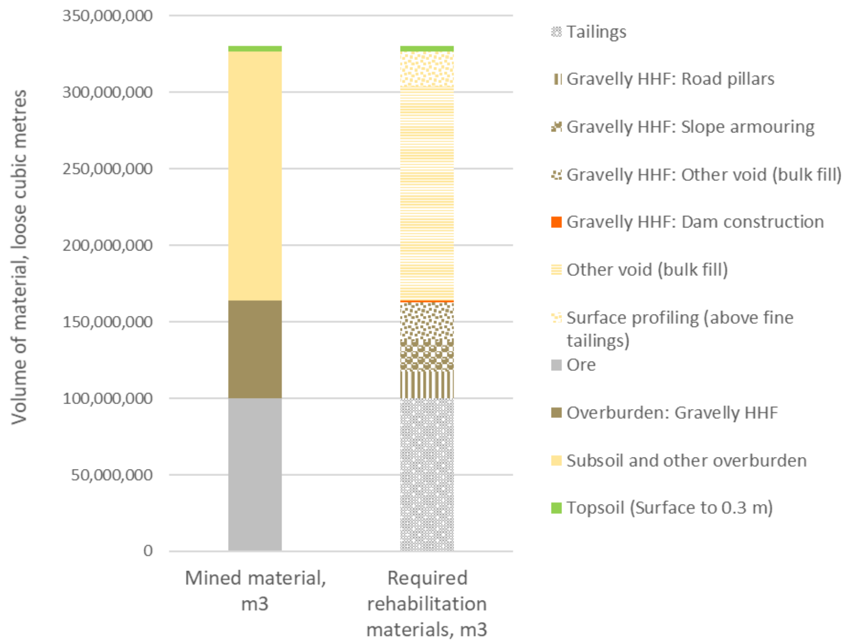


Figure 9-2: Life of project materials mass balance

9.3.7 Surface water and groundwater management

Changes to the topography during closure activities will affect the surface water flow regime and potentially the behaviour of groundwater beneath the project area. The approach to managing surface water and groundwater during closure are described below.

9.3.8 Surface water

9.3.8.1 Surface water flows

In most cases, the mine area will be rehabilitated so that the post-closure topography and surface drainage gullies will approximate the pre-mining surface topography. Changes in topography and the effect on surface flows, between existing conditions and the proposed, post-closure landform were assessed as part of the flood modelling assessment (Water Technology, 2020b).

Surface water flows within Lucas Creek catchment were largely predicted to follow the pre-mining drainage line. Some shallow ponding (mostly less than 100 mm but up to 200 mm in depth) was predicted in the upper reaches of the creek around the Fingerboards intersection. Ponding is a result of irregularities in the modelled rehabilitated topography in areas of shallow gradient. Wider, shallower flow paths are predicted with the post-closure landform, and lower flood flow velocities (typically less than 1 m/s, compared to current velocities averaging higher than 1.5 m/s) in the reshaped gullies leading into the creek.

The proposed main drainage line within Simpson Gully is largely consistent with the current alignment. Reshaping of tributaries in the upper reaches of this drainage line will result in wider, shallower inflows into the main line.

Perry Gully will undergo the most significant modification compared to the current configuration, with a large portion of the upper reaches proposed to be filled. A ridge line will divert flow into adjacent catchments, reducing the overall length of the waterway. The modelled 1:100-year average return interval (ARI) one-hour flow in the remaining reach of Perry Gully tended to be deeper than 1 m, with water velocities greater than 2 m/s.

Changes in topography in the Honeysuckle Creek system will increase the catchment boundary and watershed. Adjustments to the landform, including reducing channelisation, will create generally wider, shallower flow paths.

The following measures will be considered during the design of rehabilitated areas to prevent excessive surface water from entering the interior of the landform and causing potential stability issues:

- Natural surface water drainage courses will be re-routed away from the landform.
- Surface water ponding on the landform will be avoided through appropriate slope profile design and topsoil treatments.

9.3.8.2 Surface water quality

Potential impacts to surface water quality are discussed in the Conceptual Surface Water Management Strategy and Water Balance report (EMM,2020a).

Water management, including the capture of possible sediment-laden runoff following initial rehabilitation, will be incorporated into the water management system throughout the mine plan. On the downhill side of containment structures (such as surface water drains and road batters), batters will undergo soil conditioning and be spread with topsoil and revegetated as soon as possible to minimise erosion and sediment-laden runoff. Options such as seeding, hydromulching and other spray emulsions will be considered and trialled for this application.

In active rehabilitation areas susceptible to erosion, the surface (minimum of 500 mm) of overburden will be mixed with gypsum to form a subsoil layer that reduces the dispersive qualities of the soil and improve stability. Topsoil will be mixed at the surface of the overburden layer and seeded to encourage the rapid establishment of vegetation to minimise erosion.

Runoff controls including water management dams downstream of rehabilitation areas will be decommissioned once post-rehabilitation monitoring demonstrates that water quality controls are no longer required, and vegetation has stabilised the landform. Dams are expected to be in place for approximately two years following final shaping, seeding and mulching of rehabilitated areas.

9.3.9 Groundwater

Groundwater modelling was undertaken (EMM,2020b) and results assessed (EHP,2020) to determine the potential effects of groundwater mounding on groundwater dependent ecosystems.

Modelling of post-mining groundwater levels indicated that, following mine closure, groundwater mounding will dissipate rapidly, with a maximum residual mounding of around 1 m expected at the south-eastern section of the project area, 10 years after mining is completed. The assessment found that the effects from mounding on groundwater dependent ecosystems are likely to be negligible to low.

9.3.10 Revegetation

Each proposed post-closure land use zone will be revegetated in accordance with the proposed post-mining land uses. The strategy for revegetation of each zone is described in the following sections. A summary of estimated seeding rates and target planting densities for each zone is provided in Sections 9.3.10.2 to 9.3.10.6

The primary goals of revegetation will be to establish vegetation that meets, or assists in meeting, both the overarching goals for the area and the more specific goals for each post-closure land use zone (refer to Section 11.4: Closure strategy). For example, in pasture areas with an intended post-closure land use of grazing, species mixes will be developed considering local experience and knowledge, and with advice from local landholders, to ensure compatibility with future stocking requirements. Other aspects such as seeding times and rates of application will also draw on such knowledge alongside advice from agronomists to help maximise the chance of successful vegetation establishment.

9.3.10.1 Weed Control

Kalbar will take advantage of opportunities presented by restoration to reduce weed populations. Standard weed control actions and strategies will be undertaken as part of post-rehabilitation land management which would include targeted controls for weeds that migrate onto the site. Pre-mining soil seedbank sampling across all rehabilitation domains will help to characterise existing weed loads and inform soil management for rehabilitation. Pre-mining surveys of standing weed vegetation (identity, density, cover) will also be undertaken for base-line information to gauge the success of rehabilitation in minimising weeds. Rehabilitation strategies also aim to supress weed competition through the use of competitive perennial pasture species.

9.3.10.2 Zones A and B (plateau grazing and swale /plateau edges)

Pasture grasses will be an important component of the vegetation to be established in these zones. To maintain sufficient pasture growth in areas subject to grazing, a significant component of legumes such as clovers will be sown to ensure a continued supply of nitrogen to the pasture (through nitrogen-fixation by rhizobium bacteria on legume roots) and improve pasture quality for grazing.

A likely mixture of grass species suitable for the sandy surface soil in the project area would include AusVic perennial ryegrass, cocksfoot, and sub clover, along with summer-active tall fescue and lucerne to take advantage of the increased soil water storage capacity and extend the effective growing season. All legume seeds will be inoculated with commercial rhizobium bacteria prior to sowing, as the boron-deficient soils in the project area are likely to contain relatively ineffective rhizobia.

A sowing rate of 15 to 20 kg per hectare (kg/ha) is recommended for pasture seed in Stephens Pasture Seeds' Pasture Reference Guide (see the Rehabilitation report prepared by Landloch Pty Ltd; Appendix A014). The sowing rate will be increased to 30 to 40 kg/ha where required to facilitate rapid development of surface cover and allow sown pasture to outcompete local weed populations present in the soil seed bank. Coffey, A Tetra Tech Company 754-ENAUABTF11607_6_Ch11_Closure_v5 November 2020 11-29

Trees will also be established in these post-closure land use zones, most likely through tubestock planting (young plants ready for planting in the field). Tree species established on the plateau (Zone A) will be the same as those currently present, including Gippsland red gum (Eucalyptus tereticornis subsp. mediana), red box (E. polyanthus) and white stringybark (E. globoidea), with a proposed initial density of 20 to 30 stems/ha and a final density of 10 to 20 stems/ha following thinning.

For swales and plateau edges (Zone B), a wider range of plant species, typically associated with the Plains Grassy Woodland ecosystem (Ecological Vegetation Class [EVC] 55), will be considered. Tree species will include Gippsland red gum, river red gum (E. camaldulensis), and acacia species (such as black wattle (Acacia mearnsii)) and blackwood (A. melanoxylon). A slightly higher initial density of trees will be planted in swales and plateau edges (Zone B) to achieve a final stand density of approximately 20 to 30 stems/ha. The higher tree density in this zone is intended to promote greater water extraction from depth in the soil as a result of evapotranspiration by the trees.

9.3.10.3 *Zone C (valley slopes)*

Revegetation plant species for this zone will be selected from typical species associated with the Valley Grassy Forest ecosystem (EVC 47). Plants used in revegetation will be established from provenance seed from the project area or nearby areas wherever possible. A targeted research and development program and initiated once mine operation begins to identify seed sources, seed handling and management requirements, planting methods and maintenance requirements.

Groundcover will need to be established soon after the final landform is constructed to reduce the risk of erosion. A relatively high density of trees and shrubs will be required on the steeper slopes bordering flow channels. Trees in this zone will be most effectively established by seeding to achieve a density significantly higher than the target. This approach allows for losses due to animal damage and other causes. Established vegetation will be thinned to achieve the target number of 20 stems/ha of Eucalyptus species.

Fencing may be required to prevent grazing animals from entering valley slope areas during vegetation establishment.

9.3.10.4 Zone D (channels)

Tree, shrub and groundcover species for revegetation in this zone will be selected from typical species present in the Valley Grassy Forest ecosystem (EVC 47) and/or other relevant riparian or aquatic ecosystems. Vegetation will be established from provenance seed or other suitable propagules from the project area or nearby areas wherever possible. Trees and shrubs will be most effectively established by direct seeding to establish a relatively high density and allow for losses due to animal damage and other causes. Established vegetation will be thinned where necessary.

Fencing to exclude grazing animals may be required during vegetation establishment.

9.3.10.5 *Zone E (native grass woodland)*

9.3.10.6 A range of species associated with the Plains Grassy Woodland ecosystem (EVC 55) will be considered for this zone. An optimal revegetation method will be developed by a targeted research and development program and initiated once mine operation begins. The program *will consider a range of factors such as seed sources, seed handling and management, soil requirements, planting methods and maintenance requirements. The potential impact of the existing soil seed bank (including weed content) will also be investigated.Zone F (Road Verges)*

One of the key objectives of this zone is to establish low-maintenance vegetation that provides high amenity, minimises erosion by maintaining adequate levels of groundcover, and avoids impact to the function and safety of roads. A range of species associated with the Plains Grassy Woodland ecosystem (EVC 55) will be considered for this zone, to the extent that is consistent with road safety, fire safety and local government requirements. Revegetation methodology and planting selections will also benefit from research undertaken on native grass woodland.

Road verges will be revegetated to serve multiple functions, as wildlife corridors, as amenity planting and generally to enhance the safety and amenity of roads. Plant species and vegetation densities targeted in this domain will generally be those associated with EVC 55, to the extent that that is consistent with road safety, fire safety and local government requirements.

9.3.10.7 Fire management

The primary fire risk-reduction strategy for the project will be to maintain fuel loads at an acceptable level by slashing, which may include slashing of rehabilitated areas as early as one year after vegetation establishment if vegetation condition is suitable. Firebreaks may be established and maintained at strategic points within the project area to protect juvenile rehabilitation sites.

Where grazing activities become possible during the life of the project, they will be closely monitored and managed to keep fuel loads within an acceptable range without reducing groundcover below critical thresholds for erosion control. Areas of high erosion risk, such as gullies, will be fenced to prevent overgrazing, and areas with low tree density, such as road corridors, will be strategically managed as firebreaks.

If controlled burning is undertaken, revegetated areas will be protected from all fire until the trees are taller than 5 m. Firebreaks may be established and maintained at strategic points within the project area to protect juvenile rehabilitation sites.

9.4 Final Mine Closure

Final mine closure will take place after mining has ceased. Closure planning also takes into account an unplanned closure of the mine.

9.4.1 Overview

Within the project area, final mine closure will need to consider all completed mining areas, tailings emplacements and areas cleared prior to mining as well as ~~run of mine (ROM) ore and~~ product stockpiles. Infrastructure within the project area will also need to be considered, including:

• Freshwater storage dam, process water dam, contingency water dam, sediment detention basins and drainage infrastructure.

• Ore processing plant and associated facilities (mining unit plants and the wet concentrator plant).

• Product loadout and materials handling area.

• Pipelines, powerlines, the electrical substation, light vehicle roads, mine haul roads, site access roads, administration buildings, laboratory and ancillary buildings, hardstand and laydown areas, and the carpark area.

The infrastructure options area sits outside the project area. All infrastructure associated with the project in this area is proposed to be decommissioned. Infrastructure that could provide a community benefit may be retained. This option will be explored in consultation with relevant stakeholders. Final closure of the infrastructure options area will need to consider the groundwater borefield, the pump station and pipelines from the Mitchell River, road diversion corridors, the Fernbank East rail siding and the infrastructure corridor (including pipelines, powerlines and the haulage road).

Other infrastructure to be considered during final mine closure includes ~~the~~ any realigned roads and upgraded intersections for the transport of concentrate. ~~to the Maryvale siding, Bairnsdale siding and Port Anthony or Barry's Beach Marine Terminal.~~.

9.4.2 Planned closure

At the end of the mine life any equipment~~, loaders, excavators and haul trucks~~ suitable for closure activities will be directed to rehabilitation and decommissioning works where required. The remaining mining fleet will be demobilised. Additional equipment may be required for specialist tasks or to facilitate efficient closure.

9.4.3 Decommissioning

Fixed plant, buildings and infrastructure will be decommissioned and removed prior to, or during, mine closure. Decommissioning will commence with the decontamination of all plant and equipment through draining and/or removal of all liquids, solids and/or potentially hazardous materials. Remaining (unused) chemicals and hydrocarbons will be returned to the appropriate suppliers or sold to a third party.

Mine contact water is only expected to be of poor quality with respect to turbidity. Nethertheless, residual water after completion of mining will be assessed before the remaining water is jused during the continuing rehabilitation into closure.

Infrastructure will be progressively removed as works reach completion and crews are demobilised. All economically salvageable structures and parts will be dismantled and removed. Other structures will be demolished and disposed of appropriately.

Some structures or equipment may be retained for use beyond closure. In these instances, agreement will be sought with Earth Resources Regulation and the relevant landowner. Where required, these structures will be certified as safe and fit-for-purpose by a suitably-qualified civil, structural and/or mechanical engineer. Structure that could remain include water catchment dams or other water storages required by landowners for agricultural purposes once mining has been completed.

Scrap metal and other economically recyclable materials will be taken offsite to an appropriate recycler. Any areas of ground contamination identified during decommissioning will be treated appropriately. Hazardous waste and/or contaminated material will be disposed of offsite by a licensed contractor, where necessary.

A waste management plan specific to decommissioning activities will be developed with detailed schedules of salvaged and recyclable material and all waste products and chemicals expected to be generated at the site. The types of materials, quantities and proposal management and/or disposal methods will also be specified. The plan will include details of agreements with receivers of decommissioning materials and waste and will set out the requirements for chain of custody documentation to track the movement of materials to ensure they are managed and/or disposed of appropriately.

All surface pipelines, powerlines and security fences will be removed, and materials sold or disposed of by a licensed contractor. Sub-surface pipelines will be drained, flushed and sealed, and left in place if they cannot be economically salvaged. Dams will be drained, and any poly liners cut, folded and removed for disposal to an appropriate landfill. Dam decommissioning should be undertaken with extreme care so as not to initiate upstream moving bed instabilities. This should be undertaken with the advice of a suitably qualified geomorphologist or environmental engineer.

~~In year five, the temporary TSF will be decommissioned. Fines tailings from the facility will be deposited in the mine voids. From year five onwards, the area underneath the temporary TSF will be mined for ore and subsequently rehabilitated. Fines tailings will continue to be deposited into the mine voids for the remaining life of the mine. A maximum of six fines tailings cells will be available within the mine voids to allow for adequate drying of tailings before overburden is replaced during rehabilitation.~~

~~Nineteen~~ Twenty water management dams are proposed to be located across the mine site over the life of the project. The dams will operate until rehabilitation in each catchment is complete. Decommissioning of dams will not occur until water quality monitoring demonstrates that runoff from the catchment no longer requires active management.

A large stockpile of overburden and coarse sand tailings will be located northwest of the wet concentrator plant. This stockpile will be used to backfill the final mining voids and the freshwater storage dam.

9.4.4 Remediation

Any unplanned spills and leaks that occur during the project are expected to be recorded and cleaned up when they occur. A contamination assessment will also be conducted as part of project decommissioning and closure activities to check for hydrocarbon or other contamination, such as metals or radioactive materials.

Any required remediation will be to a standard compatible with the agreed post-mining land use. The levels of radioactivity and other contaminants in surface soils within the project area will not be greater than the background concentrations measured prior to the project commencing.

9.4.4.1 Rehabilitation

Mining will be conducted on a progressive basis, with areas of topsoil, then overburden being removed prior to the removal of ore. Mined areas will be progressively backfilled with coarse sand tailings, ~~overburden and where designed, fines tailings,~~ followed by centrifuge cake and overburden. The resulting interim profile will be covered with ~~overburden (including~~ a manufactured subsoil~~)~~ and topsoil, and then rehabilitated. The time from overburden stripping to completion of rehabilitation planting is likely to be between three to five years.

Two mine voids, of less than 100 ha total, are expected to be active at any one time. Progressive rehabilitation behind the active mining areas~~, tailings facilities~~ and other infrastructure will result in a maximum area of disturbance of about ~~360~~ 285ha at any one time. On average, an area of about 80 ha is expected to be rehabilitated each year. ~~This area will vary as new fines tailings cells withhold areas for rehabilitation and completed fines tailings cells allow additional areas for rehabilitation. No tailings will remain at the surface of the final post-closure landform and tailings will not be used in the construction of outer slopes of built landforms. Tailings will be in a dried or partly dried state prior to covering with overburden.~~

Project infrastructure, such as buildings, fencing, pipelines, powerlines, haul roads and other pavements, will be removed after discussion with all relevant stakeholders. Some infrastructure may be retained at the request of landholders, Southern Rural Water or East Gippsland Shire.

9.4.4.2 Consolidation in Final Landform Design (After Osborne,2019)

The final landform profile will be achieved through returning various layers of consolidating materials including coarse sand tailings, fines tailings cake and overburden, and will be influenced by:

• Variable properties of each layer of material used to create the landform profile (coarse sand tailings, fines tailings and overburden).

• Rate of placement of each layer.

• Timing of placement of each layer, and potential delays between placement.

• Proportion of each layer in the landform profile.

• Use and placement of various controls such as containment embankments and road pillars.

The rehabilitation process will need to be managed so that these aspects are considered and appropriate action taken to allow placement of different materials at varying thicknesses across the mine void to achieve the designed landform.

The backfill treatments in order of placement is summarised in Table 9-2: Backfill treatments, in order of placement.

~~Table 9-2 details the quantities of returned ore component materials (sand and fines tailings and oversize material) and the thickness of each layer in the landform profile, if tailings were to be placed uniformly over the mine area.~~

~~Table 9-2: Post mining profile at time of placement for tailings deposited uniformly over the mine area~~

~~Material~~	~~Mass per m² (t)~~	~~Placed dry density (t/m³)~~	~~Layer thickness (m)~~
~~Coarse sand tailings~~	~~10.3~~	~~1.4~~	~~7.4~~
~~Fine tailings~~	~~2.8~~	~~1.4~~	~~2.2~~
~~Oversize~~	~~0.2~~	~~1.7~~	~~0.1~~
~~Total~~	~~13.3~~	~~4.5~~	~~9.7~~

~~The actual placement of fines tailings will be contained to specific storage cells, anticipated to cover 33% of the mine area, while coarse sand tailings will be returned partially with the fines tailings and, also across the remaining 67% of the mine area. The volume of coarse sand tailings stored with the fines tailings will be optimised to create similar consolidation characteristics to address the potential issue of an uneven landform surface following differential consolidation. A breakdown of the materials within the landform profile following rehabilitation is provided in tables 9-3 and 9-4 and these investigate the net depth and compaction of component materials.~~

An overall increase of 5% of the volume of the landform is expected due to swelling of material backfilled into the mine void. As a result, the post-mining landform will be on average 1.3 m higher than the existing pre-mining landform. ~~The dominating factor influencing settlement of the returned material to the mine void will be the fine slurry within the fines and coarse sand tailings. Consolidation of this material is expected to be completed after 12 months of placement, with some subsequent insignificant settlement or 'creep'.~~

Table 9-3: Profile compaction model for areas without fine tailings cells (two thirds of mine)

Parameter	Measurement
Mine void depth	26.9 m
Pre-mining depth of overburden and topsoil	18.3 m
Ore depth	8.6 m
Thickness of coarse sand tailings at time of placement	9.26 m
Density at time of placement	1.4 t/m³
Final (consolidated) density	1.55 t/m³
Mass of sand per square metre	12.96 t
Final thickness of coarse sand tailings	8.36 m
Oversize thickness	0.10 m
Thickness of overburden and topsoil as placed (1.22 bulking factor)	22.33 m
Final thickness of overburden and topsoil (1.08 bulking factor)	19.76 m
Total final thickness of landform profile	**28.22 m**

Source: Osborne (2019) [R249]

Table 9-4: Profile compaction model for areas including fine tailings cells (one third of mine)

Parameter	Measurement
Mine void depth	26.9 m
Pre-mining depth of overburden and topsoil	18.3 m
Ore depth	8.6 m
Place thickness of coarse sand tailings	3.6 m
Density at time of placement	1.4 t/m³
Final (consolidated) density	1.55 t/m³
Mass of coarse sand tailings per square metre	5.04 t
Final thickness of coarse sand tailings	3.25 m
Placed thickness of fines tailings	6.51 m
Settlement of fines tailings under surcharge of overburden	1.4 m
Parameter	Measurement
Final thickness of coarse sand and fines tailings	8.36 m
Mass of coarse and fines tailings per square metre	13.89 t
Oversize thickness	0.10 m
Thickness of overburden and topsoil as placed (1.22 bulking factor)	22.33 m
Final thickness of overburden and topsoil (1.08 bulking factor)	19.76 m
Total final thickness of profile	**28.22 m**

Source: Osborne (2019) [R429]

An allowance will be made for additional fill material to be used for fines and coarse sand tailings settlement 'creep' of up to 0.5 m to help ameliorate the potential for surface water ponding. Observations of settlement levels during the early stages of rehabilitated areas will be conducted to

~~inform future rehabilitation. Consolidation of overburden placed in the mine void is anticipated to result in only minor 'creep' beyond the time of placement.~~

9.4.4.3 Final Landform Design

The post-mining topography in the project area will be integrated with existing land surfaces and contours and will generally be similar to the pre-mining topography (except for Perry Gully and Honeysuckle Creek). Flow paths in the final post-mining landform will generally be returned to their current location (Figure 9-3).

Local modifications include shallowing of steeper slopes and the filling of the Perry Gully to approximately the same height as the current Clay Hill to produce an additional 10 million cubic metres of backfilling space. A large stockpile, located north-west of the WCP, will remain to the end of life and will be used to backfill the mining void and the fresh water dam during closure. Finally, the Honeysuckle~~ey~~ Creek valley will be reconstructed to a wider profile than the current.

In two areas, the post-mining topography and hydrology will differ substantially from the existing topography, Perry Gully and the valley of Honeysuckle Creek.

After mining has passed the Perry Gully area, the gully will be backfilled to form a broad plateau gently sloping away from the current Clay Hill location at the south . This will redistribute the upper reaches of the current Perry Gully watershed into the adjacent watersheds. A modest size re-direction of the northern flank of the new landform into the valley to the north; and a larger re-direction of approximately 54% of the new landform into Simpson Gully to the south (Figure 9-3). A small area will continue to flow eastward down the new slope into the lower Perry Gully.

To accommodate the Perry Gully changes and manage the increased watershed, the northern tributary of Simpson Gully will be extended, rocks and gravel from overburden mining will be introduced, vegetation densities increased, and the valley floor widened.

The existing watershed into the Perry Gully will be shortened to reduce runoff onto the new hill slope down to the remaining section of the Perry Gully. This change will produce an additional 10 million cubic metres of backfilling space to allow for a sufficient void to undertake mining activities and reduce the size of stockpiles in the early stages of the mine life. Figure 9-5 demonstrates a schematic profile along the rehabilitated filled Perry Gully.

The valley of Honeysuckle Creek at the end of the mine path will be broadened to reduce the amount of overburden required to backfill the area and allow the final mine voids to be backfilled.

Reinstatement of flow channels will be guided by hydrologic and geomorphic design to maximise stability. Measures proposed to increase the stability of drainage channels during storm flows include increasing the channel width to reduce flow depths and velocity, including rock in the bed of the channel to reduce the potential for scouring, and establishing riparian vegetation to reduce flow velocity. As a minimum, grazing by livestock will be excluded to help maintain a high coverage of vegetation on the surface of the channel bed and banks and to prevent disturbance of soils from trampling by livestock.

Upper drainage paths (swales) which convey surface runoff from the constructed plateaux to the drainage channels have been designed as broad, concave landforms without any undercutting or overfalls. This design approach is intended to support the aesthetic objectives, but will also serve an erosion control function by managing the factors that drive water erosion risk (i.e.) slope lengths and valley slope gradients will be similar to existing slope parameters.

Swales will be designed to be broad, concave landforms to avoid concentration of erosive wate flows.

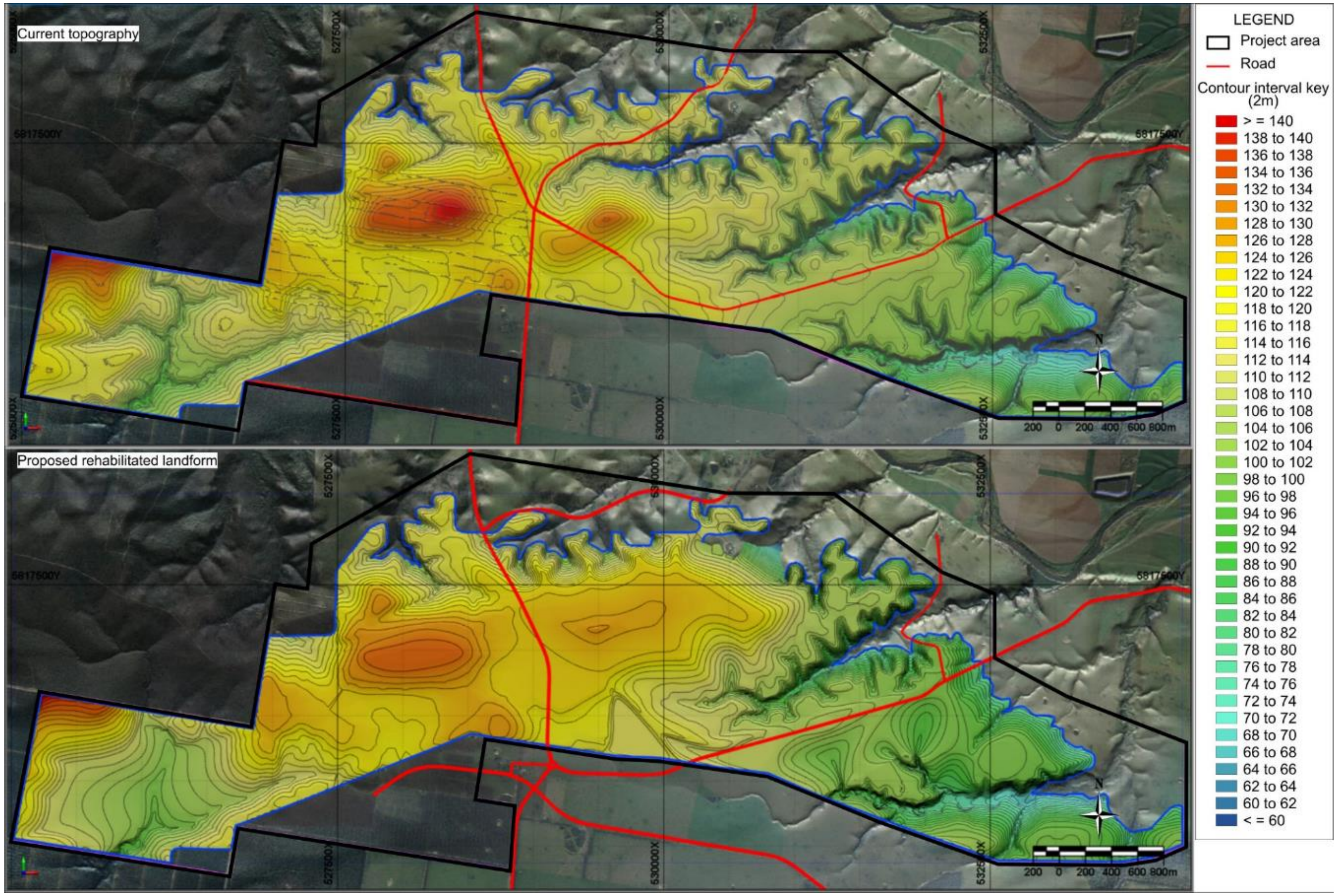


Figure 9-3: Fingerboards topography – before and after mining (Landloch, 2019a)

Maximum slope gradients will occur at the south facing scarp within incised gullies, where they naturally vary up to 1:3. During final design, the steeper slopes will be flattened as far as practically possible to a maximum of 1:4. The valley slopes will be constructed using gravel from the base of the Haunted Hills Formation. Where there are steeper slopes, the Haunted Hills Formation gravel will be used for the full depth to the mine void floor, whereas in shallower slopes, a 5m layer of Haunted Hill Formation gravel will overlay a core of coarse sand tailings chosen for its geotechnical strength. The steepest slopes of swale areas will occur at the north-facing scarp and scarps within incised gullies.

Drainage will be incorporated into the design of the mine void floor to increase the stability of the rehabilitated landform through a dewatering and consolidation process.. The void floor will also be cleared of weak materials such as clays prior to placement of tailings and overburden. Clays restrict water infiltration and, (in the absence of other controls) could cause water seepage around the base of the mine void, which could lead to tunnel erosion (Mining One Consulting, 2020).

Table 9-2: Backfill treatments, in order of placement

	On plateau areas	**On hillside areas**
Final land surface	Conditioned topsoil mix, containing fertiliser and organic amendment added prior to stripping	Erosion resistant topsoil mix placed over subsoil mix with added gravel/rock to provide increased erosion resistance. Tilled to bring rock close to surface.
	Constructed subsoil mix, designed to enhance vegetation productivity, tilled to mix in amendments and fertilisers as required to maximise productivity and stability	Core of sand tailings (If possible, keep HHF away from slopes)
	Overburden and fine tailings cake to fill margins and profile to design floor of subsoil level	
	Sand tailings	
Base of mine void	Engineered road pillar where required	Engineered road pillar where required

Where used for backfilling, the tailings storage cells will be constructed and closed in the following sequence :

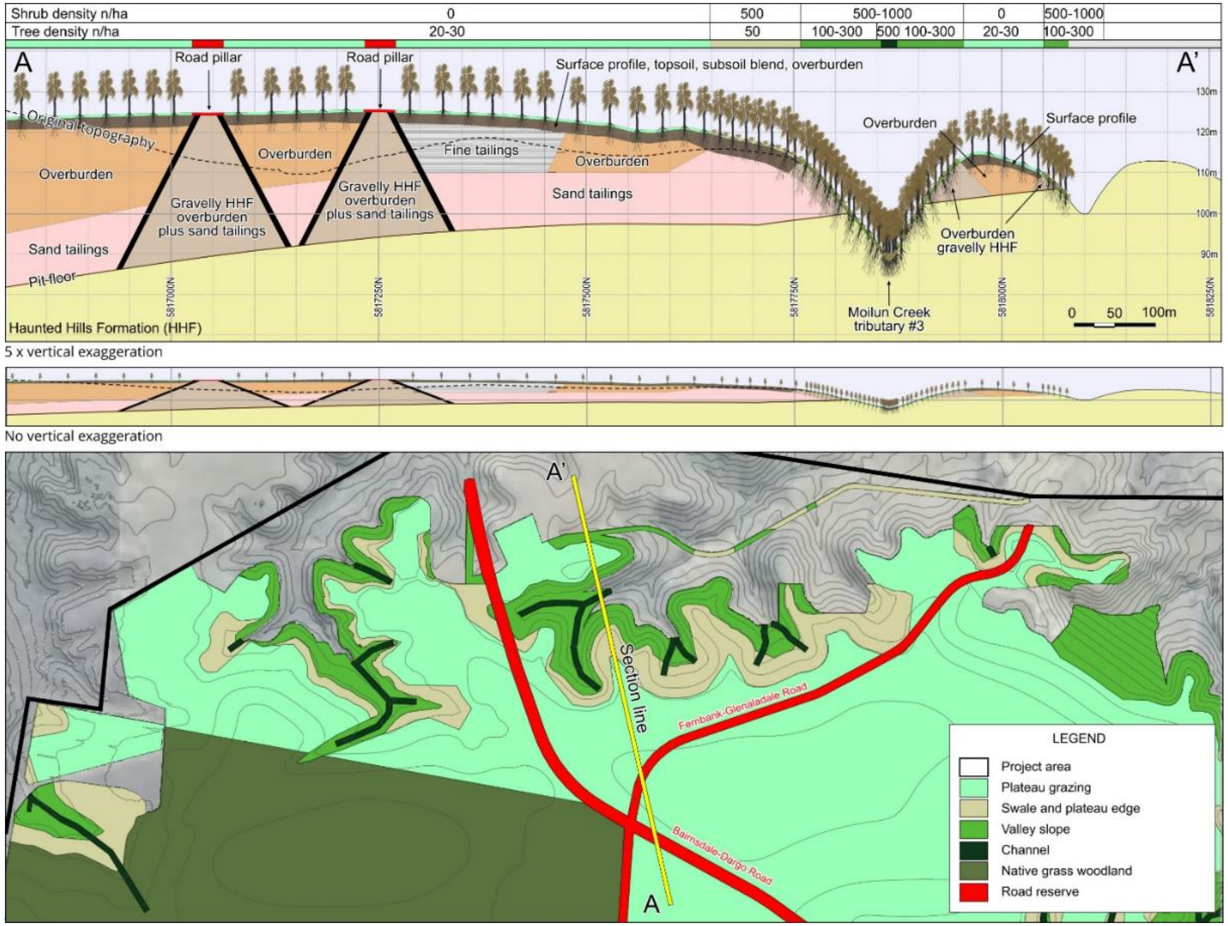
1. Construction of coarse sand tailings toe bunds
2. Placement of coarse sand tailings
3. Placement of overburden
4. Placement and contouring of fine tailings
5. Fill to topographic profile with overburden – blended subsoil 300 to 900 mm below surface
6. Place topsoil – typically 200 to 300 mm depth
7. Revegetate

For areas outside the fine tailings storage cells, the sequence of profile construction will be:

1. Construct coarse sand tailings toe bunds
2. Place coarse sand tailings
3. Fill to topographic profile with overburden – blended subsoil mix 300 to 900 mm below surface
4. Place topsoil – typically 200 to300 mm depth
5. Revegetate.

Figure 9-4 presents the same data schematically.

The depth of cover required to encapsulate stored tailings will vary, depending upon the topographic relief to be applied. In the Plateau Grazing and Swale and Plateau Edge land use zones, gradients are low and tailings are covered by a minimum 3m of cover composed of overburden, constructed subsoil and topsoil. Geotechnical costraints (described later in this section) prescribe that unmixed fine tailings are not present in the valley slopes, but usually sand tailings will have a minimum of 5m coverage under HHF gravelly overburden. In the steepest slopes, a strong and erosion resistant profile will be constructed using only the basal gravelly stratum of the HHF Figures 9-3 and 9-4.



Shrub density n/ha
Tree density n/ha
0
20-30
500
50
500-1000
100-300
500
100-300
0
20-30
500-1000
100-300
A
A'
Road pillar
Road pillar
Surface profile, topsoil, subsoil blend, overburden
Original topography
Overburden
Overburden
Fine tailings
Overburden
Overburden
Surface profile
Gravelly HHF overburden plus sand tailings
Gravelly HHF overburden plus sand tailings
Sand tailings
Sand tailings
Overburden gravelly HHF
Pit floor
Moilun Creek tributary #3
Haunted Hills Formation (HHF)
0 50 100m
130m
120m
110m
100m
90m
5817000N
5817250N
5817500N
5817750N
5818000N
5818250N
5 x vertical exaggeration
No vertical exaggeration
A'
Section line
A
Fernbank-Glenaladale Road
Bairnsdale-Dargo Road
LEGEND
Project area
Plateau grazing
Swale and plateau edge
Valley slope
Channel
Native grass woodland
Road reserve

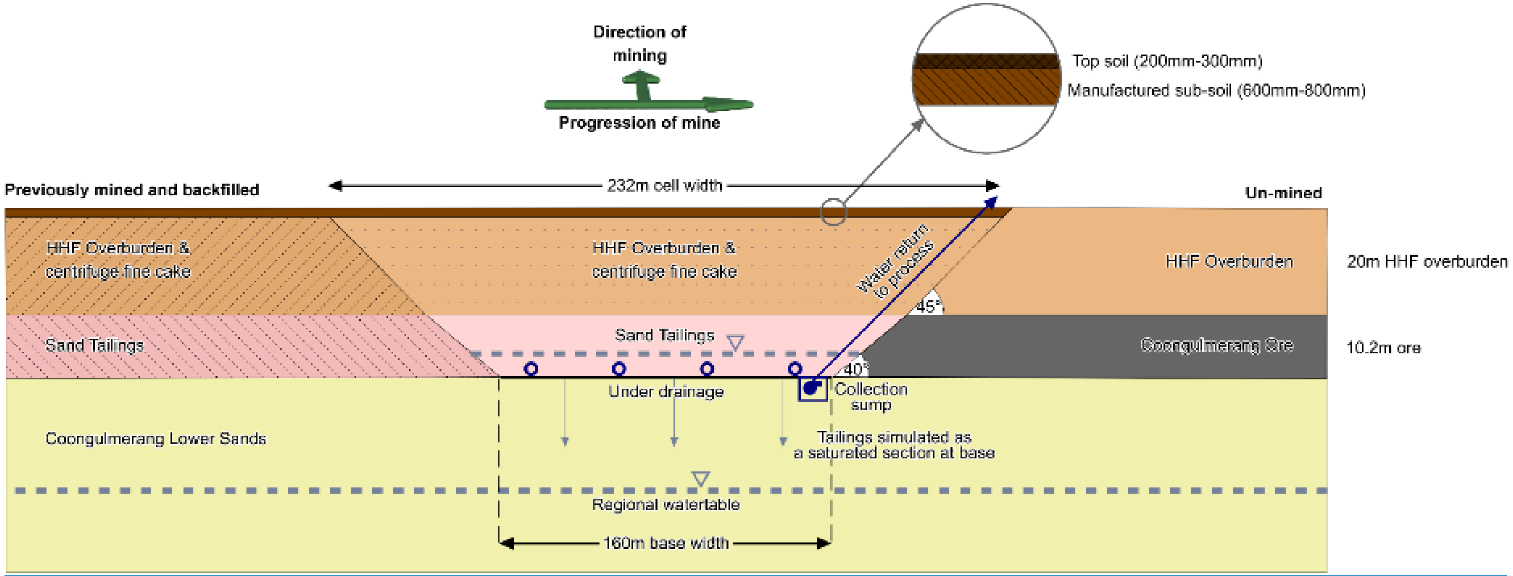
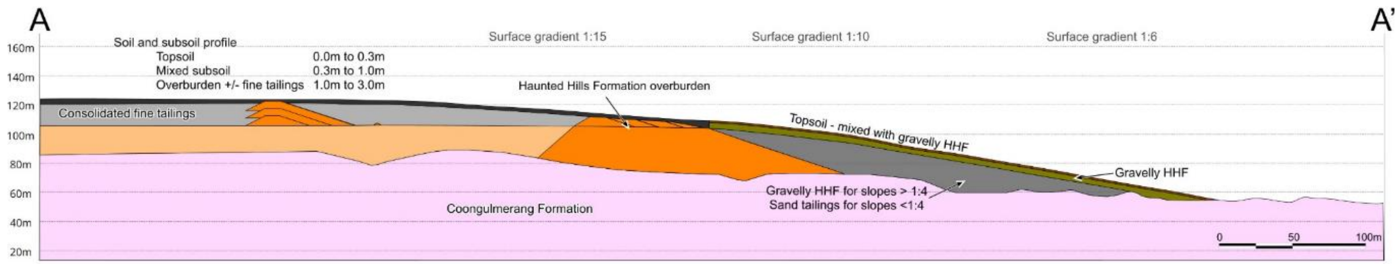
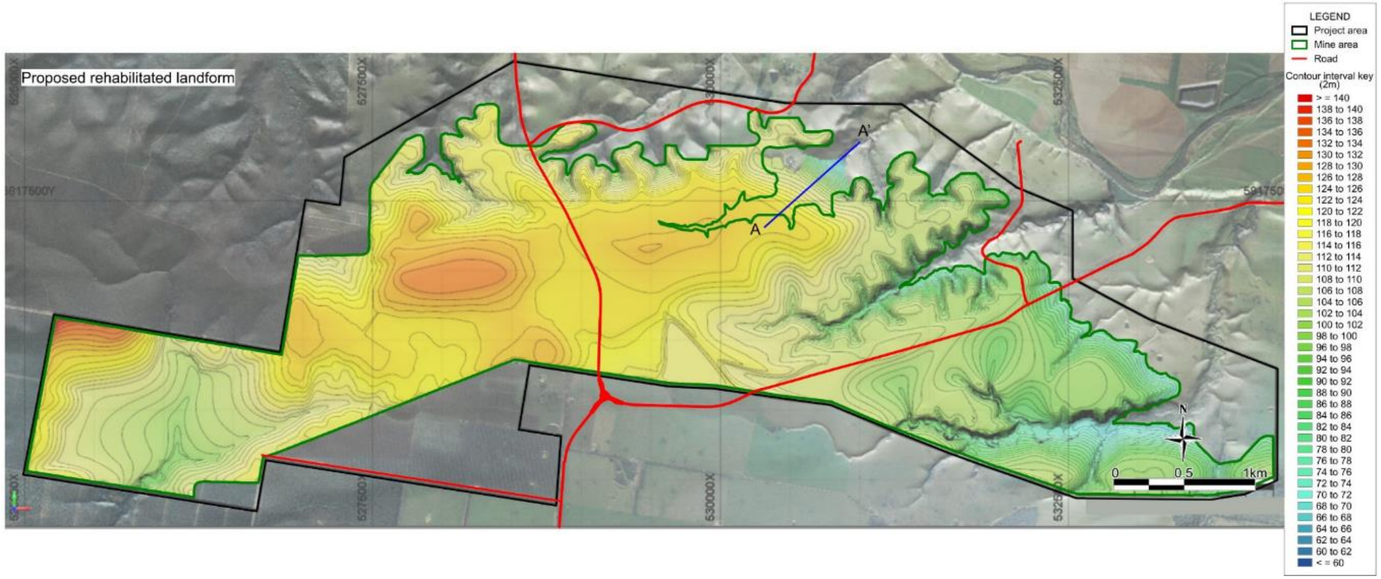


Figure 9-4: Schematic rehabilitation cross section ~~– Moulin Creek Tributary #3~~of the mine void

The project will be mined by progressive open-cut mining methods, with progressive mining, backfilling, and rehabilitation rehabilitation as shown in the cross section pictorial representation in (Figure 9-4: Schematic rehabilitation cross section of the mine void). The mining operations area is approximately 9 km across, with maximum mining depth of 50 m. The mine void will average 30.2 m deep. The greatest depth of mining will be along the southern part of the deposit as the deposit dips to the south. All mining will occur above the regional watertable and no dewatering is required. The wall angle of the mine void will be approximately 40 - 45 degrees.

Cross Section - Rehabilitation Profile





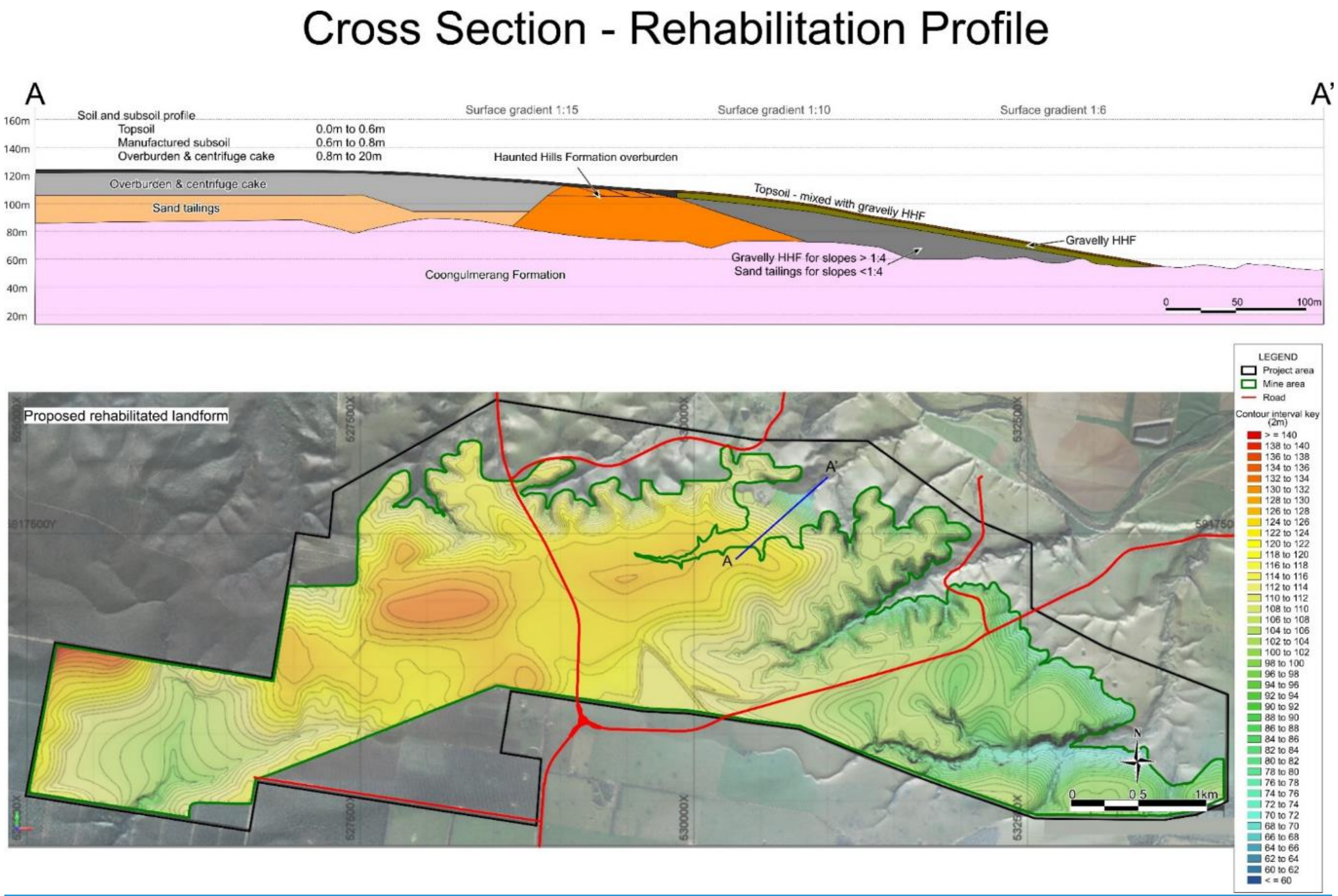


Figure 9-5: Schematic post-rehabilitation longitudinal section - Perry Gully

The predominant valley slopes shallower than 1:4 will be constructed using the gravel stratum from the base of the Haunted Hill Formation (HHF) on a base of overburden or compacted sand tailings. In areas with shallower slopes sand tailings or undefined overburden can be used in parts of the reconstructed profile (Figure 9-7). Further from the scarp, the other components of subeconomic Coongulmerang Formation, silty HHF and ~~compacted~~ fine tailings cake will also be included in the profile. The Factor of Safety for slopes incorporating coarse sand tailings (essentially a silty sand) would be well in excess of 2.0 for slopes of 1:4 and flatter (Mining One, 2020).

In the rare valley slopes steeper than 1:4, the gravelly HHF will be used for the full depth down to the pit floor (Figure 9-6). The green line in this figure indicates the location of the most probable failure line in the slope profile. The Factor of Safety for this slope configuration has been estimated at over 3.0, assuming the floor is graded or dozed clean prior to backfilling (Mining One, 2020).

For erosion control, a surface cover will be applied to these slopes to facilitate vegetation regrowth. Surface cover characteristics (roughness, infiltration rate, particle erosion thresholds) on the constructed landform will be managed by a range of techniques, including:

- Inclusion of rock into the surface soil in susceptible areas (mainly along drainage channels).
- Higher density of trees and shrubs to reduce flow velocities, reduce runoff, promote accumulation of surface litter.
- Ripping of soils to break up hardpans or compacted zones.

For the higher erosion risk areas – steep outer faces and major flow channels – a range of engineering options are readily available and have been widely used, including application of hydromulches with tackifiers, surface stabilisation compounds, compost blankets, and (in channels) strategic placement of rocks, logs or other roughness elements. Appropriate options will be trialled and assessed during initial rehabilitation operations. Implementation of any required waterway stabilisation works will be done under the supervision of a qualified and experienced waterway engineer.

In higher gradient areas with greater erosion risk (valley slopes), it is planned to place topsoil directly over gravelly overburden. The overburden will be treated with gypsum to address high levels of sodium and magnesium in this material (Landloch 2020a), and the topsoil will be lightly ripped into the overburden surface, with amendment and fertiliser used to ensure vigorous establishment of grass, trees, and shrubs. The resulting gravelly surface will be more erosion resistant, and the profile formed will be less susceptible to tunnel erosion due to: amendment to prevent clay dispersion in the surface 0.5 metre of overburden; and mixing of topsoil into the surface of the overburden layer to eliminate the layering that facilitates lateral seepage flows.

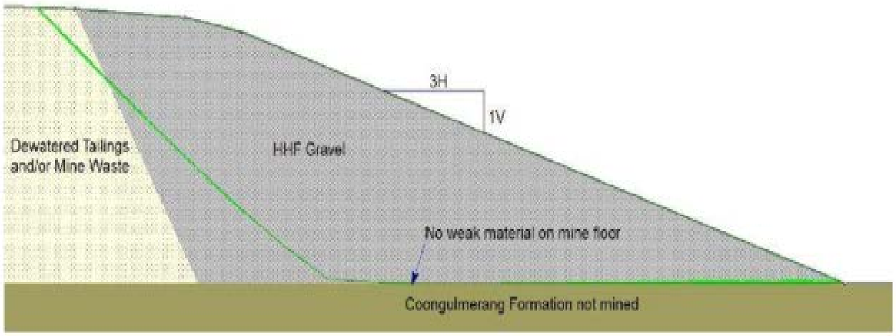


Figure 9-6: Schematic cross section showing cover near 1:3 slope (not to scale).

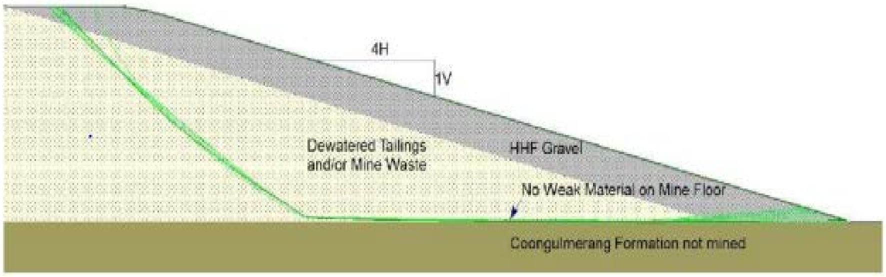


Figure 9-7: Schematic cross section showing cover near 1:4 slope (not to scale)

9.4.5 Unplanned closure

Unplanned closure of mining operations can be triggered by a range of internal or external factors, ranging from political or industrial unrest to market factors to natural disasters. In the event of a temporary suspension of operational activities, the *Mineral Resources (Sustainable Development) Act 1990* and relevant occupational health and safety legislation would be used to guide development of a Suspension Plan. Earth Resources Regulation would be notified of the nature of the suspension,its cause, and the measures implemented to limit impact to the environment and ensure health and safety requirements are met.

A suspension plan would include details of the following:

- Signage, physical barriers and security to prevent unauthorised access to the mine site.
- Removal or safe storage of any concentrate stockpiles remaining on site to minimise any impacts from radiological contamination.
- Removal of domestic and industrial wastes, chemicals, hydrocarbons and other hazardous substances.
- Provision of adequate onsite facilities for any staff remaining at the site (e.g., a caretaker).
- Revision of statutory reporting arrangements, in consultation with regulators.

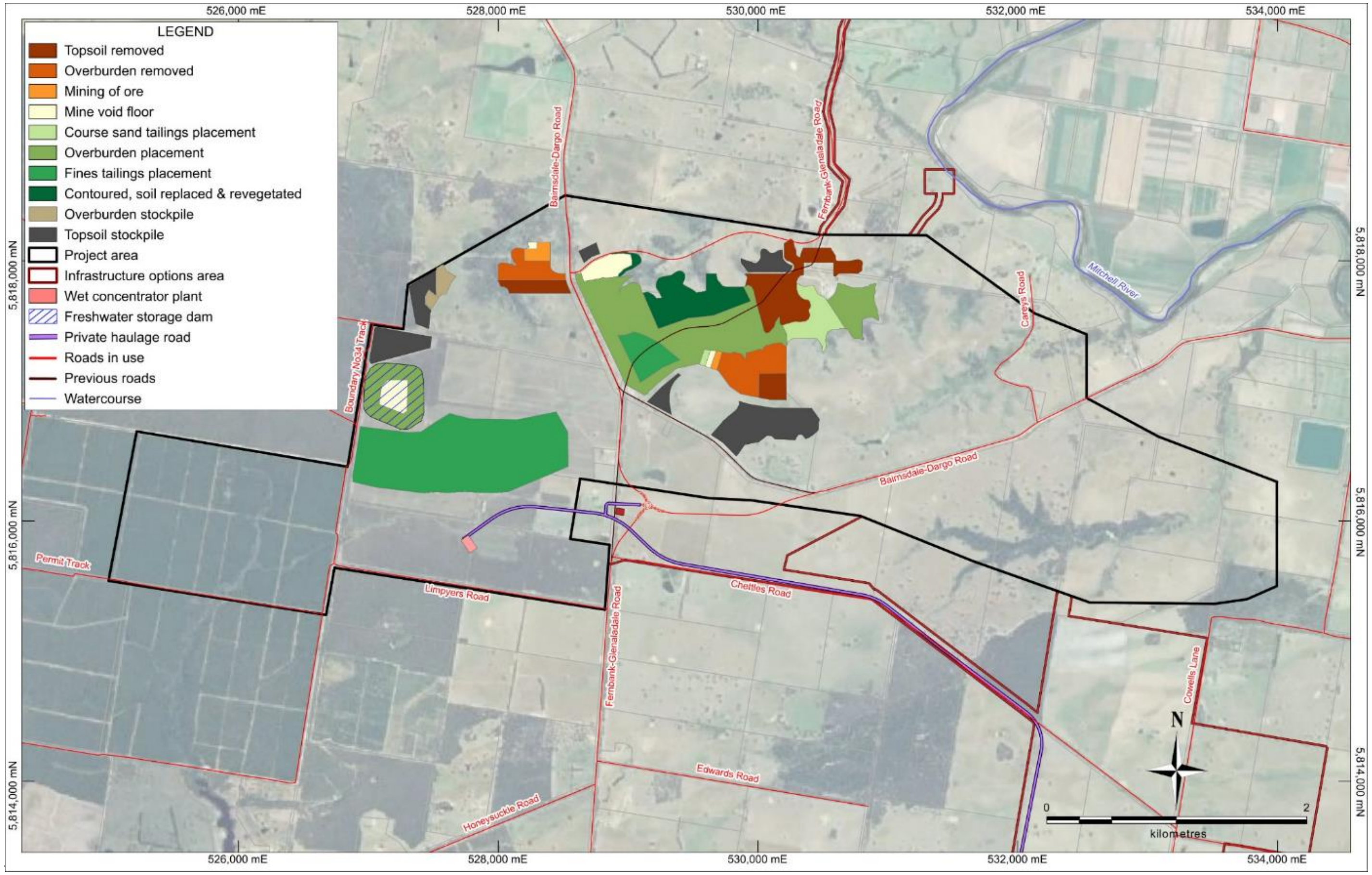
- review of the current surface water drainage for the duration of closure including all waterways, dams and mining areas with consideration of stabilisation of landforms, monitoring of structures, and management of water accumulations in dams or mining voids.

In the event of sudden, unanticipated permanent cessation of mining operations, a final closure report would be immediately prepared and, if necessary, a post-closure monitoring schedule would be developed.

9.5 Rehabilitation and closure timetable

Kalbar proposes to implement the project over a period of up to 20 years, which includes up to a two year construction and commissioning period. After the initial production ramp up at project commencement, the rate of mining and mineral processing will be approximately constant from year to year. At full capacity the project will mine the estimated mineral reserves in 15 years. The total area of disturbance will not exceed about ~~360~~ 285ha at any given time, of which approximately 18 ha corresponds to the active mine floor) and on average, ~80 ha is expected to be rehabilitated each year..

Rehabilitation will be implemented progressively,and follows the minepath which is optimised to several factors rather than following a simple progression. . For this reason, the simplest way to explain the planned rehabilitation schedule is in a series of figures, showing cleared areas, active mining areas and areas under rehabilitation. A series of plans illustrating the planned progressive rehabilitation of the Fingerboards project is provided in Figure 9-8 through Figure 9-12.



LEGEND
Topsoil removed
Overburden removed
Mining of ore
Mine void floor
Course sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
526,000 mE
528,000 mE
530,000 mE
532,000 mE
534,000 mE
5,818,000 mN
5,816,000 mN
5,814,000 mN
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Boundary-No34 Track
Careys Road
Mitchell River
Permit Track
Limpyers Road
Chettles Road
Edwards Road
Honeysuckle Road
Cowells Lane
N
0
2
kilometres

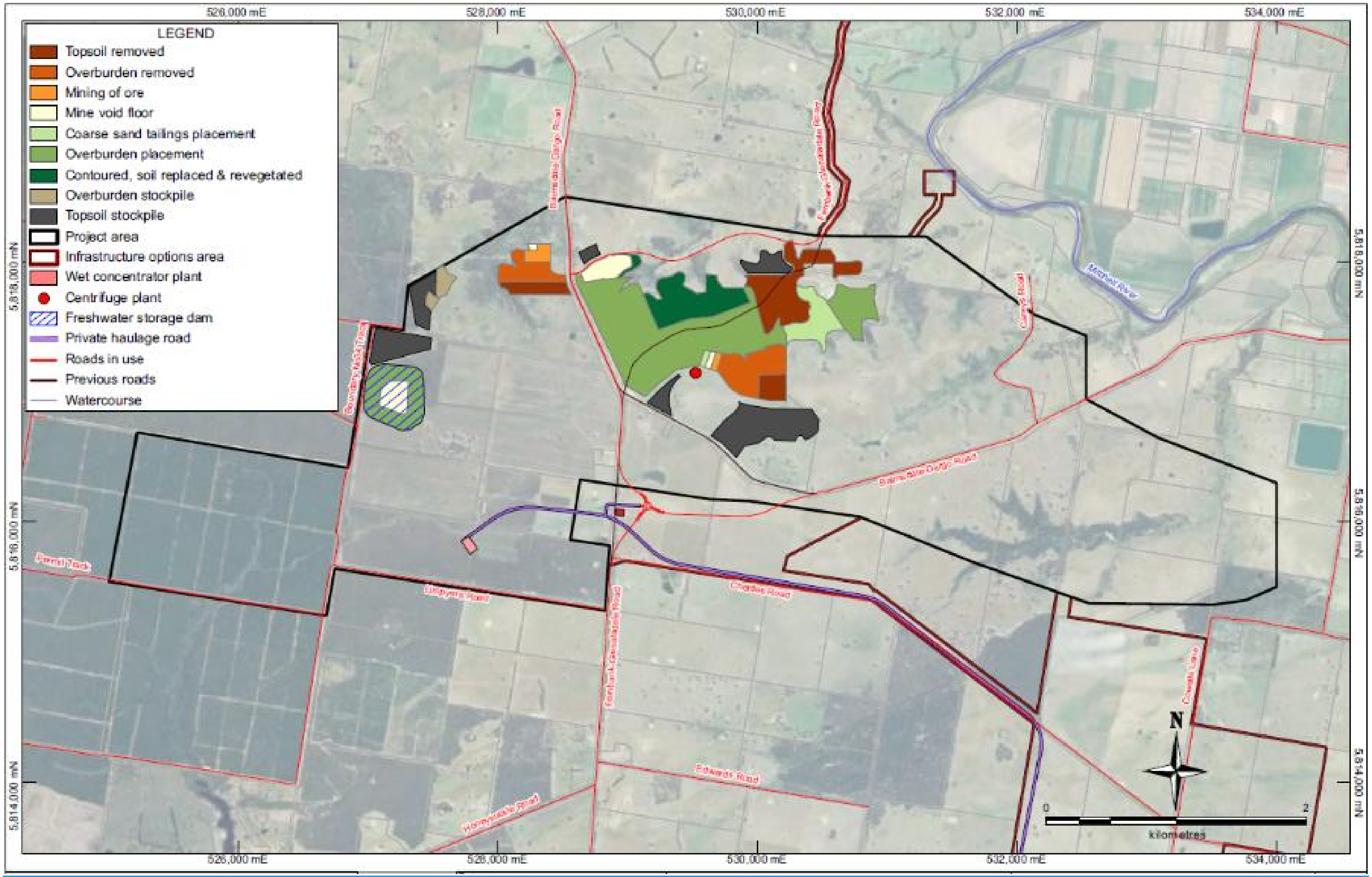
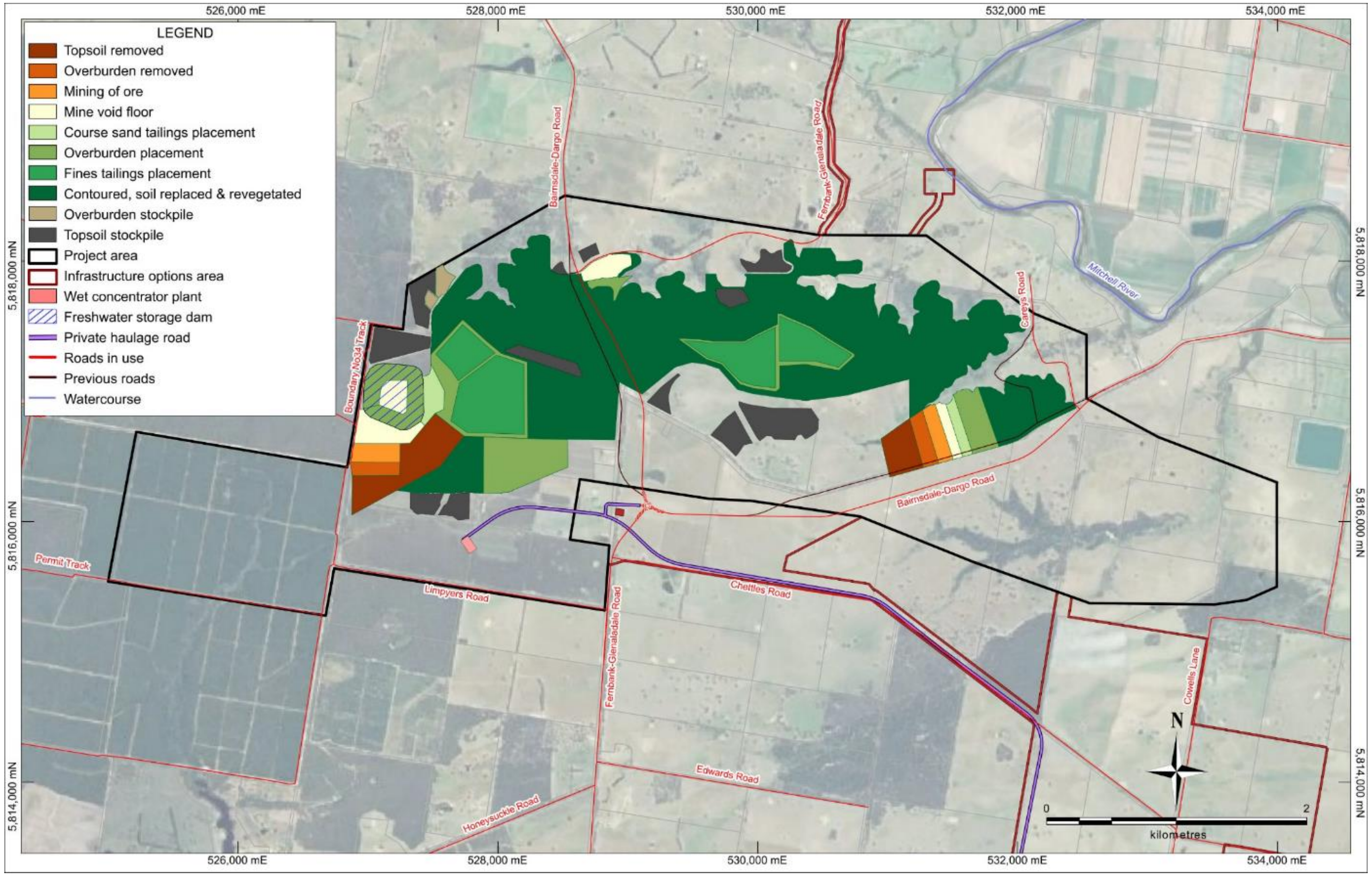


Figure 9-8: Disturbed and rehabilitated areas – Year 1 (indicative).



LEGEND
Topsoil removed
Overburden removed
Mining of ore
Mine void floor
Course sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
526,000 mE
528,000 mE
530,000 mE
532,000 mE
534,000 mE
5,818,000 mN
5,816,000 mN
5,814,000 mN
Mitchell River
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Careys Road
Boundary-No34 Track
Permit Track
Limpyers Road
Chettles Road
Cowells Lane
Edwards Road
Honeysuckle Road
N
0
2
kilometres

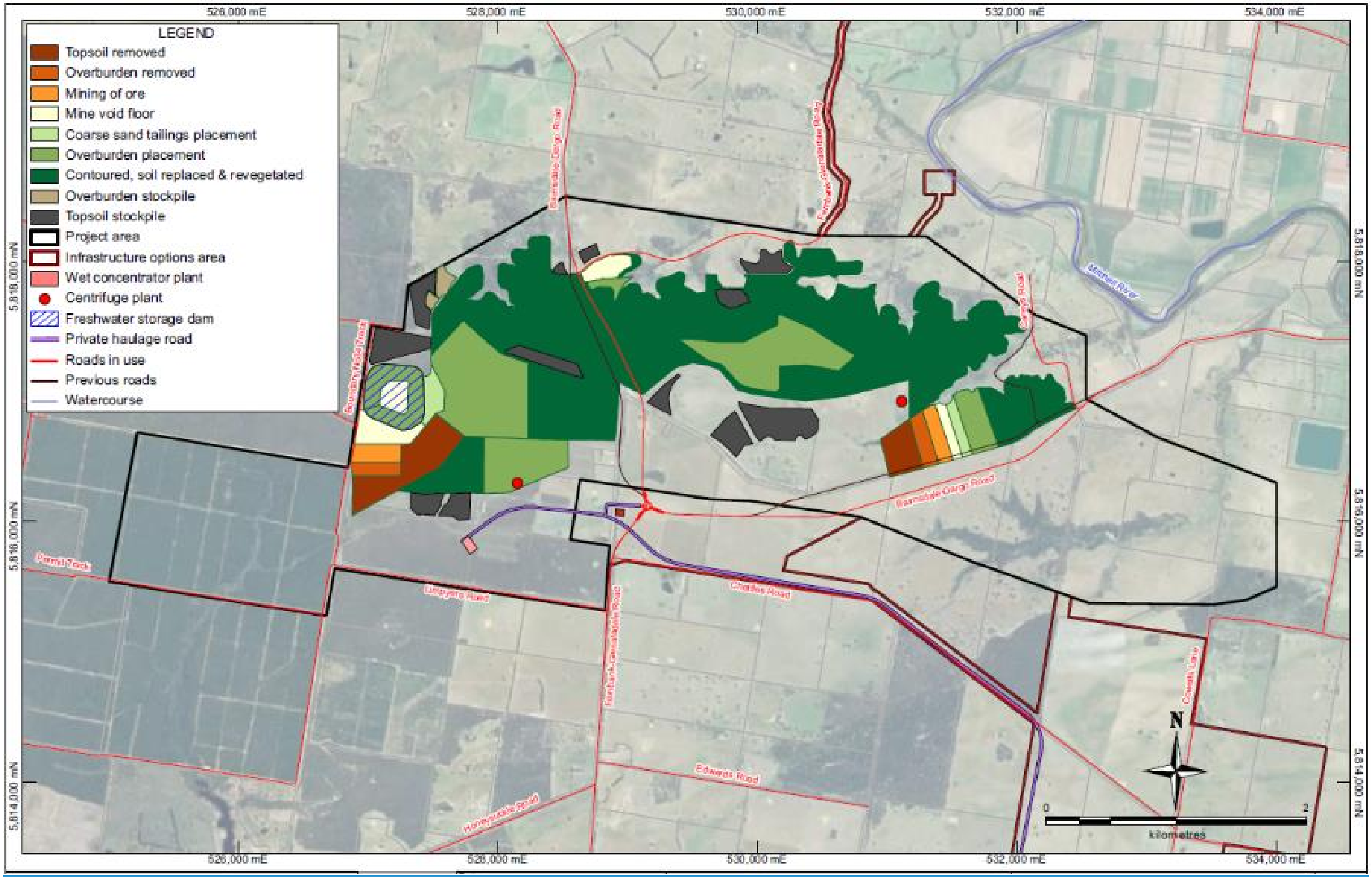
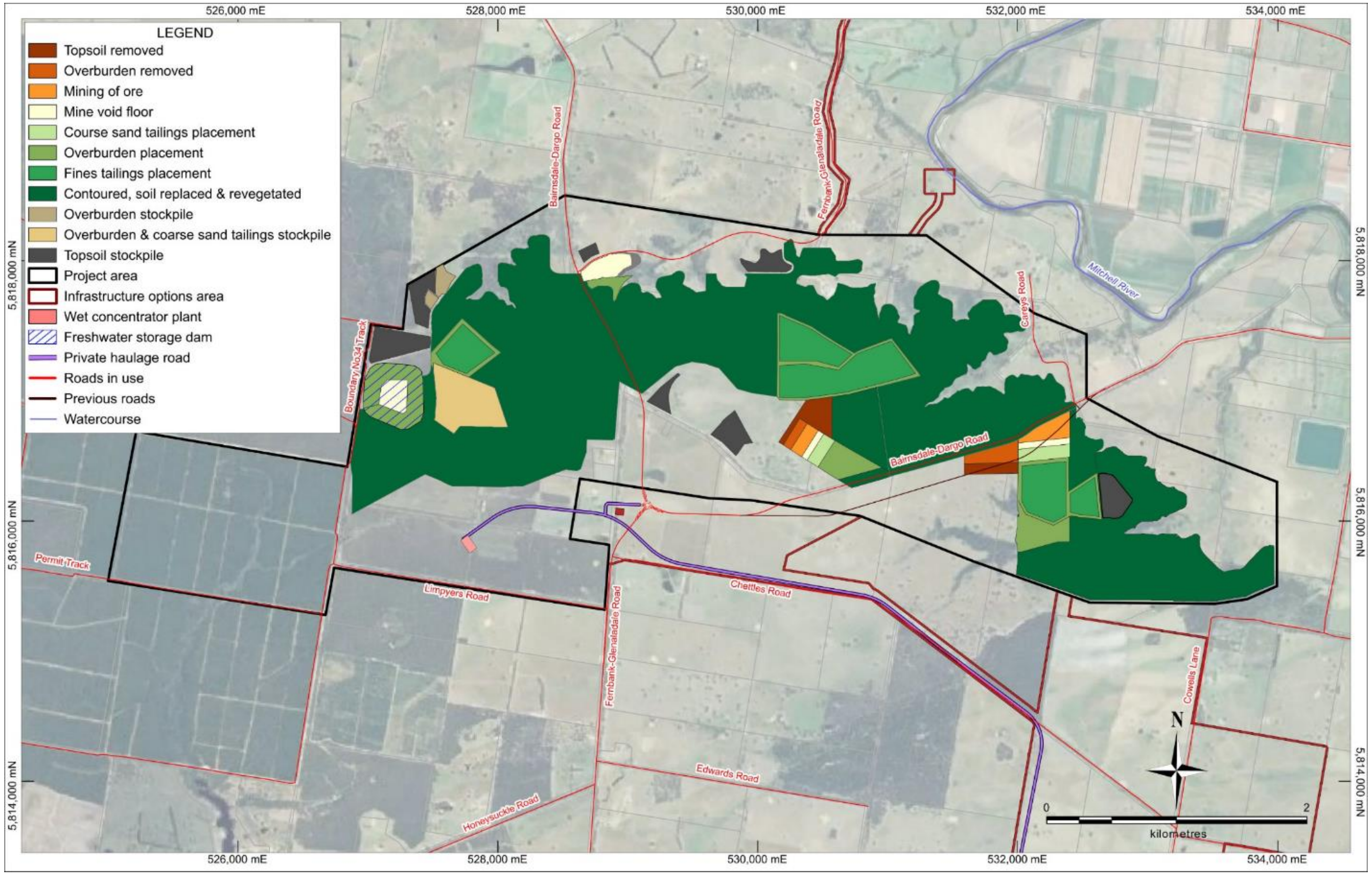


Figure 9-9: Disturbed and rehabilitated areas – Year 5 (indicative)


LEGEND
Topsoil removed
Overburden removed
Mining of ore
Mine void floor
Course sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Overburden & coarse sand tailings stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
526,000 mE
528,000 mE
530,000 mE
532,000 mE
534,000 mE
5,818,000 mN
5,816,000 mN
5,814,000 mN
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Mitchell River
Boundary No34 Track
Permit Track
Limpyers Road
Chettles Road
Edwards Road
Honeysuckle Road
Cowells Lane
N
0
2
kilometres

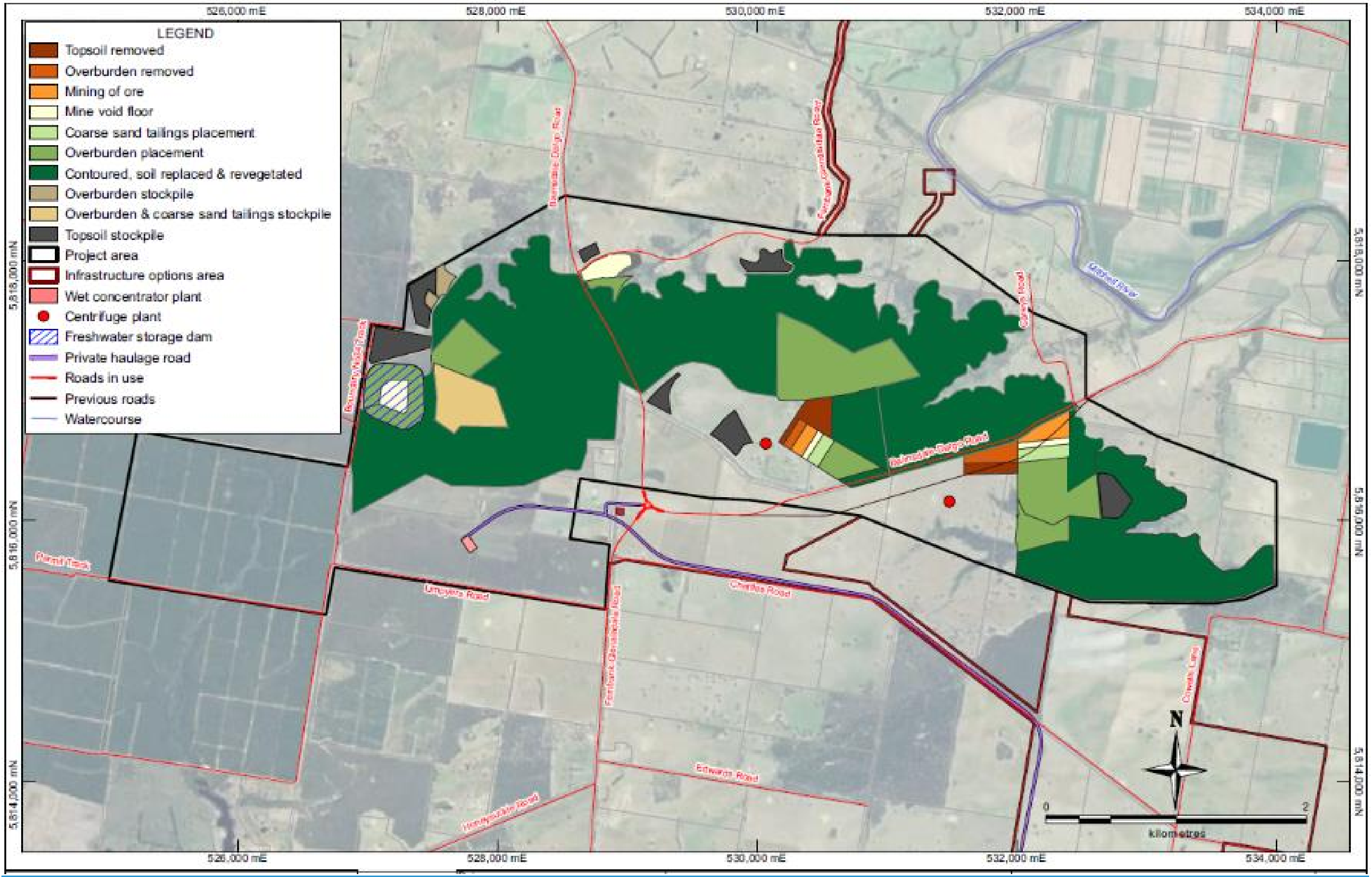
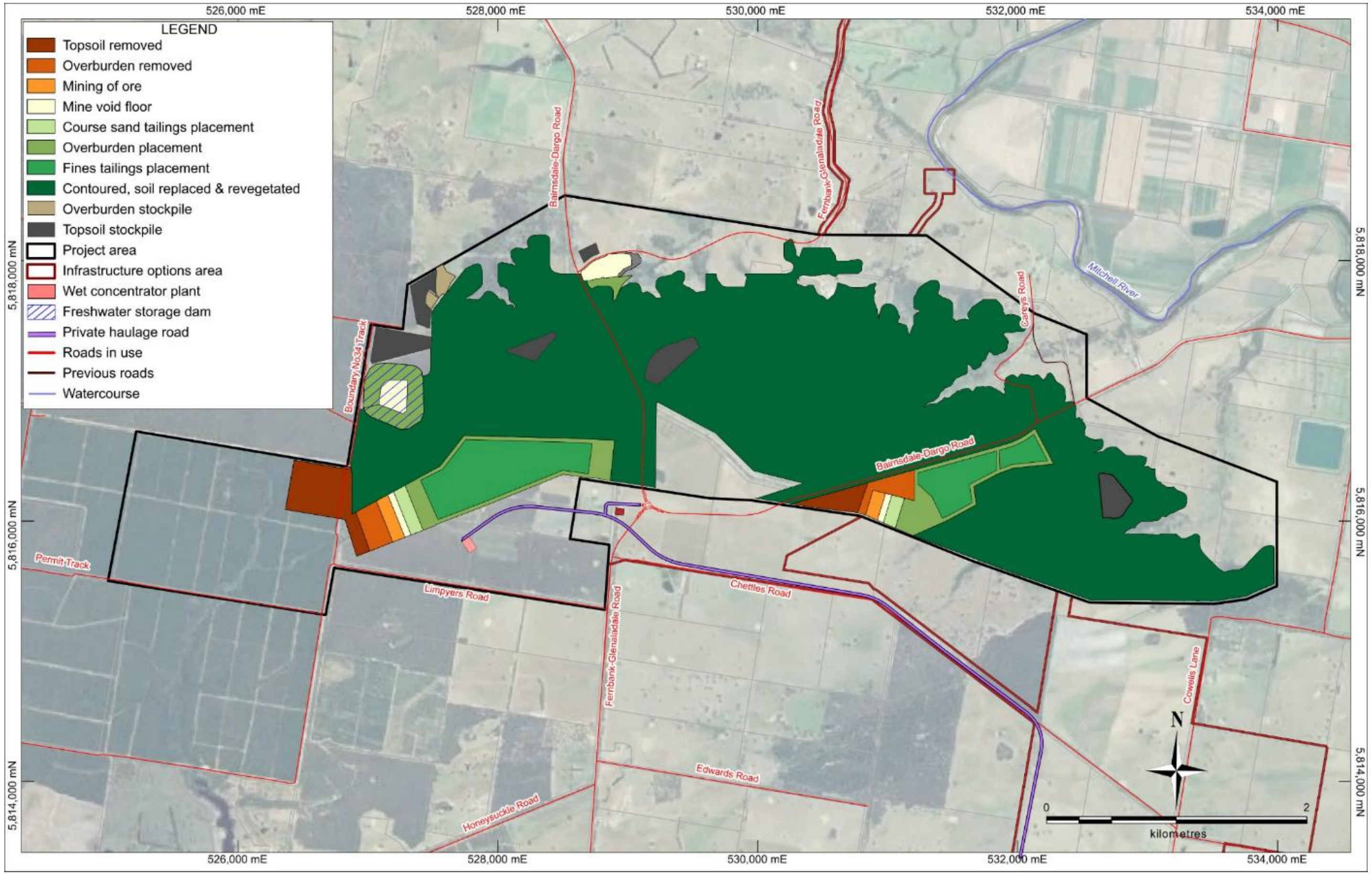


Figure 9-10: Disturbed and rehabilitated areas – Year 8 (indicative)


526,000 mE
528,000 mE
530,000 mE
532,000 mE
534,000 mE
5,818,000 mN
5,816,000 mN
5,814,000 mN
LEGEND
Topsoil removed
Overburden removed
Mining of ore
Mine void floor
Course sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Careys Road
Mitchell River
Boundary No34 Track
Permit Track
Limpyers Road
Chettles Road
Edwards Road
Honeysuckle Road
Cowells Lane
N
0
2
kilometres

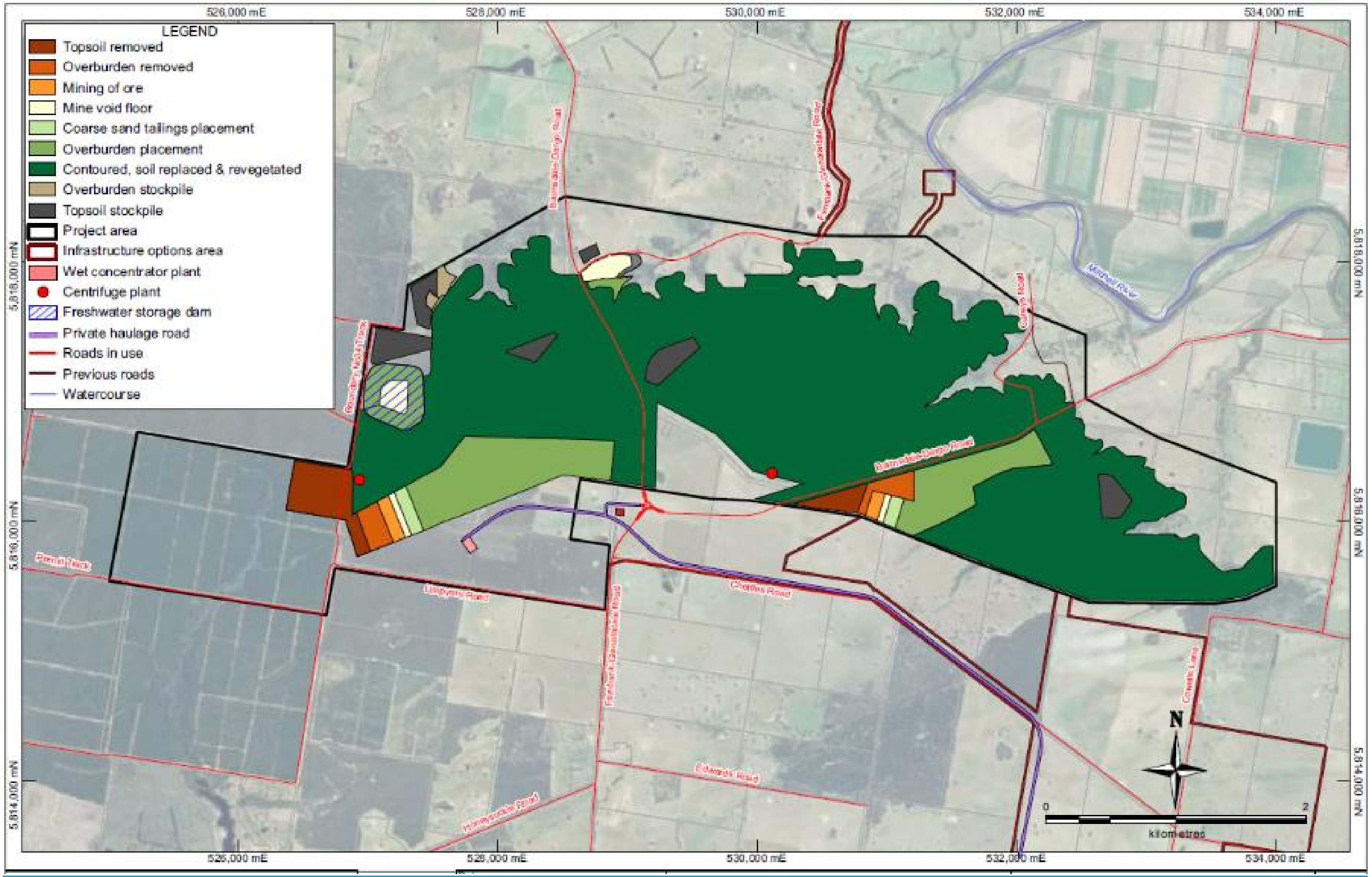
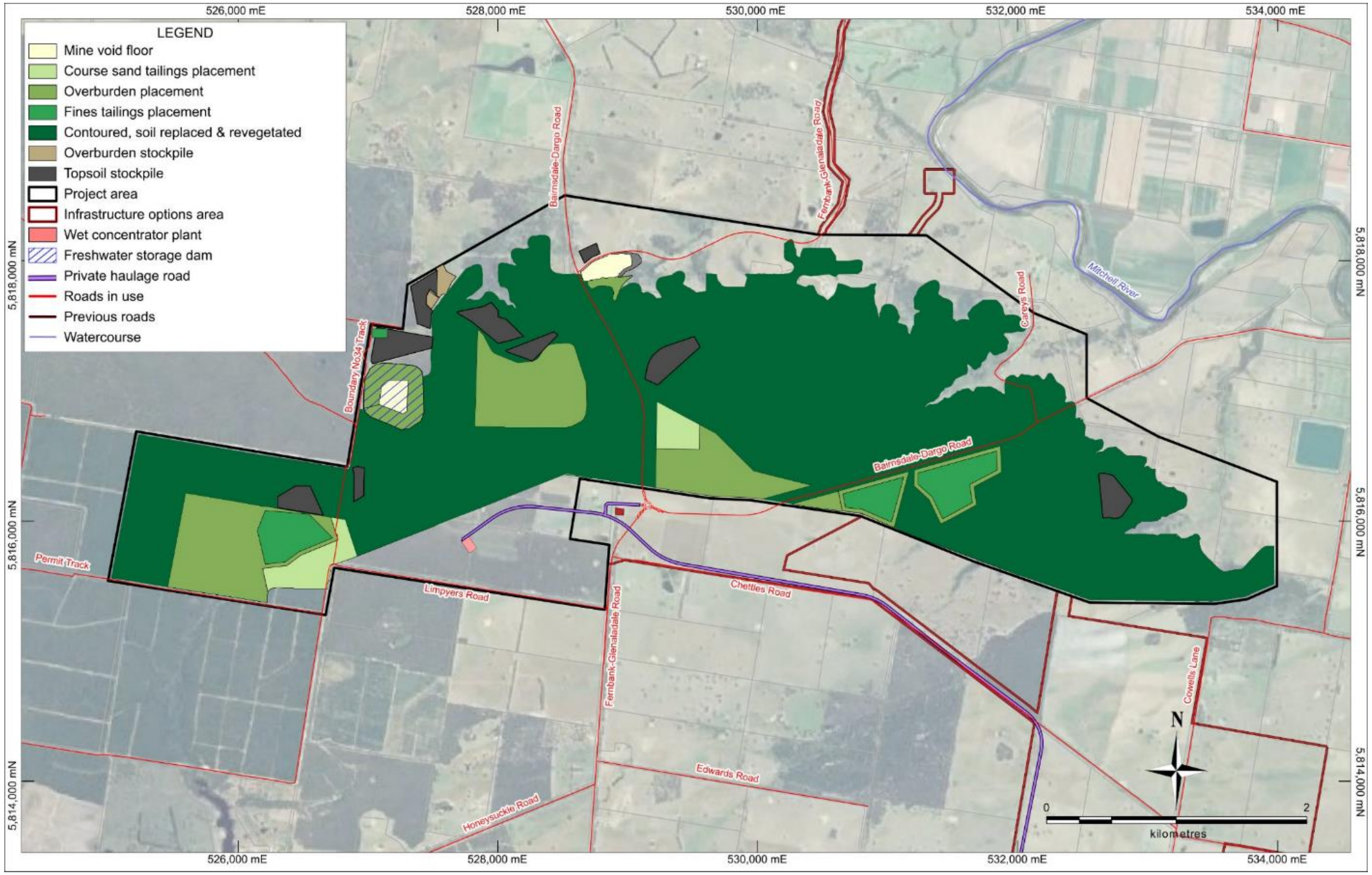


Figure 9-11: Disturbed and rehabilitated areas – Year 12 (indicative)


LEGEND
Mine void floor
Course sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
526,000 mE
528,000 mE
530,000 mE
532,000 mE
534,000 mE
5,818,000 mN
5,816,000 mN
5,814,000 mN
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Careys Road
Mitchell River
Boundary No634 Track
Permit Track
Limpyers Road
Chettles Road
Edwards Road
Honeysuckle Road
Cowells Lane
N
0
2
kilometres

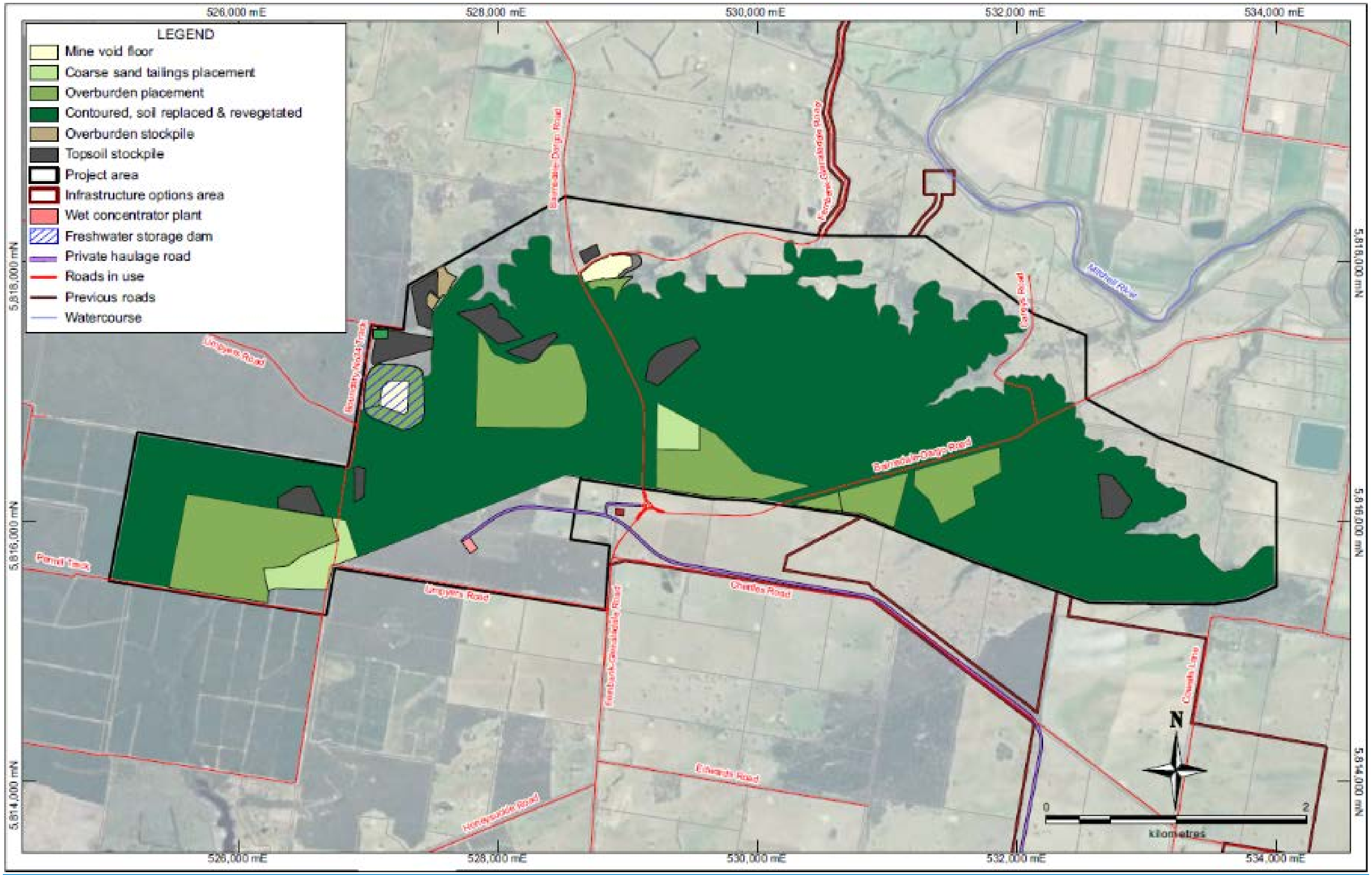


Figure 9-12: Disturbed and rehabilitated areas – Year 15 (indicative)

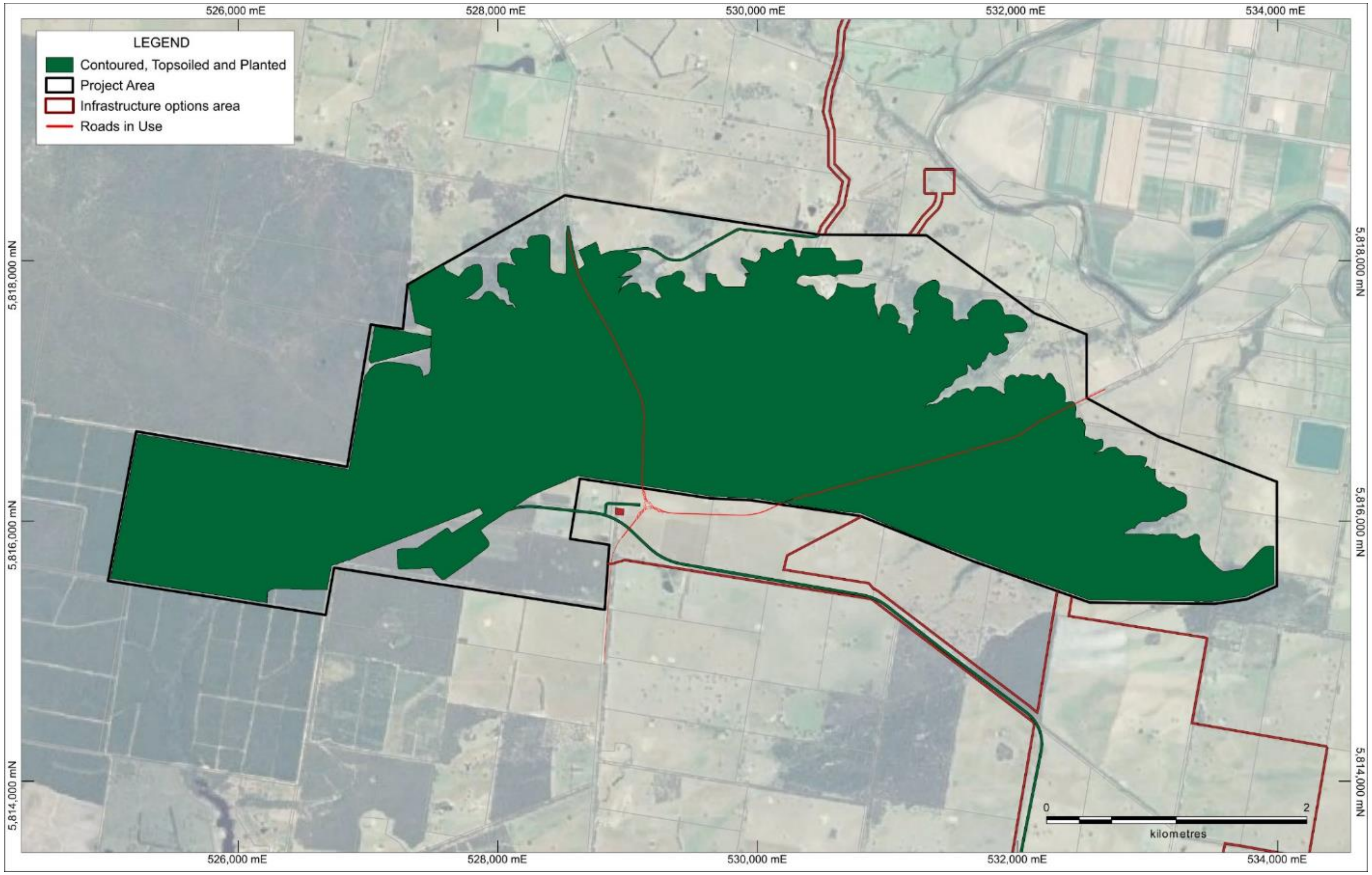


Figure 9-13: Disturbed and rehabilitated areas – Year 18 (indicative)

9.6 Knowledge gaps

The key knowledge gaps relevant to closure that have been identified to date are summarised in Table 9-4. Kalbar's proposed activities to address the gaps are also provided in the table. Knowledge gaps have ~~Kalbar~~ been identified by benchmarking against comparable projects, through the significant operational experience and knowledge in mineral sands by Kalbar staff and consultants, by expert advice, by TRG comments and by reference to regulator guidelines.

Table 9-4: Summary of rehabilitation and closure knowledge gaps

Knowledge gap	Relevant domains	Proposed activities to address	Timing
The potential for water erosion of constructed landforms, especially along drainage lines; effect of landform changes on erosion susceptibility.	All domains, but especially relevant to valley slopes and drainage lines in backfilled mining areas	Development of erosion / landform evolution model (LEM). Additional onsite soil works which include infiltration measurements, detailed soil descriptions (to B horizon) and testing samples for particle size distribution to further inform the LEM modelling. Eco Logical to develop a Faunal Mitigation and Landscape Augmentation Plan which will develop actions to improve landscape stability especially on slopes and riparian zones through the use of logs, woody debris, rocks and plantings. Field rainfall simulation trials to enable calibration of erosion / landform evolution models Development of erosion / landform evolution model	Further field or laboratory testing to better define erosion parameters proposed Q4 Q1 20202021 Development of Faunal Mitigation and Landscape Augmentation Plan Q2 2021 and landform evolution model proposed Q24 20210 (in parallel with detailed design and mine planning) Planned observations of erosion and runoff throughout operational life of mine (to validate landform evolution model) Q2 2021
The likely quality of runoff from areas disturbed by mining activities.	All domains, but especially relevant to valley slopes and drainage lines in backfilled mining areas	Leachability testing of tailings and overburden (recently completed) Hydrologic studies to be completed as part of EES (see Coffey 2020b). Field rainfall simulation trials to enable calibration of erosion / landform evolution models Water treatment testing (if required) to improve sediment settling	Hydrological studies (completed) in January 2019 Further field or laboratory testing to better define erosion parameters proposed Q4 Q1 20210 Water treatment testing (if required) to be completed Q1, 2020.

Knowledge gap	Relevant domains	Proposed activities to address	Timing
The optimum methods for placement of mining residues and recovered soil materials to achieve best land productivity and stability. Use of mine residues to improve drought resilience and pasture productivity.	Backfilled mining and tailings storage areas: especially relevant to proposed pasture areas on plateau landforms.	Study of constructed subsoil properties constructed using coarse and fine tailings mixtures has recently been completed (Landloch, 2020b) Further studies to be carried out using various mixtures of overburden and residue samples Preparation of materials inventory (quantities of various materials likely to be available at various stages of mining) Kalbar are in the process of setting up a container-based trial further investigating at the characteristics of manufactured sub soils, topsoils and amendments in relation to plant growth and productivity. This will undertaken at a larger scale that the early trial set up by Landloch and will be fully replicated so statistical analysis will be possible.	Testing of soil water properties and pasture productivity of overburden mixes – ongoing from Q4, 2018 Possible field trial of backfilling method following implementation of trial pit - 20210 (subject to regulator approval) Scheduling and placement of backfill to be reviewed as part of detailed mine planning and design, 2020 Kalbar plan to have this in place by Aug/Sept 2021 and we will monitor up to 2024.
Techniques for establishing vegetation communities typical of the pre-European vegetation communities that originally occurred within the project locality (Rehabilitation methods for establishment and maintenance of native grass woodland).	Backfilled mining and tailings storage areas: especially relevant to valley slopes and drainage lines and other areas proposed to be revegetated to resemble natural vegetation communities.	Relevant knowledge from restoration literature supported by rehabilitation trials to test planting techniques, requirement for fertiliser or other soil amendments and need for fencing to exclude herbivores. Develop seed production facilities to generate seed resources (quantity, diversity and quality) required for restoration.Rehabilitation trials to test planting techniques, requirement for fertiliser or other soil amendments and need for fencing to exclude herbivores.	Planning and seed collection – Q3, 2019 and onwards Develop 'phase 1' seed production facility (0.8 ha) to build seed resources for restoration – 2019-2024 (Bengworden). Develop 'phase 2' seed production facility (10 ha) to build seed resources for restoration – 2022 onwards (Fingerboards). Establishment of nursery to help establish seed bank – 2019-2021 Early trials of rehabilitation techniques in areas not required for mining (for example visual screening bunds), starting within 6-months of target area becoming available for revegetation. – 20212 onwards Kalbar will start some buffer plantings once approval granted along Fernbank Rd. Q3 2021

Knowledge gap	Relevant domains	Proposed activities to address	Timing
Arrangements for transferring land ownership and / or control to existing or new owners at completion of rehabilitation works.	All domains. Includes consideration of future use and control of areas revegetated to 'natural' ecosystems.	Ongoing discussions with stakeholders, including government agencies. Further development of completion criteria, in consultation with stakeholders.	Work has commenced, as part of land access negotiations and will be ongoing.
Detailed configuration of land use types. B	All domains.	Detailed mine planning and design. Ongoing discussions with stakeholders, including government agencies. Further development of completion criteria, in consultation with stakeholders.	Detailed design to commence upon completion of EES process. Further development of completion criteria requires identification of analogue sites and availability of input data from further field surveys / trials, laboratory testwork, and landform modelling. Consultation with stakeholders will be ongoing.
Consolidation behaviour of backfilled materials	Backfilled mining and tailings storage areas, chiefly where these are in proximity to public infrastructure.	Development of a documented ground control management plan (GCMP) Field trials to test deformation behaviour and compaction performance during construction of road pillars	GCMP to be developed and implemented prior to commencement of construction Field compaction trials and settlement monitoring to be conducted as part of establishment of road pillars required for mining Panels 2 and 3. Ongoing observations of slope stability, ground deformation and settlement throughout life of operation.
Implications of climate change for drainage design and selection of revegetation treatments.	All domains.	Incorporate climate change scenarios in landform evolution model Use of analogue / reference sites (rather than fixed, arbitrary criteria) as basis for assessing revegetation performance Kalbar have undertaken extensive baseline soil testing of analogue pastures on the project site during 2020-21. In 2021 we will set up grazing exclusion plots to derive baseline information on yield potential. Kalbar will also undertake baseline soil microbial analysis from pasture and analogue native site during 2021	Development of landform evolution model proposed Q2~~/Q3~~ 2021~~0~~ (in parallel with detailed design and mine planning) Establish analogue sites for target vegetation / pasture types prior to commencement of ground disturbing works. Including DEWLP data that gives a good baseline data on species composition and diversity at analogue sites. Some baseline works complete. Grazing exclusion plots to be developed in Q2/Q3 2021. Baseline soil microbial analysis will also be established Q2/Q3 2021.

10 MONITORING AND MAINTENANCE

Kalbar has developed a provisional rehabilitation and post-closure monitoring program (Table 10-1) that will build upon any monitoring conducted as part of operational environmental management. Environmental monitoring will be undertaken by Kalbar staff or by suitably qualified and experienced consultants. The proposed monitoring program will be reviewed and updated at least three-yearly during the active life of mining operations, in consultation with key stakeholders. Kalbar has assumed that the monitoring program (and any maintenance arising from monitoring information) will be conducted for at least 5 years after project completion (closure), unless otherwise agreed with ERR and other stakeholders.

Internal compliance / performance reviews will be conducted annually by Kalbar to check whether rehabilitation and closure actions proposed in this plan are being carried out as required providing reliable evidence of progress towards agreed closure outcomes. An independent audit of rehabilitation and closure activities will be conducted every 3 years to measure performance against the monitoring schedule and standards shown in Table 10-1.

Post-closure maintenance requirements have not yet been determined, although it is likely that some ongoing weed control and maintenance of fencing and sediment / erosion control structures may be required in the post-closure phase of the project. Maintenance requirements will be defined on the basis of operational experience and will be included in subsequent versions of this rehabilitation plan.

Table 10-1~~10-1~~: Rehabilitation monitoring schedule (indicative)

Aspect	Post-closure action	Method / standard	Frequency
Structural integrity of engineered elements			
Retained drainage structures and/or sediment detention dams	Visual inspection and reporting by qualified engineer	Visual inspection	Annually, with additional inspections following significant storm events (>1 in 10 years events).
Constructed landforms	Continue operational settlement monitoring Topographic survey of surface levels	Survey targets (prisms) located on mine slopes and read by a robotic total station (RTS) Lidar	Annual review of monitoring data by qualified engineer At closure and 5 years post-closure
Road pavements in geotechnical risk zone or within 50 m of geotechnical risk zone	Continue operational monitoring of pavement deformation	Visual inspection Strain and tilt gauges and/or settlement plates	Annual visual observations and review of settlement data by qualified engineer.
Erosion, slope stability and surface water management			

Aspect	Post-closure action	Method / standard	Frequency
Constructed landforms and other rehabilitated areas	Qualitative or quantitative assessment of erosion: minimum requirement is for visual assessment (including photographic record) to document evidence of sheet, rill or tunnel erosion	Comparison with condition of agreed analogue sites	Twice yearly and after significant rainfall events (>1 in 10 years event) for five years following completion of rehabilitation.
Sediment detention ponds (if retained at cessation of mining)	Observations of quantity of sediment in detention ponds;	Volumetric estimate	6-monthly
	Field and laboratory testing of water quality in ponds	Comparison with SEPP or discharge licence criteria	6-monthly
Waterway condition	Structured observations to assess stability / health of waterways within / immediately adjacent to operational areas	AusRivAS Physical Assessment Protocol (or agreed equivalent method)	2-yearly and following any major rainfall events (72 hr rainfall exceeds 136 mm, corresponding approximately to a 1 in 5 year 72 hour event
Water quality			
Water quality during construction, operations and active rehabilitation phases	Mitchell River approved compliance points (MR01 to MR05)	In accordance with relevant Australian Standards; results to be compared with SEPP or discharge licence criteria	Every two months initially, moving to quarterly thereafter with agreement from regulator.
Water quality during construction, operations and active rehabilitation phases	Field and laboratory testing of representative Perry River at two locations – to be agreed with requlators	In accordance with relevant Australian Standards; results to be compared with SEPP or discharge licence criteria	Every two months initially, moving to quarterly thereafter with agreement from regulator.
Water quality during construction,	Onsite disturbed catchments . Two locations within each	In accordance with relevant	Every two months (if water is present)

Aspect	Post-closure action	Method / standard	Frequency
operations and active rehabilitation phases	impacted drainage line – to be agreed with regulators	Australian Standards; results to be compared with SEPP or discharge licence criteria	
Water quality following significant rainfall events during construction, operations and active rehabilitation phases	Onsite surface water sampling locations SW01, SW02, SW03, SW04, SW05, SW06	In accordance with relevant Australian Standards; results to be compared with SEPP or discharge licence criteria	When rainfall received at mine site exceeds 60 mm within a 24 hour period (corresponding approximately to a 1 year ARI event), assuming water is available to sample.
Groundwater levels in Coongulmerang and Balook Formations	Monitor groundwater levels to monitor potential mounding or perching at Twelve locations – to be agreed with regulators	Dipping of bores	Monthly
Groundwater quality in Coongulmerang and Balook Formations	Monitor groundwater levels to monitor potential mounding or perching at the Twelve locations – to be agreed with regulators	pH, salinity, dissolved metals, radionuclides, major cations and anions, nutrients	Quarterly
Flora and vegetation			
Areas revegetated to natural ecosystem analogues	Vegetation cover, condition, species diversity and weed occurrence	Comparison with condition of agreed analogue sites	Annually
Areas revegetated to pasture	Vegetation cover, condition, species diversity and weed occurrence, yield or carrying capacity	Comparison with condition of agreed analogue sites	Annually
Soil quality			
Soil fertility	Monitoring of pH, EC, major macronutrient (nitrogen,	NATA-approved methods suitable	Annually during operations and

Aspect	Post-closure action	Method / standard	Frequency
	phosphorus, potassium and organic carbon) concentrations in the root zone (0 to 600 mm) (measured onsite and at reference sites)	for assessing plant growth media	rehabilitation activities and for for five years following completion of rehabilitation.
Radiation			
Constructed landforms	Gamma radiation survey across backfilled areas	Comparison with pre-mining radiation levels at Fingerboards site and in surrounding areas	Annually for first two years and then every 3 years if radiation is below baseline levels
Atmosphere	Radon and thoron monitoring	Comparison with pre-mining radiation levels at Fingerboards site and in surrounding areas	Annually for first two years and then every 3 years if radiation is below baseline levels
Atmosphere	Dust deposition	Dust deposition measurements	Monthly during operations and rehabilitation activities
Water (Surface and ground	Total gamma radiation levels	Comparison with pre-mining radiation levels at Fingerboards site and in surrounding areas	Quarterly

11 FINANCIAL PROVISIONING FOR CLOSURE

Kalbar has used the Department of Economic Development, Jobs, Transport and Resources' bond calculator as the basis for preparing a preliminary rehabilitation and closure cost estimate. The closure cost estimate will be provided to Earth Resources Regulation to inform its estimation of the bond required for project approvals. The manner and form used to determine the rehabilitation bond will be determined by the Minister for Resources.

The preliminary estimate of decommissioning, rehabilitation and closure costs took into account the full extent of disturbance for the planned 20 year mine life. It included the following cost components:

- Demolition / removal of industrial infrastructure, including associated hardstand areas and services.
- Completion of a contaminated site assessment (including radiation monitoring) over the whole of the industrial infrastructure area and over any area in which mining products or residues (tailings) have been stored (either permanently or on a temporary basis).
- An allocation for clean-up of soil contamination (assumed to affect up to 20% of the industrial area to a nominal depth of 0.5 m).
- General site clean up to remove demolition debris and other rubbish.
- Backfilling, capping and recontouring of mine voids.
- Removal / recontouring of on-site access and haul roads.
- Removal / reshaping of bunds (if required).
- Removal of any dam lining or burial of clay dam lining where demonstrated to be benign to the environment.
- Backfilling of water storages.
- Re-establishment and erosion control of any replaced watercourses
- Subsoil mixing and placement over all disturbed areas
- Topsoil replacement over all disturbed areas.
- Revegetation of all disturbed areas to agreed post-mining vegetation types, using a combination of direct seeding and planting of tubestock; allocation.
- Fencing of revegetated areas which require protection from livestock and other herbivores (nominal allocation of 25 km of fencing); post-closure maintenance of fences for up to 5 years.
- Post-closure monitoring, maintenance and reporting for 10 years, or until completion criteria have been achieved (whichever is less).
- A 10% contingency sum, as recommended in the DEDJTR bond calculator.

Key assumptions included in the closure and rehabilitation cost estimate include:

- Decommissioned plant and equipment are assumed to have no resale value.
- Rehabilitation is assumed to be carried out progressively, in accordance with this plan and commitments given in the EES.
- Revegetation treatments and final land uses are assumed to be those described in this plan.
- No power, water, telecommunications or other on-site infrastructure will be retained at project completion, unless separately negotiated with landowners and approved by relevant government authorities.

- Funding of post-closure maintenance and monitoring arrangements will be reviewed periodically to ensure consistency with statutory requirements.

The following cost items are part of overall project costs, but do not form part of the rehabilitation and closure cost estimate:

- Compensation agreements with landholders.
- Severance or redundancy payments to employees or contractors.
- Shire rates, royalties or taxes.

Kalbar's financial provisioning process is linked to the company's annual budget cycle. During operations, costs and unit rates for rehabilitation and closure activities will be developed at a site level and used as the basis for annual review of closure and rehabilitation cost provisioning.

12 ACQUISITION, ANALYSIS AND MANAGEMENT OF CLOSURE INFORMATION

12.1 Baseline data

Data and information from baseline studies conducted as part of the Fingerboards EES are stored in electronic format. A shared folder database will be created to provide members of the Environmental Review Committee ready access to monitoring data and other relevant environmental information as the project moves to an operational footing.

12.2 Other closure-related data

Once the Fingerboards project is operational, a range of other information relevant to mine rehabilitation and closure outcomes will be generated. Relevant information includes:

- The history of rehabilitation and closure implementation at the site.
- Environmental management plans and procedures.
- Licences and permits and associated compliance reports
- Spatial datasets documenting disturbed and rehabilitated areas and approved operations boundaries.
- Materials inventories.
- Monitoring records (for example, radiation, air quality, water quality, vegetation health, weather).
- Stakeholder consultation records.
- Incident reports, investigations and corrective action reports.
- Annual environmental reports.
- Rehabilitation monitoring reports.
- Internal and external audit reports.

Information and data required for implementing and evaluating mine rehabilitation and closure would be held in electronic format at the Fingerboards operations site, with daily back-up of records in Kalbar's Perth server and /or to a cloud-based storage location.

Kalbar will consult with other mine operators in the mineral sands sector to explore the possibility of data and information sharing to facilitate benchmarking of closure and rehabilitation performance.

Annual environmental reports and statutory compliance reports would be provided in the formats stipulated by the relevant agencies. Summaries of monitoring results required for annual compliance reporting would be made publicly available through Kalbar's website and in other formats.

As part of its stakeholder engagement, Kalbar would develop a succinct, plain-language rehabilitation performance and progress report to provide information on mine rehabilitation and other environmental results in an accessible format.

13 SUMMARY OF CLOSURE AND REHABILITATION COMMITMENTS

A full list of commitments including all of the closure and rehabilitation commitments from this plan and from the Fingerboards EES is provided in the Draft Work Plan. Section 8.2 of this document provides the key rehabilitation plan subset of these commiitments. The register will be updated periodically to capture additional requirements arising from statutory licensing and ongoing stakeholder engagement.

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15 GLOSSARY

Adaptive Management: The implementation of new control measures and management strategies based on learning from new information obtained from practices and monitoring, ensuring continual improvement.

Actions: defined activities aimed at achieving a given *objective*. May be outcome-based (prevent surface water pollution by release of entrained sediment) or process-based (implement Surface Water Management Plan). A given action may support more than one objective.

Care and Maintenance: A period during which mining and /or mineral processing activities are temporarily suspended, but management activities continue to be implemented to controlimpacts to the environment, community and other receptors.

Closure Planning: A life-of-mine process which ultimately can culminate in relinquishment of tenure. It broadly includes planning for the entire life of operation from pre-feasibility through to approvals, operations to cessation of operations, and includes decommissioning, rehabilitation and monitoring and maintenance for a defined period. The term 'closure' alone is sometimes used to indicate the point at which operations cease, infrastructure is removed and management of the site is largely limited to monitoring.

Criterion: a measure by which attainment of objectives may be assessed. A criterion may be used to assess *conformance with specified actions* or to evaluate the *effectiveness of those actions* in achieving objectives (or both).

Decommissioning: A process usually undertaken at the end of operations (e.g. cessation of mineral or ore production) involving the dismantling and removal and/or transfer of all infrastructure, services and utilities where no longer required, as well as decontamination of contaminated land and infrastructure.

Encapsulation: Surrounding a hazardous or reactive waste with inert or benign materials in order to isolate the waste from oxygen, water and erosive forces and prevent further environmental impact.

Factor Of Safey: The ratio of the driving force for failure (the shear force applied by the mass of a potential failure block in the direction of the most probable sheer plane) to the strength of the rock or soil resisting that failure. Examples of design criteria for open pit walls are supplied below (DOME, 1999)

Wall Class	Consequence of failure	Design FOS	Design POF	Pit wall examples
1	Not Serious	Not applicable		Walls (not carrying major infrastructure) where all **potential**+ failures can be contained within containment structures.
2	Moderately Serious	1.2	10%	Walls not carrying major infrastructure.
3	Serious	1.5	1%	Walls carrying major mine infrastructure (e.g. treatment plant, ROM pad, tailings structures).
4	Serious ++	2.0	0.3%	Permanent pit walls near public infrastructure and adjoining leases.

Goal: an overall outcome towards which rehabilitation and closure effort is directed.

Groundwater: Water that is located below the earth's surface and stored in saturated porous soil, sand and rock formations, known as aquifers.

Hazard: A source of potential harm or risk to the environment, any member of the public, or to land, property or infrastructure in the vicinity of work carried out at a mine.

Indicator: An attribute which can be measured or described and used to evaluate if a *criterion* has been met (performance indicator, trend indicator) or whether agreed actions are being implemented (milestone indicators).

Licence: A mining licence as per Part 2 of the MRSDA.

Licensee: The holder of a licence.

Low risk mines: A mining licence that covers an area of 5 hectares of less and does not involve underground operations, blasting, clearing of native vegetation or the use of chemical treatments (unless, the Department Head declares in writing that the applicant must lodge a work plan).

Measure (or metric): A qualitative or quantitative aspect of an *indicator*; a variable which can be measured (quantified) or described. Used for tracking completion of actions, assessing performance or showing trends.

Mine: Any land on which mining is taking place under a licence.

Mine closure: Permanent cessation of mining activities, typically because the mineral resource has been exhausted or for other reasons - for example, because operations are no longer profitable, safe or legal. Closure may be planned or unplanned and may be dictated by a range of technical, social / political, economic and environmental factors (or some combination of these). Mine closure is usually considered to include not only decommissioning and shut down of mining facilities, but also activities required for rehabilitation of environmental disturbance / restoration of land capability.

Mining: Extracting minerals from land for the purpose of producing them commercially, and includes processing and treating ore.

Minister: The Minister for Resources, Victorian Government.

Objective: a specific outcome which, if achieved, will contribute to the attainment of one or more closure *goals*. An objective can serve as the basis or focal point for a regime of closure activities.

Progressive rehabilitation: Progressive rehabilitation refers to all temporary or permanent rehabilitation works undertaken progressively throughout the various stages of the operation.

Project completion: The stage of the project when planned mining and rehabilitation works have been implemented and the land within the project area is available and suitable for relinquishment so that it may be used productively by others.

Proponent: The person or entity/company ultimately responsible for the rehabilitation and closure of the mine, who has submitted the RP. May be the holder of the mining licence (licensee) or under the MRSDA.

Rehabilitation: The return of disturbed land in a safe, stable and non-polluting condition to an agreed and sustainable end land use. It broadly involves stable landform design including voids and mining wastes, construction and shaping, materials characterisation, materials handling and placement, surface water management and revegetation.

In some situations the end land use may be to a state as close as practicable to its state before mining activities took place, or otherwise to an alternative agreed land use. Rehabilitation is to take place as per the approved rehabilitation plan under the MRSDA and any conditions contained within the relevant licence.

Rehabilitation bond: A financial security provided by the operator to fund rehabilitation work carried out by the State should the operator default on its obligations to complete rehabilitation. In Victoria, the bond is determined by the Minister for the rehabilitation of land affected as set out in Section 80 of the MRSDA.

Rehabilitation plan: An approved plan that includes the issues relating to, and actions required for, rehabilitation of land during and after cessation of mining operations, with considerations listed in Section 79 of the MRSDA.

Rehabilitation cost calculator: A spreadsheet tool that applies probabilistic methods and forms to assess rehabilitation liabilities. The calculator derives estimates of rehabilitation base cost, risk cost and total liability.

Rehabilitation liability: The cost estimate to rehabilitate the existing disturbed footprint as per the approved work plan.

Rehabilitation liability assessment: The methodology used in calculating the cost of completing the rehabilitation works in order to determine the amount of a rehabilitation bond.

Relinquishment: Formal approval by the relevant regulating authority indicating that the closure criteria for the mine have been met to the satisfaction of the regulating authority and stakeholders, accompanied by release from mining.

Restoration: Re-establishment of an ecosystem structure and function as close as possible to its prior natural state or replication to a desired natural reference ecosystem.

Revegetation: The establishment of vegetation cover after earthworks are finished, consistent with the agreed post closure land use.

Risk: The chance of something occurring that will have an impact on desired outcomes. A risk is often specified in terms of an event or circumstance and the consequences that may form from it.

Social licence to operate: The recognition and acceptance of a company's contribution to the community in which it operates, moving beyond basic legal requirements towards developing and maintaining constructive, honest and respectful relationships with stakeholders, necessary for the business to be sustainable.

Stakeholder: A person, group or organisation with the potential to affect or be affected by the process or outcome of mine rehabilitation and closure. A stakeholder can also be a decision maker in the process.

Standard: A rule established by authority. Environmental standards may take the form of prescribed numerical values set through approvals, legislation, policy or codes of practice. Assessments against standards are used to assess regulatory compliance.

Sustainable: Able to meet the needs of the present without compromising the ability of future generations to meet their needs.

16 ACRONYMS AND ABBREVIATIONS

% w/w	Percentage weight of solute in a total weight of solution after mixing
°C	Degrees centigrade
AEP	Annual Exceedance Probability – the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year
AHD	Australian Height Datum
ANCOLD	Australian National Committee on Large Dams
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BOM	Bureau of Meteorology
CFA	Country Fire Authority
CNG	Compressed natural gas
CRG	Community Reference Group
DEPI	Department of Environment and Primary Industries
DO	Dissolved oxygen
DOC	Dissolved Organic Carbon
DPI	Department of Primary Industries
DSDBI	Department of State Development, Business and Innovation
DTPLI	Department of Transport Planning and Local Infrastructure
EC	Electrical conductivity
EE Act	*Environment Effects Act 1978* (Vic)
EES	Environment Effects Statement
EGSC	East Gippsland Shire Council
EMS	Environmental management system
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (C'wlth)
EQO	Environmental Quality Objective
ERC	Environmental Review Committee
EVC	Ecological Vegetation Community – native vegetation types used for biodiversity planning and conservation assessment at landscape, regional and broader scales in Victoria
g/t	Grams per tonne

H:V	Horizontal to vertical ratio
ha	Hectare
HAZOP	Hazard and operability study
HDPE	High density polyethylene
HHC	Half height shipping container
IBC	Intermediate bulk container
IML	Infrastructure Mining Licence
kg	Kilogram
kL	Kilolitre
km	Kilometre
kt	Kilotonne
kV	Kilovolt(s)
L/a	Litres per year
L/s	Litres per second
m	Metre(s)
m^3/a	Cubic metres per annum
m^3/h	Cubic metres per hour
Ma	Million years ago
mAHD	Metres above Australian Height Datum
MCE	Maximum Credible Earthquake
Mha	Millions of hectares
ML	Megalitre(s)
mmNB	Millimetres nominal bore
MOU	Memorandum of Understanding
MRSD Act	*Mineral Resources (Sustainable Development) Act 1990* (Vic)
Mtpa	Million tonnes per annum
MVA	Megavolt ampere(s)
MW	Megawatt(s)
NAF	Non-acid-forming

NAG	Net Acid Generation, an estimate of the amount of acid that could be generated by oxidation of sulphide minerals, determined by a test method that involves adding hydrogen peroxide to a mineral sample to rapidly oxidise sulphide minerals.
NAPP	Net acid producing potential, measured in kilograms of sulphuric acid per tonne of material (kg H_2SO_4/t)
NHMRC	National Health and Medical Research Council
NMD	Neutral Mine Drainage, a neutral pH, sulfate-rich drainage, commonly high in metals or metalloids, which can occur when metal sulfides are exposed to atmospheric conditions.
NORM	Naturally occurring radioactive material
ORP	Oxidation / Reduction Potential, a measure (expressed in millivolts) of the strength of chemical oxidising or reducing agents present in water
Pa	Pascal(s)
PAF	Potentially acid-forming
PFRD	Process Facility Runoff Dam
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation – the greatest accumulation of precipitation for a given duration meteorologically possible for an area.
RO	Reverse osmosis – a commonly-used method of water purification
ROM	Run of mine
ROM pad	Run of mine pad – storage area for mined ore awaiting crushing
SMZ	Special Management Zone
SPZ	Special Protection Zone
t	Tonne(s)
TN	Total nitrogen
TOC	Total organic carbon
TP	Total phosphorus
tpa	Tonnes per annum
TPH	Total Petroleum Hydrocarbons
TSF	Tailings storage facility

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KALBAR

Attachment 1

Risk Assessment (Rehabilitation)

Fingerboards Project Risk Assessment, Abridged (Mine Rehabilitation and Closure Risks Only)

Risk ID	Hazard	Causes / contributing factors (risk events)	Receptors / Impacts	Phase	Standard mitigation	Additional mitigation	Residual likelihood over life of activity	sidual Consequen	Residual risk
1	Release of sediment or contaminated water to surface waters	Runoff from disturbed or rehabilitated areas	Sedimentation increases water turbidity and harms aquatic species	CL	• Where practical, undisturbed water will be diverted around disturbance areas. (SW24) • Construction of stockpiles will be designed to avoid flow pathways to minimise erosion (RH04). • Seeding times and rates will consider site/local experience to ensure maximum reliability of vegetation establishment. Seed will be re-applied in areas where rehabilitation performance does not meet established targets at a later date when suitable conditions, e.g. rainfall, are considered likely to occur (RH13). • Rehabilitated areas will be irrigated where required to achieve satisfactory performance and vegetation establishment (RH14). • Rehabilitation will be designed to ensure plateau tops are close to level and evenly distribute runoff to drainage paths (swales) discharging off the plateau to adjoining major flow channels. Swales will be designed to be broad, U-shaped, no steeper than current stable drainage paths, and consistent in shape with the most stable drainage paths currently present (RH07). • Riparian vegetation will be established in rehabilitated flow channels to increase effective hydraulic roughness of the channels, reduce flow velocities, increase channel stability to storm flows and minimise erosion (RH08). • High rates of vegetation establishment will be prioritised in rehabilitated flow channels (especially in the first three years of rehabilitation) to maximise surface cover and minimise erosion (RH09). • Hydroseeding will be used in rehabilitation areas where appropriate to stabilise the soil surface and minimise erosion (RH12). • Rocks will be included in rehabilitated channel beds to increase critical shear of the bed, resist initiation of scour, and channel stability to storm flows and minimise erosion (RH06).	• Surface runoff will be directed around or away from areas of land disturbance, stockpiles, embankments or nearby sensitive areas, where practicable. (SW04) • Runoff that comes into contact with construction areas will be captured by surface water management infrastructure and directed to sedimentation dams. (SW04) • If required, flocculant treatment (i.e., alum, gypsum or hydrated lime) will be used to drop suspended sediment levels in the stormwater. (SW04) • Erosion within gullies will be controlled using primary and secondary sediment traps constructed at appropriate sites. (SW04) • Catchment water onsite will be retained to approximately 10% annual-exceedance-probability. (SW04) • All site drains will be designed and profiled to reduce water flow velocity, to reduce erosion. (SW04) • Stockpiles will be vegetated where appropriate to minimise erosion (RH22). • Stockpile slope angles will be constructed as low as practicable and mulch materials and contour ripping will be strategically used to stabilise stockpiles, prevent runoff and minimise erosion (RH23). • The density of deep-rooted trees and shrubs will be increased in areas at risk from	Unlikely	Moderate	Medium
7	Release of sediment or contaminated water to surface waters	Altered site hydrology results in increased rate of erosion in natural drainage lines downstream of project.	Sedimentation increases water turbidity and harms aquatic species	O, CL	• Erosion within gullies will be controlled using primary and secondary sediment traps constructed at appropriate sites. Catchment water onsite will be retained to approximately 10% annual-exceedance-probability. (SW04) • All site drains will be designed and profiled to reduce water flow velocity, to reduce erosion. (SW04) • If required, bed instability will be addressed though appropriately designed grade controls, such as the use of rock chutes. (SW07) • All stream bed instability areas will be inspected prior to, and annually during construction to ascertain a rate of movement and potential risks posed to mine infrastructure. (SW08) • Surface water management infrastructure designed to capture run-off (and eroded sediments) will be maintained until such a time that vegetation is fully established and stabilising the landscape. (SW09) • The fresh water storage, process water, contingency water and water management dams will have design storage allowance for a 1 in 100-year average-exceedance probability, 72-hour storm event. (SW11) • Permanent and long-term drains and bund walls will be topsoiled and vegetated with suitable vegetation as soon as possible. (SW29) • Appropriate outlet scour protection will be placed on all stormwater outlets, chutes, spillways and slope drains to dissipate flow energy and minimise risk of soil erosion.(SW30) • Ephemeral drainage gullies will be revegetated in areas downstream of future mining activities prior to operations commencing (SW34) • Rocks will be included in rehabilitated channel beds to increase critical shear of the bed, resist initiation of scour, and channel stability to storm flows and minimise erosion. (RH06) • Swales will be designed to be broad, U-shaped, no steeper than current stable drainage paths, and consistent in shape with the most stable drainage paths currently present. (RH07) • Riparian vegetation will be established in rehabilitated flow channels to increase effective hydraulic roughness of the channels, reduce flow velocities, increase channel stability to storm flows and minimise erosion. (RH08) • The density of deep-rooted trees and shrubs will be increased in areas at risk from tunnel erosion by minimising the volume of seepage flows reaching valley slopes and channels. (RH24)	• Augment vegetation / rock cover / other roughness elements in drainage lines; • Conduct routine and event-based erosion observations to check effectiveness of erosion control; maintenance as required	Rare	Moderate	Medium
17	Seepage of contaminated water into groundwater	1	Contamination of groundwater by acidity, metals or radionuclides	O, CL	• Management techniques, such as underdrains, sumps and water recovery pumps will be used to maximise the recovery of water in the mine void tailings containment cells. (GW15) • The project will recover and reuse water where practicable (such as run-off from ore stockpiles and and water recovered from in-pit tailings storage) ~~supernatant water from the TSF and tailings area within the mine void)~~ (SW23) • Visual assessments of water controls will be undertaken on a regular basis, and after rainfall, to ensure that any ponding, seepage or run-off meets design specifications. (GEO006)		Unlikely	Minor	Low
27	Altered hydrology	Seepage from tailings in mine void Seepage from tailings in mine void	Groundwater seepage compromises geotechnical stability of surrounding areas Groundwater seepage increases risk of tunnel erosion in surrounding areas	O, CL O, CL	• Tailings will be returned to the mine void in a partly dried state (damp but not wet). (GEO22) • Surface water run-off controls will be incorporated into mine designs, including: i) Prevent uncontrolled ponding of surface water from rainfall within the specified stand-off distance from slope crests. ii) Prevent any surface water run-off over mine slopes with crest windrows, including no ponding behind the windrows. iii) if necessary, collect any rainfall run-off and any seepage water in drains along the toes, and re-direct it down the slope via a lined drain to the mine void floor. iv) Manage water storage and ponding areas on the mine void floor well away from slope toes, and away from areas that will form foundations for road pillars. (GEO05) • Visual assessments of water controls will be undertaken on a regular basis, and after rainfall, to ensure that any ponding, seepage or run-off meets design specifications. (GEO06)		Rare	Major	Medium
28	Altered hydrology	Seepage from mine contact water dams	Groundwater seepage increases risk of tunnel erosion in surrounding areas Groundwater seepage reduces geotechnical stability of surrounding areas	O, CL	• All dams for regular water storage will be constructed with engineered liners to reduce infiltration to groundwater. (GW01) • The design, construction and operation of the freshwater storage dam will follow the Australian National Committee on Large Dams (ANCOLD) Guidelines on the Consequence Categories for Dams (October 2012). (SW12)		Unlikely		Medium
29	Altered hydrology	Altered site hydrology: redirection of flow, modified storage.	Increased flood risk in Mitchell / Perry catchments	C,O,CL	• The design and placement of infrastructure in the project area will consider potential for flow accumulation and increased flood risk. (SW02)		Unlikely	Minor	Low
34	Erosion	Water erosion in drainage channels	Vegetation / ecosystem damage	C,O,CL	• Erosion within gullies will be controlled using primary and secondary sediment traps constructed at appropriate sites. Catchment water onsite will be retained to approximately 10% annual-exceedance-probability. All site drains will be designed and profiled to reduce water flow velocity, to reduce erosion. (SW04) • Surface water management infrastructure designed to capture run-off (and eroded sediments) will be maintained until such a time that vegetation is fully established and stabilising the landscape.(SW09)		Unlikely	Minor	Low

Fingerboards Project Risk Assessment, Abridged (Mine Rehabilitation and Closure Risks Only)

Risk ID	Hazard	Causes / contributing factors (risk events)	Receptors / Impacts	Phase	Standard mitigation	Additional mitigation	Residual likelihood over life of activity	sidual Consequer	Residual risk
36	Erosion	Use of inappropriate materials in constructed landforms	Slope instability: loss of containment from constructed landforms	PC	• Rigorous geotechnical design methodology will be undertaken using all available information and account for variability and uncertainty. (GEO001) • Slopes of landforms will be constructed from Haunted Hills Formation gravel, particularly for slopes with a gradient of 1:3. For slopes of 1:4 or flatter, dewatered, stacked and compacted coarse sand tailings can be placed within the outer zone of the slope, with Haunted Hills Formation gravel forming an outer layer. (GEO20) • Haunted Hills Formation clay will be placed well within the landform. (GEO21)Haunted Hills Formation gravel will be compacted to minimise latent settlement of the landform that may affect the final landform profile. (GEO23) • Road pillars will be constructed from HHF Gravel and/or coarse sand tailings. (GEO13)		Unlikely	Moderate	Medium
37	Airborne and deposited dust	Ground clearing, mining, materials handling, vehicular traffic Wind erosion from disturbed surfaces Wind erosion from stockpiles ~~Wind erosion from TSF~~	Exposure to airborne particulates (total particulates, PM10, PM2.5, crystalline silica) sensitive receptors exceeds human health guideline values	C,O ~~O~~	• Areas will be cleared in a staged manner only as required to reduce dust generation by minimising the area of exposed ground surfaces at any one time. (AQ01) • Water or appropriate suppressants will be applied to working surfaces, stockpiles, haul roads and other areas where rehabilitation is not yet practical, to minimise dust generation. In particular, during drier months when less rainfall is expected. (AQ02) • Drop heights for topsoil and overburden during creation of stockpiles will be minimised as far as practicable to reduce dust generation. (AQ03) • Topsoil stripping will be planned and conducted in consideration of forecast and actual weather conditions to minimise dust generation. (AQ05) • The mine void will be progressively backfilled and rehabilitated to minimise the area required for topsoil and overburden stockpiles . (AQ07) • Haul vehicles will travel on designated haul roads only and haul routes will be minimised where possible. (AQ08) • Construction and management of haul roads will use best practice dust control measures. For example, the application of water or chemical suppressants, cessation of haulage during adverse weather conditions or in response to real-time monitoring.(AQ16) • Construction of the wear course of internal haul roads will use an optimal size grading of aggregate with road stabilisation and compaction agents.(AQ17)	• Certain activities will be scheduled to avoid excessive dust emissions during forecast adverse weather conditions. (AQ14) • Certain activities will cease when real-time monitoring indicates that trigger level near key sensitive receptors have been reached. (AQ13)	Unlikely	Minor	Low
39	Airborne and deposited dust	Wheel-generated dust and lift off from disturbed areas and stockpiles	Contamination of horticultural crops (inert dust)	C,O	• Areas will be cleared in a staged manner only as required to reduce dust generation by minimising the area of exposed ground surfaces at any one time. (AQ01) • Water or appropriate suppressants will be applied to working surfaces, stockpiles, haul roads and other areas where rehabilitation is not yet practical, to minimise dust generation. In particular, during drier months when less rainfall is expected. (AQ02) • Drop heights for topsoil and overburden during creation of stockpiles will be minimised as far as practicable to reduce dust generation. (AQ03) • Speed limits will be implemented and enforced on unsealed project roads to minimise dust generation. (AQ04) • Topsoil stripping will be planned and conducted in consideration of forecast and actual weather conditions to minimise dust generation. (AQ05) • The mine void will be progressively backfilled and rehabilitated to minimise the area required for topsoil and overburden stockpiles .(AQ07) • Haul vehicles will travel on designated haul roads only and haul routes will be minimised where possible. (AQ08) • Construction and management of haul roads will use best practice dust control measures. For example, the application of water or chemical suppressants, cessation of haulage during adverse weather conditions or in response to real-time monitoring.(AQ16) • • Construction of the wear course of internal haul roads will use an optimal size grading of aggregate with road stabilisation and compaction agents.(AQ17)	Additional mitigation measures will be implemented and monitored through the proposed environmental management framework. In particular, the development of an air quality risk treatment plan (AQ15)	Unlikely	Moderate	Medium
40	Airborne and deposited dust	Wheel-generated dust and lift off from disturbed areas and stockpiles	Contamination of horticultural crops (metals) Contamination of horticultural crops (radionuclides)	C,O	• Areas will be cleared in a staged manner only as required to reduce dust generation by minimising the area of exposed ground surfaces at any one time. (AQ01) • Water or appropriate suppressants will be applied to working surfaces, stockpiles, haul roads and other areas where rehabilitation is not yet practical, to minimise dust generation. In particular, during drier months when less rainfall is expected. (AQ02) • Drop heights for topsoil and overburden during creation of stockpiles will be minimised as far as practicable to reduce dust generation. (AQ03) • Speed limits will be implemented and enforced on unsealed project roads to minimise dust generation. (AQ04) • Topsoil stripping will be planned and conducted in consideration of forecast and actual weather conditions to minimise dust generation. (AQ05) • The mine void will be progressively backfilled and rehabilitated to minimise the area required for topsoil and overburden stockpiles .(AQ07) • Haul vehicles will travel on designated haul roads only and haul routes will be minimised where possible. (AQ08) • Construction and management of haul roads will use best practice dust control measures. For example, the application of water or chemical suppressants, cessation of haulage during adverse weather conditions or in response to real-time monitoring.(AQ16) • Construction of the wear course of internal haul roads will use an optimal size grading of aggregate with road stabilisation and compaction agents.(AQ17)		Possible	Insignificant	Low
41	Airborne and deposited dust	Lift off of dust during haulage of concentrate	Increase in airborne or deposited dust along haul route	O	• Speed limits will be implemented and enforced on unsealed project roads to minimise dust generation. (AQ04) • Haul vehicles will travel on designated haul roads only and haul routes will be minimised where possible. (AQ08) • Construction and management of haul roads will use best practice dust control measures. For example, the application of water or chemical suppressants, cessation of haulage during adverse weather conditions or in response to real-time monitoring. (AQ16)		Rare	Minor	Low

Fingerboards Project Risk Assessment, Abridged (Mine Rehabilitation and Closure Risks Only)

Risk ID	Hazard	Causes / contributing factors (risk events)	Receptors / Impacts	Phase	Standard mitigation	Additional mitigation	Residual likelihood over life of activity	sidual Consequer	Residual risk
42	Airborne and deposited dust	Wheel-generated dust and lift off from disturbed areas and stockpiles	Adverse impacts on vegetation health / productivity / marketability	C,O	• Areas will be cleared in a staged manner only as required to reduce dust generation by minimising the area of exposed ground surfaces at any one time. (AQ01) • Water or appropriate suppressants will be applied to working surfaces, stockpiles, haul roads and other areas where rehabilitation is not yet practical, to minimise dust generation. In particular, during drier months when less rainfall is expected. (AQ02) • Drop heights for topsoil and overburden during creation of stockpiles will be minimised as far as practicable to reduce dust generation. (AQ03) • Speed limits will be implemented and enforced on unsealed project roads to minimise dust generation. (AQ04) • Topsoil stripping will be planned and conducted in consideration of forecast and actual weather conditions to minimise dust generation. (AQ05) • The mine void will be progressively backfilled and rehabilitated to minimise the area required for topsoil and overburden stockpiles .(AQ07) • Haul vehicles will travel on designated haul roads only and haul routes will be minimised where possible. (AQ08) • Construction and management of haul roads will use best practice dust control measures. For example, the application of water or chemical suppressants, cessation of haulage during adverse weather conditions or in response to real-time monitoring.(AQ16) • Construction of the wear course of internal haul roads will use an optimal size grading of aggregate with road stabilisation and compaction agents.(AQ17)	Additional mitigation measures will be implemented and monitored through the proposed environmental management framework. In particular, the development of an air quality risk treatment plan. (AQ15)	Unlikely	Moderate	Medium
43	Airborne and deposited dust	Wheel-generated dust and lift off from disturbed areas and stockpiles	Soiling of surfaces at sensitive receptors Deposition on rooftops, followed by contamination of rainwater tanks Aesthetic impacts: reduction in clarity of air	C,O	• Areas will be cleared in a staged manner only as required to reduce dust generation by minimising the area of exposed ground surfaces at any one time. (AQ01) • Water or appropriate suppressants will be applied to working surfaces, stockpiles, haul roads and other areas where rehabilitation is not yet practical, to minimise dust generation. In particular, during drier months when less rainfall is expected. (AQ02) • Drop heights for topsoil and overburden during creation of stockpiles will be minimised as far as practicable to reduce dust generation. (AQ03) • Speed limits will be implemented and enforced on unsealed project roads to minimise dust generation. (AQ04) • Topsoil stripping will be planned and conducted in consideration of forecast and actual weather conditions to minimise dust generation. (AQ05) • The mine void will be progressively backfilled and rehabilitated to minimise the area required for topsoil and overburden stockpiles .(AQ07) • Haul vehicles will travel on designated haul roads only and haul routes will be minimised where possible. (AQ08) Construction and management of haul roads will use best practice dust control measures. For example, the application of water or chemical suppressants, cessation of haulage during adverse weather conditions or in response to real-time monitoring.(AQ16) • Construction of the wear course of internal haul roads will use an optimal size grading of aggregate with road stabilisation and compaction agents.(AQ17)		Possible	Insignificant	Low
44	Airborne toxicants and greenhouse gases	Wind erosion from disturbed surfaces Wind erosion from stockpiles ~~Wind erosion from TSF~~	Exposure to airborne toxicants at sensitive receptors exceeds human health guideline values Exposure to airborne toxicants at sensitive receptors exceeds human health guideline values	C,O O	• Areas will be cleared in a staged manner only as required to reduce dust generation by minimising the area of exposed ground surfaces at any one time. (AQ01) • Water or appropriate suppressants will be applied to working surfaces, stockpiles, haul roads and other areas where rehabilitation is not yet practical, to minimise dust generation. In particular, during drier months when less rainfall is expected. (AQ02) • Drop heights for topsoil and overburden during creation of stockpiles will be minimised as far as practicable to reduce dust generation. (AQ03) • Topsoil stripping will be planned and conducted in consideration of forecast and actual weather conditions to minimise dust generation. (AQ04) • The mine void will be progressively backfilled and rehabilitated to minimise the area required for topsoil and overburden stockpiles. (AQ07) • A principal contact person will be identified for community queries and follow a complaint response procedure (see Chapter 12: Environmental management framework for the detailed complaints procedure). Twenty-four hour contact details for relevant project personnel will be provided through letters and signage onsite. (AQ19)	Certain activities will cease when real-time monitoring indicates that trigger level near key sensitive receptors have been reached. (AQ13) Certain activities will be scheduled to avoid excessive dust emissions during forecast adverse weather conditions. (AQ14)	Possible Unlikely	Insignificant Minor	Low
49	Noise	Operation of machinery and materials handling	Noise levels at sensitive receptors exceed night time guideline values (EPA Publication 1254 Noise Control Guidelines;Noise from Industry in Regional Victoria (NIRV)) Noise levels at sensitive receptors exceed daytime or evening guideline values (EPA Publication 1254 Noise Control Guidelines;Noise from Industry in Regional Noise levels at sensitive receptors exceed night time guideline values (EPA Publication 1254 Noise Control Guidelines;Noise from Industry in Regional Victoria (NIRV))	C O O	• When slurry pumping units are located within 800 m of any dwelling, temporary acoustic barriers will be used. (NV03) • A noise and vibration risk management plan will be prepared and implemented. (NV09) • Mobile plant items will be fitted with broadband reversing signals to avoid tonal characteristic associated with traditional reversing beepers at nearby sensitive receptors. (NV10) • Activities such as overburden movement will be restricted to day and evening periods during year 1 to mitigate noise propagation during the night. (NV11) • Earth bunds will be used as a screening measures at strategic locations to screen operational noise impacts on sensitive receptors. (NV12) • Direct treatment through plant noise-reduction kits and cladding or screening of the WCP will be undertaken. Suitable noise-reduction kits have been identified for specific items of plant in consultation with industry specialists. (NV13) • Cladding will be installed on the sides of the WCP closest to sensitive receptors. The cladding will comprise 0.6 mm thick sheet steel with a lining of 75 mm thick, 32 kg/m2 glasswool insulation, which is expected to provide a sound insulation rating of Rw 31. (NV14) • The quietest available plant and equipment will be selected for the project, where feasible. (NV16) • Noisier activities will be scheduled for less sensitive times where feasible and works will be limited as much as practicable during the night and weekends. (NV17) • Residents at noise-sensitive receptors will be informed of the timing and location of each construction stage and associated noise reduction measures, and given notice and details of periods of noisy activities (such as excavation). (NV18) • Managerial processes will be implemented (such as 'push-back' mining operations) to optimise the direction of pit excavation so the terrain provides maximum natural attenuation of plant and equipment. (NV19) • All personnel will be informed about the measures required to minimise noise including through regular toolbox talks. (NV20) • All pneumatic tools used near residential areas will be fitted with an effective silencer on the air exhaust port. (NV22) • Plant will be turned off when not in use. (NV23) • All plant and equipment will be maintained in accordance with manufacturers' specifications. (NV24) • No truck associated with the work will be left standing with its engine operating for more than five minutes, where possible. (NV25)	• Contingency procedures will be developed and implemented if noise emissions during construction are observed to exceed those modelled for this EES, including additional mitigation measures to be considered during less favourable meteorological conditions that may enhance noise emissions from the project area. (NV06) • Consultation with affected residents located in the vicinity of the site will be conducted during the course of the project to investigate any need for alternative noise control measures depending on each individual situation (e.g., acoustic treatment for dwellings, or temporary relocation). (NV15)	Unlikely	Moderate	Medium

Fingerboards Project Risk Assessment, Abridged (Mine Rehabilitation and Closure Risks Only)

Risk ID	Hazard	Causes / contributing factors (risk events)	Receptors / Impacts	Phase	Standard mitigation	Additional mitigation	Residual likelihood over life of activity	sidual Consequer	Residual risk
			Noise levels at sensitive premises cause sleep disruption and / or loss of amenity	C,O	• All project vehicles will be maintained in accordance with manufacturers' specifications. (NV27) ~~• Activities which generate the highest potential noise and vibration will not be scheduled at night, where feasible, including the use of front-end loaders to load overburden to trucks, dozers for fines tailings screening, compacters on coarse sand tailings and amphirols in tailings storage areas. (NV30)~~ • A permanent power supply will be secured as early as possible to minimise the time diesel generators are used. (NV31) • Equipment and processes that do no exhibit characteristics of intermittency or impulsiveness will be selected, where feasible. (NV32)				
55	Weeds, pests and pathogens	Ground disturbance	Ground disturbance encourages weed establishment	C,O,CL	Disturbed areas will be revegetated to increase habitat value and visual amenity while reducing the likelihood for establishment and proliferation of weeds. (TE46)	Revegetation of mined areas will include management of weeds and pest animals. (TE47)	Possible	Minor	Medium
60	Radiation	Radionuclides in backfilled materials	Radiation levels in rehabilitated land exceeds pre-mining levels.	O, CL	Fines tailings (centrifuge cake) will be ~~placed at depth in the backfilled mine void~~ blended with coarse sand tailings and placed so as to ensure any restrictions to drainage are far enough below the soil surface such that the growth of vegetation is unaffected. (RH03)		Rare	Minor	Low
		Radon / thoron emanation from backfilled materials	Exposure to radon / thoron exceeds public health guidelines	O, CL			Rare	Minor	
61	Radiation	Wastes or contaminated materials abandoned on site at closure	Potential exposure to people or animals	O, CL			Rare	Minor	Low
62	Mined materials, mineral wastes and mineral products	Mineralised materials abandoned on site (unplanned closure)	Human health / safety	O, CL			Rare	Minor	Low
63	Radiation	Inappropriate handling,storage or disposal of radiation sources (density gauges, neutron probes, etc)	Accidental exposure to radiation	O	• Radiation exposure to workers will be minimised by implementing standard operating procedures for handling and transport of radioactive materials, use of radiation sources/apparatus and industrial gauges. (RD01) • Workers will be provided with training specific to their role on potential radiation risks and measures to be implemented to reduce or minimise radiation exposures. All training will be documented. (RD02) • The project will be operated in accordance with a management licence covering radiation safety-related aspects of the project in accordance with the provisions of the Radiation Regulations. (RD25)		Rare	Major	Medium
66	Ground movement / landform instability	Slope failure causes ground movements	Damage to public infrastructure (roads, powerlines) or properties outside mining licence area.	O, CL	Rigorous geotechnical design methodology will be undertaken using all available information and account for variability and uncertainty. (GEO01) • Daily visual assessments around mining areas near infrastructure will be undertaken, including checks for signs of deformation (e.g., cracks, compressional ridges), over steepening of slopes and poor management of surface water (e.g., pooling). (GEO03) • Surface water run-off controls will be incorporated into mine designs (GEO05) • Visual assessments of water controls will be undertaken on a regular basis, and after rainfall, to ensure that any ponding, seepage or run-off meets design specifications. (GEO06) • Earthquake motion (acceleration) will be accounted for in mine slope designs. (GEO07) Visual assessments of excavations for any variability of expected geological conditions will be undertaken, with particular focus on weaker than expected materials or features. (GEO08) • Excavation visual assessments will be routinely completed by an experienced geologist or mining engineer with geotechnical understanding. (GEO09) • Where possible, exclusion zones will be put in place for the geotechnical risk zones around each mining area and public access will be limited in affected areas. (GEO16) • Where possible, affected properties will be acquired to prevent access to these affected areas. (GEO17) •Tailings will be placed on a sound, free-draining mine floor. (GEO18) • If excess materials are placed on natural surfaces, weak materials such as topsoil, alluvium, and dune sand will be removed prior to placement. (GEO19) • Tailings will be returned to the mine void in a partly dried state (damp but not wet). (GEO22) Haunted Hills Formation gravel will be compacted to minimise latent settlement of the landform that may affect the final landform profile. (GEO23) • Geotechnical assessments of the tailings cell structures will be conducted. (GEO25)	• Slope stability and displacement monitoring of mine slopes will be undertaken (GEO02) • All mined slopes adjacent to infrastructure will be surveyed and verified that they have been mined within acceptable tolerances of specified slope designs. (GEO04) • Deformation and settlement monitoring of mine slopes around mining operations will be undertaken and horizontal strain and tilt at margins of existing roads will be assessed, measured by strain gauges and tilt meters. (GEO11)	Rare	Major	Medium
			Damage to public infrastructure (roads, powerlines) or properties outside mining licence area.	O, CL	• Rigorous geotechnical design methodology will be undertaken using all available information and account for variability and uncertainty. (GEO01) • Surface water run-off controls will be incorporated into mine designs (GEO05) • Visual assessments of water controls will be undertaken on a regular basis, and after rainfall, to ensure that any ponding, seepage or run-off meets design specifications. (GEO06) • Earthquake motion (acceleration) will be accounted for in mine slope designs. (GEO07)	• Daily visual assessments around mining areas near infrastructure will be undertaken, including checks for signs of deformation (e.g., cracks, compressional	Rare		

Fingerboards Project Risk Assessment, Abridged (Mine Rehabilitation and Closure Risks Only)

Risk ID	Hazard	Causes / contributing factors (risk events)	Receptors / Impacts	Phase	Standard mitigation	Additional mitigation	Residual likelihood over life of activity	Residual \Consequen	Residual risk
67	Ground movement / landform instability	Consolidation of backfllled materials	Land within mining licence area unsuitable for agree post-mining uses	PC	• Excavation visual assessments will be routinely completed by an experienced geologist or mining engineer with geotechnical understanding. (GEO09) • Road pillars will be constructed from HHF Gravel and/or coarse sand tailings. (GEO13) • Initial trials will be conducted during the early stages of building road pillars to verify construction methods and achieved densities. (GEO14) • The construction and monitoring of all road pillars will be documented, reviewed and quality controlled. (GEO15) • Where possible, exclusion zones will be put in place for the geotechnical risk zones around each mining area and public access will be limited in affected areas. (GEO16) • Where possible, affected properties will be acquired to prevent access to these affected areas. (GEO17) • Haunted Hills Formation gravel will be compacted to minimise latent settlement of the landform that may affect the final landform profile. (GEO23) • Geotechnical assessments of the tailings cell structures will be conducted. (GEO25)	ridges), over steepening of slopes and poor management of surface water (e.g., pooling). (GEO03) • Deformation and settlement monitoring of mine slopes around mining operations will be undertaken and horizontal strain and tilt at margins of existing roads will be assessed, measured by strain gauges and tilt meters. (GEO11)	Unlikely	Moderate	Medium
68	Ground movement / landform instability	Excessive slope gradients on constructed landforms	Slope instability: erosion or slope failure on constructed slopes	PC	•Slopes of landforms will be constructed from Haunted Hills Formation gravel, particularly for slopes with a gradient of 1:3. For slopes of 1:4 or flatter, dewatered, stacked and compacted coarse sand tailings can be placed within the outer zone of the slope, with Haunted Hills Formation gravel forming an outer layer. (GEO20) • Haunted Hills Formation clay will be placed well within the landform. (GEO21) • Surface watercourses will be directed away from the landform during construction and operation, so rainfall does not pond or cause localised infiltration. (GEO24)	• Rocks will be included in rehabilitated channel beds to increase critical shear of the bed, resist initiation of scour, and channel stability to storm flows and minimise erosion. (RH06) • Swales will be designed to be broad, U-shaped, no steeper than current stable drainage paths, and consistent in shape with the most stable drainage paths currently present. (RH07) • Riparian vegetation will be established in rehabilitated flow channels to increase effective hydraulic roughness of the channels, reduce flow velocities, increase channel stability to storm flows and minimise erosion. (RH08) • Riparian vegetation will be established in rehabilitated flow channels to increase effective hydraulic roughness of the channels, reduce flow velocities, increase channel stability to storm flows and minimise erosion. (RH09) • The density of deep-rooted trees and shrubs will be increased in areas at risk from tunnel erosion by minimising the volume of seepage flows reaching valley slopes • and channels. (RH24) • Tree densities in areas planned for grazing land use, particularly in swale areas, will be increased to reduce deep drainage and seepage flows, and to maximise erosion stability. (RH27)	Possible	Minor	Medium
69	Modified landscapes / landforms	Establishment of open pit and stockpiles	Impact on visual amenity	C, O	• Visual bunds and screen plantings will be established at locations around the perimeter of the project area to visually screen project activities from sensitive viewpoints. (VL01) • The mine void will be progressively backfilled and rehabilitation will be progressive to re-instate pre-mining landforms and re-establish vegetation. (VL05) • Topsoil will be managed and maintained throughout rehabilitation activities to promote successful re-grassing and tree planting. (VL11) • Temporary visual bunds will be placed to screen operations within the mine void. (VL13) • Disturbed areas will be revegetated to recreate pre-existing vegetation communities will be undertaken, where possible, increasing habitat value and visual amenity (TE10)	• The landscape will be restored to reduce the visual impacts from elevated viewpoints. (VL07) • Regular slopes and/or sharp transition angles will be rounded to provide a natural appearance to the final landform. (VL08)	Unlikely	Minor	Low
73	Land access, clearing and ground disturbance	Unauthorised clearing / disturbance	Loss / damage to terrestrial flora, vegetation, ecosystems, habitats	CO	• • Vegetation removal will not proceed until applicable approvals and permits obtained. (TE01) • Extent of clearance and buffers around no-go areas will be clearly defined to ensure disturbance within areas to be retained are avoided. (TE04) • Access tracks and roads will be clearly marked to prevent establishment of secondary tracks and disturbance to adjacent vegetation. Existing roads to be used where practicable. (TE05) • Parking areas, stockpiles, machinery depots and site buildings will be located in areas of low ecological value (such as blue gum plantations). (TE07) • Large trees will be retained adjacent to the project footprint are to be clearly marked and Tree Retention Zones to be identified. (TE08) • Staff/contractor inductions will incorporate an environmental component that has been signed off by a suitably qualified representative (e.g., site environmental advisor/specialist). (TE12) • Construction machinery will not be permitted to access Cowells Lane to avoid potential indirect impacts to swamp everlasting, native vegetation and low-lying areas within the infrastructure options area.(TE49) • Prior to any proposed disturbance in unsurveyed areas, a detailed flora survey will be undertaken. (TE53)	• Prior to clearing, nest boxes will be installed in areas of potential habitat adjacent to the project footprint to compensate for the removal of hollow-bearing trees and impacts on hollow-dependent fauna known or potentially present (yellow-bellied sheathtail bat, powerful owl, masked owl and eastern pygmy possum).(TE02) • Logs, dead trees, stumps and other habitat elements will be included in the restoration and rehabilitation works for fauna habitat. (TE11) • Sensitive areas, such as those with fauna habitat, will be cleared of fauna by a suitably trained ecologist or other qualified environmental specialist prior to construction and operational activities commencing. (TE13) • Pre-clearing activities will remove the understorey and smaller non-hollow-bearing trees to disturb fauna and encourage them away from the clearing area. (TE14) • Animals disturbed during clearing works will be relocated in accordance with a Management Authorisation under the Wildlife Act. (TE15) • Where construction permits, hollow-bearing trees will be retained around project infrastructure.(TE19) • Pre-clearance survey and supervision of large hollow-bearing tree felling activities will be carried out by a suitably qualified zoologist. (TE20)) • Salvaged or artificial hollows will be installed (under the supervision of an ecologist) in retained vegetation adjacent to the project footprint where hollow-bearing trees are lost. (TE21) • Fauna salvage and relocation / translocation procedure will be developed and implemented to supported the biodiversity risk treatment plan.(TE28) • All remaining areas of ecological value near the project area and infrastructure options area will be managed to enhance habitat features and compensate for those lost; including installing nesting boxes and logs, and other large woody debris relocated from cleared areas .(TE30) • Project infrastructure and activities will be microsited to avoid native vegetation. For example, if vegetation of high quality is identified during pre-clearance surveys,	Unlikely	Minor	Low

						where reasonably possible, the location will be adjusted to avoid it. (TE37) • The extent of native vegetation cover and habitat connectivity within and adjoining the project area will be increased through restoration as part of progressive rehabilitation. (TE50) • Faunal habitat features, such as logs and hollows, will be created as part of habitat restoration works.(TE51) • Populations of listed or rare native plant species from ecological vegetation categories within the project area will be increased through targeted recovery programs. (TE52) • Prior to any proposed disturbance in unsurveyed areas, a detailed flora survey will be undertaken. (TE53) • Appropriate biodiversity offsets will be secured in accordance with State and Commonwealth legislation/ policy. (TE03)			
76	Hazardous materials and non-process wastes	Spillage or loss of containment during storage / dispensing / use		C,O,CL	• Bunding for the fuel storage area (fuel farm) will be in accordance with Australian Standard 1940:2017 (Standards Australia, 2017). The capacity (i.e., bund height), storage, stormwater control and maintenance, and operation of bunded areas will comply with EPA bunding guidelines (EPA, 1992). (SW19) • Inductions and training will be provided to all relevant project personnel on the safe storage, handling and transport of dangerous goods and in emergency management. (SW18, GW03) • Limited quantities of chemical will be stored on site. Any hazardous materials, such as laboratory chemicals, will be stored in designated areas in accordance with their safety data sheets. (SW13) • Hazardous materials will be managed (including storage, handling, transport and disposal) in accordance with relevant safety data sheets. (RH18) • Areas used for handling and/or storage of hazardous materials will be appropriately bunded and contain spill response equipment. (SW20) • Spills of fuels or chemical will be managed in accordance with requirements set out in the Spill Response and Clean-up Procedure. (SW14) • Personnel will be trained in management of hazardous materials and spill response procedures prior to commencement of work. (RH20) • Mobile plant and vehicles will be maintained regularly and in accordance with manufacturers specifications. Maintenance will include inspections for leaks and spills. (RH19) • If a leak or spill occurs it will be cleaned up and contaminated soil will be excavated and disposed of at an approved facility (RH32)	• Waste hydrocarbons will be stored in suitable containers for removal from the mine site for disposal at either an EPA-approved hydrocarbon waste site or a recycling depot. (SW27) • Fuel management procedures will be developed and implemented for the project. • An inventory of hazardous materials on site will be maintained."	Unlikely	Minor	Low
87	Rehabilitation failure	Grazing, herbivory	Poor establishment and/or performance of areas rehabilitated to pasture / native vegetation	O, CL	• Larger plants that are less susceptible to grazing damage will be used in rehabilitation areas where possible. (RH15) • Guards will be placed on tubestock where required to prevent damage by rabbits, cockatoos and other pest animals. (RH16) • Grazing will be excluded in rehabilitated flow channels to maintain sufficient levels of vegetation cover on the surface of the channel bed and prevent disturbance of soils by trampling by livestock, thereby increasing channel stability to storm flows and minimising erosion. (RH25) • Revegetation will be conducted over as large an area as possible at one time to spread potential impacts of animal grazing over larger areas. (RH30)	Revegetated areas will be fenced (electric fencing with multiple closely spaced tapes) to prevent damage by stock or kangaroos, where cost-effective to do so.(RH29)	Unlikely	Moderate	Medium
	Rehabilitation failure	Erosion	Poor establishment and/or performance of areas rehabilitated to pasture / native vegetation	O, CL	• Rehabilitation activities will be timed in consultation with landholders and based on analysis of long-term rainfall patterns to maximise the rate of successful vegetation establishment and rehabilitation performance. (RH10) • Hydromulches or tackifiers will be used where appropriate to prevent erosion and ensure more effective use of incident rainfall by germinating seeds. (RH11) • Planting of tubestock will be scheduled to maximise initial growth, including in spring to take advantage of warmer growing conditions, or in autumn to take advantage of the wet winter. (RH33)		Unlikely	Moderate	
	Rehabilitation failure	Weed competition / infestation by pests	Poor establishment and/or performance of areas rehabilitated to pasture / native vegetation	O, CL	• Revegetation of mined areas will include management of weeds and pests (TE11, TE47) • Biosecurity procedures will be implemented to avoid introducing and spreading weeds, pests and diseases into the project area and surrounding areas. (TE45)		Possible	Minor	
	Rehabilitation failure	Lack of seed stock / tubestock	Poor establishment and/or performance of areas rehabilitated to pasture / native vegetation	O, CL	• Kalbar will establish local seed / propagule production facilities to ensure adequate supply of seed tube stock.	• Kalbar will collaborate with GROW to provide opportunities (potentially including seed/ plant production) to grow local small to medium sized businesses – either as suppliers to our business, as partners, or as sub-contractors .	Unlikely	Moderate	
	Rehabilitation failure	Fire damage	Poor establishment and/or performance of areas rehabilitated to pasture / native vegetation	O, CL	A bushfire management plan will be prepared and implemented that identifies measures for landscape, siting, design, defendable space, construction, water supply and access and includes site specific bushfire mitigation measures, awareness actions, preparedness levels and fire response procedures for the site. (BF01)		Rare	Major	
88	Rehabilitation failure	Tailings are hardsetting	Loss of land capability; increased erosion hazard; restriction in water infiltration	C	Fines tailings (centrifuge cake) will be blended with coarse sand tailings and placed so as to ~~placed at depth in the backfilled mine void so that~~ensure any restrictions to drainage are far enough below the soil surface such that the growth of vegetation is unaffected. (RH03)		Rare	Moderate	Medium
89	Rehabilitation failure	Surface water runoff erodes bare surface	Gullylng / tunnel erosion results in loss of land productivity	C	• High rates of vegetation establishment will be prioritised in rehabilitated flow channels (especially in the first three years of rehabilitation) to maximise surface cover and minimise erosion. (RH09) • Hydromulches or tackifiers will be used where appropriate to prevent erosion and ensure more effective use of incident rainfall by germinating seeds. (RH11) • Hydroseeding will be used in rehabilitation areas where appropriate to stabilise the soil surface and minimise erosion. (RH12) Where possible, ameliorants such as organic mulches and fertilisers will be spread on in-situ topsoils prior to stripping to increase soil fertility. (RH21)		Unlikely	Moderate	Medium
			Erosion and sediment mobilisation: loss of soil fertility and decline in land productivity	C					

Fingerboards Project Risk Assessment, Abridged (Mine Rehabilitation and Closure Risks Only)

Risk ID	Hazard	Causes / contributing factors (risk events)	Receptors / Impacts	Phase	Standard mitigation	Additional mitigation	Residual likelihood over life of activity	sidual Consequen	Residual risk
90	Rehabilitation failure	Vegetation not characteristic of local vegetation	Low habitat value for native fauna	C	• Revegetation of mined areas will include planting of a range of locally occurring native shrubs, trees and groundcover plants in consultation with DELWP to recreate the target vegetation community. (TE11) • Areas will be revegetated following the mine rehabilitation plan, to: Increase overall native vegetation cover in the project area. Increase native vegetation patch size (TE9)		Unlikely	Minor	Low
91	Rehabilitation failure	Drought	Poor establishment and/or performance of areas rehabilitated to pasture / native vegetation	O, CL	• Rehabilitation activities will be timed in consultation with landholders and based on analysis of long-term rainfall patterns to maximise the rate of successful vegetation establishment and rehabilitation performance. (RH10) • Hydromulches or tackifiers will be used where appropriate to prevent erosion and ensure more effective use of incident rainfall by germinating seeds. (RH11) • Site/local experience will be considered when determining seed timings and rates to ensure maximum reliability of vegetation establishment. Seed will be re-applied in areas where rehabilitation performance does not meet established targets at a later date when suitable conditions, such as rainfall, are considered likely to occur. (RH13)	• Rehabilitated areas will be irrigated where required to promote satisfactory performance and vegetation establishment. (RH14)	Unlikely	Minor	Low
	Rehabilitation failure	Inhospitable growth medium	Poor establishment and/or performance of areas rehabilitated to pasture / native vegetation	O, CL	Gypsum will be applied in sufficient quantity over a depth of at least 500 mm to reduce exchangeable sodium and magnesium to acceptable levels (ESP <4 and Ca/Mg ratio >0.5) where material likely to disperse (such as Haunted Hills Formation overburden or fines tailings) is placed as part of a constructed subsoil. (RH28)		Unlikely	Minor	
	Rehabilitation failure	Timing of rehabilitation works	Poor establishment and/or performance of areas rehabilitated to pasture / native vegetation	O, CL	• Rehabilitation activities will be timed in consultation with landholders and based on analysis of long-term rainfall patterns to maximise the rate of successful vegetation establishment and rehabilitation performance. (RH10) • Planting of tubestock will be scheduled to maximise initial growth, including in spring to take advantage of warmer growing conditions, or in autumn to take advantage of the wet winter. (RH33)		Unlikely	Minor	
92	Rehabilitation failure	Decline in soil fertility due to dilution of topsoil with overburden	Productivity of post-mining land is less than pre-mining land capability.	O, CL	• Site inductions for mining and rehabilitation personnel will include information on the different soil types present across the project area and their corresponding management, including in relation to stockpiling. (RH02) • Soil stockpiles will be segregated according to physical composition. (RH01) • Where possible, ameliorants such as organic mulches and fertilisers will be spread on in-situ topsoils prior to stripping to increase soil fertility. (RH21)		Unlikely	Minor	Low
93	Rehabilitation failure	Rehab and closure activities inadequately planned and funded	Incomplete or unsatisfactory implementation of closure, loss of employment	O, CL	"• Rehabilitation activities will be timed in consultation with landholders and based on analysis of long-term rainfall patterns to maximise the rate of successful vegetation establishment and rehabilitation performance. (RH10) • Hydromulches or tackifiers will be used where appropriate to prevent erosion and ensure more effective use of incident rainfall by germinating seeds. (RH11) • Site/local experience will be considered when determining seed timings and rates to ensure maximum reliability of vegetation establishment. Seed will be re-applied in areas where rehabilitation performance does not meet established targets at a later date when suitable conditions, such as rainfall, are considered likely to occur. (RH13)"	• Rehabilitated areas will be irrigated where required to promote satisfactory performance and vegetation establishment. (RH14)	Unlikely	Minor	Low
94	Rehabilitation failure	Tailings fail to consolidate within expected timeframes, resulting in delays to rehabilitation program	Timing of rehabilitation program is longer than expected; ongoing aesthetic impacts of mine site	O, CL	• Topsoil stockpiles scheduled to be in place for four months or longer (or for an unknown duration) will be restricted to a height of 2 m and treated with a soil stabiliser, or revegetated immediately following their construction. • Gypsum will be applied in sufficient quantity over a depth of at least 500 mm to reduce exchangeable sodium and magnesium to acceptable levels (ESP <4 and Ca/Mg ratio >0.5) where material likely to disperse (such as Haunted Hills Formation overburden or fines tailings) is placed as part of a constructed subsoil. (RH28)"		Unlikely	Minor	Low
107	Economic / social disruption	Constraints on post closure land use to prevent erosion, overgrazing	Loss of income	PC	• Landholder compensation will be paid in accordance with the MRSD Act and based on a full inventory of on-farm assets. (LUP08) • Progressive rehabilitation will be undertaken to return land to its pre-mining land use or an agreed alternative. (RH05)		Unlikely	Minor	Low