Nelson Bay River Mine
Mine Closure Plan

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Authorised by: _____ Date: 23 November 2011
Name

1. Introduction

A Mine Closure Plan is typically a dynamic plan which changes with the project as it progresses, as ongoing rehabilitation is completed and as any new rehabilitation needs arise.

At this stage, the Closure Plan for the Nelson Bay River mines will cover four main areas: the DSO pit, the main pit, the processing plant site and the tailings dam. The preliminary plan provided below may change over time if the requirements and expectations of the regulators, key stakeholders and interested parties change or if the project changes over time.

The Closure Plan will be regularly reviewed at the same time as the DPEMP is reviewed to ensure that it is always current and reflects the expectations of all parties and is to the mutual satisfaction of all parties.

The Plan will be used by Shree Minerals Limited to guide its preparations for eventual closure of the Nelson Bay River Mine. At some future point in time, when a decision has been made to close the mine, a final Decommissioning and Rehabilitation Plan (DRP) for acceptance by Mineral Resources Tasmania and the Board of Environmental Management and Pollution Control will need to be completed.

Mining has not previously occurred on the Nelson Bay River site. A mining lease has been applied for to cover the proposed mining operations in the Nelson Bay River area by Shree Minerals Limited.

pitt&sherry has been retained by Shree Minerals Limited to prepare the draft Closure Plan for approval by Mineral Resources Tasmania and the EPA, prior to public consultation. Finalisation of the Closure Plan towards the end of the mine's life will ultimately require further consultation with stakeholders and other interested parties.

This Plan has been prepared in accordance with the following documents:

- The *Strategic Framework for Mine Closure*, developed cooperatively by the Australian and New Zealand Minerals and Energy Council (ANZMEC) and the Australian Minerals Industry (represented by the Minerals Council of Australia (MCA)).
- The booklet *Best Practice Mine Decommissioning,* one of the booklets in the Best Practice Environmental Management in Mining Series published by Environment Australia.
- *Decommissioning and Rehabilitation Plan (DRP) – a guideline for the Tasmanian Mining Industry, version 1, May 2006.*

2. Project description

The broad aims of this project are to develop a Closure Plan for the proposed Nelson Bay River Mine that will:

- Comply with State legislative and policy requirements and public expectations.
- Ultimately leave a closed mine site, to the extent reasonable and practicable, that has long term physical stability and minimal off-site environmental impact.

2.1 Objectives of closure

The Strategic Framework for Mine Closure (hereafter referred to in this report as the SFMC) has identified the following four key objectives to be considered when developing a Closure Plan:

- *To protect the environment and public health and safety by using safe and responsible closure practices.*
- *To reduce or eliminate environmental effects once the mine ceases operations.*
- *To establish conditions which are consistent with the pre-determined end land use objectives.*
- *To reduce the need for long-term monitoring and maintenance by establishing effective physical and chemical stability of disturbed areas.*

2.2 Objectives of the closure plan

The aim of the Nelson Bay River Mine Closure Plan is to achieve the SFMC objectives outlined above by adopting a risk-based approach to the Closure Plan and implementing action plans over a specified timeframe with the following objectives:

Compliance with legislative and regulatory requirements

- Identify the legal requirements of the Closure Plan in consultation with the relevant regulatory authorities.

Physical stability

- Ensure that the physical stability of the tailings dams is consistent with future usage of the site.
- Identify any potential areas of mine instability so that risks can be identified and managed according to future land use.

Chemical stability

- Ensure that a framework is in place to ensure that the existing chemical stability of the area is maintained.

Biological stability

- Ensure that the physical and chemical natures of the Nelson Bay River are not compromised over time.
- Ensure that sufficient mine site rehabilitation is undertaken to facilitate the long-term re-establishment of endemic flora across the site and the re-introduction of animal and bird life to the area.
- Improve physical and chemical conditions of the site to augment the succession and establishment of self-sustaining native plant communities.

Public expectations and site amenity potential

- Undertake a formal ongoing public consultation process.
- Maintain amenity values and potential future uses of the site.

Aboriginal cultural heritage values

- An Aboriginal heritage survey has found no Aboriginal cultural heritage features or items on the site but if any are found over the life of the mine they will need to be managed appropriately on mine closure.

Heritage Values

- Identify and consult with relevant organisations.
- Ensure the preservation and enhancement of any identified site heritage values.

Aesthetics of the site

- Maintain the existing aesthetic appeal of the site, both in the immediate area and the wider area, after mine closure.

3. Nelson Bay River Mine site

The proposed Nelson Bay River Mine site is located within the Nelson Bay River Exploration Licence EL41/2004, east of Couta Rocks, and approximately 7 km northeast of Temma, in north western Tasmania.

The location of the Shree Minerals Exploration Licence is shown in Figure 1. The local setting of the lease area applied for is shown in Figure 2. Details of the lease area are discussed in Section 3.3, Land Tenure.

Figure 1: Location of EL41/2004 (map source: theLIST)

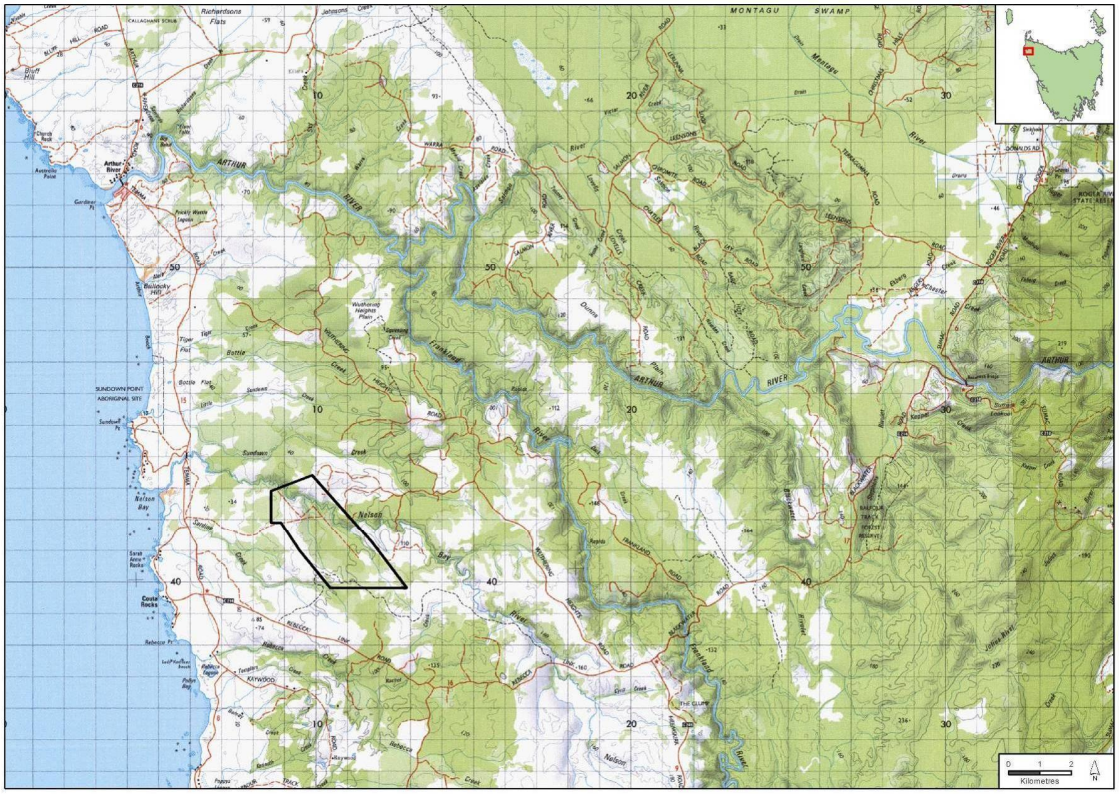


Figure 2: Local setting of lease area applied for

Plans showing details of the proposed layout of the mine workings and process plant (in years 1, 5 and 10) are included in Appendix 1. The principal mine elements (end-of-life mine footprint) are shown in Figure 3.

The site is approximately 80 – 100 m above sea level. Drainage in the area is northwest via the Nelson Bay River to the Southern Ocean.

Road access from the Arthur River township direction (northwest) is via Temma and Rebecca Roads and then Wuthering Heights Road. Road access from the Edith Creek township direction (northeast) is via Blackwater Road and the Rebecca Link Road and then Wuthering Heights Road.

Wuthering Heights Road is a frequently used forestry road, which leads past a Forestry Tasmania gravel quarry to forestry plantations, which lie on the northern and eastern side of Nelson Bay River.

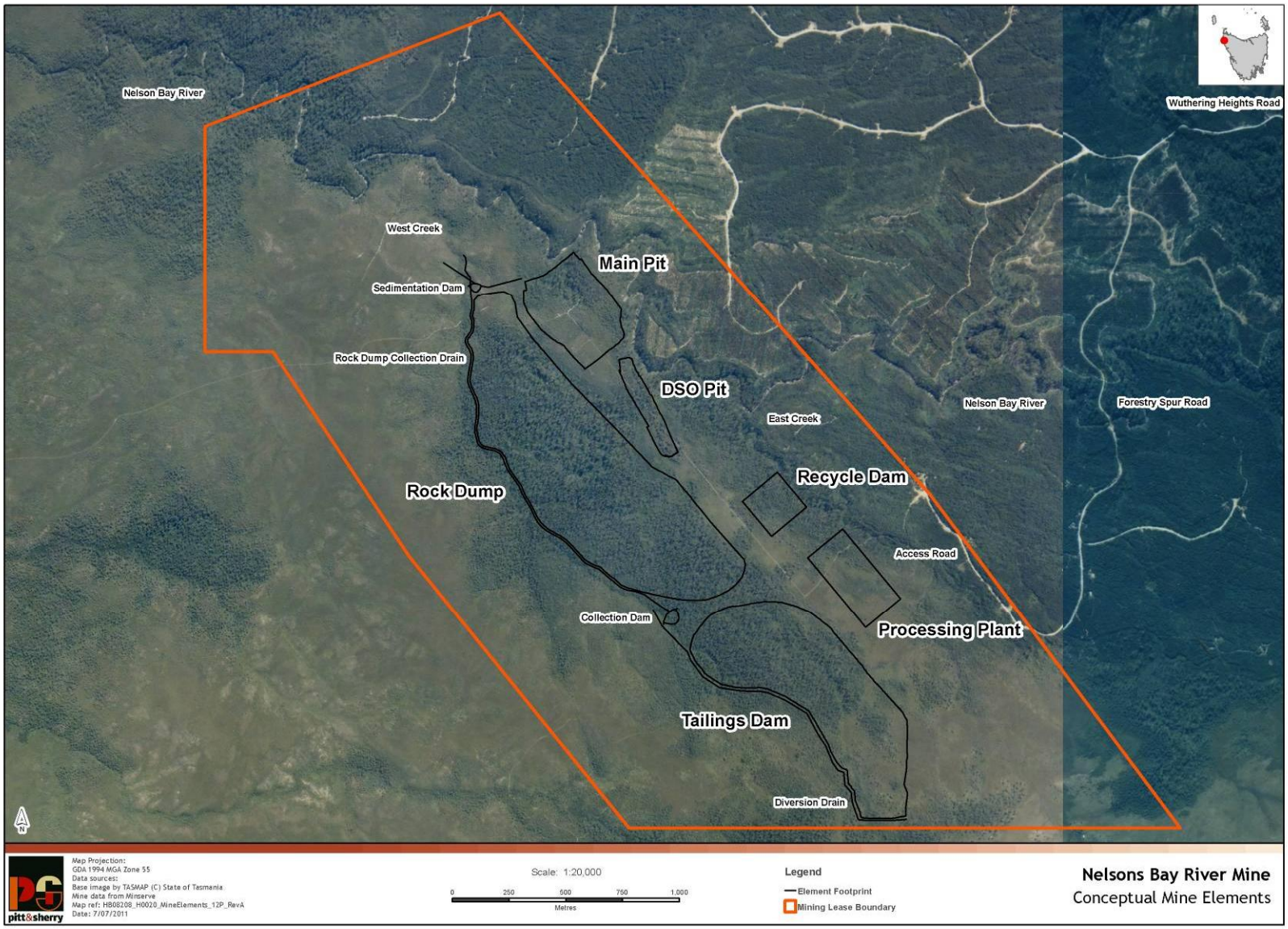


Figure 3: Principal mine elements (end-of-mine life footprint)

Local access to the resource site is via the end of a forestry spur road and then a newly upgraded local access road that leads to the baseline access road, as shown on Figure 4.

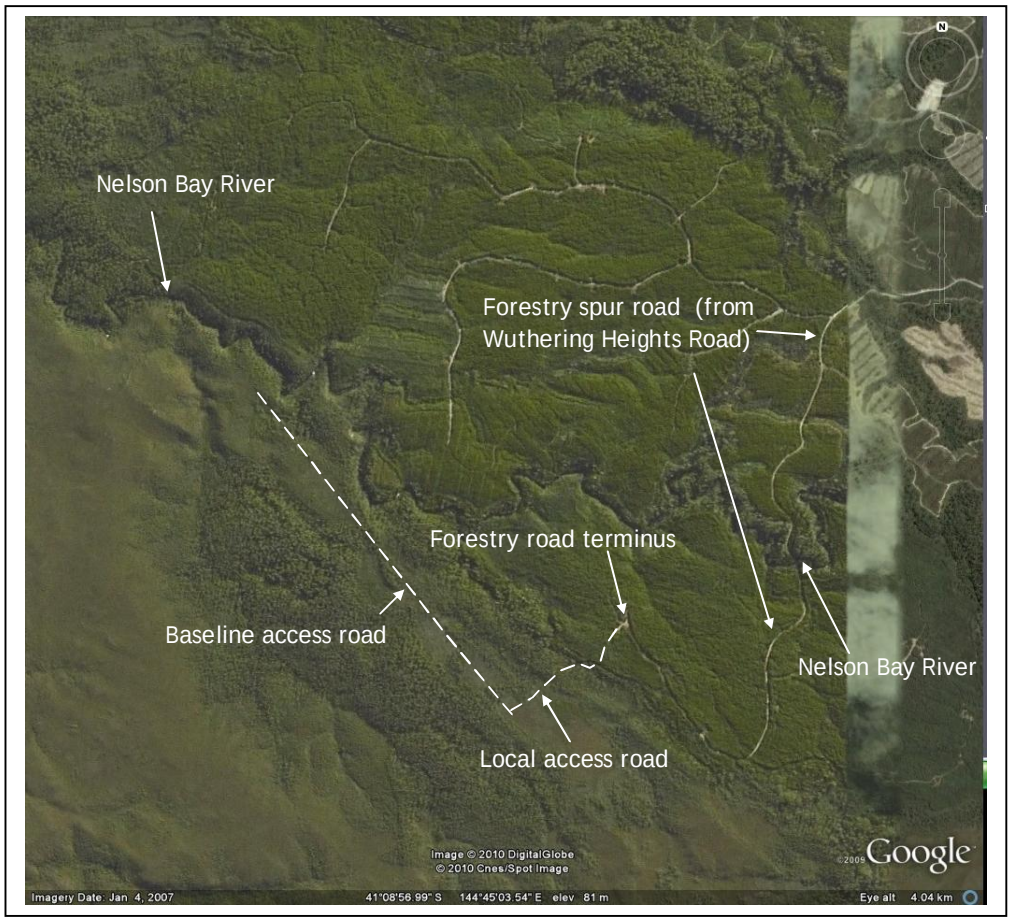


Figure 4: Existing local access to resource area (scale: width of image 4.5 km)

3.1 Mine history

There is no previous history of mining at, or in the vicinity of, the proposed Nelson Bay River Mine site.

3.2 Climate

The Bureau of Meteorology (BOM) has stations at Temma, 7 km from the mine site and at an altitude of 105 m and at Smithton.

The rainfall and temperature data from the Temma station are summarised as follows:

- Mean annual rainfall 1300 mm/year
- Maximum mean monthly temperature 16.2 °C
- Minimum mean monthly temperature 8.2 °C.

The prevailing winds at the site are north westerly to south westerly.

Annual evapotranspiration (ET) at Smithton Airport totalled 945 mm and 988 mm for 2009 and 2010 respectively, and exceeded mean monthly rain from November to March.

Effective annual rainfall (mean rainfall less ET for the period April to October) at the mine site is therefore estimated to be approximately 570 mm.

3.3 Land Tenure

The area of land that is the subject of this Closure Plan is within the proposed Nelson Bay River Mining Lease, which covers 778 ha of EL41/2004. The location of the proposed lease area (targeted resource) is shown in Figure 2.

Approximately 55% of the exploration licence mining tenement is covered by a State forest designation and 45% is classified as a Conservation area.

The areas of the proposed Mining Lease to be rehabilitated under this Closure Plan are restricted to:

- The mine sites (the DSO and the main pit)
- The processing plant and tailings dams areas
- The water recycle dam area
- The waste rock dump
- Mine site tracks
- Cut-off drains and sediment basins.

3.4 Geology

3.4.1 Topography

The topography over much of the area is relatively subdued as the site is located on an old peneplain.

Over the wider mine site area the surface is gently undulating, largely varying between about 80 and 100 m above sea level. Locally the Nelson Bay River has become incised into this old surface to a depth of 30 – 40 m.

3.4.2 Geomorphology

The landscape reflects the underlying geology, and has been shaped by fluvial processes and the development of peat bogs. The area is part of an extensive peneplain that has been formed on the Proterozoic siltstones, sandstones and carbonaceous mudstones of the Cowrie Siltstone.

The wider region is marked by an extensive drainage network that flows northwest and west to the Southern Ocean. This drainage network consists of a number of major rivers, such as the Arthur, Frankland and Nelson Bay Rivers, and numerous smaller tributaries of varying length.

To the west, the peneplain contains fossil sand dunes while to the east it becomes more undulating and incised by drainage lines, particularly by major drainage lines, such as the Frankland and Nelson Bay Rivers.

Extensive blanket bogs (peat deposits) occur throughout the wider area. The development of these blanket bogs has resulted in the surface topography being locally more subdued than would otherwise be the case.

3.4.3 Landform stability

Topography of the area is relatively subdued. No landform stability issues have been identified across the site.

3.4.4 Regional Geology

Regional geology has been outlined in the reports cited in the mine site geology section below. The regional geology consists of mixed Proterozoic siltstones, sandstones and carbonaceous mudstones of the Cowrie Siltstone, part of the Rocky Cape Stratotectonic Element.

The Rocky Cape Stratotectonic Element, which consists of Early NeoProterozoic autochthonous marine shelf clastic sequences, is relatively unmetamorphosed to lower greenschist facies and is overlain by several suites of younger neoProterozoic rocks.

These rocks, which have been extensively folded and faulted, may have been thrust over the younger Cambrian sequence of the area.

3.4.5 Mine Site Geology

Resource geology has been described in three reports prepared for earlier tenement holders:

- SMG Consultants (November 2005) *Nelson Bay River licence EL41/2004: Literature study report*. Prepared for Zinico Resources NL.

- Simon Tear (January 2007) *Report on the resource estimation of the Nelson Bay River magnetite deposit, NW Tasmania*. Report by Hellman and Schofield Pty Ltd.

- Minserve (July 2007) *Nelson Bay River magnetite deposit conceptual mining study*. Prepared for Gujarat NRE Resources NL.

This historical work has been supplemented by drilling programs undertaken by Shree Minerals in 2009, 2010 and 2011, described in:

- Simon Tear (November 2010) Report on the resource estimation of the Nelson Bay River magnetite and hematite deposit, NW Tasmania. Report by Hellman and Schofield Pty Ltd.

The following description is based on the above reports and the findings of Shree's own drilling.

Rocks in the local area are finely laminated, psammo-pelitic, Proterozoic-aged siltstones with medium grained sandstones/quartzites. The quartzites are clean well-sorted, and massive to thinly bedded and up to 200 m thick.

Within the exploration area, there are four known mineral occurrences. The occurrence of principal interest is the Nelson Bay River Iron Occurrence; the other three are sand and gravel occurrences.

The Nelson River Iron Occurrence is approximately 4 km long and is split into a northern magnetic anomaly and a southern magnetic anomaly. The body of mining interest is the northern anomaly. The southern anomaly (located between the waste rock dump and the tailings dam) does not appear to be a commercial resource.

The northern anomaly at surface is an 800 m long lode of granular aggregates of hematite and magnetite in an iron clay and/or siliceous matrix. At depth it becomes an ultramafic dyke-like structure up to 40 m wide, containing a quartz - carbonate – magnetite – pyrite – garnet – chlorite - amphibole assemblage. Associated with the dyke

are a white mineral and olive coloured silicate, fibrous amphibole and green silicates. There are also dense garnet clusters at the ultramafics contact with the sediments.

There is a magnetite footwall zone to the dyke, which is a sulphide poor magnetite-actinolite/chlorite skarn.

The resource shape is approximately 600 m long with an average downdip extension of 220 m. True thickness ranges from 2.2 m in the southern end to 27 m in the middle and 18 m at its northern end. Surface weathering extends vertically from the plateau to a depth of typically 30 m (similar to the depth to which the Nelson Bay River has incised the plateau).

The global iron resource estimate is 12.7 Mt at 36.1% Fe, including magnetite resources and goethite-hematite resources.

The upper oxidised layer of the ore body is close to the surface (upper 30 m) on the eastern side of the proposed pit and is high grade hematite, suitable for direct shipping with little beneficiation (probably crushing and screening only). This Direct Shipping Ore (DSO) layer extends southeast from the pit for approximately a further 1 km.

It is proposed to mine this DSO first, while the main pit is being prepared and the processing plant and other infrastructure is being established. The main pit and processing plant will be brought on line in parallel with the DSO mining. It is expected that the DSO will provide 1 to 2 years of resource.

Assuming an average DSO pit depth of 40 m and a 20 m wide pit floor, the surface expression of the DSO excavation is likely to be approximately 60 m wide.

The location of the main pit and the DSO pit are shown in Appendix 1, together with the processing plant, waste rock dump and the tailings dam.

3.5 Catchments

The wider region has a number of major rivers, including the Arthur, Frankland and Nelson Bay Rivers, together with an intensive network of tributary streams.

The site is located on the southern side of the Nelson Bay River, which flows northwest and west to the Southern Ocean at Nelson Bay, and is located wholly within the Nelson Bay River catchment, which in turn is part of the Arthur River catchment.

The site is located on the southwestern side of the Nelson Bay River, a class 1 stream under the Forest Practices Code. The proposed mine site and associated facilities are located between two northwesterly trending tributaries (class 2 drainage lines) of the Nelson Bay River, referred to as West Creek and East Creek. These tributaries both have an extensive network of sub-tributaries. West Creek will receive overflow water from settling dams. East Creek will receive overflow water from the recycle dam and excess pit water from mine pit dewatering.

3.6 Hydrogeology

A hydrogeological report[1] has been prepared by William C. Cromer Pty Ltd.

Based on general hydrogeological principles, the geology of the district, and a review of drill core photographs, the rocks and ores of the mine site and environs, the aquifers of the area are regarded as fractured, hard-rock, unconfined aquifers. In such an environment, effective rain (precipitation less evapotranspiration) flows overland to surface streams, or infiltrates through the unsaturated zone to the water table.

A conceptual hydrogeological model for the mine site is shown in Figure 5.

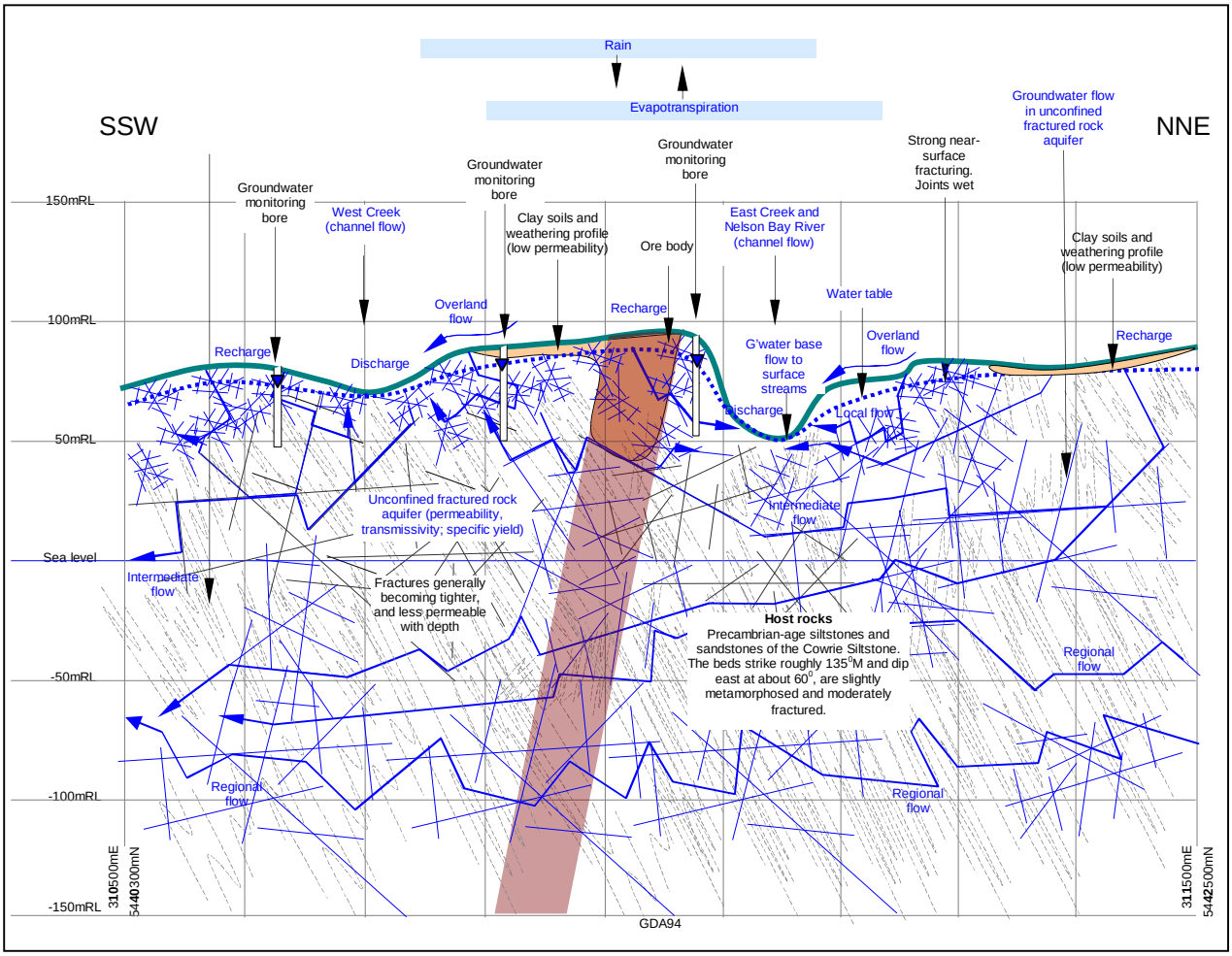


Figure 5: Conceptual hydrogeological model for the mine site (vertical exaggeration approximately 5)

[1] Cromer, W. C. (2011) *Hydrogeological report, Proposed Nelson Bay River Magnetite Mine.* (Unpublished report for Shree Minerals Ltd. by William C. Cromer Pty. Ltd.).

The key features of the model are:

- No distinctive basement rocks but at depth overburden pressure will increasingly tend to close joints and other openings and at an intermediate-scale or regional-scale constitute a lower boundary to the groundwater system.

- The steeply easterly-dipping Cowrie Siltstone which constitutes a fractured rock aquifer. Fracturing is expected to be relatively intense at and near the surface, becoming less intense with depth. Permeability and specific yield are expected to be variable, but generally decreasing with depth. Groundwater moves only through the fractures, which separate essentially dry rock. (Other secondary porosity development might include vuggy dissolution zones in carbonates within the Cowrie Formation).

- The steeply-west dipping mineralised zone, which is locally oxidised and weathered, and probably of lower permeability, near the surface.

- Fault zones, where present, may be more permeable than the country rock and the ore bodies.

- A regional water table is expected to be a subdued replica of the land surface, and intersects the land surface along drainage lines, at least in wet periods.

Near-surface groundwater flow is controlled by local systems, where flow lines are steep (equipotential lines are gently inclined) and recharge and discharge occur on hills and intervening valleys respectively. Such conditions are likely to extend beneath the level of West and East Creeks.

At increasing depths, flow becomes intermediate and then regional in scale, with equipotential lines steepening to near-vertical, and flow lines almost horizontal.

3.7 Soils and Land Capability

3.7.1 Land systems

The proposed mine site and surrounding areas are located within the Thornton River Land System, as mapped by Richley[2].

613111 Thornton River
This land system has developed on gently undulating plains on Precambrian sandstone-mudstone sequences in areas with an average annual rainfall of 1250 – 1500 mm.

Black sandy organic soils, becoming gravelly, have developed on the plains (average sideslope of 1^0). These soils have a peat surface texture, high permeability, an average depth of 0.6 m and a low susceptibility to sheet erosion. The native vegetation in these areas is open heath.

On the slight rises (average sideslope 2^0) stony, strong brown duplex soils have developed. These soils have a loam surface texture, moderate permeability, an average depth of 1.6 m and a low susceptibility to sheet erosion. The native vegetation in these areas is open forest.

In the drainage lines (average sideslope 24^0) the soils are black sandy organic soils with a sandy peat surface texture. These soils have high permeability, an average depth of 0.3 m and a high susceptibility to rill and gully erosion. The native vegetation is closed scrub.

[2] Richley, LR. 1978. *Land Systems of Tasmania Region 3*. Tasmanian Department of Agriculture.

3.7.2 Land Capability

Although a specific land capability survey has not been undertaken for the area, an estimation of the likely land capability classes can be made, based on the known geology, land systems and land usage. As the area is currently protected in either State Forest or Conservation Areas, it would be excluded from agricultural use (classified as Exclusion Areas in land capability mapping).

If any of this land was capable of being converted to an agricultural land classification, it would be likely to be classified as land capability Class 7 (land with very severe to extreme limitations which make it unsuitable for agricultural use) or Class 6 (land marginally suitable for grazing because of severe limitations).

4. Baseline Environmental Data

Water monitoring programs have been established to provide baseline surface water quality data for Nelson Bay River and the site. Groundwater monitoring bores have been installed and sampled and a conceptual groundwater model has been developed.

4.1 Water Flows

A water balance diagram, showing natural and process water movement for the mine site, is included as Figure 6.

4.1.1 Catchment monitoring

Stream flow and water quality are currently measured by the Government at the Nelson Bay River at Temma Road (Nelson Bay) – Station No. 1307. This information is contained on the Water Information System of Tasmania website:
http://water.dpiw.tas.gov.au/wist/ui

A summary of that monitoring follows (stream flow data accessed 12 October, 2010; water quality data accessed 2 July 2010).

Stream flow:
Average monthly stream flow between 1997 and 2008 ranged from a low of 1.1 cumecs in 2007 to a high of 1.6 cumecs in 1999. Minimum recorded flows ranged from 0.002 cumecs (18 March, 2008) to 0.023 cumecs (19 January, 1996). Maximum recorded flows ranged from 9.473 cumecs (1 September, 2008) to 24.598 cumecs (23 September, 1998).

Analytical data:
Turbidity ranged from 1.27 to 22.2 NTU's, with a mean value of 4.4 NTU's (based on 98 samples).

Field conductivity ranged from 91 to 368 µS/cm, with a mean value of 180 µS/cm (based on 107 samples).

Field pH ranged from 3.49 to 6.65, with a mean value of 4.57 (based on 71 samples).

Dissolved oxygen levels ranged from 4 to 13.2 mg/L, with a mean value of 9.4 mg/L (based on 92 samples).

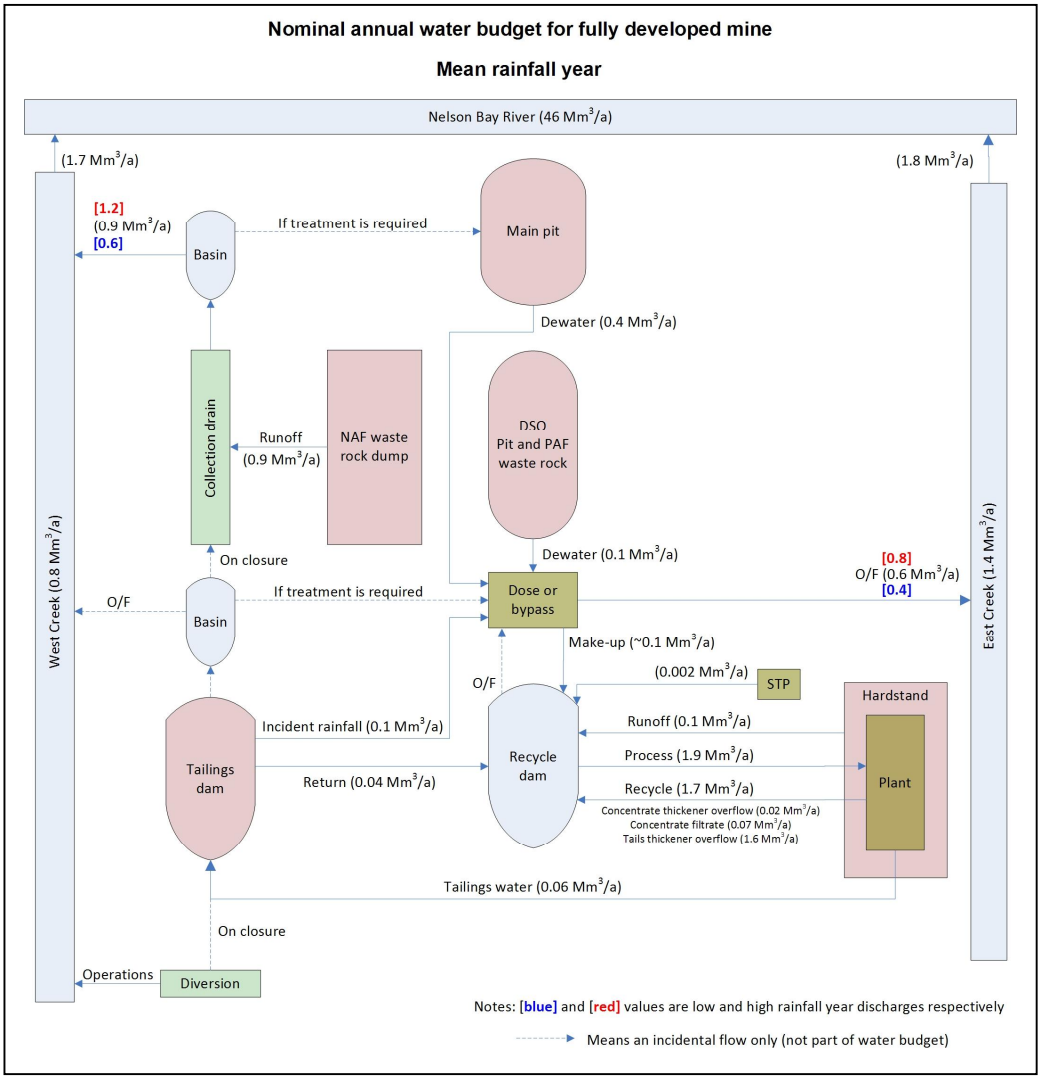


Figure 6: Nominal annual water budget for fully developed mine (mean rainfall year)

4.2 Water quality

4.2.1 Groundwater quality

Groundwater monitoring commenced at six locations in May 2011. This background data will provide a reference against which future groundwater quality and depth can be assessed, when the mine becomes fully operational.

Comparison of the results from the first monitoring run with the ANZECC guidelines for surface waters shows differences typical of those between surface and ground waters, notably higher pH, conductivity, suspended solids and some metals and lower dissolved oxygen in groundwater relative to surface waters.

4.2.2 Surface water quality

Surface water monitoring in Nelson Bay River commenced in February 2010, following confirmation of proposed mine location. The aim of the surface water quality investigations is to establish the existing surface water quality in the area.

Samples were collected over a 15 month period from February 2010 to May 2011, during high and low flow conditions consistent with winter and summer flow conditions in the catchment.

Eight surface water monitoring locations (NBRSW01, NBRSW02, NBRSW03, NBRSW04, NBRSW05, NBRSW06, NBRSW07 and NBRSW08) have been established to obtain representative samples of surface water quality in Nelson Bay River, immediately upstream and downstream of the proposed mine, and in the lower reaches of Nelson Bay River along Temma Road.

The water quality across the general site area is good with no elevated concentrations causing concern.

The monitoring results indicate good water quality when assessed using *Australian and New Zealand Environment and Conservation Councils (ANZECC) Guidelines for Fresh and Marine Water Quality, 2000.* The physical water quality properties are mostly within the range of the guidelines. Concentrations of nutrients are considered to be low.

No noticeable scums, sheens or gross odours were identified during any of the sampling events at the monitoring locations.

4.3 Vegetation communities and flora species

A flora survey of the proposed lease area has been undertaken[3]. Vegetation communities are shown in Figure 7. The conservation status of the communities is described in Table 1. The distribution of communities by project element is listed in Table 2.

No vegetation community listed under Schedule 3A of the Tasmanian Nature Conservation Act 2002 or the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) occurs within or adjacent to the study area.

There is no non-native vegetation on the site.

Threatened flora species, listed on one or both of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBCA) and the Tasmanian Threatened Species Protection Act 1995 (TSPA), previously identified within 5 km of the study area are shown in Table 3.

Two threatened vascular plant species *Epacris curtisiae* – northwest heath – and *Prasophyllum pulchellum* - pretty leek-orchid - listed under the schedules of the *Threatened Species Protection Act 1995* were recorded from the study area. *Prasophyllum pulchellum* - pretty leek-orchid is also listed under the *Environment Protection and Biodiversity Conservation Act 1999*. However, neither of these species was recorded from any of the potential disturbance areas associated with the mine. Neither species, therefore, will be impacted by the proposal.

[3] Northbarker Ecosystem Services (22 March 2011) *Nelson River – Shree Minerals Mine & Infrastructure Proposal, Flora and Fauna Assessment.* Report prepared for Shree Minerals.

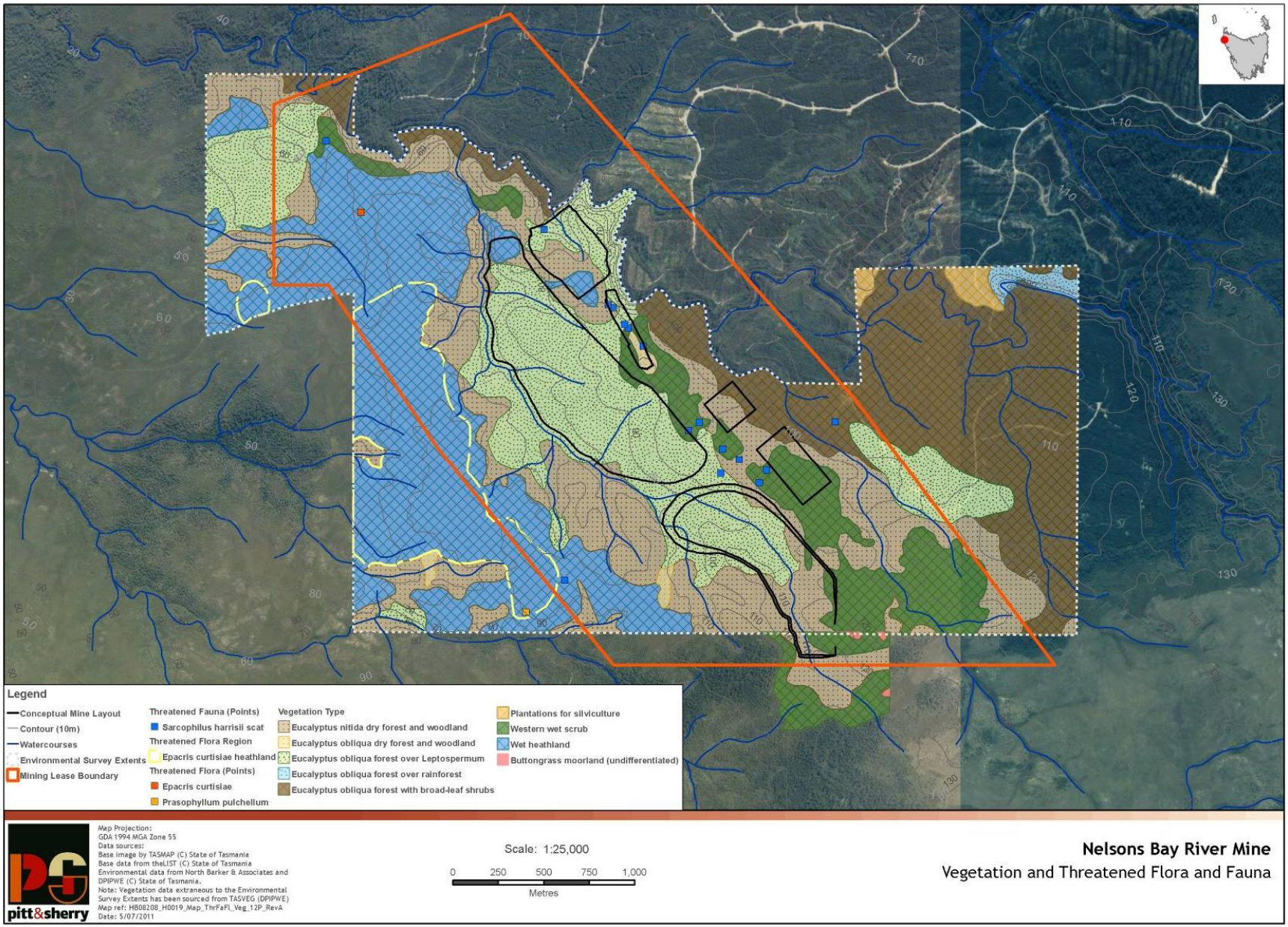


Figure 7: Vegetation communities and significant flora species

Table 1: Vegetation communities in the study area

TASVEG Community	State-wide Conservation Status	Bioregional Conservation Priority
Wet *Eucalyptus obliqua* forest over broad-leaf shrubs		
Wet *Eucalyptus obliqua* forest over broad-leaf shrubs WOB	Not threatened and well reserved	Not threatened but not adequately reserved
Wet *Eucalyptus obliqua* forest over tea tree		
Wet *Eucalyptus obliqua* forest over *Leptospermum* WOL	Not threatened and well reserved	Not threatened but not adequately reserved
Wet *Eucalyptus obliqua* forest over rainforest		
Wet *Eucalyptus obliqua* forest over rainforest WOR	Not threatened and well reserved	Not threatened but not adequately reserved
Dry *Eucalyptus nitida* forest and woodland		
Dry *Eucalyptus nitida* forest and woodland DNI	Not threatened and well reserved	Not threatened and well reserved
Dry *Eucalyptus obliqua* woodland and forest		
Dry *Eucalyptus obliqua* woodland and forest DOB	Not threatened and well reserved	Not threatened but not adequately reserved
Western wet scrub		
Western wet scrub SWW	Not assessed for conservation and reservation status	Not assessed for conservation and reservation status
Wet heathland		
Wet heathland SHW	Not assessed for conservation and reservation status	Not assessed for conservation and reservation status

Table 2: Distribution of vegetation communities

Component	Disturbance area (ha)	Vegetation type
DSO pit	0.4614	*Eucalyptus nitida* dry forest and woodland (DNI)
	1.1734	*Eucalyptus obliqua* dry forest and woodland (DOB)
	0.7099	Western wet scrub (SWW)
	1.1763	*Eucalyptus obliqua* forest over Leptospermum (WOL)
Main pit	4.9763	*Eucalyptus nitida* dry forest and woodland (DNI)
	1.5337	Wet heathland (SHW)
	6.9351	*Eucalyptus obliqua* forest over Leptospermum (WOL)
Rock dump	2.223	*Eucalyptus nitida* dry forest and woodland (DNI)
	1.9281	Wet heathland (SHW)
	1.303	Western wet scrub (SWW)
	64.6855	*Eucalyptus obliqua* forest over Leptospermum (WOL)
Processing plant	1.7425	*Eucalyptus nitida* dry forest and woodland (DNI)
	5.6491	Western wet scrub (SWW)
	0.6084	*Eucalyptus obliqua* forest with broad-leaf shrubs (WOB)
Collection dam	0.0737	*Eucalyptus nitida* dry forest and woodland (DNI)
	0.2409	*Eucalyptus obliqua* forest over Leptospermum (WOL)
Tailings dam	14.3741	*Eucalyptus nitida* dry forest and woodland (DNI)
	0.0046	Buttongrass Moorland (undifferentiated) (MBU)
	3.5554	Western wet scrub (SWW)
	23.8946	*Eucalyptus obliqua* forest over *Leptospermum* (WOL)
Sedimentation dam	0.0167	*Eucalyptus nitida* dry forest and woodland (DNI)
	0.1231	Wet heathland (SHW)
Recycle dam	2.6045	*Eucalyptus nitida* dry forest and woodland (DNI)
	0.1599	Western wet scrub (SWW)
	1.2356	*Eucalyptus obliqua* forest with broad-leaf shrubs (WOB)
Cut-off drains and bunds	3.4051	*Eucalyptus nitida* dry forest and woodland (DNI)
	0.6331	Wet heathland (SHW)
	0.1669	Western wet scrub (SWW)
	3.823	*Eucalyptus obliqua* forest over Leptospermum (WOL)
Access and haul roads	0.4373	*Eucalyptus nitida* dry forest and woodland (DNI)
	0.117	*Eucalyptus obliqua* dry forest and woodland (DOB)
	0.0251	Wet heathland (SHW)
	0.9245	Western wet scrub (SWW)
	0.2993	*Eucalyptus obliqua* forest with broad-leaf shrubs (WOB)
	0.4756	*Eucalyptus obliqua* forest over *Leptospermum* (WOL)
Total	151.6955	

Table 3: Threatened flora species known within 5 km of the study area

Species	EPBC Act listing	TSP Act listing	Potential to occur[4]	Closest distance of known populations to the mine lease boundary (km)[5]
Caladenia dienema windswept spider orchid	Critically Endangered	Endangered	low	0.1
Caladenia pusilla tiny fingers	-	Rare	low	-
Corunastylis brachystachya short-spiked midge orchid	Endangered	Endangered	low	3.0
Cullen microcephalum dusky scurfpea	-	Rare	none	-
Diuris lanceolata large golden moths	Endangered	Endangered	none	3.4
Epacris curtisiae northwest heath	-	Rare	present	-
Lotus australis Australian trefoil	-	Rare	none	-
Phyllangium divergens wiry mitrewort	-	Vulnerable	none	-
Prasophyllum favonium western leek orchid	Critically Endangered	Endangered	moderate	3.3
Prasophyllum pulchellum pretty leek orchid	Critically Endangered	Endangered	present	0.2
Prasophyllum secutum northern leek orchid	Endangered	Endangered	none	4.8
Pterostylis rubenachii Arthur River greenhood	Endangered	Endangered	none	4.8
Spyridium vexilliferum var. *vexilliferum* helicopter bush	-	Rare	low	-
Xerochrysum bicolor eastcoast everlasting	-	Rare	low	-

[4] Northbarker Ecosystem Services (22 March 2011) *Nelson River – Shree Minerals Mine & Infrastructure Proposal, Flora and Fauna Assessment.* Report prepared for Shree Minerals.
[5] Natural Values Atlas data (Download on 3/05/2011) and field survey data from Northbarker Ecosystem Services

4.3.1 Threatened flora species management

- Vegetation to be cleared almost entirely comprises *Eucalyptus obliqua* and *nitida* forest and western wet scrub, which do not have significant conservation values.
- There is a small, isolated fragment of wet heathland over the main pit and the northern end of the rock dump, which will be lost when the pit overburden is removed. However, the site survey found no threatened plant species in this area and these patches represent no more than 1.2% of the wet heathland in a surrounding 5 km radius.
- There will be no disturbance of the sensitive wet heathlands to the west of West Creek, which provide known and potential habitat for threatened orchid species.
- The extent of clearance required for the project will be clearly defined; appropriate measures will be taken to ensure that no additional clearance occurs
- There is no significant likelihood for direct, facilitated or cumulative impacts on any plant species listed under the Tasmanian *Threatened Species Protection Act 1999* or the *Environment Protection and Biodiversity Conservation Act 1999*.

4.3.2 Rehabilitation

Species consistent with the adjoining vegetation will be used in the rehabilitation of disturbed areas wherever practicable. In some areas such as the waste rock dump this will not be practicable as groundwater and drainage in the dump will not be consistent with the original drainage and groundwater levels in the dump footprint. In these areas, vegetation consistent with similar conditions from the surrounding areas will be utilised.

4.4 Fauna habitat

The area contains a diverse range of habitats including low heathlands, dense wet scrub, dry sclerophyll forest and wet sclerophyll forest with fire damaged old growth, and considerable riparian habitat within an altitudinal range of approximately 20 to 120 m AHD.

A fauna habitat assessment of the site has been undertaken by North Barker Ecosystem Services[6] and an *Astacopsis* Survey by Kanunnah Pty Ltd[7].

Threatened fauna species, listed on one or both of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA) and the *Threatened Species Protection Act 1995* (TSPA), that have previously been recorded from, or which are considered to potentially occur in suitable habitat within 5 km of the proposed development, based on habitat mapping[8] or identified in the EPBC Protected Matters Report[9], are listed in Table 4.

[6] North Barker Ecosystem Services (February 2011) *Nelson River – Shree Minerals Mine & Infrastructure Proposal Flora and Fauna Habitat Assessment*.
[7] Walsh, T and Walsh, B. (2011). Survey of the Giant Freshwater Lobster (*Astacopsis gouldi*) at Nelson Bay River. *Report by Bronwyn Walsh and Todd Walsh of Kanunnah Pty Ltd for Pitt and Sherry June 2011.*
[8] Natural Values Report 10/11/2010, no. 40737
[9] EPBC Act Protected Matters Report 15/11/2010

Table 4: Threatened fauna species previously recorded, or which may potentially occur in suitable habitat, within 5 km of the study area – species shown in bold have significant suitable habitat within the study area.

Species	EPBCA listing	TSPA listing
Birds		
Ceyx azurea subsp. *diemenensis* azure kingfisher	Endangered	Endangered
Accipiter novaehollandiae grey goshawk	-	Endangered
Lathamus discolor swift parrot	Endangered	Endangered
Neophema chrysogaster orange-bellied parrot	Critically Endangered	Endangered
Myiagra cyanoleuca satin flycatcher	Migratory	-
Aquila audax subsp. *fleayi* wedge-tailed eagle	Endangered	Endangered
Haliaeetus leucogaster white-bellied sea eagle	-	Vulnerable
Tyto novaehollandiae subsp. *castanops* Tasmanian masked owl	Vulnerable	Endangered
Mammals		
Dasyurus maculatus subsp. *maculatus* spotted-tailed quoll	Vulnerable	Rare
Sarcophilus harrisii Tasmanian devil	Endangered	Endangered
Fish		
Prototroctes maraena Australian grayling	Vulnerable	Vulnerable
Galaxiella pusilla eastern dwarf galaxias	Vulnerable	Vulnerable
Amphibians		
Limnodynastes peroni striped marsh frog	-	Endangered
Litoria raniformis green and gold frog	Vulnerable	Vulnerable
Invertebrates		
Astacopsis gouldi giant freshwater crayfish	Vulnerable	Vulnerable
Oreisplanus munionga tax. *larana* Marrawah skipper	-	Endangered

4.4.1 Threatened fauna species management

The following management measures will be undertaken:

- Preclearance surveys will be conducted immediately before each stage of clearing to identify any occupied masked owl nests or maternal quoll dens or devil dens.
- A temporary 50 metre buffer will be established around any masked owl nest, or maternal quoll or devil den during the forest clearing operations. Only after the nest or den has been confirmed to be vacated will the vegetation clearing be completed.
- A Fauna Habitat Protection Zone (FHPZ) will be established in the western part of the lease, west of West Creek, within which quoll and devil denning and refugia opportunities will be established and enhanced.
- Dogs and other pets will be banned from the mine site.
- The speed limit for mine workers and product transporters on Wuthering Heights Road from the Rebecca Road turnoff will be limited to 50 km per hour.

- Mine staff will remove any roadkill observed on Wuthering Heights Road (weekly) and within the mine site (daily).

4.5 Aboriginal heritage

Assessment

An Aboriginal cultural heritage survey of the proposed route has been undertaken by CHMA[10]. The survey assessment consisted of three components:

- A pre-fieldwork background study
- Field investigations
- Consultation with the Aboriginal community, and report preparation.

Previously recorded sites

There are ten Aboriginal heritage sites located within a 5 km radius of the study area that have been previously recorded and registered on the Tasmanian Aboriginal Site Index (TASI) data base. None of these sites, however, are within the bounds of the study area.

Field investigation

No Aboriginal heritage sites or specific areas of potential archaeological sensitivity were identified during the field investigations.

Surface visibility varied considerably across the site, ranging from 5% on the off track transects to 60% on transects along graded vehicle tracks.

Recommended management guidelines

Based on the findings of this investigation, there are no site specific heritage constraints or requirements for development.

In the event that any artefacts or sites are discovered during operations on the site, the processes outlined in the Unanticipated Discovery Plan of the CHMA report are to be followed.

4.6 Historic Heritage on Mine Site

Assessment

No site specific heritage assessment of the mine site has been undertaken.

Listings

There are no sites around the proposed mine areas listed on any of the various heritage registers.

Recommended Management Guidelines

No specific recommendations regarding heritage management are considered necessary.

[10] CHMA (December 2010) *An Aboriginal Cultural Heritage Assessment of the Proposed Nelson Bay River Magnetite Mine Development, North-West Tasmania.*

4.7 Geochemical Assessment

A geochemical sampling program has been undertaken to determine the potential for acid drainage to occur at the mine site as a result of mining operations. The aim of the analytical program was to enable the determination of (as required by the Project Specific Guidelines):

- The occurrence and quantities of the acid and non acid forming materials and acid consuming materials
- The acid generating capacity of the ore and, by default, the acid generating potential of the tailings (on the assumption that all pyritic material in the ore will be removed during processing)
- The extent of element enrichment and leaching potential in waste rock and the potential for enrichment and leaching in tailings
- The identification of elements and concentrations that may be of concern based on background levels
- The potential period from PAF exposure to the onset of acid generating conditions (through K-NAG tests).

Aspects of this study are summarised briefly below.

4.7.1 Sampling results

The outcomes of the sampling were as follows:

- A poorly constrained "pre-resource" 4.5Mt @ 1.01% Pyrite was inferred for (>0.5% Pyrite) PAF rock in the Magnetite Pit, with a comparatively small ~40kt @ 2.99% Pyrite modelled for the DSO Pit
- The majority of the significant PAF rock is shown to be in the northern half of the Magnetite Pit on sections 10000 and 10100mN. Pervasive silica, primarily located within more porous sandstone appears to encapsulate elevated pyrite concentrations, resulting in some NAF classifications for this material, whereas the disseminated pyrite within the less altered siltstones is more often classified as PAF
- PAF distribution and character is uncertain, partly since most drilling is sub-parallel to rock dip; actual distribution will become evident during mining
- Pyrite is mostly erratically distributed within hanging wall quartz veins in the DSO Pit area, but should be readily visually identified during planned mining
- Samples subjected to K-NAG testing indicated significant potential to generate acid drainage, with rapid onset of acid production predicted. The predicted lag time to the onset of acid conditions ranged between 4 and 16 weeks.

4.7.2 Potential acid forming materials

The potential amounts of pyritic waste rock material have been estimated on the basis of the analytical results and the estimated percentages of the various lithologies. The approximate anticipated quantities of pyritic material are shown in Table 5.

Table 5: Estimated amounts of potentially acid forming PAF

Section (mN)	Pyrite %	Estimated pyritic volume m^3	PAF (tonnes)
Main (magnetite) Pit			
10100	1.00	407,500	1,100,250
10000[1]	1.27	812,600	2,194,000
incl. Zone 1	*1.37*	*750,741*	*2,026,750*
incl. Zone 2	*0.08*	*61,852*	*167,000*
9900	0.05	321,850	869,000
9800	<0.05	120,000	324,000
Total PAF	1.01*	1,661,950	4,487,250
DSO Pit			
9550	2.97	2,724	7,355
incl. Zone 1	*6.00*	*1,005*	*2,713*
incl. Zone 2	*1.20*	*1,719*	*4,642*
9400	3.47	10,299	27,807
9300	0.60	1,074	2,900
9200	2.06	2,356	6,360
Total PAF	2.99*	13,729	37,067
Both pits			
Main pit	1.01*	1,661,950	4,487,250
DSO pit	2.99*	13,729	37,067
	Total PAF	1,675,679	4,524,317

* Weighted average

[1] Section 1000N comprises two zones, zone 1 and zone 2 of 2,026,750 and 167,000 tonnes respectively.

[2] Section 9550N comprises two zones, zone 1 and zone 2 of 2,713 and 4,642 tonnes respectively.

Anticipated timing and exposure of potentially acid forming materials

The potential amounts of pyritic waste material and anticipated periods of removal over the first half (5 years) of the mine life are summarised in Table 6. At that time the remaining available volume for PAF disposal into the DSO pit will be reviewed.

Table 6: Pyritic waste rock - anticipated volumes and likely removal times during the first half of mine operations

Year	DSO Pit m^3	Main Pit m^3	Both Pits m^3	Cumulative m^3
1	14,000	-	14,000	14,000
2	-	24,000	24,000	38,000
3	-	135,000	135,000	173,000
4	-	346,000	346,000	519,000
5	-	309,000	309,000	828,000

4.7.3 Carbonate acid neutralisation potential

There is no specific mention of carbonaceous sediment in the drill logs. A few zones of recognised carbonate veining were identified during the sampling program but overall quartz – carbonate veins (eg. NBR007 from 17.3 to 17.8 m) form a very small volume that is unlikely to contribute significantly to acid neutralisation potential. Furthermore, the NBR007 interval cited above is narrower than a likely minimum mining unit size.

Although extensive HCL (10%) testing of various lithologies was undertaken, no carbonate was identified.

4.7.4 Tailings

Testing on tailings derived from exploration cores shows that they are likely to be non-acid forming. However, the sporadic occurrence of pyrite in quartz veins means that there is some potential for potentially acid forming material to be discharged in the tailings stream. As a conservative protection measure, the tailings stream will therefore be pH adjusted to achieve an excess of alkalinity, prior to deposition in the tailings dam. This means that the tailings could not become acidic and they will also hold a residual alkalinity.

4.8 Waste rock disposal

4.8.1 Non acid forming (NAF) waste rock

The non acid forming (NAF) waste rock will be utilised in the construction of the tailings storage facility, hardstands for the processing plant and internal mine roads. Some may be sold for road construction elsewhere, under appropriate approvals.

All non acid forming waste rock not required for these purposes (the bulk of this material) will be stored in a waste rock dump to be constructed on the western side of the pits.

4.8.2 Acid forming (PAF) waste rock

All potentially acid forming (PAF) will be encapsulated in specially designed cells, to be initially developed within the DSO pit. The basic cell design for the disposal of pyritic material will consist of cells with clay lined floors and walls (clay lined containment bunds). Clay will be compacted to achieve a permeability of less than 1×10^{-9} m/s. Periodically the material within the cells will be capped with clay or compacted crushed NAF rock that will act as a barrier to air and water ingress, before the

introduction of additional pyritic material. These cells will be covered with water following flooding of the DSO pit on mine closure.

If the actual PAF rock production rates and the actual DSO pit volume lead to a mid-mine-life (year 5) projection that the pit volume will not be sufficient for the last few years of mining then the PAF storage will be raised above the DSO pit.

The basic structure of the cell will be similar to that of the cells within the pit but, rather than making use of the pit walls, the raised cell will be constructed within a wall constructed from NAF rock. Drainage off the dump will be directed into a sump void that will be retained and water collected in this sump will continue to be pumped out as before.

This same approach would be adopted as a contingency response for the unlikely situation that a significantly greater amount of PAF rock is found than is expected, which could lead to the DSO pit's PAF storage capacity being filled earlier in the mine life than anticipated.

This temporary dump will be managed until mining finishes, at which time it will be demolished, with the rock being trucked to the edge of the main pit where a safe chute arrangement will be constructed. The PAF rock will be pushed through the chute into the pit. The excess PAF rock will therefore become flooded with a permanent cover of water as the main pit fills because of the cessation of dewatering.

5. Legislative Framework

5.1 Key Statutes and Regulations

The Legislation applicable to any current or future activity on the site includes the following:

- *Mineral Resources Development Act 1995* (MRDA)
- *Environmental Management and Pollution Control Act 1994* (EMPCA)
- *Water Management Act 1999*
- *Workplace Health and Safety Act 1995* (WHSA)
- *Threatened Species Protection Act 1995* (TSPA)
- *Weed Management Act 1999*
- *Land Use Planning and Approvals Act 1993 (LUPAA)*
- *Forest Practices Act 1985*
- *Forestry Act 1920*
- *Aboriginal Relics Act 1975*
- *Historic Cultural Heritage Act 1995*

The Regulatory instruments applying to the site include:

- *The State Policy on Water Quality Management 1997*
- *The Workplace Health and Safety Regulations 1998*
- *The Weed Management Regulations 2000*

5.2 Responsible Authority

The responsible authority for each of the individual key statutes and their roles in the Closure Plan for the Nelson Bay River Mine are summarised in Table 7 below.

Table 7: Responsible authorities and their respective roles for each of the key statutes

Legislation	Responsible Authority	Roles relevant to the Decommissioning and Rehabilitation of the Nelson Bay River Mine Site
Mineral Resources Development Act 1995 (MRDA)	Mineral Resources Tasmania	Allocation of mineral exploration and mining leases Crown custodian of minerals Oversight and approval of mine site rehabilitation Control of bonds for rehabilitation Mining heritage Final approval for relinquishment of leases
Environmental Management and Pollution Control Act 1994 (EMPCA)	EPA, the Director of the Environment Protection Authority	Environmental management & environmental conditions on permit Approval of Closure Plans Approval of Decommissioning and Rehabilitation Plans Regulatory authority for environmental impact
State Policy on Water Quality Management	EPA, the Director of the Environment Protection Authority and the local Councils	Protected Environmental Values (PEVs) and Water Quality Objectives (WQOs)
Land Use Planning and Approvals Act 1993 (LUPAA)	Circular Head Council	Approval for any activity proposed for the site, if and as required by the Circular Head Planning Scheme 1995
Water Management Act 1999	Department of Primary Industries, Parks, Water and the Environment (DPIPWE)	Water allocation, use and environmental flows
Threatened Species Protection Act 1995	Department of Primary Industries, Parks, Water and the Environment (DPIPWE)	Approval for any impact on species listed under the act
Weed Management Act 1999	Department of Primary Industries and Water (DPIPWE)	Weed management
Workplace Health and Safety Act 1995 (WHSA)	Workplace Standards Tasmania	Occupational health and safety for all rehabilitation operations Occupational health and safety for any onsite tourist activities
Forestry Act 1920 *Forest Practices Act 1985*	Forestry Tasmania	Management of State Forests
Aboriginal Relics Act 1975	Department of Primary Industries, Parks, Water and the Environment (DPIPWE)	Management of Aboriginal cultural heritage issues
Historic Cultural Heritage Act 1995	Department of Primary Industries, Parks, Water and the Environment (DPIPWE)	Management of historic cultural heritage issues

5.3 Key Regulatory Instruments

5.3.1 Municipality of Circular Head Planning Scheme

Any proposed activity on the land will require planning approval in accordance with the Municipality of Circular Head Planning Scheme (*Circular Head S.46 Planning Scheme No.1, 1995*) and LUPAA.

5.3.2 Workplace Health and Safety

The proposed Closure Plan will be implemented in accordance with health and safety regulations.

5.3.3 Exploration Licence EL41/2004

The proposed Closure Plan for the proposed operation in part of EL41/2004 is being developed in consultation with the EPA, Mineral Resources Tasmania and Forestry Tasmania and will be implemented following acceptance and approval by these organisations.

5.3.4 Mining lease

An application for a mining lease over part of EL41/2004 under the *Mineral Resources Development Act 1995* has been made to Mineral Resources Tasmania.

5.3.5 Land use planning permit

The primary legislative instrument for the development and implementation of the Closure Plan will be the land use planning permit issued by Circular Head Council. This permit will include any environmental conditions placed on the proposed operation by the EPA. The Closure Plan, as modified, will address the requirements of this land use planning permit.

5.3.6 Arthur-Pieman Conservation Area

Several small areas of the proposed mining operations will occur within the boundaries of the Arthur-Pieman Conservation Area. The proposed development will be undertaken in accordance with the requirements of the Arthur-Pieman Conservation Area Management Plan 2002.

5.3.7 State Policy on Water Quality Management 1997

The aim of the *State Policy on Water Quality Management 1997* (State Water Policy) is to maintain or enhance the quality of Tasmanian surface waters. The principal objectives of the Policy include the following:

- Move on from reliance on 'end of pipe' controls to take into consideration the number of discharges into a given water body, or the sensitivity or current condition of the water body.
- Ensure that diffuse source and point source pollution does not endanger the achievement of water quality objectives, and that pollutants discharged to waterways are reduced as much as possible by the use of best practice environmental management.
- Facilitate and promote integrated catchment management.
- Focus on overall water quality management strategies by identifying those water quality values and uses that are considered worthy of protection.

This Closure Plan aims to achieve compliance with the State Water Policy.

Protected Environmental Values (PEVs)

Environmental management goals for surface waters in this area are contained in the Department of Primary Industries, Water and Environment document:

Environmental Management Goals for Tasmanian Surface Waters, Catchments within the Circular Head & Waratah/Wynyard Municipal Areas, January 2000.

Examination of this document indicates that the proposed mine site is located within State Forest in the Arthur catchment. Sections of the established PEVs for surface waters in State Forest in the Arthur River catchment that are relevant to this proposal are:

A: Protection of Aquatic Ecosystems

(ii) Protection of modified (not pristine) ecosystems
a. from which edible fish are harvested;

having regard for Forestry Tasmania's 'Management Decision Classification System'.

B: Recreational Water Quality & Aesthetics

(i) Primary contact water quality
(ii) Secondary contact water quality
(iii) Aesthetic water quality

These PEVs reflect historical impacts on the Arthur River from upstream mining.

The Nelson Bay River, however, has not been subject to such impacts and for the purposes of this project the PEV of Nelson Bay River catchment will be assumed to be:

A: Protection of Aquatic Ecosystems

(i) Protection of pristine or nearly pristine ecosystems.

The project's Water Quality Objectives (WQOs) will be developed to ensure that this PEV is not compromised. The final WQOs will be set by the EPA.

5.4 Corporate governance

Shree Mineral Limited is listed on the Australian Stock Exchange and is governed in accordance with relevant corporation laws.

6. Stakeholder Involvement

The objective of stakeholder involvement is to enable all stakeholders to have their interests considered during the mine closure process [Strategic Framework for Mine Closure (SFMC)].

The SFMC identifies the following five principles regarding stakeholder involvement in the process:

- *Identification of stakeholders and interested parties is an important part of the closure process.*
- *Effective consultation is an inclusive process, which encompasses all parties and should occur throughout the life of the mine.*

- *A targeted communication strategy should reflect the needs of the stakeholder groups and interested parties.*
- *Adequate resources should be allocated to ensure the effectiveness of the consultation process.*
- *Wherever practical, work with communities to manage the potential impacts of mine closure.*

6.1 Stakeholder Identification

This process, which has only been partially completed at this stage, has sought to identify all parties considered to be stakeholders in development of the proposed mine. It is considered that these stakeholders will also be interested parties with regard to the closure process.

Stakeholders have been identified as all those parties, whether companies, organizations or individuals, with the potential to be affected by operation of the mine, and hence by the mine closure process.

All other parties that have an interest in the process and/or the outcomes of the process have been regarded as interested parties.

Interested parties and key stakeholders were identified by:

- Consulting with known State and local government organisations.
- Using professional knowledge of persons or organisations known to have an interest or to be a key stakeholder in the consultative process.

The identification of other interested parties and key stakeholders will be further developed in the future by:

- Consulting with known community groups and non-government organisations.
- Undertaking public consultation.

6.2 Stakeholder Groups

The key stakeholder groups are:

- Shree Minerals Limited – Nelson Bay River Mine.
- The Circular Head community.
- The Tasmanian Government.
- Local Government (Circular Head Council).

6.2.1 Shree Minerals Limited – Nelson Bay River Mine

The key company stakeholders are considered to be the future mine management at the Nelson Bay River Mine, Shree Minerals Limited board and management, and the shareholders of the company.

Mine closure will ultimately result in the loss of approximately 125 direct and indirect jobs, assuming that employment levels at the time of closure are similar to the anticipated full production employment levels.

The Nelson Bay River Mine Mine does not, as yet, have any employees. Interested employees will be given the opportunity to participate in the closure process through future community consultation.

6.2.2 The Circular Head community

The key community stakeholders are the local business and service providers, specifically those that will provide services to the mine and those catering to the tourist industry.

6.2.3 The Tasmanian Government

The key Tasmanian Government stakeholders are Mineral Resources Tasmania (MRT), responsible for Mining Lease allocation, and the Department of Primary Industries, Parks, Water and the Environment (DPIPWE) responsible for water management and environmental protection.

Forestry Tasmania is considered to be an important stakeholder because it is likely to assume responsibility for the current Mining Lease following mine closure and lease relinquishment.

6.2.4 Local Government

The Circular Head Council is considered to be a key stakeholder because it may assume responsibility for some aspects of the area, particularly access roads. The DRP closure works and the construction of any business, tourist or other facilities on the site, including the reuse of existing facilities, will also require the approval of the Council.

6.3 Interested Parties

Interested parties are likely to include the following:

- Individual persons.
- The Australian Workers Union.
- The Tarkine National Coalition
- Other conservation groups such as Landcare and Waterwatch.
- The Tasmanian Minerals Council.
- Service organisations.
- Specific (unidentified) interest groups.

6.4 Consultation

Wide consultation with stakeholder groups and interested parties has not been undertaken at this stage. Consultation undertaken is indicated below. Input from other stakeholders will be sought as required, through a combination of information drop in days (eg. at Smithton and Arthur River), media releases and discussions with stakeholder group representatives.

6.4.1 Circular Head community

Although community consultation as a specific component of the mine closure process has not been undertaken at this stage, such consultation will be undertaken at an appropriate time in the future.

6.4.2 The Tasmanian Government

Shree Minerals Limited is committed to an open and constructive dialogue with key stakeholders and interested parties. Consultations have also been undertaken with relevant government organisations / personnel and politicians. These discussions will continue throughout during the wider approvals process.

6.4.3 Local government

Preliminary discussions have been held with the Circular Head Council but at this stage these discussions have focused on mine approval. Detailed discussions regarding closure will be undertaken at a more appropriate time in the future.

6.4.4 Interested parties

Representatives of the Tarkine Coalition have been consulted at this stage regarding development of the mine. Discussions have also been held with representatives of Tasports, Tasrail, ppotential transport operators and ppotential mining and construction contractors.

All interested parties will be consulted regarding closure at a more appropriate time in the future.

6.4.5 Consultation summary

A list of all identified key stakeholders and interested parties ultimately contacted will be included in the final version of the closure plan.

Copies of the minutes of meetings and summaries of the outcomes of the consultative process will also be included in the final version of the closure plan.

7. Options Analysis

Potential options for dealing with the various components of infrastructure, specific environmental issues and other site issues are assessed by topic below, with preferred options summarised in Table 8.

All options are to be confirmed in consultation with key stakeholders and interested parties.

Table 8: Preferred options for dealing with mine infrastructure, and environmental and other site issues

7.1 Infrastructure	Preferred Options
Mine – main and DSO pits	Remove and dispose of all hazardous material; remove infrastructure; ensure the safety and stability of the site
Processing plant and associated facilities	Remove and dispose of all hazardous material; remove infrastructure; ensure the safety and stability of the site
Concrete foundations	Remove and dispose of in main pit
Tailings storage facility (TSF)	Provide a wet cover; provide for ongoing diversion from adjoining creek to maintain wet cover; make the site safe and stable
Roads, water supply, process piping	All mine roads, water supply, and process piping will be retained to service the requirements of the Closure Plan; any removal will be the final aspect of closure and will only be undertaken if no future uses identified
Main internal roads	Leave for future access for fire fighting, etc
Pit and tailings dam diversion drains	Remove and rehabilitate tailings dam diversion drain; retain main pit diversion drain as discharge channel for flooded main pit
NAF rock dump collection drain	Leave in place but connect bottom end directly to West Creek after removal of sediment basin at end of vegetation maintenance period
Sediment basins	Remove after completion of vegetation maintenance period

7.2 Specific Environmental Issues	Preferred Options
Mine flooding – main and DSO pits	The pits will gradually flood on closure of the mine and cessation of pumping; the water will provide a suitable cover for the pyritic disposal cells
Mine drainage (groundwater and surface runoff outflow)	Divert the excess flow from the DSO pit into the main pit; divert the excess flow from the main pit to West Creek; make the groundwater and surface water outfall areas safe and secure
Mine stability (main and DSO pit walls)	Assessment of mine stability at the time of closure; ensure that the area is as safe and stable as possible by undertaking all reasonable and practicable measures
Waste rock (non acid forming)	Store non acid forming waste rock in a dedicated dump on the western side of the pits; rehabilitate and revegetate
Waste rock (potentially acid forming - PAF)	Store as much PAF material as possible in special cells within the DSO pit and flood on closure. Store remaining amount in special cells above the DSO pit; remove this material to main pit on closure.
Acid drainage	Flood all PAF rock under at least 2 m of water; flood tailings under at least 1 m of water (in addition, the tailings will have a residual alkalinity through dosing during operations)
Surface Water	Discharge to West and East Creeks via the sedimentation dams until the end of the vegetation maintenance period with monitoring of this discharge water to ensure compliance with environmental requirements; provision of a safe and stable stormwater system; provision of armoured spillway from DSO pit to main pit and from main pit to the main pit diversion drain, which runs to West Creek
Revegetation	Development of a comprehensive site revegetation plan
7.3 Other Site Issues	Preferred Options
Site aesthetics	Acknowledgement of the importance of site aesthetics by incorporating these values in revegetation planning for the site
Site access	Provide controlled access to the site; fence the main pit (DSO pit will be backfilled with acid forming material)
Aboriginal cultural heritage	Identify all sites of Aboriginal cultural heritage significance; ensure that protocols for dealing with the discovery of Aboriginal heritage sites are known and understood by mine staff and contractors undertaking surface work on the mine lease area
Amenity values	Identify the amenity values of the mine site; manage these amenity values consistent with community expectations
Weeds	Develop a weed management plan; ongoing treatment of any weeds across the mine site in accordance with the site weed management plan
Fire	Develop an appropriate fire management plan for the mine site
Phytophthora cinnamomi	Develop an appropriate hygiene management plan for the mine site

7.1 Infrastructure

7.1.1 Main and DSO pits

The options available with regard to mine infrastructure in the main and DSO pits are:

a) Do nothing, abandoning all infrastructure on mine closure: this is not considered to be an acceptable solution.

b) Remove all hazardous materials.

c) Selectively remove infrastructure.

d) Remove everything.

e) Make safe and stable.

The preferred options are b), d) and e):

- Remove all hazardous materials.
- Remove everything.
- Make the site as safe and stable as is possible.

The removal of all in pit infrastructure is considered to be practical, both physically and financially, because most (if not all) of this will be mobile equipment.

7.1.2 Processing plant and associated facilities

The options available with regard to the processing plant infrastructure are:

a) Do nothing, leaving all processing plant infrastructure where it is on mine closure: this is not considered to be an acceptable solution.

b) Remove and dispose of all hazardous material.

c) Selectively remove aboveground infrastructure.

d) Remove all aboveground infrastructure.

e) Make safe and stable.

The preferred options are b), d) and e):

- Remove and dispose of all hazardous material.
- Remove all aboveground infrastructure.
- Ensure the safety and stability of the site.

Following closure of the mine:

- The processing plant will operate until all mined material is processed.
- Process tanks will be run out and any reagents used up or returned to suppliers.
- Tanks and buildings will be cleaned out and cleanings disposed of to the tailings dam or a hazardous waste landfill facility.

If appropriate any redundant equipment will be divested during operations.

All foundations and structures associated with the mill will be removed and disposed of in the main pit, unless there is adequate reason to retain them for future use / asset.

In order to adequately assess options for the mill infrastructure, the following investigations are required:

- Consultation with key stakeholders and interested parties to identify future uses.
- A survey that identifies equipment that is to be:
  - Retained for future community benefit.
  - Recycled.
  - Sold.
  - Otherwise disposed of to appropriate standards.
- A contaminated site assessment of the mill area completed in accordance with Australian Standard AS 4482.1-2005 *Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*.

7.1.3 Tailings storage facility (TSF)

The options available with regard to the tailings storage facility (tailings dam) are:

a) Do nothing, leaving the tailings storage facility 'as is' on mine closure: this is not considered to be an acceptable solution.

b) Cover the storage facility with water (wet cover).

c) Establish a 'mushy' cover (swamp type cover) over the storage facility.

d) Cover the storage facility with soil (dry cover).

e) Make safe and stable.

The preferred options are b) and e):

- Provide a wet cover.
- Make the sites safe and stable.

In order to adequately address these preferred options, the following actions should be undertaken:

- Permanent partial diversion of West Creek over the dam will be established to help maintain a permanent wet cover (there is a net surplus of rainfall over evaporation, so water cover is not dependent on the creek inflow).
- On site stormwater should be directed to seepage areas in order to flush any seepage away.
- All pumps and pipework should be removed once the area has been rehabilitated
- The tailings will have been dosed to excess alkalinity during production, so the tailings will retain a residual alkalinity and will not be acid forming.

7.1.4 Roads, water supply and process piping

The options available with regard to all roads, water supply infrastructure and process piping are:

a) Do nothing, leaving all such infrastructure in the existing state on mine closure (that is, abandoning it): this is not considered to be an acceptable solution.

b) Systematically remove the infrastructure.

c) Make the sites safe and stable.

All roads, water supply, and process piping will be retained to service the requirements of the Closure Plan and the DRP.

Removal of roads, water supplies and external pipework will be the final aspect of closure, and will only be undertaken if no future uses for the mill and mine site have been identified at that time or as part of the consultative process.

The following uses of some of this infrastructure have already been identified:

- Roads: the main mine surface roads (ie. out of pit) will be retained for fire access purposes, subject to Forestry Tasmania requirements.

7.2 Specific environmental issues

Specific environmental issues associated with closure of the Nelson Bay River Mine are discussed below.

7.2.1 Mine flooding

There are no options that can be considered with regard to this issue. On closure of the mine and cessation of pumping, the mine pits will gradually flood.

7.2.2 Mine drainage (groundwater and surface water outflow)

As indicated above, on closure and cessation of pumping, the mine pits will gradually flood. Flooding of the pits will continue until the water level reaches the existing ground surface. At this stage this water will flow out from the pits.

The options available with regard to this mine drainage are:

a) Do nothing, allowing the pits to flood and water to flow out across the existing landscape from the low points in the pit walls.

b) Divert pit drainage from the DSO pit to the main pit along a constructed drainage line.

c) Divert the main pit drainage to West Creek via a constructed drainage line.

d) Make the outfall areas safe and secure.

The preferred options are b), c) and d):

- Divert the DSO pit drainage to the main pit.
- Divert the main pit drainage to West Creek.
- Make the outfall areas safe and secure.

In order to adequately address these preferred options, it is necessary to:

- Construct drainage lines from the DSO pit to the main pit and from the main pit to West Creek (using the diversion drain) that are adequately sized to cope with the likely overflow rates. This drain will be armoured against erosion.

7.2.3 Mine stability

Ground stability in the vicinity of the pits is a potential environmental issue post closure. The options available with regard to this issue are:

a) Do nothing, allowing the pit walls to collapse in over time: this is not considered to be an acceptable solution.

b) Assess final pit wall stability, including surface expression.

c) Make the area as safe and stable as is practicable.

The preferred options are b) and c):

- Assessment of mine stability at the time of closure and future stability, as far as is practicable.
- Ensuring that the area is as safe and stable as possible by undertaking all reasonable and practicable measures.

In order to adequately address these preferred options, it is necessary to undertake a study / report that:

- Addresses post closure mine stability, including any impacts on surface expression and future groundwater levels.
- Establishes that stability of the mine post closure will represent a minimal risk to the community.

Mine development that is undertaken with due regard to the geotechnical properties of the waste rock, particularly with regard to long term batter stability within the pits, will ensure that pit wall stability will not be an issue post closure. Pit design for operations and closure will be undertaken as part of detailed mine design, following project approval. Dewatering holes may be installed in pit walls to relieve hydrostatic pressure.

7.2.4 Waste rock

The options available for dealing with waste rock are as follows:

a) Dispose of all waste rock in a single dump.

b) Separate non acid forming and potentially acid forming waste rock and dispose of separately.

c) Encapsulate potentially acid forming material in specially designed and constructed cells to eliminate / control any acid drainage.

d) Make all waste rock areas as safe and stable as is practicable.

The preferred options are b), c) and d):

- Separate the potentially acid forming and non acid forming waste rock and dispose of separately.
- Encapsulate the potentially acid forming waste rock in special cells.
- Make all the disposal areas as safe and stable as is practicable.

In order to adequately address these preferred options it will be necessary to:

- Identify all potentially acid forming waste rock in the pits during mining.
- Ensure that each of the waste rock types is transported to the correct site; in particular, that no potentially acid forming waste rock ends up with the non acid forming waste rock (the reverse case would not be an issue).
- Encapsulation cells are appropriately designed and constructed and the potentially acid forming waste is properly emplaced within the cells.
- Where necessary, appropriate drainage controls are constructed and sedimentation ponds provided where any acid drainage can be treated prior to discharge.

7.2.5 Acid drainage

The options available for dealing with waste rock are as follows:

a) Dispose of all waste rock in a single dump; ie do nothing specific to deal with the potential problem.

b) Separate out the potentially acid forming waste rock and encapsulate it in specially designed and constructed cells to eliminate / control any acid drainage.

c) Cover the encapsulation cells with water on mine closure.

d) Make the encapsulation cells as safe and stable as is practicable.

The preferred options are b), c) and d):

- Separate the PAF and encapsulate.
- Cover the cells with water on closure.
- Make the cells as safe and stable as possible.

In order to adequately address these preferred options it will be necessary to:

- Identify all potentially acid forming waste rock in the pits during mining.
- Ensure that all potentially acid forming waste rock is transported to the encapsulation cells.
- Encapsulation cells are appropriately designed and constructed and the potentially acid forming waste is properly emplaced within the cells. A description of the cells is provided in the DPEMP.
- Appropriate drainage controls are constructed and sedimentation ponds provided.
- Continue the operational surface water monitoring until the end of the vegetation maintenance period to confirm that no acid drainage is emerging.

7.2.6 Revegetation

The options available with regard to revegetation of areas affected by the mining operations are:

a) Do nothing, allowing any disturbed areas to revegetate naturally: this is not considered to be an acceptable solution.

b) Develop and implement a site revegetation plan that aims to return disturbed areas of the mine site to their original vegetation cover after closure.

The preferred option is b):

- Development of a comprehensive site revegetation plan.

In order to achieve this preferred option the following actions are required:

- Develop a full revegetation plan for all disturbed areas of the mine site.
- Ensure that the plan contains a monitoring component to measure the success of the revegetation process.
- Undertake revegetation of the site on an ongoing basis, as and when particular areas are no longer required for operations.
- A vegetation maintenance period of 3 to 5 years is anticipated.

7.3 Other site issues

7.3.1 Site aesthetics

The options available with regard to site aesthetics are:

a) Do nothing: this is not considered to be an acceptable solution.

b) Acknowledge the importance of site aesthetics by incorporating these values in revegetation planning for the site.

The preferred option is b):

- Acknowledgement of the importance of aesthetic values of the area by incorporating these values in site revegetation planning.

In order to achieve this preferred option the following actions are required:

- Preparation of a baseline survey that identifies the aesthetic values of the site.
- Inclusion of aesthetic values in the revegetation plan to ensure that the revegetation in any particular area is consistent with the surrounding vegetation; this will ensure that the disturbed and undisturbed areas will ultimately become indistinguishable.

7.3.2 Site access and pits

The options available with regard to site access and the pits associated with the present phase of mining, subject to wider community consultation, are:

a) Do nothing, leaving access to the site and the pits completely uncontrolled: this is considered to be completely unacceptable.

b) Provide controlled access to the site, including the pits.

c) Restrict access to the site, particularly the pits.

The preferred option is c):

- Restrict access to the site, particularly the pits (subject to wider community consultation).

In order to achieve this preferred option the following actions are required:

- Complete a site safety survey and establish site safety procedures to be followed.
- Ensure that all areas, particularly the area around the pits, have adequate safety fencing and appropriate signage.
- Identify any required/preferred community site access requirements.

7.3.3 Historic heritage

As there are no identified historic heritage features on the site, there are no management options required.

7.3.4 Geoheritage

Although it is considered extremely unlikely that any features of geoheritage significance could be identified on the site, the options available, should any such features be identified, are:

a) Do nothing: this is not considered to be an acceptable solution.

b) Identify any features of geoheritage significance that should be preserved and managed (subject to consultation).

The preferred option is b):

- Identify features of geoheritage significance that are considered worthy of preservation.

In order to achieve this preferred option the following actions are required:

- Identify any sites and/or features considered to be of geoheritage significance.
- Prepare a management plan for all such features.

7.3.5 Aboriginal cultural heritage

An Aboriginal cultural heritage assessment of the site has already been undertaken (An Aboriginal Cultural Heritage Assessment of the Proposed Nelson Bay River Magnetite Mine Development, North-West Tasmania. CHMA, 2010).

No matters of Aboriginal significance were found. However, it is possible that unknown items of Aboriginal heritage significance might be found during the operations of the mine. If this is the case, the following provisions will apply.

- Ensure that the protocols for dealing with the discovery of sites or artefacts of Aboriginal cultural heritage significance are known and understood by mine staff and contractors undertaking surface work on the mine lease area.
- Ensure that all staff and contract personnel working aboveground understand that, in the unlikely event that any Aboriginal heritage sites or artefacts are identified during any mining, construction, rehabilitation or other activities, work must cease immediately in that area pending advice from Aboriginal Heritage Tasmania, Department of Primary Industries, Parks, Water and the Environment (DPIPWE), in accordance with the requirements of the *Aboriginal Relics Act 1975*.

7.3.6 Amenity values

The options available with regard to amenity values of the mine lease area are:

a) Do nothing: this is not considered to be an acceptable solution.

b) Identify all amenity values of the mine site.

c) Manage amenity values, subject to appropriate consultation with the wider community.

The preferred options are b) and c):

- Identify the amenity values of the mine site.
- Manage these amenity values consistent with community expectations.

In order to achieve these preferred options the following actions are required:

- Consult with the wider community to identify the perceived amenity values of the mine site.
- Establish a management plan to preserve and develop site amenity values identified by the wider community during the consultation process.

7.3.7 Weeds

The options available with regard to site weed infestation are:

a) Do nothing: this is not considered to be an acceptable solution.

b) Develop a weed management plan for the site.

c) Treat any weeds that appear onsite according to the management plan.

The preferred options are b) and c):

- Development of a weed management plan.
- Ongoing treatment of any weeds that appear across the mine site, in accordance with the site weed management plan.

In order to achieve these preferred options the following actions are required:

- Development of a weed management plan consistent with the wider community weed management objectives and the requirements of the Weed Management Act 1999.
- Systematic treatment of any weeds that appear across the site in accordance with the weed management plan.
- Inclusion of weed management as a key component of the revegetation program.

7.3.8 Fire

The options available with regard to fire risk are:

a) Do nothing: this is not considered to be an acceptable solution.

b) Develop an appropriate fire management plan.

The preferred option is b):

- Develop an appropriate fire management plan for the mine site.

In order to achieve this preferred option the following action is required:

- Development of a fire management plan that is consistent with the wider community fire management plans and requirements.

7.3.9 Phytophthora cinnamomi

The options available with regard to potential infection of susceptible vegetation by *Phytophthora cinnamomi* are:

a) Do nothing: this is not considered to be an acceptable solution.

b) Develop an appropriate hygiene management plan.

The preferred option is b):

- Develop an appropriate hygiene management plan for the mine site.

In order to achieve this preferred option the following actions are required:

- Development of an appropriate mine site hygiene management plan that is consistent with the following document:

  Rudman T (2005). *Interim Phytophthora cinnamomi Management Guidelines*. Nature Conservation Report 05/7, Biodiversity Conservation Branch, Department of Primary Industries, Water and Environment, Hobart.

- Appropriate action to ensure that the hygiene management plan is followed on susceptible mine site areas.

7.4 Strategy and management

7.4.1 GIS

A Geographical Information System (GIS) will be utilised to record all relevant mine information, including the results of ongoing monitoring.

7.4.2 Mine life

This Closure Plan has been developed for a projected mine closure in 2022, with a three year post-closure rehabilitation program. It will be modified over time to account for any future variations in projected mine life.

7.4.3 Post closure monitoring and maintenance

Monitoring will be continued at the various sites for the agreed periods of time, consistent with achieving the agreed aims or targets. Maintenance will also be undertaken over this period of time to ensure the success of all rehabilitation measures undertaken.

7.4.4 Future mining activity

The closure strategy will specifically avoid any actions that will preclude any future mining activity on the site. Risk Assessment

7.5 Risk assessment

7.5.1 Introduction

The objective of a risk-based approach to closure planning is to reduce both cost and uncertainty (2.2 Strategic Framework for Mine Closure).

The quantification of subjective factors and the analysis of uncertainty related to both design performance and cost are seen as particular advantages of a risk-based approach to closure planning[11].

Shree Minerals Limited has adopted a risk-based approach to the Nelson Bay River Mine Closure Plan. The Closure Plan takes into account the Nelson Bay River Mine risk management system and procedural commitments.

The Nelson Bay River Mine Closure Plan has been developed using a risk based approach. The aim of the Closure Plan is to implement actions over specific timeframes to control inherent risks and minimise residual risks.

[11] Morrey, DR, 1999. Principles of economic mine closure, reclamation and cost management. In: *Remediation of Degraded Lands.* MH Wong *et al.* (eds). Lewis, New York.

7.5.2 Methodology

pitt&sherry on behalf of Shree Minerals Limited has undertaken a qualitative risk assessment.

The Nelson Bay River Mine Site risk assessments are linked to the Nelson Bay River Mine Site Risk Analysis Matrix (Appendix 2) and the Nelson Bay River Mine Site Cost Matrix (Appendix 1).

Should the proposed controls associated with Appendix 2 be changed, the risks will require additional review.

The qualitative risk assessment was based on the following processes to ensure identification of hazards, risks, issues and values associated with the Nelson Bay River Mine Closure Plan:

- The existing Shree Minerals Limited guideline procedures and processes.
- The procedures and processes outlined in AS/NZS 4360:1999.
- Identification of inherent and residual hazards and risks associated with developing, implementing and finalising the proposed Closure Plan.
- Nelson Bay River Mine scientific literature review.
- Nelson Bay River Mine remediation options assessment.
- Site inspections.

A full qualitative risk assessment has not been undertaken at this stage. The existing qualitative risk assessment will be further refined following utilisation of the following additional processes:

- Report on the above to the Department of Primary Industries, Parks, Water and the Environment and Mineral Resources Tasmania.
- An extensive community, key stakeholder and interested parties consultative program to identify community, key stakeholder and interested parties issues and values for consideration in the Closure Plan.

7.5.3 Risk assessment context

The qualitative risk analysis involved five risk types: safety, legal, environmental, stakeholder/media and cost.

Safety

The safety risks are associated with the waste rock dump stability, the open cuts (main and DSO pits) and the tailings dam; the quality of the water discharged from the site is also considered to be a safety risk.

The probability and consequence measures, used for the inherent and residual risk determinations, relate to the likelihood of a health or safety incident occurring on or near the site.

Legal

Preparation of the Closure Plan has been conducted in accordance with the legislative framework outlined in Section 5. The specific legal risks associated with the Closure Plan relate to the likely requirements of the proposed mining lease. The probability and consequence measures, used for the inherent and residual risk determinations, relate to the likelihood of legal action including class action.

Environmental

The main regional area of environmental significance is State Forest. The existing state of the site as well as the Closure Plan activity itself has the potential to cause environmental nuisance or harm. The probability and consequence measures, used for the inherent and residual risk determinations, relate to the likelihood of causing environmental nuisance or harm from implementing the Closure Plan or as a result of the Closure Plan. The parts (14.7 ha) of the footprint that intersect with the Arthur-Pieman Conservation Area will be unencumbered after rehabilitation on mine closure.

Stakeholder/media

There will be loss of mining jobs in the Circular Head area when the operating mine closes. This loss may be offset by alternative mining developments utilising the site and further development of the tourism potential of the area.

Stakeholder risks are site access, impacts on receiving water ecosystems, reduction in amenity value of the wider area and failure of the Closure Plan to meet Government and/or public expectations. The probability and consequence measures, used for the inherent and residual risk determinations, relate to the likelihood of failure to meet Government and/or public expectations and adverse media reports.

Cost

Rehabilitation of the site following mine closure will result in loss of jobs but this loss may, in fact, be offset by some future employment opportunities in alternative mining developments and/or tourism in the area. The implementation of the Closure Plan actions over the specified timeframes may present employment opportunities for some of the people of the Circular Head area in general. The probability and consequence measures used for the inherent and residual risk determinations relate to the likelihood of Closure Plan future costs to Shree Minerals Limited, government and the community.

7.6 Inherent risks, proposed controls, and residual risks

The potential Nelson Bay River Mine site legacies are described below, including inherent risks, proposed controls to mitigate the inherent risks and residual risks. A detailed risk analysis matrix is integrated with this section in Appendix 3.

7.6.1 Project administration

Inherent risk

The Mine Closure plan may not meet stakeholder expectations for future land use and values.

Proposed controls

- Design and project supervision by external consultancy.
- Possible ISO14001 accreditation
- A limited GIS will be developed to assist planning and implementation of rehabilitation of the mine site. The Closure Plan works will be recorded on the GIS maps for future reference and for final reporting.
- Annual reporting and review of monitoring and progress to plan.
- Ongoing consultation with stakeholders and other interested parties.

Residual risk

Despite ongoing and wide consultation with stakeholders and other interested parties, it may not be possible to meet some stakeholder expectations.

7.6.2 Monitoring

Inherent risk

The proposed monitoring programs for the Nelson Bay River Mine Site may prove to be inadequate or unsuitable.

Proposed controls

Water quality monitoring quantity and quality data, together with biological monitoring, will provide baseline information that is essential for the identification of any changes in groundwater and / or surface water parameters resulting from mine operations.

The information obtained from these monitoring regimes will provide baseline data from which, once mining operations commence, any changes in water quality can be assessed and groundwater impacts identified. Operational or management changes that allow the mitigation of potential impacts will be implemented on the basis of this information.

Residual risk

Over time the monitoring program objectives may drift from the site closure objectives and stakeholder expectations.

An annual review of all the monitoring information will ensure that any impacts on receiving waters are readily identified and that the monitoring objectives for the individual programs remain in line with closure objectives.

7.6.3 Site aesthetics

Inherent risk

The site, which has not been impacted by historic mining activities and practices, is at risk of degradation of site environmental values if closure practices are poor or inadequately controlled.

Proposed controls

- A baseline vegetation survey (already undertaken).
- Development of a scientifically sound revegetation plan dedicated specifically to the Nelson Bay River site, with specific goals and targets set, along with the development of appropriate action and monitoring plans.
- Implementation of the revegetation plan.
- Development of appropriate surface water management at the mine site to assist revegetation and control general erosion and degradation.
- Annual reporting to stakeholders and interested parties.

Residual risk

On site environmental degradation that results from the proposed mining operations may be reduced more slowly than anticipated, with scars remaining a feature of the landscape for a longer period of time. Objective closure targets will be set to recognise these potential limitations.

7.6.4 Tailings storage facility

Inherent risk

Disposal of tailings at the Nelson Bay River Mine by Shree Minerals Limited will be to a dedicated storage facility (the tailings dam), that will be designed in line with parameters outlined in the DPEMP (2011).

Although the dam will be constructed with a clay lining, there is an inherent risk of percolation through the dam walls and / or floor to the surrounding groundwater and / or surface water.

Proposed controls

- Construction of an appropriately designed tailings storage facility
- Development of a significant depth of flotation tailings to reduce the impact over time.
- Annual reporting to stakeholders and interested parties.

Residual risks

The residual risks associated with the tailings dams are:

- Seepage through the dam wall over time.
- Impact on water quality, both surface and groundwater.
- Any seepage may present an environmental risk.

7.6.5 Acid mine drainage

Inherent risks

A significant amount of the waste rock is potentially acid forming material (PAF). There is an inherent risk that not all this material will be correctly identified and / or correctly separated during the mining process. There is also an inherent risk that some PAF material will be contained within the tailings.

Proposed controls

Appropriate measure will be initiated to ensure that all PAF material is identified within the pits and directed to the encapsulation cells.

Potentially acid-forming waste rock (PAF) produced will be buried in specially designed encapsulation cells within the DSO pit. These cells will be flooded on mine closure. Sludge from the central acid neutralisation plant will be codisposed in these cells.

In the event that there is insufficient volume available in the DSO pit, excess PAF material will be stored temporarily in similar cells constructed above the DSO pit. The material in these cells will be transferred to the main pit on mine closure and flooded.

Regular static and kinetic (K-NAG) testing of pit material as part of the mine's operational grade control will be used to minimise the likelihood of PAF material being inadvertently taken to the NAF rock dump.

Residual risks

The residual risks are:

- There may be some acid drainage from the additional encapsulation cells above the DSO pit during operations before this material is transferred to the main pit on mine closure but this will be collected inside the pit and would be pumped to the central acid neutralisation plant for treatment if required. Once transferred to the main pit, the material would progressively flood and would be completely

submerged many years before the pit flooded to full capacity (which is likely to take for than 20 years).

- Despite the regular testing, some PAF material being inadvertently taken to the NAF rock dump. Regular testing of runoff during operations will detect any acid runoff. If this occurs, water will be pumped to the main pit and hence neutralisation plant during operations and investigations will be undertaken to attempt to identify the part of the dump that is responsible to allow suspect material to be removed to the PAF dump. Similar investigations and actions would be undertaken if acid drainage emerged during the post-closure monitoring (vegetation maintenance) period.
- Acid mine drainage (AMD) is not expected to be formed within the tailings dam because tailings will be dosed to excess alkalinity.

7.6.6 Surface water management

Inherent risk

On closure, acid generating conditions are not likely to form because:

- All PAF material will be permanently flooded in the DSO and main pits.
- Tailings will hold a residual alkalinity and therefore would not become acid forming.

Erosion of drains and disturbed areas present the greatest risk to surface water quality.

Proposed controls

The drain to West Creek for the main pit overflow will be rock armoured. It is likely to be more than 20 years before the pit fills to overflowing, and this drain will therefore be well consolidated. The NAF rock dump collection drain will have been established for more than 10 years before the mine closes, so this drain will also be well consolidated. The tailings dam spillway will similarly have been armoured for the life of the processing operations, and will therefore be well established on closure.

All the drains that will be left in place on mine closure will therefore be well protected against erosion.

Redundant drains and sediment basins will be removed and revegetated on closure.

Residual risks

Slow revegetation may leave disturbed areas vulnerable to erosion for longer than anticipated.

7.6.7 Site access and safety issues

Inherent risk

The main pit will remain as an inherent safety risk because it will not be backfilled and will become a very deep water filled pit over time. The DSO pit will also be an inherent risk because, although it will be backfilled with PAF material, it will retain a water cover.

Proposed controls

Unauthorised access to the site will be restricted by the use of appropriately located gates, fences and warning signs.

Residual risks

The risk of access by unauthorised personnel to unsafe areas such as the main and DSO pits, the waste rock dump and site access roads will remain.

Failure of the pit walls may occur over time and may impact significantly upon safety, particularly if pit wall failure results in the destruction of safety fencing.

7.6.8 Mine stability

Inherent risk

There may be failure of the pit walls over time, resulting in extension of the pit boundaries in existence at mine closure.

Proposed controls

This risk will be minimised by appropriate geotechnical design of the of the pit walls. This will include the determination of appropriate batter slopes for closure and consideration of dewatering holes in the pit walls to relive hydrostatic pressure.

Residual risk

Failure of the pit walls may alter the water and safety management plans.

7.6.9 Mine flooding

Inherent risk

The pits will flood after closure. Based on evidence presented in the site groundwater assessment (DPEMP), the pits are likely to take the following lengths of time to infill with groundwater and surface water flow:

- DSO pit: 2 – 6 years; if this pit is used for PAF encapsulation, as planned, then the DSO pit would be likely to flood within the first year after closure.
- Main pit 12 – 20 years.

There are no significant opportunities to divert surface water into the pits to speed up the flooding process (diverting East Creek to achieve this is not favoured).

Proposed controls

As it will not be possible to limit mine flooding, the following controls are proposed:

- Diversion of excess drainage from the DSO pit to the main pit by construction of a drain from the northern end of the DSO pit to the main pit.
- Provision of an overflow from the north western corner of the main pit to West Creek.

These controls will ensure that the groundwater inflow and surface water runoff to the pits is ultimately diverted to the Nelson Bay River via constructed drainage lines and West Creek rather than spreading out over the surrounding countryside.

Residual risk

Failure of the pit walls and the subsequent impacts on drainage controls is a residual risk.

7.6.10 Processing plant site

Inherent risk

Soil around the processing plant site may contain varying levels of contamination, the nature and extent of which may be uncertain or unknown.

Proposed controls

Undertake a contaminated site assessment of the processing plant site area following closure and remove material from contaminated areas to approved disposal sites.

Residual risk

Soil in the area may contain some residual contamination.

7.6.11 Roads and tracks

Inherent risk

Some mine roads and tracks may permit uncontrolled access to unsafe areas of the mine site.

Proposed controls

The number of roads available for vehicle access on site will be restricted. An engineering assessment of the key site haulage and access roads will be completed to establish requirements for long-term use.

This assessment will include the expected maintenance program for essential access ways and drains. Where necessary, internal roads will be rehabilitated in line with the revegetation program requirements and restricted to foot access.

Residual risk

The maintenance of roads and tracks, or simply leaving roads and tracks open, will enable access by unauthorised personnel to unsafe areas and rehabilitation areas.

7.6.12 Historic heritage

Inherent risk

No specific historic heritage values have been identified on the site.

Implementation of the Closure Plan will, therefore, not result in any loss of important heritage values.

Proposed control

No particular controls are required as no historic heritage has been identified.

Residual risk

There is no residual risk.

7.6.13 Geological heritage and education

Inherent risk

No specific geological heritage or geological educational values have been identified on the site.

Implementation of the Closure Plan will, therefore, not result in any loss of important geological heritage and / or educational values.

Proposed controls

No particular controls are required as no geological heritage has been identified.

Residual risk

There is no residual risk.

7.6.14 Aboriginal cultural heritage

Inherent risk

Although the risk of disturbance to any Aboriginal cultural heritage values in the area is considered to be low, there may be an inherent risk of impact on such values in some areas, particularly where access and/or surface visibility were restricted during the site Aboriginal heritage investigations.

Proposed controls

Ensure all contractors and sub contractors undertaking works on the site are aware of the requirements of the *Aboriginal Relics Act 1975* and also ensure that these requirements are included in all contracts.

Residual risk

Despite all steps being taken to educate personnel working at the Nelson Bay River Mine Site to preserve Aboriginal cultural heritage material, such cultural material may not be recognised when encountered and hence may be inadvertently damaged or destroyed.

7.6.15 Amenity

Inherent risk

There may be a loss of existing amenity values and standards at the proposed Nelson Bay River Mine site.

Proposed controls

Extensive community consultation will be undertaken prior to preparation of the final Closure Plan to ensure any community concerns are identified. This consultation is likely to identify a range of requirements such as:

- Installation of a Nelson Bay River Mine interpretation display or information board at an appropriate location.
- Installation of safety signs.
- Ongoing consultation with the consultative group and reporting to stakeholders and interested parties.

Residual risk

The proposed controls for amenity may not be completed to the satisfaction of all stakeholders. The presence of any amenities on the site will require ongoing maintenance and management, which will need to be included in the closure provisions.

7.6.16 Revegetation

Inherent risk

Revegetation may be slow and/or only partly successful in some areas. There is an added risk that further degradation of site environmental values may occur due to poor or inadequate closure practices.

Proposed controls

Revegetation guidelines will be prepared for the mine site. These guidelines will identify local plant species that are known to be colonisers of disturbed sites and that are economic to establish from seed.

During the maintenance period reseeding / replanting and remedial works aimed at erosion control and surface stability will also be undertaken.

Revegetation will be monitored and maintained until it is confirmed to have been successful. This maintenance period is excepted to take 3 to 5 years.

Annual reporting to stakeholders and interested parties will be undertaken.

Residual risk

Revegetation measures undertaken on the mine site and/or any future revegetation measures undertaken may not ultimately be successful in restoring vegetative cover to the site over the specified timeframe. There is the further potential risk that part or all of any successful rehabilitation may be lost through bushfires in the area or future mining activities, either during the current mine life or as a result of some future mining activity in the area.

7.6.17 Weed management

Inherent risk

Weed species have the potential to affect the revegetation process by out competing existing natural vegetation on the Tasmania Mine site.

Proposed controls

A weed management plan will be developed for the mining lease. All weed infestations will be treated according to this plan.

Heavy mobile machinery used for any work in the area, including weed control, will be washed down to prevent the spread of weeds. A vehicle wash station will be established at an appropriate location on the site.

Residual risk

Weed management will not be as successful as expected because of inadequate weed management timing and control.

7.6.18 Fire management

Inherent risk

Revegetated areas and existing flora and fauna may be destroyed by fire, as well as new and / or upgraded infrastructure implemented for closure within the Lease.

Proposed controls

Nelson Bay River Mine will prepare a Fire Management Plan in consultation with the relevant Tasmania Fire Service Brigade.

Residual risk

Fires being lit deliberately by unauthorised persons and fires arising from careless behaviour by persons on the site or adjoining areas.

7.6.19 Phytophthora cinnamomi

Inherent risk

Spread of infection into sensitive areas, including revegetated areas, by the root fungus *Phytophthora cinnamomi*.

Proposed controls

Establishment of appropriate management controls consistent with the guidelines (*Interim Phytophthora cinnamomi. Management Guidelines*. Nature Conservation Report 05/7, Biodiversity Conservation Branch, Department of Primary Industries, Water and Environment, Hobart).

Induction of rehabilitation staff/contractors to the plant hygiene controls.

Residual risk

Spread of the infection by unauthorised persons entering the Nelson Bay River Mine site by vehicle, foot, bike or horse.

7.6.20 Post closure maintenance

Inherent risk

There will be inadequate post closure maintenance.

Proposed controls

A monitoring and maintenance plan will be developed as part of the Closure Plan and appropriate provision for supervision of this plan will be made in the projected closure costs.

Planned inspections and maintenance of roads, tracks, drains and rehabilitated areas will be undertaken on a regular basis during the projected post-closure maintenance period.

Residual risk

Maintenance may be more costly and / or less successful than anticipated.

7.6.21 Future mining activity

Inherent risk

Future mining activity may damage or destroy the rehabilitated areas and increase access to the site.

Proposed controls

As this risk is unavoidable no risk treatments are appropriate. Any areas mined in the future, however, would be subsequently rehabilitated under a separate closure plan.

Residual risk

Future mining activity in the area may destroy or damage rehabilitated areas, a potential future risk that cannot be controlled.

Implementation of the Closure Plan including construction of any necessary infrastructure will not, however, restrict the potential for any future mining activity on the site.

Furthermore, a rehabilitation plan would be required as part of the approval process for any future mining activity on the site and further rehabilitation would be required at the end of any future mining operation.

7.6.22 Nelson Bay River Mine life

Inherent Risk

The Nelson Bay River Mine life may not be sufficiently long for achievement of the agreed long-term closure plan objectives.

Proposed Controls

Progressive rehabilitation, risk management and ongoing reviews will ensure that the agreed rehabilitation outcomes are met.

Residual Risk

Fluctuations in raw material and commodity prices represent a significant residual risk because of their potential impact on mine life.

7.7 Findings

The general findings of the risk analysis can be summarised as follows:

Significant risks are apparent on the site and have been identified in the development of the Closure Plan as outlined in Section 8.3. The Nelson Bay River Mine Site risk assessments are linked to the Nelson Bay River Mine Site risk analysis matrix (Appendix 3) and the Nelson Bay River Mine Site Cost Matrix (Appendix 2).

The following five main residual risks, which will require ongoing controls, have been identified:

1. Site safety.
2. Leakage from the tailings dam into the surrounding groundwater.
3. Acid mine drainage.
4. Failure to maintain existing water quality and biota values.
5. Further degradation of the site environmental values due to poor or inadequately designed closure practices.

Ongoing minimum controls likely to address any potential residual risks are:

1. Addressing safety risks by restricting access with fencing, gates and signs.
2. Construction of an appropriately lined tailings storage facility.
3. Encapsulation of PAF material in appropriately designed cells within the DSO pit and flooding on mine closure.
4. Temporary encapsulation of excess PAF material (material in excess of DSO pit capacity) in appropriately designed cells above the DSO pit; removal of this material to the main pit and flooding on mine closure.
5. Confirmation monitoring of NAF dump runoff during operations and the post-closure vegetation maintenance period to check that no PAF material has inadvertently gone to the NAF dump, with identification and removal of that material if it is present.
6. Maintenance of ongoing monitoring and reporting programs.
7. Undertaking a comprehensive and ongoing rehabilitation program.

Although most of the potential risk scores have been reduced as a result of the proposed controls, some risks still remain moderate to high.

The proposed controls in the Closure Plan will reduce the likelihood of occurrence of a risk type, but the consequences of any occurrence frequently may remain the same regardless of the risk mitigation measures proposed.

Strategic actions will be implemented in two stages; the key staged strategic actions to be implemented in order of priority are as follows:

Stage 1 (to be undertaken during the mine operation phase):

- Continuation of the current monitoring programs.
- Ongoing site rehabilitation wherever possible.

Stage 2 (to be undertaken following mine closure):

- Contaminated site assessments of the mine and mill sites.
- Rehabilitation of all sites following removal of infrastructure and equipment.
- Ongoing monitoring programs for the agreed periods of time.

8. Tenement Relinquishment

The objective of relinquishment is to reach a point where the company has met agreed completion criteria to the satisfaction of the Responsible Authority [SFMC].

It is proposed that:

- The components of the Final Closure Plan would be accepted as the agreed criteria of the Tasmanian Government (MRT and DPIPWE).
- Completion of the Final Nelson Bay River Mine Closure Plan by Shree Minerals Limited would be accepted by the Tasmanian Government (MRT and DPIPWE), as satisfactory completion of the criteria required for lease relinquishment, should Shree Minerals Limited wish to relinquish the tenement.

9. Conclusion

- This Nelson Bay River Mine Closure Plan has been prepared in accordance with the Strategic Framework for Mine Closure (SFMC), developed cooperatively by the Australian and New Zealand Minerals and Energy Council (ANZMEC) and the Australian Minerals Industry represented by the Minerals Council of Australia.
- The aim of this Closure Plan is to achieve the SFMC objectives as well as fulfil regulatory and community expectations.
- Specific objectives may not be achieved in the short term but the Closure Plan puts in place a practical and logical approach to their longer-term achievement.
- The Closure Plan has adopted a risk based strategy to achieve the mutual long-term satisfaction of MRT, DPIPWE and Shree Minerals Limited.
- The strategy of the Final Closure Plan will be developed to achieve the mutual long-term satisfaction of all stakeholders and interested parties.
- The key attributes of the Closure Plan are:
  - Improve further the knowledge and understanding of the key rehabilitation areas of the site.
  - Ensure the site has a stable and sustainable water management system, which is amenable to potential future land use.

- Build on the previously proven site management strategies and infrastructure.
- Maintain the potential for future beneficial reuse of the mine site including future mining, industrial and tourism activities.
- Protect the main site features, assets and values.

Appendix 1

Nelson Bay River Mine plans

SHREE

Minserve

SHREE MINERALS LIMITED
Nelson Bay River Iron Ore Project - NW Tasmania

Snapshot at end of Year 1
Aerial Photograph - March 2006
Showing Local Grid and MGA94 Systems

FIGURE .

Design	A. Hyde Page	10.2011	Scale	1 : 12,500 (A3)	Rev2.1
Drawn	PRM Cad and Graphics	11.10.2011	Cad File	Sml001m019.dwg	

Scale 1 : 12 500
0 100 200 300 400 500
metres
Air Photography - TASMAP 01 March 2006
Position of Air Photography approximate

NELSON BAY RIVER

Bund Wall/Drain Diversion heading to Sedimentation Dam at RL70m (To be Designed)

Waste Dump RL90m

Bund Wall/Drain Diversion on 30m setback from creek drainage

Part backfilled PAF

DSO Pit

Explosives Storage Area

Area for Recirclation and make up Water Dams

Acid Neutralisation Plant

Topsoil Dump

Process Plant and Stockpile Area 80000m²

Access Road

Baseline for Local Grid

Local Grid

Proposed Mining Lease Boundary

N
MGA 94 ZONE 55

N
LOCAL GRID

5443000mN
5442000mN
5441000mN
5431000mN
24000mN
23000mN
22000mN
20000mN
9000mE
8000mE
309000mE
310000mE
311000mE
312000mE
313000mE
10000mE
11000mE

SHREE

Minserve

SHREE MINERALS LIMITED
Nelson Bay River Iron Ore Project - NW Tasmania

Snapshot at end of Year 5
Aerial Photograph - March 2006
Showing Local Grid and MGA94 Systems

FIGURE .

Design	A. Hyde Page	10.2011	Scale	1 : 12,500 (A3)	Rev2.0
Drawn	PRM Cad and Graphics	11.10.2011	Cad File	Sml001m018.dwg	

Scale 1 : 12 500
0 100 200 300 400 500
metres
Air Photography - TASMAP 01 March 2006
Position of Air Photography approximate

NELSON BAY RIVER

Bund Wall/Drain Diversion heading to Sedimentation Dam at RL70m (To be Designed)

Deep Magnetite Pit

DSO Pit

Backfilled PAF

Explosives Storage Area

Bund Wall/Drain Diversion on 30m setback from creek drainage

Bund Wall to Toe of Dump setback 10m

Waste Dump RL 100m

Topsoil Dump

Area for Recirclation and make up Water Dams

Acid Neutralisation Plant

Baseline for Local Grid

Process Plant and Stockpile Area 80000m²

Access Road

Sedimentation Dam /Runoff Collection Dam RL85m

Tailing Dam
Volume 3.0M m³ Nett
Design Top of Wall 6m wide at RL115m
Wall Volume 1.02M m³

Local Grid

Proposed Mining Lease Boundary

N
MGA 94 Zone 55

N
LOCAL GRID

24000mN 23000mN 22000mN 20000mN
5443000mN 5442000mN 5441000mN 5431000mN
9000mE 8000mE
309000mE 310000mE 311000mE 312000mE 313000mE
10000mE 11000mE

SHREE MINERALS LIMITED
Nelson Bay River Iron Ore Project - NW Tasmania

End of Mining - Mine Layout Plan
Aerial Photograph - March 2006
Showing Local Grid and MGA94 Systems

FIGURE .

Design	A. Hyde Page	10.2011	Scale	1 : 12,500 (A3)	Rev4.0
Drawn	PRM Cad and Graphics	11.10.2011	Cad File	Sml001m017.dwg	

Scale 1 : 12 500
0 100 200 300 400 500
metres
Air Photography - TASMAP 01 March 2006
Position of Air Photography approximate

NELSON BAY RIVER

Bund Wall/Drain Diversion heading to Sedimentation Dam at RL70m (To be Designed)

Deep Magnetite Pit

DSO Pit

Backfilled PAF

Bund Wall/Drain Diversion on 30m setback from creek drainage

Bund Wall to Toe of Dump setback 10m

Potential Waste Dump RL 125m Volume 14.7M m³

Explosives Storage Area

Area for Recirculation and make up Water Dams

Acid Neutralisation Plant

Process Plant and Stockpile Area 80000m²

Baseline for Local Grid

Access Road

Sedimentation Dam /Runoff Collection Dam RL85m

Tailing Dam Volume 3.0M m³ Design Top of Wall 6m wide at RL115m Wall Volume 1.02M m³

Proposed Mining Lease Boundary

Local Grid

LEGEND
- Waste Dump Rehabilitated
- DSO Pit and Tailing Dam Filled with Water

N MGA 94 Zone 55
N Local Grid

SHREE

Minserve

SHREE MINERALS LIMITED
Nelson Bay River Iron Ore Project - NW Tasmania

Mining Areas 10 Years after End of Mining
Aerial Photograph - March 2006
Showing Local Grid and MGA94 Systems

FIGURE
.
Rev1.0

Design	A. Hyde Page	10.2011	Scale	1 : 12,500 (A3)
Drawn	PRM Cad and Graphics	14.10.2011	Cad File	Sml001m021.dwg

Scale 1 : 12 500
0 100 200 300 400 500
metres
Air Photography - TASMAP 01 March 2006
Position of Air Photography approximate

NELSON BAY RIVER

Deep Magnetite Pit Area

DSO Pit Area

Waste Dump Area

Tailing Dam Area

Baseline for Local Grid

Access Road

Proposed Mining Lease Boundary

Local Grid

LEGEND
Waste Dump Rehabilitated
DSO Pit and Tailing Dam Filled, and Main Pit Filling with Water

N
MGA 94 Zone 55

N
Local Grid

24000mN
23000mN
22000mN
20000mN
5443000mN
5442000mN
5441000mN
5431000mN
9000mE
8000mE
10000mE
11000mE
309000mE
310000mE
311000mE
312000mE
313000mE

Appendix 2

Cost estimate matrix

Nelson Bay River Mine
Closure Plan Cost Estimate

		Unit	Rate	Quantity	Unit	Rate	End of Year 2 Estimated Cost (stage 1 , DS0,BFO)		End of Year 3 Estimated Cost		End of Mine Life Estimated Cost		End of Year 3 Estimated Cost		End of Mine Life Estimated Cost	
A	Site decommissioning								With Concentrator & Tailings Dam				Without Concentrator & Tailings Dam			
	1 Plant internal flushing & external cleansing						0		20,000		50,000		0		0	
	2 Site contamination survey						20,000		20,000		80,000		20,000		80,000	
	3 Removal & disposal of contaminated material						5,000		5,000		20,000		5,000		20,000	
	Subtotal						25,000	25,000	45,000	45,000	150,000	150,000	25,000	25,000	100,000	100,000
B	Site demolition - buildings and fixed plant															
	1 Small buildings	m^2	$50.00	2,500	m^2	$50.00	50,000		125,000		125,000		50,000		50,000	
	2 Mobile plant/mechanical workshops (concrete floor)	m^2	$150.00	1,000	m^2	$150.00	50,000		150,000		150,000		50,000		50,000	
	3 Decommission/remove crusher	No.	$5,000	1	No.	$5,000	20,000		20,000		20,000		20,000		20,000	
	4 Screening plant	No.	$5,000	1	No.	$5,000	5,000		5,000		5,000		5,000		5,000	
	5 Thickeners	No.	$10,000	1	No.	$10,000	0		10,000		10,000		0		0	
	6 Ball mill	No.	$10,000	1	No.	$10,000	0		10,000		10,000		0		0	
	7 Regrind mill	No.	$10,000	1	No.	$10,000	0		10,000		10,000		0		0	
	8 Truck dump bin, feeder & crusher	No.	$5,000	1	No.	$5,000	5,000		5,000		5,000		5,000		5,000	
	9 Conveyors/gantries	m2	$50.00	150	m2	$50.00	7,500		7,500		7,500		7,500		7,500	
	10 Concrete pads and footings	m^2	$20.00	10,000	m^2	$20.00	0		200,000		200,000		0		0	
	Subtotal						137,500	137,500	542,500	542,500	542,500	542,500	137,500	137,500	137,500	137,500
C	Hardstand after removal of infrastructure															
	1 Recontouring required			3	ha	$500.00	1,500		1,500		1,500		1,500		1,500	
	2 Drainage required			500	m	$5.00	2,500		2,500		2,500		2,500		2,500	
	3 Ripping required			3	ha	$500.00	1,500		1,500		1,500		1,500		1,500	
	4 Topsoil required from site			2,000	m^3	$3.00	6,000		6,000		6,000		6,000		6,000	
	5 Seeding/fertilising			3	ha	$3,000	9,000		9,000		9,000		9,000		9,000	
	Subtotal						20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500

		Unit	Rate	Quantity	Unit	Rate		End of Year 2 Estimated Cost (stage 1 , DS0,BFO)		End of Year 3 Estimated Cost		End of Mine Life Estimated Cost		End of Year 3 Estimated Cost		End of Mine Life Estimated Cost	
D	Access roads/external haul roads																
	1 Recontouring required			5	ha	$500.00		2,500		2,500		2,500		2,500		2,500	
	2 Drainage required			2,000	m	$5.00		10,000		10,000		10,000		10,000		10,000	
	3 Ripping required			5	ha	$500.00		2,500		2,500		2,500		2,500		2,500	
	4 Topsoil required from site			10,000	m^3	$3.00		30,000		30,000		30,000		30,000		30,000	
	5 Seeding/fertilising			5	ha	$3,000		15,000		15,000		15,000		15,000		15,000	
	Subtotal							60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
E	Waste rock dump																
	1 Recontouring required			70	ha	$500.00	Assume 20%	7,000		7,000		35,000		7,000		35,000	
	2 Drainage required			500	m	$150.00		15,000		15,000		75,000		15,000		75,000	
	3 Ripping required			70	ha	$500.00		7,000		7,000		35,000		7,000		35,000	
	4 Topsoil required from site			12,000	m^3	$3.00		7,200		7,200		36,000		7,200		36,000	
	5 Seeding/fertilising			70	ha	$3,000		42,000		42,000		210,000		42,000		210,000	
	Subtotal							78,200	78,200	78,200	78,200	391,000	391,000	78,200	78,200	391,000	391,000
F	Stockpiles																
	1 Recontouring required			1	ha	$500.00		500		500		500		500		500	
	2 Drainage required			250	m	$150.00		37,500		37,500		37,500		37,500		37,500	
	3 Ripping required			1	ha	$500.00		500		500		500		500		500	
	4 Topsoil required from site			2,000	m^3	$3.00		6,000		6,000		6,000		6,000		6,000	
	5 Seeding/fertilising			1	ha	$3,000		3,000		3,000		3,000		3,000		3,000	
	Subtotal							47,500	47,500	47,500	47,500	47,500	47,500	47,500	47,500	47,500	47,500
G	Process water dam																
	1 Draining and backfilling required			4	ha	$1,000.00		4,000		4,000		4,000		4,000		4,000	
	2 Recontouring required			4	ha	$500.00		2,000		2,000		2,000		2,000		2,000	
	3 Ripping required			4	ha	$500.00		2,000		2,000		2,000		2,000		2,000	
	4 Topsoil required from site			8,000	m^3	$3.00		24,000		24,000		24,000		24,000		24,000	
	5 Seeding/fertilising			4	ha	$3,000		12,000		12,000		12,000		12,000		12,000	
	Subtotal							44,000.00	44,000	44,000.00	44,000	44,000.00	44,000	44,000.00	44,000	44,000.00	44,000
H	Other costs																
	1 Main pit security fencing				2000 m	$60/m		60,000		60,000		120,000		60,000		120,000	
	2 DSO pit security fencing				1500 m	$60/m		0		0		0		0		0	
	Subtotal							60,000	60,000	60,000	60,000	120,000	120,000	60,000	60,000	120,000	120,000

		Unit	Rate	Quantity	Unit	Rate	End of Year 2 Estimated Cost (stage 1 , DS0,BFO)		End of Year 3 Estimated Cost		End of Mine Life Estimated Cost		End of Year 3 Estimated Cost		End of Mine Life Estimated Cost	
I	Closure management allowances															
	Site rehabilitation manager		100,000													
	Contractors management fees															
	Supervising engineer		75,000													
	Supervisor		70,000													
	Leading hand		50,000													
	Consultants & testwork various (validation in broad sense)		75,000													
	Map, plan and report		5,000													
	Subtotal		375,000			Assume 25% stage 1 , 33% year 3		93,750		125,000		375,000		125,000		375,000
J	ANCOLD inspections		20,000			Assume 50%	10,000	10,000	10,000	10,000		20,000	10,000	10,000		20,000
K	PAF Temporary dump back dumping in main pit				800000 M3	$1.50M3					1,200,000	1,200,000			1,200,000	1,200,000
	TOTAL ESTIMATED MINE CLOSURE COSTS						End of stage 1, year 2	576,450	End of year 3	1,032,700	End of mine life	2,970,500	End of year 3	607,700	End of mine life	2,515,500

Appendix 3

Qualitative risk matrix

Qualitative risk analysis matrix - level of risk

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
	1	2	3	4	5
A (almost certain)	H	H	E	E	E
B (likely)	M	H	H	E	E
C (possible)	L	M	H	E	E
D (unlikely)	L	L	M	H	E
E (rare)	L	L	M	H	H

Risk Score Legend

E	Extreme risk; immediate action required.
H	High risk; senior management attention needed.
M	Moderate risk; management responsibilty must be specified.
L	Low risk; manage by routine procedures.

Risk Types		
	Safety	Risk of an injury on site.
	Legal	Risk of legal action against Shree Minerals Limited.
	Environmental	Risk of causing ongoing serious or material harm.
	Social	Risk of not meeting social expectations.
	Economic	Risk of closure plan cost blow-outs.

Nelson Bay River Mine - Qualitative Risk Assessment										
Item	Potential Risk	Risk Type	Inherent Risk			Risk Treatment	Residual Risk			Comments
			Probability	Consequence	Risk Score		Probability	Consequence	Risk Score	
Mine Stability	Failure of main pit walls	Safety	C	4	E	No safe & feasible risk treatment identified. Safety/legal risk control by restricting access with fencing, gates & signs.	D	4	H	Manage safety issue by controlling access to the site. Risk should be minimised by appropriate geotechnical design of the pit walls.
		Legal	C	4	E		D	4	H	
		Environmental	C	4	E		C	4	E	
		Social	D	2	L		D	2	L	
		Economic	C	3	H		D	3	M	
Mine Stability	Failure of DSO pit walls	Safety	C	4	E	No safe & feasible risk treatment identified. Safety/legal risk control by restricting access with fencing, gates & signs.	D	4	H	Manage safety issue by controlling access to the site. Risk should be minimised by appropriate geotechnical design of the pit walls. Infill of the DSO pit will provide added security.
		Legal	C	4	E		D	4	H	
		Environmental	C	4	E		C	4	E	
		Social	D	2	L		D	2	L	
		Economic	C	3	H		D	3	M	
Mine Stability	Subsidence of mine areas	Safety	NA			Not applicable				Subsidence of mine areas will not be an issue as there will be no underground mining
		Legal	NA							
		Environmental	NA							
		Social	NA							
		Economic	NA							
Open cuts - main pit	Access to main pit a significant safety risk for unauthorised visitors.	Safety	C	4	E	Erect appropriate safety barriers or fencing around the pit; erect appropriate signage. Control access to site.	D	4	H	Construction of safety barriers or fencing around the main pit will significantly reduce the risk; fencing cannot completely exclude determined unauthorised visitors.
		Legal	C	4	E		D	4	H	
		Environmental	NA				NA			
		Social	NA				NA			
		Economic	C	4	E		D	4	H	
Open cuts - DSO pit	Access to DSO pit a safety risk for unauthorised visitors.	Safety	C	4	E	Erect appropriate safety barriers or fencing around the pit; erect appropriate signage. Control access to site.	D	3	M	Construction of safety barriers or fencing around the main open cut will significantly reduce the risk; fencing cannot completely exclude determined unauthorised visitors. Infilling of the DSO pit will further reduce the risk.
		Legal	C	4	E		D	3	M	
		Environmental	NA				NA			
		Social	NA				NA			
		Economic	C	4	E		D	4	H	
Adits	Adits.	Safety	NA			Not applicable				This will not be an issue as there will be no underground workings.
		Legal	NA							
		Environmental	NA							
		Social	NA							
		Economic	NA							
Waste Rock Dump Stability	Failure of the dump, in part, allowing flow of material into the adjoining West Creek	Safety	C	3	H	Undertake geotechnical investigation of foundation conditions and dump slope stability; construct in accordance with these conditions.	D	3	M	Construction of the waste rock dump in accordance with the detailed geotechnical investigations and early and ongoing rehabilitation will significantly reduce this risk potential.
		Legal	B	4	E		C	3	H	
		Environmental	A	4	E		C	3	H	
		Social	C	2	M		D	2	L	
		Economic	C	3	H		C	2	M	

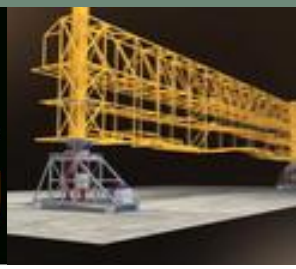
Tailings Dam	Dam failure	Safety	C	4	E	Construct in accordance with ANCOLD requirements; undertake periodic monitoring of dam stability.	D	3	M	Periodic monitoring will reduce the risk of any sudden and unexpected failure of dam walls, thereby enabling structural modifications to be carried out to ensure that the integrity of dam structures is not compromised.
		Legal	B	4	E		C	3	H	
		Environmental	A	4	E		C	3	H	
		Social	C	2	M		D	2	L	
		Economic	B	4	E		C	4	H	
Tailings Dam	Leakage from the tailings into the surrounding groundwater	Safety	B	3	H	Construction of the dam with a suitable clay lining to significantly reduce the possibility of leakage	C	2	M	Appropriate construction will ensure that leakage to groundwater is minimised;ongoing monitoring of groundwater will ensure that any leakages are identified, allowing for early remediation.
		Legal	B	4	E		C	3	H	
		Environmental	B	4	E		C	3	H	
		Social	C	3	H		D	1	L	
		Economic	B	4	E		C	3	H	
Tailings Dam	AMD in tailings dam	Safety	B	3	H	Ensure that acid-forming material is mixed with neutralising material within the tailings dam.	D	3	M	The residual risk is that some AMD will be formed within the tailings dam disposal area if sufficient neutralising material is not mixed with any acid-forming material.
		Legal	B	3	H		D	3	M	
		Environmental	B	4	E		C	4	E	
		Social	D	2	L		D	2	L	
		Economic	B	2	H		D	2	L	
Pyritic Waste Rock	Acid drainage from encapsulation cells in DSO pit	Safety	C	2	H	Ensure that cells are properly constructed and drainage from these cells is treated prior to discharge from the site if and as necessary	D	2	L	Encapsulation during operations and subsequent flooding on mine closure will ensure that there is very little likelihood of acid drainage from this site.
		Legal	A	3	E		D	2	L	
		Environmental	A	3	E		D	3	M	
		Social	B	3	H		D	2	L	
		Economic	A	3	E		D	3	M	
Pyritic Waste Rock	Acid drainage from temporary encapsulation cells above the DSO pit	Safety	C	3	E	Ensure that cells are properly constructed and drainage from these cells is treated prior to discharge from the site if and as necessary and that on mine closure the PAF rock is relocated into the main pit for flodding on mine closure	D	2	L	Appropriate design and construction of the temporary encapsulation cells, together with the appropriate treatment of any drainage therefrom, should ensure that the risk of acid drainage to the environment is minimised. Removal of this material to the main pit on mine closure and flooding will ensure that there will be very little likelihood of acid drainage from this site.
		Legal	A	4	E		D	4	H	
		Environmental	A	4	E		D	4	H	
		Social	B	3	H		D	2	L	
		Economic	A	4	E		D	3	M	
Pyritic Waste Rock	Acid drainage from pyritic material not encapsulated in special cells	Safety	C	3	E	Ensure that all pyritic material (potentially acid forming) is identified in the pit and directed to encapsulation cells; construct appropriate drainage controls for the dump.	D	2	L	If due care is taken to ensure that all pyritic material (potentially acid forming) is identified during the mining process and directed to the special encapsulation cells the potential for the formation of acid drainage from the waste rock dump will be minimised. Appropriate draiange controls will allow for the treatment of any acid drainage prior to discharge.
		Legal	B	4	E		D	4	H	
		Environmental	A	4	E		D	4	H	
		Social	B	3	H		D	2	L	
		Economic	A	4	E		D	3	M	
Heavy metal and other concentrations in Nelson Bay River.	Impact on aquatic ecosystems. Health risk to humans, fauna and flora.	Safety	C	2	H	Encapsulation of pyritic material in special cells, recycling of process water and treatment in neutralisation plant if and as necessary prior to any discharge.	D	3	M	Recycling of process water, appropriately designed and constructed cells for potentially acid forming waste rock and tretament of any discharge water will significantly reduce the potential for this risk to occur.
		Legal	C	4	E		C	3	H	
		Environmental	C	4	E		C	3	H	
		Social	C	3	H		D	2	L	
		Economic	C	4	E		D	3	M	
Site Access (foot & roads).	Uncontrolled access.	Safety	B	4	E	Provision of suitable access control gates / barriers and signage.	C	3	H	Access by unauthorised personnel to unsafe areas such as the open cuts is seen as a significant future safety risk in the area. Uncontrolled access may also lead to degradation of the existing environment and impact on rehabilitation measures completed and/or being undertaken.
		Legal	B	4	E		C	3	H	
		Environmental	B	3	H		C	3	H	
		Social	C	3	H		D	3	M	
		Economic	B	2	H		C	2	M	
Degraded Site.	Ongoing environmental degradation of site; extension of degradation beyond site.	Safety	C	2	M	Undertake a comprehensive site rehabilitation program to assist revegetation of the area.	D	2	L	The potential for environmental degradation beyond the site is likely to be significantly reduced or eliminated; on site environmental degradation may only be slowly reduced in some areas.
		Legal	A	4	E		C	2	M	
		Environmental	A	4	E		C	2	M	
		Social	A	4	E		C	2	M	

		Economic	A	4	E		C	3	H	
Revegetation.	Revegetation may be slow and/or only partly successful in specific areas.	Safety	D	2	L	Undertake revegetation trials; enhance site soils; foster natural revegetation.	D	2	L	The natural revegetation process may be very slow in some areas. Ongoing trials and a monitoring program will ensure that appropriate responses can be undertaken when necessary.
		Legal	B	4	E		C	2	M	
		Environmental	B	3	H		C	2	M	
		Social	A	4	E		C	2	M	
		Economic	B	3	H		C	2	M	
Visual Impact.	Scars remain on the landscape	Safety	NA			No extra risk abatement measures proposed. Actions implemented for revegetation of the site should address this issue.	NA			The scars associated with the mining activities are likely to remain a feature of the landscape for some time; only parts of the waste rock dump are likely to be visible from Temma Road.
		Legal	C	3	H		D	2	L	
		Environmental	B	2	H		D	2	L	
		Social	B	3	H		D	3	M	
		Economic	D	3	M		D	2	L	
Mine heritage, geological conservation and education.	Loss of important values.	Safety	NA			Not applicable as there are no known geoconservation values in the area				
		Legal	NA							
		Environmental	NA							
		Social	NA							
		Economic	NA							
Future mining activity in the rehabilitated area.	May damage or destroy the rehabilitated areas.	Safety	NA			Not applicable				This risk is unavoidable; no risk treatments are appropriate; any areas mined in future would be subsequently rehabilitated under a separate plan.
		Legal	NA							
		Environmental	B	3	H					
		Social	C	3	H					
		Economic	NA							
Resources.	Sterilisation or loss of resources by rehabilitation measures undertaken on the site.	Safety	NA			Avoid rehabilitation measures that could sterilise or result in the loss of mineral resources.				Resources will not be sterilised or lost as the waste rock dump and tailings dam will not be located over any potential resource areas.
		Legal	C	3	H		D	2	L	
		Environmental	NA				NA			
		Social	B	3	H		D	2	L	
		Economic	D	3	M		E	2	L	
Nelson Bay River Mine: Mine Life.	The mine life of the Nelson Bay River Mine may not be sufficiently long for achievement of the agreed long term closure plan objectives.	Safety	C	3	H	Shree Minerals Limited make full provision for contingency costs.	D	2	L	Full provision for contingency costs by Shree Minerals Limited will ensure that all commitments in the Closure Plan are met.
		Legal	B	4	E		C	2	M	
		Environmental	A	4	E		C	2	M	
		Social	B	4	E		D	2	L	
		Economic	B	3	H		D	2	L	
Government and public expectation.	The mine closure plan may not meet Government and public expectations or future land use and values.	Safety	D	2	L	Undertake a consultation process that provides for input from all stakeholders and any interested parties.	D	2	L	Wide consultation with all stakeholders and other interested parties will ensure the widest possible consensus.
		Legal	C	3	H		D	2	L	
		Environmental	B	3	H		D	2	L	
		Social	B	3	H		C	2	M	
		Economic	B	3	H		C	2	M	
Surface water	Elevated concentrations of solids, etc may pose a safety, health and environmental risk	Safety	C	3	H	Recycling of all mine waterand discharge of any excess via neutralisation plant will significantly reduce this risk during operations; flooding of PAF material on closure will prevent odidation of pyritic material and hence acid generation.	D	2	L	Mine design is based on flooding of all PAF material on closure
		Legal	B	4	E		C	2	M	
		Environmental	A	4	E		C	2	M	
		Social	B	4	E		C	3	H	
		Economic	B	4	E		C	2	M	
Mine Flooding - DSO Pit	Groundwater inflow, rainfall and surface runoff will fill the pit and	Safety	C	3	H	Construct an overflow at the north western corner of the DSO pit to allow water to overflow to the main pit	D	2	L	Overflow from the DSO pit will go to the main pit via a constructed overflow.
		Legal	A	3	E		D	2	L	

	spread uncontrolled across the mine site	Environmental	A	3	E	when the water level in the pit reaches existing ground level.	C	3	H		
		Social	A	2	H		D	2	L		
		Economic	A	3	E		C	3	H		
Mine flooding - Main Pit	Groundwater inflow, rainfall and surface runoff will fill the pit and spread uncontrolled across the mine site	Safety	C	3	H	Construct an overflow at the north western corner of the main pit to allow water to overflow to West Creek when the water level in the pit reaches existing ground level.	D	2	L	Overflow from the main pit will go to the Nelson Bay River via a constructed overflow to West Creek.	
		Legal	A	3	E		D	2	L		
		Environmental	A	3	E		C	3	H		
		Social	A	2	H		D	2	L		
		Economic	A	3	E		C	3	H		
Contaminated site	The mill and mine site are contaminated	Safety	B	4	E	Undertake a contaminated site investigation and risk assessment; remove any contaminated material	D	3	M	Contaminated site investigation and risk assessment, together with removal of any contaminated material to an appropriate facility will significantly reduce this risk.	
		Legal	A	4	E		C	3	H		
		Environmental	A	4	E		C	3	H		
		Social	B	4	E		C	2	M		
		Economic	A	4	E		C	3	H		
Risk Types	Safety	Risk of an injury on site.									
	Legal	Risk of legal action against Shree Minerals Limited.									
	Environmental	Risk of causing ongoing serious or material harm.									
	Social	Risk of not meeting social expectations.									
	Economic	Risk of closure plan cost blow-outs.									

transport infrastructure | community infrastructure | industrial infrastructure | climate change



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