GRANVILLE TIN PROJECT
GRANVILLE EXPANSION (LEVEL 2)

Development Proposal and Environmental Management Plan

Aus Tin Mining Ltd.

21st December 2016

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This Development Proposal and Environmental Management Plan (DPEMP) has been prepared to support a development application by Ten Star Mining Pty Ltd (the Proponent) to the West Coast Council, EPA Tasmania and Mineral Resources Tasmania.

The application is for the intensification of use of the Granville Tin Project (Granville Expansion) and operation of the proposed Tailing Storage Facility (proposed TSF), over two Mining leases located approximately 20km north east of Zeehan on Heemskirk Road on the west coast of Tasmania.

The Granville Tin Project is located on Crown Land within Mount Heemskirk Regional Reserve and Permanent Timber Production Zone. Ten Star Mining currently holds existing use rights for a level 1 activity (Appendix K) and mining leases (9M/2006 and 21M/2003).

The purpose of this DPEMP is to provide;

- Supporting documentation to the development application to the West Coast Council;
- a basis for West Coast Council and the Board of the Environment Protection Authority to consider the planning and environmental aspects of the proposal under the *Land Use Planning and Approvals Act 1993* and the *Environmental Management and Pollution Control Act 1994*;
- a basis for the conditions under which any approval can be given; and
- a source of information for interested individuals and groups to gain an understanding of the proposal.

The DPEMP has been prepared according to the Board of the Environment Protection Authority's (EPA) General Guidelines for the preparation of a Development Proposal and Environmental Management Plan for Level 2 activities and 'called in' activities, January 2014 and the EPA's Development Proposal and Environmental Management Plan Project Specific Guidelines for Ten Star Mining Pty Ltd Intensification of use – Granville tin upgrade operations off Heemskirk Rd, near Zeehan. The EPA's DPEMP guidelines were issued to the Proponent on 2nd February 2016.

A referral to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) was not considered warranted as there is no likelihood of significant impacts on any Matter of National Environmental Significance (MNES).

The development application will be advertised by the West Coast Council in relevant newspaper(s) and the DPEMP will be available for public scrutiny at;

- West Coast Council offices in Queenstown; and
- the Environment Protection Authority's internet site: www.epa.tas.gov.au\regulation\assessments-in-progress.

For a period of 28 days following the formal newspaper advertisement of the application any member of the public may submit a representation on the proposal, describing their comments and/or objections.

Representations must be in writing and lodged within the statutory period with;

The General Manager

West Coast Council

P.O. Box 63 Queenstown

Tasmania 7467

Council will consider the development application in accordance with its obligations under the Land Use Planning and Approvals Act 1993 and the Environmental Management and Pollution Control Act 1994.

Because the proposed activity is deemed a Level 2 activity under Schedule 2 of the Environmental Management and Pollution Control Act 1994, the Board of the Environment Protection Authority (the Board) will assess the potential environmental impacts and impose conditions for the proposed activity in accordance with the Environmental Management and Pollution Control Act 1994. The EPA has advised that the assessment will be undertaken as a class 2B.

The environmental conditions from the Board's assessment will be forwarded to the West Coast Council for inclusion in the permit, if and when Council approves the proposed activity.

Any persons who made written representations on the proposal will be notified of the decision.

Persons aggrieved by a decision to approve the development, or by the conditions or restrictions of the permit, may appeal to the Resource Management and Planning Appeal Tribunal (the Tribunal). The Proponent, Ten Star Mining, may also appeal a refusal of the proposal or the conditions or restrictions imposed.

Appeals must be lodged in writing within 14 days of notification. The Tribunal will hear appeals and either confirm, overturn or modify the decision and/or the permit conditions and restrictions.

Glossary

Acronyms

Elements referred to in the text may be abbreviated to their respected chemical symbol as per the periodic table of the elements. Similarly, measurements are abbreviated to the Recommended Unit Symbols based on the International Systems of Units (SI) code.

AHD	Australian Height Datum
AHPA	*Aboriginal Heritage Protection Act/bill 2013*
AHT	Aboriginal Heritage Tasmania
Air Quality EPP	Environment Protection Policy (Air Quality) 2004
ANW	Aus Tin Mining Ltd. (ANW ASX listing code)
AMD	Acid and Metalliferous Drainage
ANZECC	The Australian and New Zealand Environment Conservation Council
ARA	*Aboriginal Relics Act 1975*
ARD	Acid Rock Drainage
BPESC	Best practice erosion and sediment control under IECA Guidelines
CFEV	Conservation of Freshwater Ecosystem Values Database
CHMA	Cultural Heritage Management Australia
DA	Development Application
dB(A)	A-weighted decibels – a measure of loudness to the human ear
DGA	*Dangerous Goods (Road and Rail Transport) Act 2010*
DGR	*Dangerous Goods (Road and Rail Transport) Regulations 2010*
DO	Dissolved oxygen
DPEMP	Development Proposal and Environmental Management Plan (this document)
DPIPWE	Department of Primary Industries, Parks, Water and Environment
DRP	Decommissioning and Rehabilitation Plan
EC	Electrical conductivity or a measurement of how much electric current can pass through a water sample. Fresh water has a low EC because it is salt free. EC is a measure of total salts, both 'good' salts for the irrigator like nitrate and potassium and 'bad' salts like sodium chloride.
Eh	Chemical potential to be reduced – the opposite of oxidation.

EPA	Environment Protection Authority
EL	Exploration Licence as granted in accordance with the *Mineral Resources Development Act 1995.*
EMP	Environmental Management Plan
EO	Entrained oxygen
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EMPCA	Environmental Management and Pollution Control Act 1994.
EMPCN	*Environmental Management and Pollution Control (Miscellaneous Noise) 2004*
EMPCW	*Environmental Management and Pollution Control (Waste Management) Regs 2010*
FPA	*Forest Practices Act 1985*
FPP	Forest Practices Plan required under the *Forest Practices Act 1985*. Mining operations are excluded from this requirement where a LUPAA permit is in place
GEM	Granville East Mine
GIS	Geographical Information System
GPP	Granville Processing Plant
GST	Goods and Services Tax
Ha or ha	Hectares. 1 Ha = 10,000 square metres = 2.4710538 acres
HDPE	High Density Polyethylene
IECA	International Erosion Control Association
kph	kilometres per hour
LA	*Litter Act 2007*
LOI	Loss On Ignition
LUPAA	*Land Use Planning and Approvals Act 1993*
ML	Mining Lease in accordance with the *Mineral Resources Development Act 1995.*
MNES	Matters of National Environmental Significance
MRDA	Mineral Resources Development Act 1995
MRT	Mineral Resources Tasmania
NAF	Non Acid Forming
NAG	Net Acid Generation

NAPP	Net Acid Producing Potential
NCA	*Nature Conservation Act 2002*
NEPC	National Environment Protection Council
NEPCA	*National Environment Protection Council (Tasmania) Act 1995*
NEPM	National Environment Protection Measure
NGERSC	National Greenhouse and Energy Reporting System Calculator
PAF	Potentially Acid Forming
PAL	Policy *State Policy on Protection of Agricultural Land 2009*
PAX	Potassium Amyl Xanthate
PEV	Protected Environmental Values
pH	A measure of the acidity or alkalinity. Acids have a pH less than 7 and alkalis have a pH greater than 7.
PPE	Personal protection equipment
PSG	Project Specific Guidelines (Board of the Environment Protection Authority Appendix I)
RMPS	Tasmanian Resource Management and Planning System
ROM	Run-of-Mine. Ore material extracted from the pits.
SPPA	*State Policies and Projects Act 1993*
T or t	Metric tonnes
THC	Tasmanian Heritage Council
TML	Transport Moisture Limit: the safe moisture level for shipping bulk materials (varies with ore types, grain sizes etc)
Tpa	Tonnes per annum (tonnes per year)
Tpd	Tonnes per day
TQCP	*Tasmanian Quarry Code of Practice 1999*
TSF	Tailing Storage Facility
TSPA	*Threatened Species Protection Act 1995*
UTM	Universal Transit Mercator
WCC	West Coast Council

Weed Act	*Weed Management Act 1999*
WHSA	*Work and Health Safety Act 2012*
WMA	*Water Management Act 1999*
WMR	*Waste Management Regulations* under section 102 of the EMPCA
WRE	Waste Rock Emplacement

General Glossary

Cassiterite	Mineral comprised of SnO_2 main ore of tin.
Concentrate	A material which has had the majority of its base component removed. In the case of the Granville Expansion, a concentrate is material >40percent tin.
Dressing	Extracting metal from an ore by removing gangue.
Footwall	Strata that is positioned on the underside of an inclined fault or structure.
Flotation	A process for separating the different minerals in a mass of ground ore based on their tendency to sink in, or float on, a given liquid.
Gangue	Commercially valueless material in which ore is found.
Grain/Particle Sizes	Diameter of individual grains of sediment, or the lithified particles in clastic rocks. The term may also be applied to other granular materials. This is different from the crystallite size, which refers to the size of a single crystal inside a grain/particle. Terms such as coarse and fine are used to describe the diameter of particles.
Hydrocarbon	A compound of hydrogen and carbon, such as any of those which are the chief components of petroleum and natural gas.
Hanging-wall	Strata that is positioned over a fault or structure.
Lime/Lime Stone	Rock type or material containing $CaCO_3$. Commonly used in industry for its potential to 'buffer' acidic material.
Magnetite	Dark magnetic mineral comprised of Fe_3O_4.
Rejects/Tailings	Residue of ore refining.
Coarse Rejects	By-product of processing ore in the gravity circuit (also referred to as jig rejects).
Screening	Practice of taking granulated ore material and separating it into multiple grades by particle size.
Skarn	A skarn is a term to describe a rock formed by super-heated fluids derived from a granite interacting with a calcareous rock type.
Strata Form/Strata Bound	Said of a mineral deposit confined to a single stratigraphic (rock type) unit.

Executive Summary

Ten Star Mining Pty Ltd (the **Proponent**) recently resumed Level 1 operations at the Granville Tin Project (the **Project**) located approximately 20km from Zeehan on Tasmania's west coast. It is anticipated the Level 1 operations will run for three months. The Project comprises the Granville East Mine (**GEM**) and the Granville Processing Plant (**GPP**) and is located on two granted Mining Leases, ML 9M/2006 and 21M/2003, both held wholly by the Proponent. The Proponent is a wholly owned subsidiary of Aus Tin Mining Ltd (**ANW**).

The Project is situated within the Mount Heemskirk Regional Reserve and Permanent Timber Production zones off Heemskirk Road.

The mineral inventory occurs at an existing open cut pit at GEM which has been developed to extract a strata bound, medium to high grade, banded magnetite bearing cassiterite skarn replacement body extending approximately 50 metres north-south, with an estimated width of 15 metres (based on a small number of drill holes completed by the Proponent). The deposit is hosted in metamorphosed Neo-Proterazoic black carbonaceous shale and quartzite of the Oonah formation overlaid by Tertiary conglomerate, gravel and grit and subsequent Quaternary stream alluvium and swamp and marsh deposits.

Level 2 activities will comprise the mining of approximately 40,000 tonnes of ore and 145,000 tonnes of waste from Granville East Mine by extending length (north-south) of the pit base to 90 m. The footprint at the crest (top of pit) is expected to increase to about 180 m in length and 110 m wide (east-west). The final pit depth will be nominally 40 m from the crest of the footwall (western slope) and 60 m from the crest of the hanging-wall (eastern side).

Mining activities will include drilling and blasting, removal of waste rock to a new WRE, removal of ore to the ROM pad, de-watering of the void and monitoring of geotechnical conditions. Ore material will be crushed and temporarily stockpiled at the proposed ROM/ Crusher pad. Mining operations will be conducted by suitably qualified mining contractors.

Waste material from the mine will be classified as Non Acid Forming (NAF), or Potentially Acid Forming (PAF). NAF and PAF waste material will be stored east of the pit and retained for future site rehabilitation at a proposed Waste Rock Emplacement (propped **WRE**).

Ore stockpile material at GEM will be crushed and temporarily stockpiled on a proposed Crusher/ROM pad. Crushing will occur from Monday to Saturday on a 12 hours per day campaign basis. In addition, the Proponent proposes to treat up to 20,000 tonnes of existing stockpiles and tailings.

Crushed ore material will be hauled via Heemskirk Road to GPP in 25 tonne batches as required. Crushed material will be temporarily stockpiled at the GPP prior to undergoing processing.

Crushed ore will be initially screened (trommel) and treated through a jig, relying on specific gravity to separate the lighter waste or rejects from the heavier pre concentrate. Heavier minerals, including cassiterite, magnetite and sulphides will principally report to the pre-concentrate which will be delivered from the gravity concentrator to the dressing plant.

Coarse rejects will be retained for future rehabilitation at the proposed WRE with finer rejects reporting to a proposed Tailings Storage Facility (proposed **TSF**). Ore will be processed on a campaign basis at GPP, up to 12 hours per day from Monday to Saturday.

Both GEM and GPP will have basic support infrastructure including parking, workshop site administration, ablutions, storage buildings and lay down areas, power supply and re-fuelling zones (refer Section 2.6).

Construction activities are estimated to disturb up to a combined total area of 5ha at both GPP and GEM. All proposed construction activities will be conducted in accordance with associated control and mitigation measures aimed at limiting the project's impacts on the environment.

Potential impacts on natural values have been assessed and there will be no significant impacts, as follows;

Surface Water. Following the upgrade of the Sediment Retention Ponds at GEM and the construction of the proposed WRE, water management structures and implementation of mitigation measures, the Proponent will expect to observe an improvement in surface water quality.

Waste Rock. The construction of the proposed WRE and implementation and continued refinement of the preliminary Waste Rock Management Plan and coinciding contingency measures will minimise the potential risk waste rock material may have on the receiving environment.

Geoconservation. A portion of GEM is situated on the Geoconservational feature Western Tasmanian Blanket Bogs(ID 2527). Proposed construction activities at GEM are expected to impact less than 0.001 percent of the total estimated extent of this feature. Disturbed material will be retained and utilised during rehabilitation. Thus the impact is considered negligible and no significant loss of geoconservation values is expected to arise during activities.

Flora. No vegetation communities at GEM and GPP meet the criteria to be listed as threatened. A small number of *Comesperma defoliatum* will be disturbed at GEM however the proportion will not likely impact on the broader community. A permit to disturb these species will be submitted prior to construction activities.

Fauna. The field surveys found no fauna species listed as threatened under the Tasmanian *Threatened Species Protection Act 1995* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* within the Mining Leases. However, records show that Tasmanian Devil and Spotted-Tailed Quoll do occur within the vicinity. The implementation of appropriate mitigation measures will minimise the impact to both species.

The DPEMP has been prepared according to the Board of the Tasmanian Environment Protection Authority's (EPA) General Guidelines for the preparation of a Development Proposal and Environmental Management Plan for Level 2 activities, January 2014 and the EPA's Development Proposal and Environmental Management Plan Project Specific Guidelines for Ten Star Mining Pty Ltd Intensification of use – Granville tin upgrade operations off Heemskirk Rd, near Zeehan (Appendix I). Feedback from the EPA was received following the submission of a drafted DPEMP and were considered and addressed in this final version of the DPEMP.

The DPEMP guidelines were developed by the Board of the EPA based on the information supplied by the Proponent in a Notice of Intent (NOI) submitted 17th December 2015 in accordance with the Board of the EPA NOI guidelines and the requirements of section 27B of the *Environmental Management and Pollution Control Act 1994.*

The DPEMP identifies and assesses potential impacts associated with the proposed Granville Expansion. Specific commitments contained in the DPEMP demonstrate that appropriate operational and management measures will be in place to minimise any potential impacts and to minimise any risks to the environment and human health. With these measures in place, there are no significant risks of damaging environmental impacts.

The DPEMP demonstrates that the proposal will be compliant with Tasmanian and Commonwealth policies, legislation and regulations.

1 Introduction

1.1 General Background

1.1.1 Proponent

Ten Star Mining Pty Ltd (ACN 113 022 914) (**The Proponent**) is a wholly owned subsidiary of Aus Tin Mining Ltd (**Aus Tin Mining**) (ACN 122 957 322), an Australian Securities Exchange (ASX) listed minerals exploration company. Aus Tin Mining is an Australian based minerals exploration company focused on the discovery and development of tin and nickel-cobalt mineral deposits. The Proponent's sole operation at the time of writing is the Granville Tin Project.

Relevant contact details for the Proponent and Aus Tin Mining are:

Peter Williams

Chief Executive Officer (Aus Tin Mining)

Level 27, 111 Eagle Street Brisbane QLD 4000,

Tel: 07 3303 0611

Email: dpemp@austinmining.com.au

For the purposes of the *Environmental Management and Pollution Control Act* 1994 (EMPCA) the entity responsible for the Project will be Ten Star Mining Pty Ltd.

1.1.2 Proposal background

The Proponent has recommenced Level 1 operations at the Granville Tin Project (the **Project**) located approximately 20km from Zeehan on Tasmania's west coast. It is anticipated the Level 1 operations will run for three months. The Project comprises the Granville East Mine (**GEM**) and the Granville Processing Plant (**GPP**) and is located on two granted Mining Leases, ML 9M/2006 and 21M/2003, both held wholly by the Proponent.

The Proponent proposes moving to a Level 2 operation (the **Granville Expansion**) as soon as possible. The Granville Expansion will comprise the resumption of mining from the existing open cut (the **Granville East Mine** or **GEM**) of up to 40,000 tonnes of ore and 145,000 tonnes of waste material to provide stable geotechnical conditions. Waste rock will be stored at a new waste rock emplacement (**WRE**) east of the pit. Ore will be crushed at GEM and transported to the Granville Process Plant (**GPP**) approximately 8km from GEM along the Heemskirk Road. Ore will be processed using gravity, magnetic separation and flotation methods to produce a tin concentrate for export overseas. Tailings from the processing plant will be discharged to a proposed Tailings Storage Facility (proposed **TSF**). In addition, the Proponent may process up to 20,000 tonnes of existing stockpiles and tailings situated at both GEM and GPP. It is anticipated the Granville Expansion will run for 18 to 24 months.

The DPEMP is submitted to support a Level 2 application for an intensification of use for the Granville Tin Project, to EPA Tasmania, West Coast Council and Mineral Resources Tasmania.

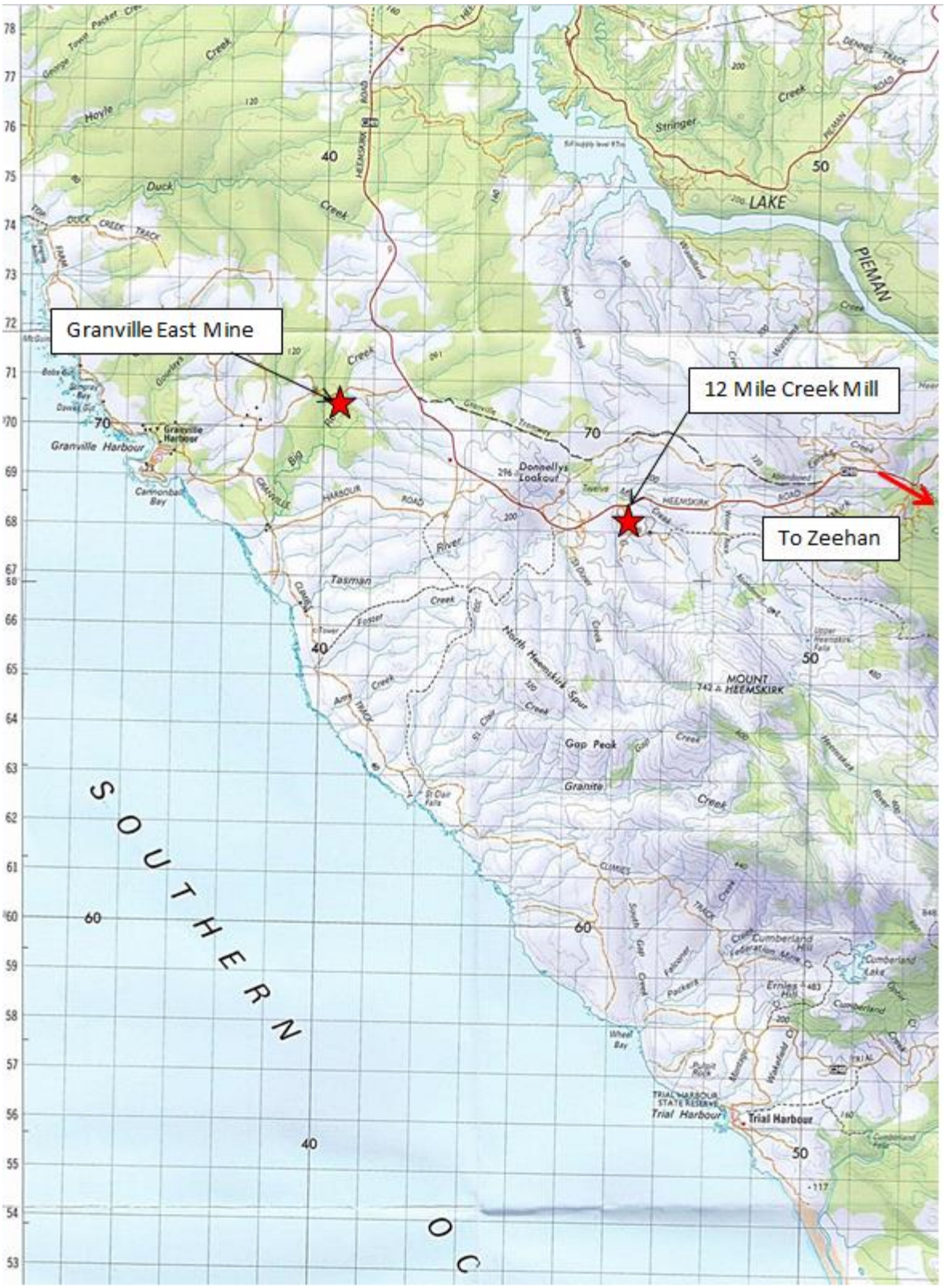


Figure 1.1 - General location of Granville Tin Project - extract from 1:1000 Pieman sheet 7914

1.1.3 Estimated Capital Costs

The estimated capital cost of the Granville Expansion is $600,000.

1.1.4 Other Proposals in the Region

At the time of writing, a number of existing mining leases are currently active in the Zeehan region, including:

- 3M/2003 - Category 1 – Metallic Minerals, 400 hectares, Nickel, Allegiance Mining Pty Ltd.
- 6M/2007 - Category 1 – Metallic Minerals, 400 hectares, Nickel, Allegiance Mining Pty Ltd.
- 12M/1995 – Category 1 – Metallic Minerals, Category 3 – Construction Minerals, 4495 hectares, All Minerals, Bluestone Mines Tasmania Pty Ltd and YT Parksong Australia Holding Pty Ltd.
- DA 2013/00051 2B – 99 Mw wind farm with supporting quarry activities.

1.2 Applicable Guidelines

The proposed Granville Expansion will occur at an already established mining and processing site. The land is already highly modified and disturbance from the increased activity will be minimal. Subsequently, there is no credible likelihood of significant impacts on Matters of National Environmental Significance (MNES) and a referral to the Commonwealth under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) is therefore not considered to be warranted and has not been made.

1.2.1 State Legislation and Regulations

The Tasmanian Resource Management and Planning System (RMPS) was established to achieve sustainable outcomes from the use and development of the State's natural and physical resources. Several pieces of legislation embody the aims of the RMPS.

Within the context of this development proposal, there are a number of applicable statutes:

- *Mineral Resources Development Act 1995.*
- *State Policies and Projects Act 1993.*
- *Land Use Planning and Approvals Act 1993*.
- *Environmental Management and Pollution Control Act 1994*.

These are briefly outlined below.

Mineral Resources Development Act 1995

This Act governs the management of Tasmania's mineral resources, including the granting of mining leases.

State Policies and Projects Act 1993

The *State Policies and Projects Act 1993* establish the process to put in place State Policies under the RMPS of Tasmania. State Policies seek to ensure a consistent and coordinated approach and incorporate the minimum amount of regulation necessary to achieve their objectives of managing natural resources. State Policies are implemented through their integration into Local Government Planning Schemes.

Currently there are three State Policies:

- *State Coastal Policy 1996* (Coastal Policy).
- *State Policy on Water Quality Management 1997* (Water Quality Policy).
- *State Policy on Protection of Agricultural Land 2009* (PAL Policy).

***State Coastal Policy 1996* (Coastal Policy)**

The purpose of the *State Coastal Policy* 1996 is to implement the sustainable development objectives of the RMPS in Tasmania's coastal areas and is applicable to all Tasmanian State waters and land (excepting Macquarie Island) within one kilometre inland of the high-water mark.

The Coastal Policy is not applicable to any part of this proposal as no part of the site is within one kilometre of the high-water mark.

***State Policy on Water Quality Management 1997* (Water Quality Policy)**

The purpose of the Water Quality Policy is to achieve the sustainable management of Tasmania's surface water and groundwater resources. This is achieved by protecting or enhancing their qualities while allowing for sustainable development in accordance with the objectives of the RMPS.

A full description of erosion and sediment control measures which will be applied to ensure compliance with the Water Quality Policy are provided in Section 6.2.

***State Policy on Protection of Agricultural Land 2009* (PAL Policy)**

The purpose of the PAL Policy is to "conserve and protect agricultural land so that it remains available for the sustainable development of agriculture, recognising the particular importance of prime agricultural land. The main objective of the PAL policy is to ensure that the productive capacity of agricultural land is appropriately recognised and protected in the use and development of agricultural land. The PAL Policy focuses on protecting prime agricultural land (land capability classes 1, 2 and 3) from conversion to non-agricultural uses.

There is no prime agricultural land in the area, and the proposed development will not conflict with agricultural land.

***Land Use Planning and Approvals Act 1993* (LUPAA)**

Under LUPAA, Councils are required to administer the development and use of land within their municipal boundary. The assessment of development and use is undertaken in accordance with the relevant planning scheme(s).

The project is a discretionary use under the *West Coast Council Interim Planning Scheme 2013* and a permit from Council is required. If Council approves the application, it may include conditions of approval relating to planning aspects and it must also include any environmental conditions specified by the Board of the Environment Protection Authority under *the Environmental Management and Pollution Control Act* 1994 (see below) The Granville Expansion has been classed as a 2B assessment.

***Environmental Management and Pollution Control Act 1994* (EMPCA)**

The project is a level 2 activity under Schedule 2 of the *Environmental Management and Pollution Control Act 1994* and a Development Proposal and Environmental Management Plan (DPEMP) will be submitted to the EPA for assessment and approval.

This DPEMP describes in detail how the potential environmental impacts of the mining proposal will be managed and mitigated. Assessment in accordance with this Act will establish the environmental operating permit and conditions for the mine.

1.3 Other State Legislation Applicable to the Project

1.3.1 Cultural Heritage

Aboriginal Relics Act 1975

It is recognised that all registered and unregistered Tasmanian Aboriginal sites are protected by the *State Aboriginal Relics Act 1975* and the *Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984.*

Historic Cultural Heritage Act 1995

The purpose of this Act is to promote the identification, assessment, protection and conservation of places having historic cultural heritage significance and to establish the Tasmanian Heritage Council.

Environmental Management and Pollution Control (Miscellaneous Noise Regulations) 2004

The purpose of these regulations is to define the operating conditions for 'neighbourhood' noise sources such as lawn mowers, chainsaws, power tools, heat pumps, car and building alarms, off-road vehicles and mobile machinery. In general the regulations are implemented by local government and Tasmania Police.

Environmental Management and Pollution Control (Waste Management) Regulations 2010

These regulations are used to regulate the management of controlled waste and some aspects of the disposal of general waste with in Tasmania. Controlled waste is the most hazardous category of waste and requires special management. General waste is less hazardous.

The Waste Management Regulations were made under section 102 of the *Environmental Management and Pollution Control Act* 1994 (EMPCA**).**

National Environment Protection Council (Tasmania) Act 1995

The NEPCA mirrors corresponding legislation made by the Commonwealth and other States and Territories. This legislation collectively provides the basic framework for the development of national environmental standards in Australia.

NEPM Ambient Air Quality 1998

The NEPM was made with the desired outcome of ambient air quality that allows for the adequate protection of human health and well-being. The Measure requires each participating jurisdiction to submit to NEPC a plan setting out how the jurisdiction proposes to monitor air quality for the purposes of the Measure. This Measure established a set of standards and goals for six air pollutants, and outlined the methods by which these pollutants are to be measured, assessed and reported.

Environment Protection Policy (Air Quality) 2004

This is also known as the Air Quality EPP and provides a framework for the management and regulation of point and diffuse sources of emissions to air for pollutants with the potential to cause environmental harm. The EPP was developed to help regulatory authorities and industry maintain and improve Tasmania's air quality.

Weed Management Act 1999

The *Weed Management Act 1999* replaced the *Noxious Weeds Act 1964* and provides for the development of a management plan for a specific weed prior to its proclamation as a 'noxious weed'. This is essential if the proclamation of a weed is to result in its long term management.

The objectives of the Act further the objectives of the resource management and planning system (RMPS) of Tasmania and, provides for the control and eradication of weeds having regard to the need to;

- Minimise the deleterious effects of weeds on the sustainability of Tasmania's productive capacity and natural ecosystems;
- promote a strategic and sustainable approach to weed management;
- encourage community involvement in weed management; and
- promote the sharing of responsibility for weed management between the different spheres of government, natural resource managers, the community and industry in Tasmania.

1.3.2 Hazardous Substances

Dangerous Goods (Road and Rail Transport) Act 2010

The *Dangerous Goods Act 2010* regulates the transportation of Dangerous Goods by road and rail in Tasmania, in order to promote public safety and protect property and the environment.

Dangerous Goods (Road and Rail Transport) Regulations 2010

Where quantities transported by road exceed;

- 500 litres or kilograms for a container Class 2-9;
- 3000 litres for an IBC (Intermediate Bulk Container for Class 2-9 where not filled or emptied on the vehicle); and
- risk category 2 of the Australian Explosives Code for Class 1 (Explosives) both the driver and the vehicle must be licensed to transport Dangerous Goods.

Work Health and Safety Act 2012

The *Work and Health Safety Act 2012* mirrors the provisions of the national model WHS Act and replaces the *Workplace Health and Safety Act 1995*. It is designed to secure the health, safety and welfare of persons at work and for related purposes.

1.3.3 Water Management

Water Management Act 1999

The *Water Management Act 1999* provides for the management of Tasmania's freshwater resources. In particular the Act is to provide for the use and management of freshwater resources in Tasmania having regard to the need to;

- Promote sustainable use and facilitate economic development of water resources;
- recognise and foster the significant social and economic benefits resulting from the sustainable use and development of water resources for the generation of hydro-electricity and for the supply of water for human consumption and commercial activities dependent on water;
- maintain ecological processes and genetic diversity for aquatic and riparian ecosystems;
- provide for the fair, orderly and efficient allocation of water resources to meet the community's needs;
- increase the community's understanding of aquatic ecosystems and the need to use and manage water in a sustainable and cost-efficient manner; and
- encourage community involvement in water resources management.

Water Management Regulations 2009

There are three separate sets of regulations under *the Water Management Act 1999*. Only one is relevant to this project, the *Water Management Regulations 2009*, which sets limits on the taking of water for specific uses and set fees for water licences. They also cover the requirements for well drillers' licences, and set fines for contravention of, or failure to comply with, any regulations.

1.3.4 Forestry

Forest Practices Act 1985

For many activities a Forest Practices Plan (FPP) is required under the *Forest Practices Act 1985* where the clearing of forest is in excess of 1 hectare or 100 tonnes of timber (in areas of 'vulnerable land' these thresholds are lower). However, mining operations are explicitly excluded from this requirement where a LUPAA permit is in place, which will be the case for this project.

1.3.5 Nature Conservation

Threatened Species Protection Act 1995

The *Threatened Species Protection Act 1995* is designed to provide for the protection and management of threatened native flora and fauna and to enable and promote the conservation of native flora and fauna.

Nature Conservation Act 2002

This Act makes provision with respect to the conservation and protection of the fauna, flora and geological diversity of the State, to provide for the declaration of national parks and other reserved land and for related purposes.

1.3.6 Solid Waste

Litter Act 2007

The L*itter Act 2007* is Tasmania's key litter legislation, providing strong anti-littering provisions to;

- Prohibit the deposition of litter in the environment;
- regulate the distribution of materials that may become litter; and
- protect and enhance the quality of the natural and urban Tasmanian environments.

1.3.7 Local Government

The proposed development is located within the boundaries of the West Coast Municipality. The proposed use and development within the municipality will be assessed in accordance with the *West Coast Council Interim Planning Scheme 2013*.

West Coast Council Interim Planning Scheme 2013

The proposed development is within the environmental management zone. The use class is extractive industry, which is discretionary within the environmental management zone. Development approval from Council is required.

Refer to Section 2 of this DPEMP for information on the key planning aspects of the project.

2 Proposal Description

Preamble

At the time of writing, the Proponent has recommenced Level 1 operations at the Granville Tin Project (the **Project**) located approximately 20km from Zeehan on Tasmania's west coast. It is anticipated the Level 1 operations will run for three months.

The Proponent proposes moving to a Level 2 operation (the **Granville Expansion**) as soon as possible. The Granville Expansion will comprise the resumption of mining from the existing open cut (the **Granville East Mine** or **GEM**) of up to 40,000 tonnes (refer Section 2.1.4) of ore and 145,000 tonnes of waste material to provide stable geotechnical conditions. Waste rock from the extended open pit will be classified as Non Acid Forming (NAF) or Potentially Acid Forming (PAF) and stored in a new waste rock emplacement (**WRE**) east of the pit (refer Section 6.5). Ore will be crushed at GEM and transported to the Granville Process Plant (**GPP**) approximately 8km from the mine along the Heemskirk Road. Ore will be processed using gravity, magnetic separation and flotation methods to produce a tin concentrate for export overseas. Tailings from the processing plant will be discharged to the proposed Tailings Storage Facility (proposed **TSF**) (Refer section 6.5). In addition, the Proponent will seek to process up to 20,000 tonnes of existing stockpiles and tailings situated at both the mine and processing plant. It is anticipated the Granville Expansion will run for 18 to 24 months.

During the course of the Granville Expansion, the Proponent will undertake a program of exploration at the GEM with a view to extending the Life of the Mine (**LOM**). The Proponent also intends to undertake an assessment for regional targets that could provide feed for the processing plant. Contingent on the success of this work, the Proponent may at a future date seek an expansion of the activities detailed in this DPEMP or undertake a program of rehabilitation and conclusion of operation.

At the conclusion of operations, at the GEM it is proposed that all PAF waste (located east of the pit) will be returned to the base of the pit and NAF waste (located east of the pit) will be used where possible for rehabilitation purposes in accordance with the Appendix C. Any remnants from the existing ROM / waste dump to the north west of the open pit will either be moved to the base of the pit or ripped and rehabilitated using topsoil currently located at the southern end of the pit (refer Section 6.5). The angle of the pit walls will be reduced, ripped and rehabilitated using material currently located at the southern end of the pit. Local provenance species will be used for revegetation. The final form of the pit will be a water filled void with re-vegetated surrounds. Upon completion of processing operations, mobile equipment will be removed from the GPP and areas of disturbance ripped and rehabilitated. The proposed TSF and existing TSF will be dewatered and a low permeability, water shedding cover provided. Both the cover and the embankments would be dressed with topsoil and revegetated with native species. The relatively flat downstream batters would limit erosion and meet long term stability requirements.

The Granville Expansion will provide a number of positive socio-economic benefits, including employment opportunities and increased expenditure within west coast businesses and communities. In addition, a number of legacy environmental issues have been identified at the Granville Tin Project and the proposed Granville Expansion will provide an opportunity to remediate them.

The DPEMP is submitted to support a Level 2 application for an intensification of use for the Granville Tin Project, to EPA Tasmania, West Coast Council and Mineral Resources Tasmania.

2.1 General

2.1.1 Existing Activities

The Granville East Mine (**GEM**) comprises of an open cut pit with approximate crest dimensions of 125 m in a north south orientation ((length) 60 m at base of pit), 45 m to 50 m (25 m to 30 m at base) in an east west orientation (width) to an approximate depth of 20m. The site contains an existing waste rock emplacements, ROM pad and various other stockpiles (Figure 2.1). The site also contains three sediment retention ponds with an estimated combined capacity of 80,000L including a pre-treatment basin (limestone drain). The GEM is serviced by 11kVa power and an unsealed road approximately 1km from the Heemskirk Road. The GEM has not been mined for a number of years and is currently on care and maintenance.

The Granville Processing Plant (**GPP**) currently comprises of comminution (ball mill), gravity and magnetic separation, flotation and tabling. The existing Level 1 user rights entitle the Proponent to extract up to 5,000m^3 per annum of rock and gravel and crush, grind and process no more than 1,000m^3 per annum of rock, ore and minerals. A series of water structures are in place to provide water for the existing activities (Figure 2.2). Tailings material from Level 1 processing operations are expected to be derived mainly from retreated tailings recovered from the existing TSF. Tailings from the processing of existing tailings material will return to the existing Tailings Storage Facility (existing **TSF**). Tin concentrate is bagged for export.

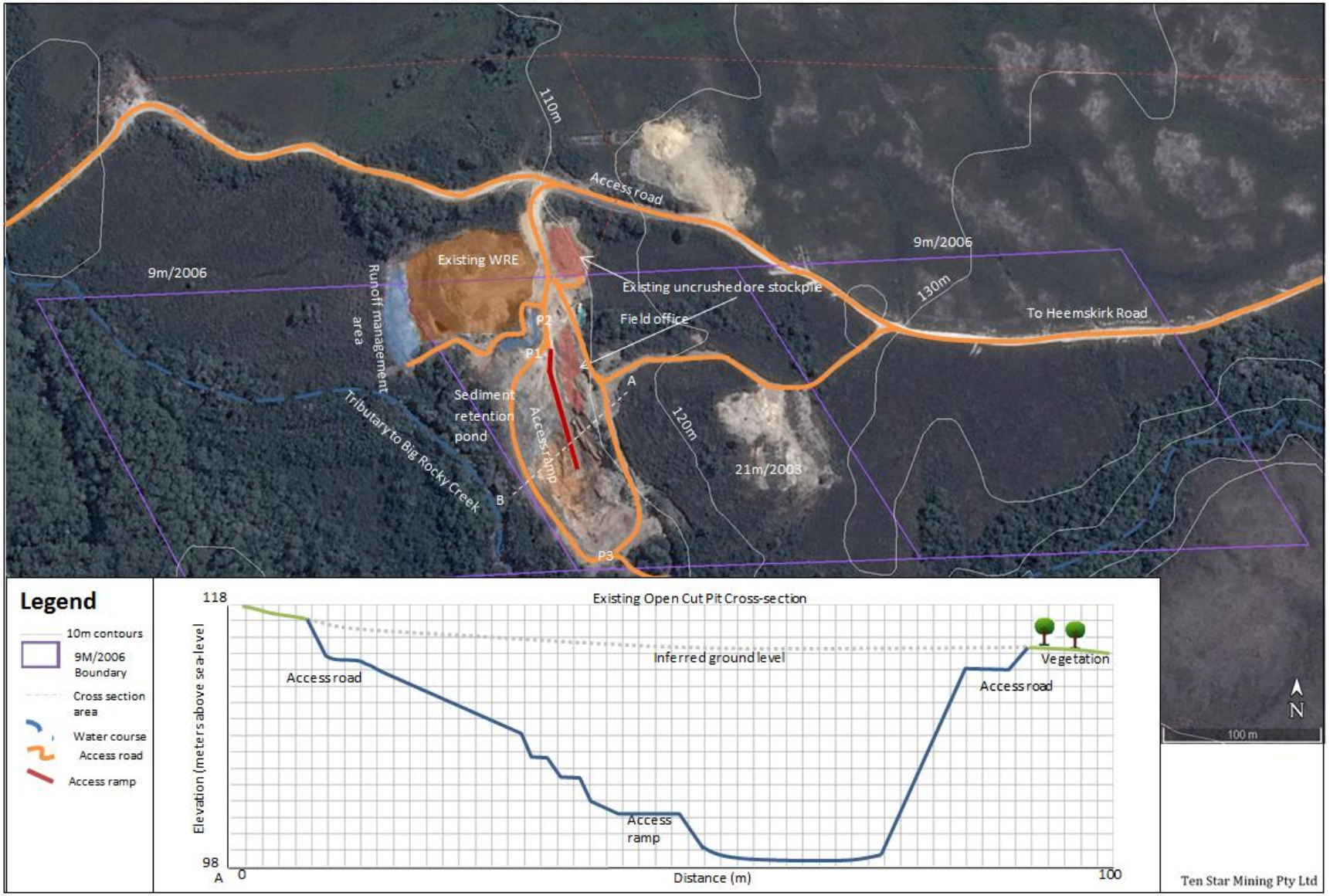


Figure 2.1 – Existing activities at Granville East Mine

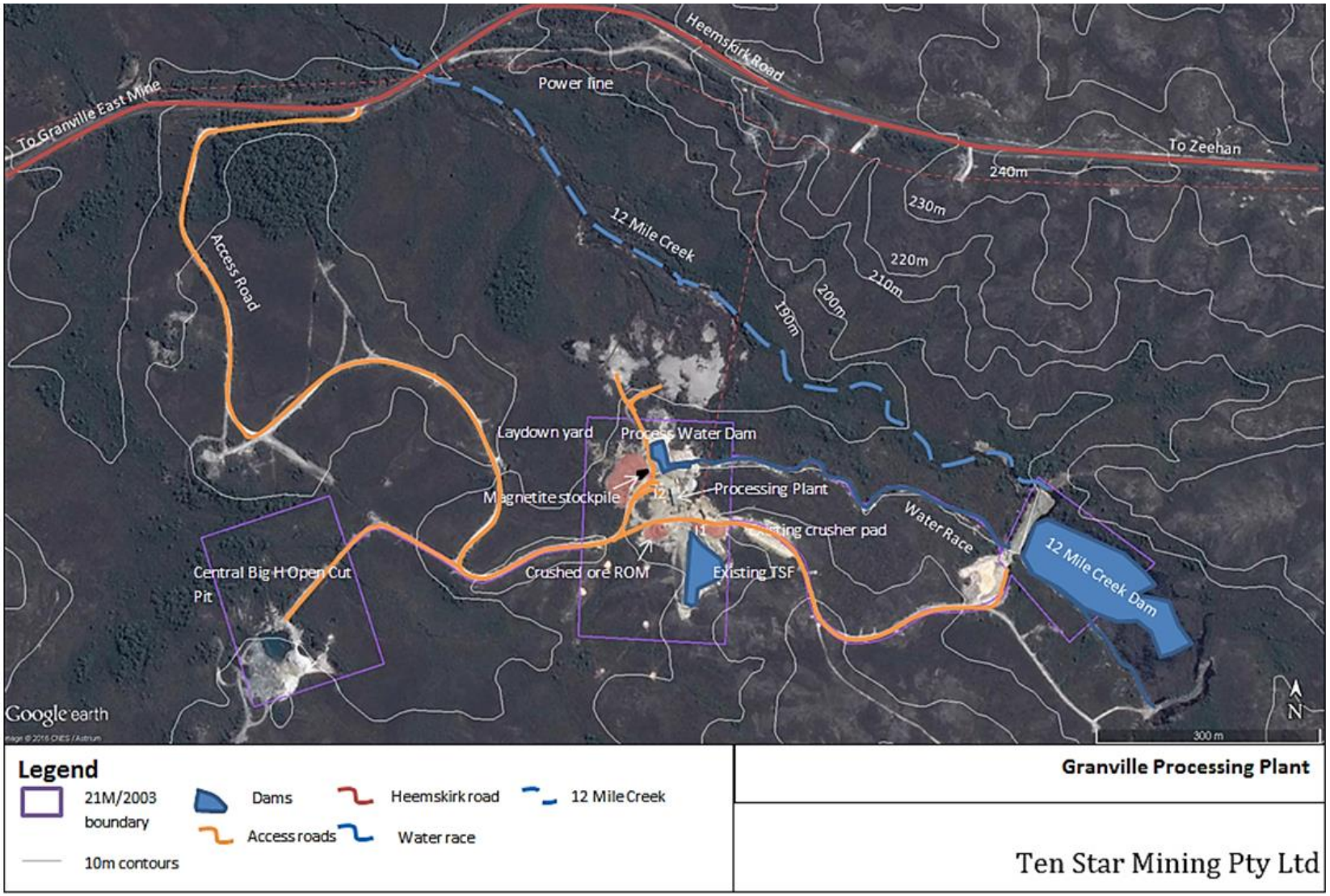


Figure 2.2 – Existing activities at Granville Processing Plant

a) Looking south from P1 (Figure 2.1)

b) Looking south west from P2 (Figure 2.1)

Plate 2.1 - a) GEM open cut pit (December 2015) b) Section of un-crushed ore stockpile at GEM (December 2015)

Plate 2.2 – a) Granville Process Plant b) Existing TSF looking south

2.1.2 Proposed Activities

The proposed expansion to a Level 2 operation (the **Granville Expansion)** will comprise the resumption of mining from the GEM of up to 40,000 tonnes of ore and 145,000 tonnes of waste material to provide stable geotechnical conditions. Waste rock from the extended open pit will be classified as Non Acid Forming (**NAF**) or

Potentially Acid Forming (**PAF**) and stored in a new waste rock emplacement (**WRE**) east of the pit and retained for future site rehabilitation (refer Figure 2.10 and Section 6.5). Ore will be crushed at the mine and transported to the Granville Process Plant (**GPP**) approximately 8km from the mine along the Heemskirk Road. Ore will be processed using gravity, magnetic separation and flotation methods to produce a tin concentrate for export overseas. Tailings from the processing plant will be discharged to the proposed Tailing Storage Facility (**Proposed TSF**). In addition, the Proponent may process up to 20,000 tonnes of existing stockpiles and tailings situated at both the mine and processing plant. It is anticipated the Granville Expansion will run for 18 to 24 months.

The resumption of mining at the GEM will comprise mining of 40,000 tonnes of ore by extending the north-south length of the open pit base from 60m to approximately 90m. The footprint at the top of the pit (crest) is expected to increase in a north-south orientation to about 180m and an east-west orientation of 110m in width. It should be noted that this increase in width will be due to an easterly mining direction (hanging-wall) aimed at creating safe geotechnical conditions. The final pit depth will be nominally 40m from the crest of the western face (footwall) and 60m from the crest of the hanging-wall. Ore will be mined to a further depth of 20m based on limited drilling completed by the Proponent in 2015. A quantity of waste rock (expected to be approximately 145,000 tonnes based on an estimated 1:4 strip ratio from limited drilling) will be removed predominately from the hanging-wall to provide safe geotechnical conditions. Geotechnically, the footwall is considered more competent than the hanging-wall and it is considered a single height footwall will be possible, enabling the ore body to be followed down this contact (a conceptual mine plan is detailed in Section 2.2.1).

Mining activities will include drilling and blasting, removal of waste rock to the WRE, removal of ore to the ROM pad, de-watering of the void and monitoring of geotechnical conditions. Dewatering will be achieved by pumping water from the void to a series of sediment retention ponds and a pre-treatment basin (refer Section 2.2.4). Mining operations will be conducted by suitably qualified mining contractors and are anticipated to operate up to six days per week, 12 hours per day for approximately seven months. Subject to obtaining all necessary approvals, it is envisaged mining operations will commence during the first quarter of 2017 to coincide with drier weather conditions on the west coast of Tasmania.

Waste rock from the mine will be classified as NAF or PAF (refer Section 6.5). Based on preliminary work undertaken by the Proponent, the majority of waste material from the mine is expected to be classified as NAF and not contribute to AMD (refer section 6.5). NAF waste material will be stored at the WRE east of the pit. PAF waste will also be temporarily stored at the WRE east of the pit, and drainage directed to the pit. PAF material will be returned to the pit at the conclusion of operations in accordance with the Draft Decommissioning and Rehabilitation Plan (Appendix C).

Ore will be crushed at GEM to 6mm (P_{80}) and stored on a new ROM / crushing pad with a capacity of up to 22,000 tonnes (refer section 2.2.3). During construction of the new ROM/crushing pad, measures will be implemented to reduce the likelihood of erosion and/or sedimentation, and will include an expansion of the existing sediment retention ponds and pre-treatment basin and diversion of surface water run-off from around the proposed ROM/Crusher pad and proposed WRE (Refer section 2.2.4). Mobile crushing equipment will be employed on a campaign basis to crush 15,000 to 20,000 tonnes at a time, operating up to six days per week, 12 hours per day. Crushing equipment is anticipated to include one primary jaw crusher, two secondary/tertiary cone crushers and two vibrating screen decks. All crushing equipment will be cleaned prior to mobilisation to site to reduce the potential to introduce weeds and pathogens.

Crushed material would be transported by a suitably qualified contractor from the ROM pad to the GPP approx. 8km southeast during daylight hours, Monday to Friday as required. It is anticipated that a 25 tonnes per semi tipper load capable of two loads per hour will be utilised. Signs will be erected at appropriate points on the Heemskirk Road (C249) to warn motorists of trucks entering. A Code of Conduct for Drivers for ore haulage will be prepared.

Transported ore will be treated at the GPP up to 12 hours per day, six days per week. The Proponent intends to install a new gravity concentrator (tommel-jig) and reconfigure the circuit as provided in Figure 2.3. Ore will be initially screened (trommel) and treated through a jig, relying on specific gravity to separate the lighter waste or rejects from the heavier pre concentrate (refer Figure 2.3). Heavier minerals, including cassiterite, magnetite and sulphides will principally report to the pre-concentrate which will be delivered from the gravity concentrator to the dressing plant. Coarse rejects will be temporarily stockpiled at the ROM at GPP before being transported to GEM to be retained at the proposed WRE for future rehabilitation. Finer rejects will report to the proposed TSF and be deposited subaqueously (refer Section 6.5). Ore will be processed on a campaign basis.

Pre-concentrate will be "dressed" through a combination of magnetic separation, comminution (ball mill), spirals, sulphide flotation and tabling. All waste material will report to the proposed TSF and magnetite by-products will be stockpiled at site for future retreatment and/or sale. Tin concentrate will be bagged (1 tonne bulka bags) and securely stored at site. Global trading house, Traxys, will purchase the concentrate ex-mine gate. It is anticipated the final concentrate will be collected in 25 tonne lots, three to four times per month.

Waste material from processing operations at the GPP (Tailings) will be stored in the proposed TSF. The proposed TSF will provide storage for tailings material derived from milled ore material and reprocessed tailings (refer to section 6.5). The proposed TSF is designed to provide tailings storage within the existing mining lease boundary for the duration of proposed operations (refer to Section 2.2.1). The proposed TSF will buttress against the existing TSF (refer Figure 2.11). During construction of the proposed TSF, measures will be implemented to reduce the likelihood of sedimentation, and will include surface water diversion structures (refer Section 2.2.1).

Table 2.1 - Summary of proposed activities

	Construction	Mining	Crushing	Haulage	Processing
Days of Operation	Monday - Saturday	Monday-Saturday	Monday - Saturday	Monday - Friday	Monday - Saturday
Proposed hours of operation	12 hours per day	12 hours per day	12 hours per day	Daylight hours	12 hours per day
Duration	two months	seven months	15,000 20,000tonne batches	LOM	LOM
Estimated production rate		1,200tonnes of ore and waste per day (average)	Estimated 375 tonnes per day	25t/load up to 20 loads per day	Average 160 tonnes per day

2.1.3 Major Equipment

An average 1,200tpd of ore and waste will be extracted from the GEM over a seven month period. Table 2.2 provides details of equipment to be employed but will be subject to finalisation with the preferred mining contractor. All mobile mining equipment will be cleaned and inspected prior to mobilisation to site to reduce the potential to introduce weeds and pathogens.

Table 2.2 – Indicative equipment list for GEM Mining

Equipment	Number	Use	Duration/Frequency at Maximum Production
D8 Bulldozer	1	Vegetation and soil clearing, Trimming waste rock emplacement	six days per week; up to 2 hours per day
Atlas Copco T35	1	Drilling of ore and waste rock for blasting.	Up to six days per week, up to 12 hours per day
WA470-1 Loader	1	Stockpile management and loading blasted rock.	six days per week; up to 12 hours per day.
329D Cat Excavator	1	Loading of shot rock to haul trucks	six days per week; up to 12 hours per day.
Cat 769 30t Haul Truck	2	Transportation of products to stockpiles.	six days per week; up to 12 hours per day.
Cat 14H Grader	1	Maintenance of internal haul road. Ancillary activities.	As required
10 000L Water truck	1	Dust suppression.	As required.
5 000L Mini tanker	1	Refuelling of mobile and fixed plant.	As required.

Ore will be crushed on a campaign basis of 15,000 to 20,000 tonnes at a time, operating up to six days per week, 12 hours per day. Mobile crushing equipment is anticipated to include one primary jaw crusher, two secondary/tertiary cone crushers and two vibrating screen decks (Table 2.3) but will be subject to finalisation with the preferred crushing contractor. All crushing equipment will be cleaned and inspected prior to mobilisation to site to reduce the potential to introduce weeds and pathogens.

Table 2.3 – Indicative equipment list for GEM Crushing

Equipment (Example Size)	Number	Use	Duration/Frequency at Maximum Production
(320D Cat) Excavator	1	Loading blasted rock to crusher	Monday to Saturday, up to 12 hours per day
Primary jaw crusher	1	Primary crushing	Monday to Saturday, up to 12 hours per day
Secondary and tertiary cone crusher and mobile screens	2	Secondary crushing and screening	Monday to Saturday, up to 12 hours per day
5 000L Mini tanker	1	Refuelling of mobile and fixed plant.	Six days – as required.

An average 160tpd of ore will be processed at the GPP over an 18 to 24 month period. Table 2.4 provides details of new major equipment to be employed for the Granville Expansion, recognising that much of the plant and equipment currently at site and used under the existing Level 1 will be employed for the Granville Expansion.

Table 2.4 – New major equipment list for GPP

Equipment	Number	Use	Duration/Frequency at Maximum Production
Howcam 20tph	1	Trommel scrubbing and gravity separation	Monday to Friday, up to 12 hours per day
Re-grind Mill (optional)		Re-grinding to liberate cassiterite	

An 11kva line runs to both the GEM and GPP. The capacity for the line to the GEM is being evaluated as a power source for the crushing plant, potentially obviating the requirement for diesel generators.

Mobile/modular facilities at the GPP will be utilised for office and amenities and temporary facilities installed at the GEM. Refuse anticipated to be generated from these facilities include general municipal solid waste and chemically treated sewage and will be removed by suitably qualified contractor on an as need basis.

Suitable potable water storage will be installed for amenities and bottled water provided for drinking.

2.1.4 Process Flow Sheet

Figure 2.3 provides a simplified flowsheet for the proposed Granville Expansion, highlighting existing and new equipment in green and blue respectively.

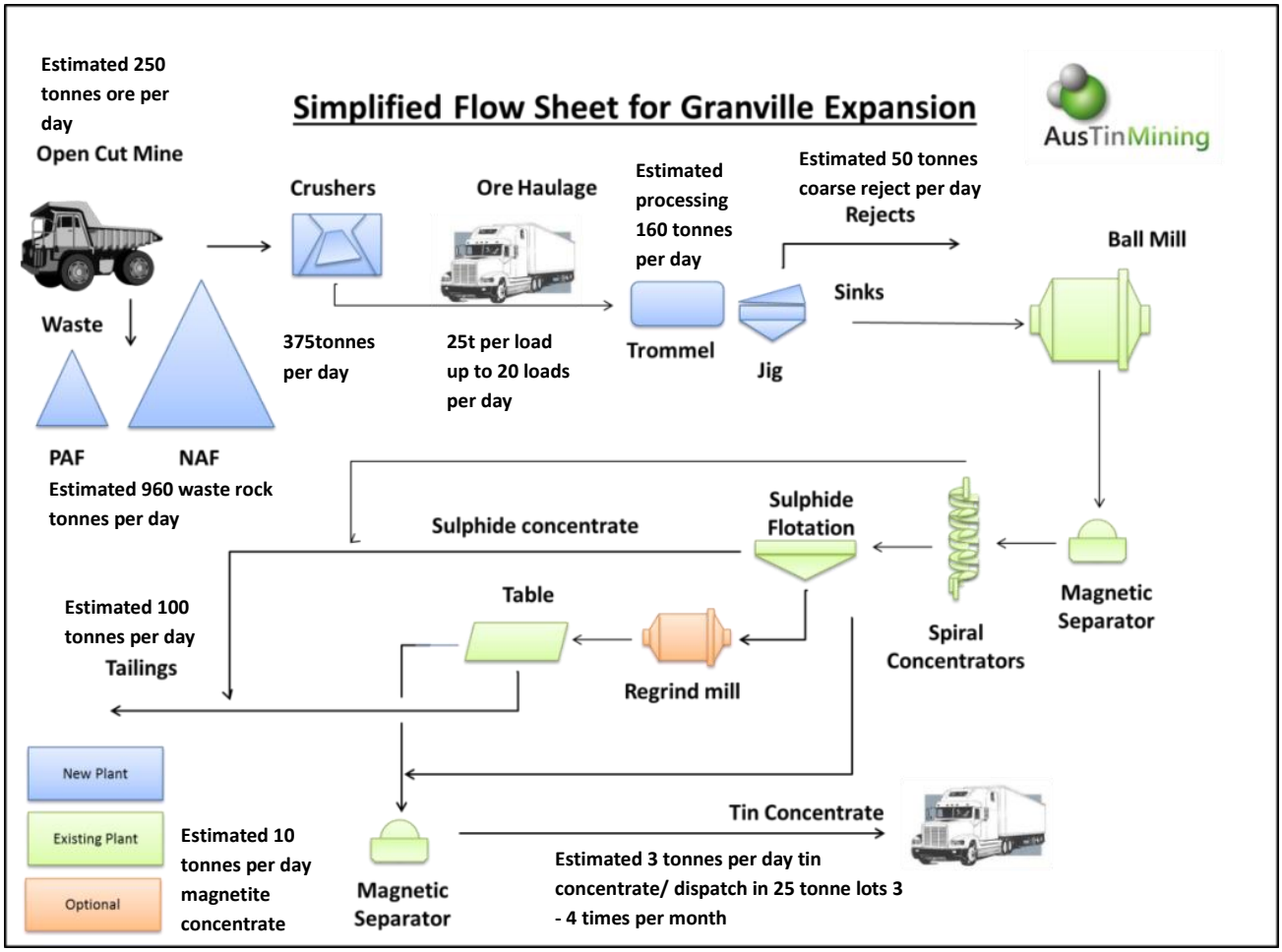


Figure 2.3 – Granville Expansion Flow Sheet. All quantities are average daily estimates

2.1.5 Raw Materials

Water for the Granville Expansion will be sourced from existing infrastructure at the GPP and mine water at the GEM.

Make-up water for the GPP is sourced from the 12 Mile Creek Dam (located within 21M/2003, refer Figure 2.10) constructed pre-2005. The 12 Mile Creek Dam supplies water via a historical water race (referred to as Water Race, Figure 2.10) to the Process Water Dam to the north of the Processing Plant at GPP. The Process Water

Dam has an estimated capacity of 2ML and is used to supply water for processing operations. A summary water balance for the GPP is provided in Table 2.5.

Table 2.5 – LOM Water balance GPP (yearly estimates)

	Quantity (ML Total)	Comments
Inflow		
Ore and Stockpiles (60kt @ 4%)	1.6	
Proposed TSF Rainfall Catchment (Annual)	38.2	Estimated proposed TSF Rainfall catchment is 38.2MLpa
Outflows		
Rejects (15kt@ 10%)	1.5	
Proposed TSF H_2O contained	37.0	Estimated tailings volume (31 000m^3) @100% plus freeboard
Miscellaneous	2.0	
Water Excess	18.7	

Water stored in the proposed TSF will be recycled for processing operations estimated at 50 percent of water from processing plus catchment water. Water stored in the proposed TSF will be managed according to the preliminary Tailing Management Plan (refer Section 6.5) and should be suitable for mineral processing.

Water requirements for the GEM will be limited to dust suppression (estimated up to 10kl per day during drier weather periods). Based on anecdotal evidence, approximately 2ML of water is generated from the open pit annually, far in excess of the anticipated demand. Excess water from the open pit will continue to be dewatered and pumped to the adjacent Rocky Creek tributary via the Sediment Retention Ponds. A drainage system will be constructed which will aim to minimise run off from the WRE into the surrounding environment and directed towards the open pit.

Waste oil and degreasers will be collected in separate receptacles and transferred to a designated bunded area at the sea-container storage area at GPP. This material will then be transferred and disposed of by a local waste removal business.

Municipal solid waste and scrap metal will be collected in designated (either scrap metal or municipal solid waste) receptacles at GEM and GPP. Municipal solid waste receptacles will be removed from site to a local refuse facility on an as needs basis. Scrap metal collected will be temporarily stored at GPP and removed from site on an as need basis by a local contractor.

2.1.6 Energy Requirements

Existing 11kva power lines to the GEM and GPP will provide the majority of energy requirements for the Granville Expansion. Whilst final energy requirements will be dependent on final equipment selection (notably the crusher), power requirements are estimated up to 250kw/hr.

In addition, diesel for mobile equipment and hauling is expected to require 350L diesel per week.

2.1.7 Production Capacity

The Granville Expansion will increase the annual capacity of the GEM and GPP to 16,000m^3pa (approx. 40,000 tpa) and will incorporate;

1. Mining of up to 40,000 tonnes of ore from the GEM by extending the internal length of the pit by an additional 30m and depth by approximately 20m. A quantity of waste rock will be removed predominately from the east to provide safe geotechnical conditions; and the
2. treatment of up to 20,000 tonnes of existing crushed and uncrushed stockpiles at both the GEM and GPP.

It is anticipated processing will produce approximately 850 tonnes of tin concentrate, 16,000 tonnes of coarse rejects and approximately 36,000 tonnes of tailings and coarse rejects. Tailings will be permanently stored in the proposed TSF (refer Section 6.5). NAF rejects will be used to contour various landforms (including the WRE and processing site) as part of rehabilitation at the GEM and GPP (refer Appendix C).

2.1.7.1 Mass Balance

Table 2.6 – LOM Mass balance (approximate)

Ore to be mined	26,667tpa	Concentrate	Tin	750tpa
Existing stockpiles	9,000tpa		Magnetite	2,500tpa
		Coarse Reject		12,500tpa
		Proposed TSF	Fine rejects / Tailings	24,250tpa
Total	40,000tpa			40,000tpa

2.1.8 Hours of Operations

Mining activities will be conducted up to six days per week (Monday to Saturday) over an approximate seven month period. Hours of operation will be finalised with the preferred contractor but are expected to be between 6am and 6pm, day shift only. Subject to receipt of all necessary approvals, it is anticipated mining would commence in in the first quarter of 2017 and operate on a campaign basis to coincide with the period of drier weather.

Crushing activities will be conducted up to six days per week (Monday to Saturday) in campaigns of up to two months, for the duration of the project (approx. 18 to 24 months). Actual hours of operation will be finalised with the preferred contractor but are expected to be between 6am and 6pm, day shift only.

Up to 100 hours per month of ore haulage will be necessary. Ore haulage will be conducted Monday to Friday as required and the hours of operation will be restricted to daylight hours only. Final hours of operation will be finalised with the preferred contractor.

Processing activities will be conducted six days per week (Monday to Saturday) for the life of the project (approx. 18 to 24 months). Hours of operation are expected to be up to 12 hours per day.

2.1.9 Vehicle Movements

Estimated heavy vehicle movements are provided in Table 2.7 including 24 for mobilisation of plant and equipment, 280 per month for ore/coarse rejects/concentrate haulage, and 32 movements for miscellaneous deliveries. Further details are provided in Section 6.20.

Table 2.7 – Estimated heavy vehicle movements

Estimated heavy vehicle traffic movements on Heemskirk Road		Total	Monthly Estimate	Total
	Route between	Mobilisation (two Months)	Operations	Demobilisation (one Month)

Estimated heavy vehicle traffic movements on Heemskirk Road		Total	Monthly Estimate	Total
Mining	Zeehan and GEM (26km)	22	6	22
Crushing	Zeehan and GEM	2	-	2
Ore haulage	GEM and GPP	-	148*	-
Coarse reject haulage / empty return	GPP and GEM	-	148*	-
Concentrate haulage	GPP and Zeehan	2	8	-
Miscellaneous	Zeehan and GEM/GPP	16	16	-

* Haulage to occur on an 8km stretch of Heemskirk Road

Light vehicle movements of up to 6 per day are estimated for Heemskirk road between the GEM/GPP and Zeehan (refer section 6.20).

A Code of Conduct will be implemented for vehicles and appropriate signage installed on the Heemskirk Road. Further details are provided in Section 6.20.

2.2 Construction at GEM

Proposed construction for the Granville Expansion at GEM includes the following;

- Pit extension;
- PAF/NAF WRE;
- pit access ramp extensions;
- ROM/crusher pad;
- surface water management structures; and
- upgrade of sediment retention ponds.

Measures will be implemented during the construction phase designed to prevent the introduced plant species, weeds, pests and diseases. All mobile equipment utilised for the construction phase will be cleaned prior to embarking to site to reduce the potential to introduce invasive plant species. Additional weed and pathogen mitigation measures are outlined in Section 6.7.4.

2.2.1 Conceptual Mine Design and Construction Plan

The current pit crest dimensions are approximately 125 m long (60 m at base of pit), 45 m to 50 m (25 m to 30 m at base) wide at its maximum and 20 m deep. The proposed expansion will increase the length of the pit base to 90 m with no effective increase in pit width at the base. The footprint at the crest is expected to increase to about 180 m in length and 110 m wide, disrupting approximately 0.5ha of relatively undisturbed vegetation in the process. The final pit depth will be nominally 40 m from the crest of the footwall shale (western slope) and 60 m from the crest of the hanging-wall (eastern side). Based on the current pit slope performance, the western pit wall will follow the footwall shale down to final pit depth as a single height highwall. The slope geometry for remaining pit wall is provided in Table 2.8 and will be confirmed following kinematic analysis of available rockmass structure information.

Based on the geometry of the final pit, it is proposed that the expansion will occur as a single cutback to the final pit void to allow adequate room for equipment to safely operate during mining. This cutback will be taken from

the eastern and southern extent of the pit, retreating from the south towards the north for each cut. Depending on ore supply a shallow drop cut may be taken initially to ensure constant feed for the plant.

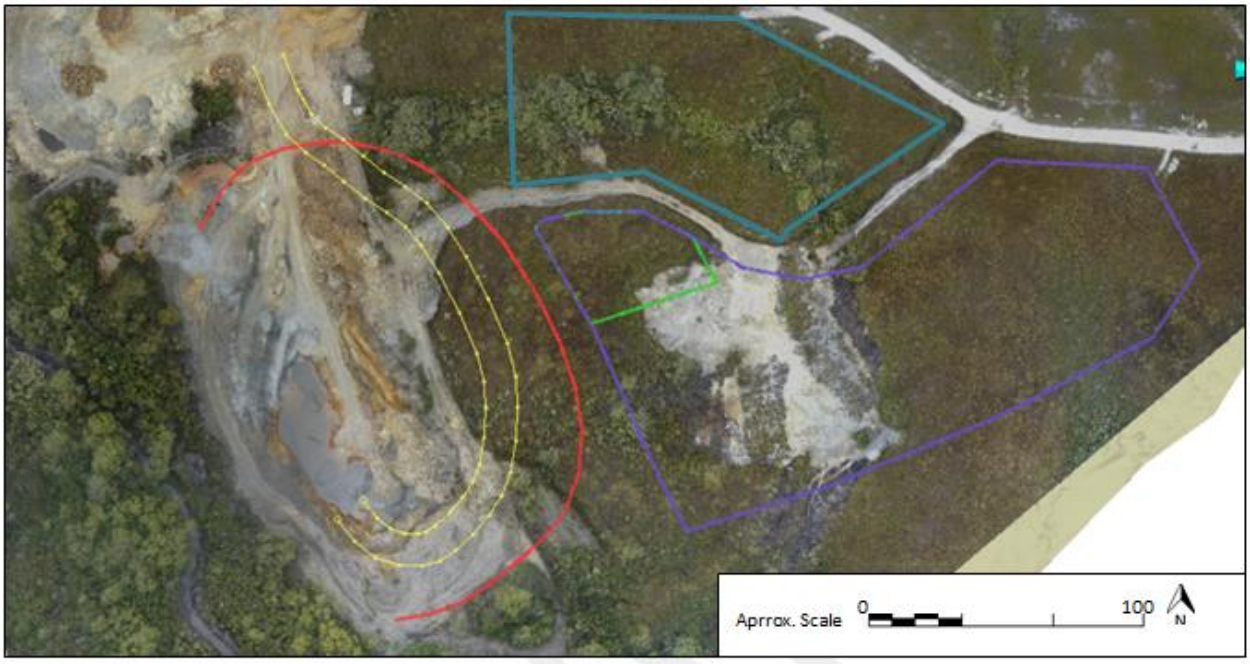


Figure 2.4 - Plan view showing approximate extent of cutback (red), the haul ramp (yellow), WRE (purple), PAF stockpile (green) and ROM stockpile

Table 2.8 - Summary of Pit Slope Geometry

Pit Geometry	**Unit**
Inter Ramp Slope Angle	50^{o}
Batter Angle	65^{o}
Bench Height	8 m
Berm Width	3 m

A nominal ramp grade of 1V to 6.5H (15 percent) will be adopted for design, so for a pit depth of 35 m, assuming a 5 m deep goodbye cut, the ramp will need to have a horizontal length of approximately 230 m, as shown in Figure 2.4. A minimum ramp width of 11.5 m will be allowed based on 2.5 x the width of the largest vehicle (40t Moxy) with allowance for a safety berm that is half the height of the largest vehicle tyre.

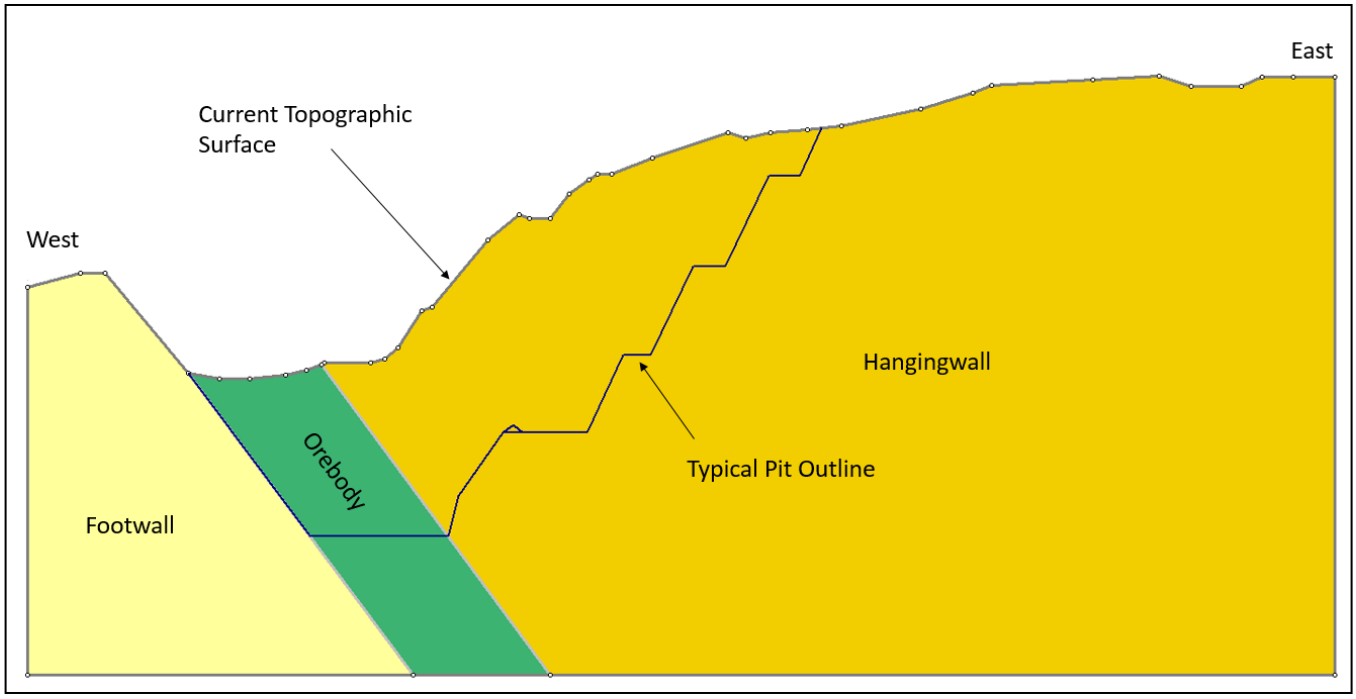


Figure 2.5 - Sketch Showing Typical Pit Cross-Section with Haul Ramp (Not to Scale)

2.2.2 WRE Design and Construction Plan

Based on current estimates of the waste rock production, it is expected that approximately 80,000 m^3 of waste rock will be generated during mining. Of this 80,000 m^3 of waste rock, it is estimated that 7,600 m^3 of this will be PAF material (refer section 6.5). Current planning has allowed a 2 ha (20,000 m^2) area to the east of the pit for waste rock emplacement. It is proposed that PAF material will be temporarily stored on the waste rock emplacement during mining operations (Appendix L). Following completion of all ore mining, the PAF material will be returned to the pit and submerged to restrict potential for acid generation (refer Section 6.5 and Appendix C). Management of the PAF material during construction is as follows and detailed in Section 6.5 and Appendix L;

- Creation of a pad at the western boundary of the WRE to temporarily stockpile PAF material. This will facilitate a short haul distance for returning the PAF to the pit and any runoff and / or water seepage will report to the pit and not the tributary to Big Rocky Creek;
- PAF section of the proposed WRE will be approximately 2,500 m^2 with PAF material to be placed to a maximum height of 5 m and trafficked over to provide compaction and graded to facilitate run-off of meteoric waters and limit water ingress through standing water;
- suitable identified clay resource from GEM described in Appendix N will be utilised in the construction of the PAF and PAF extension area;
- additional areas will be offset on designated shelves of the extended open cut pit for the temporary storage of additional PAF material (refer Figure 2.10 and Appendix L); and
- kinetic testing indicates that some PAF material will oxidise rapidly (refer Appendix H). If necessary, provisions will be made for the addition of acid consuming material (e.g limestone) (refer Section 6.5.2.1 and Appendix L).

The typical WRE design parameters are provided in Table 2.9. The proposed slope geometry facilitates final slope construction utilising dozer push to create a final slope angle of 1V:4H.

Table 2.9 - Summary of WRE Design Parameters

WRE Geometry	Unit
Batter Slope Angle	37^{o}
Maximum Batter Slope Height	5m
Minimum Berm Width	12
Overall Slope Angle	14^{o}

Considering this, the following construction plan is proposed;

- A new access road will be constructed from the pit to the existing WRE access road;
- the site will be cleared and grubbed prior in preparation for rock emplacement; and
- topsoil resource will be stockpiled at a suitable onsite location for use during final site rehabilitation.

The WRE will incorporate an area previously disturbed by mining activities and an area of approximately 2ha of previously undisturbed area, predominately *western wet scrub* and some *eucalyptus nitida forest* over *leptospermum* (refer Section 6.7.2). The construction of the WRE will not impact existing water courses, notably the tributary to Big Rocky Creek. The proposed WRE is designed to initially be contained within a small valley, with run-off diverted towards the Crusher/ROM pad (refer Figure 2.9). Appropriate measures will be taken to mitigate the generation of sediment laden run-off from the construction site and further details are provided in Section 6.2 and Section 2.2.5. Materials, including topsoil, suitable for future rehabilitation will be recovered and stored appropriately. Details on waste material and its management are provided in Section 6.5.

2.2.3 ROM/Crusher Pad Design and Construction Plan

An area of 5,500m^2 to the east of the open cut pit and the north of the proposed WRE will be cleared and utilised as a ROM/Crusher pad at GEM (Section 2.6). The ROM/Crusher pad has been designed to incorporate the following features;

- Uncrushed ore stockpile;
- crushed ore stockpile;
- mobile primary jaw crusher; and
- mobile secondary and tertiary cone crusher and screens.

The primary objective will be to provide an adequate safe operational space for the mobile crushers while also incorporating enough area for the stockpile material and incorporating appropriate sediment controls to manage sediment laden, and potentially acidic waters from entering the surrounding environment. Crushing is expected to be undertaken in campaigns of up to two months each.

The ROM/Crusher pad is designed to accommodate up to 22,000t of ore (crushed and uncrushed) based on the production estimates rates of annual crushing and hauling. Additional previously cleared areas will be investigated for ore stockpiling if more room is required and will be discussed with relevant stakeholders. Clay resource identified at GEM as described in Appendix N will be used in construction of the ROM/Crusher pad.

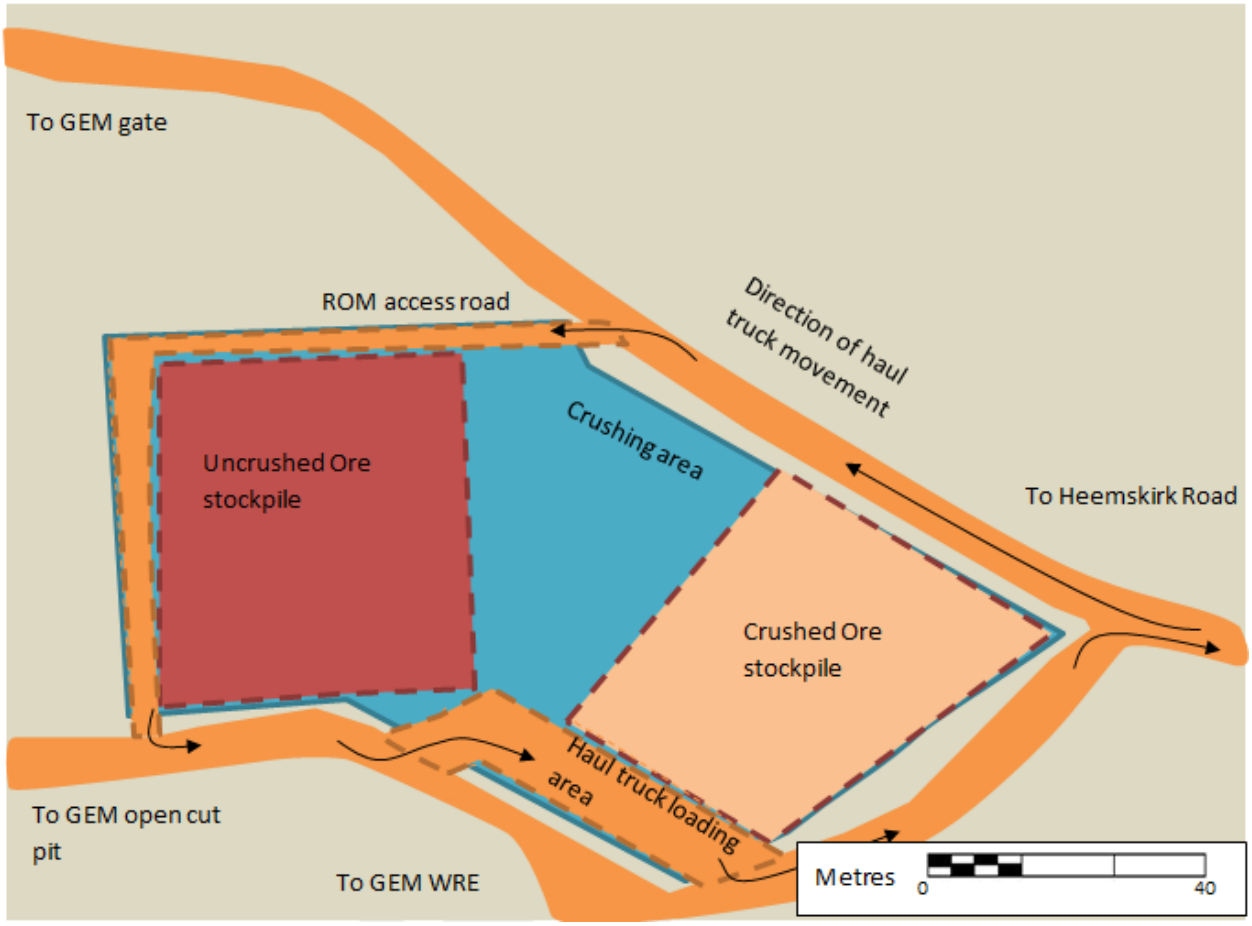


Figure 2.6 – ROM/Crusher Pad conceptual design

Materials, including topsoil, suitable for future rehabilitation that is displaced for the construction of the ROM/Crusher pad will be recovered and stored appropriately. Following crushing and hauling operations the ROM/Crusher pad will be rehabilitated in accordance with the Decommissioning and Rehabilitation Plan (Appendix C).

2.2.4 Sediment Retention Ponds

The Proponent proposes to construct a new sediment retention pond along with an upgraded pre-treatment basin to manage AMD and sediment laden waters (refer Figure 2.7) in addition to the existing sediment retention ponds which have a total combined capacity of approximately 80,000L.

The function of a sediment retention pond system is to provide storage capacity to runoff volume and to slow the flow velocity of runoff to allow the sedimentation of suspended soil particles to occur. The design of the proposed sediment retention pond will aim to provide the following;

- Measures for on-going collection and treatment of AMD to remove pollutants prior to discharge;
- measures to prevent transport of sediment off-site in stormwater runoff, including estimation of runoff volume and available detention capacity/time;
- provide containment storage volume for incoming runoff waters; and
- create uniform flow zones, increased flow path length and width and increased sedimentation times to facilitate sedimentation of suspended particles.

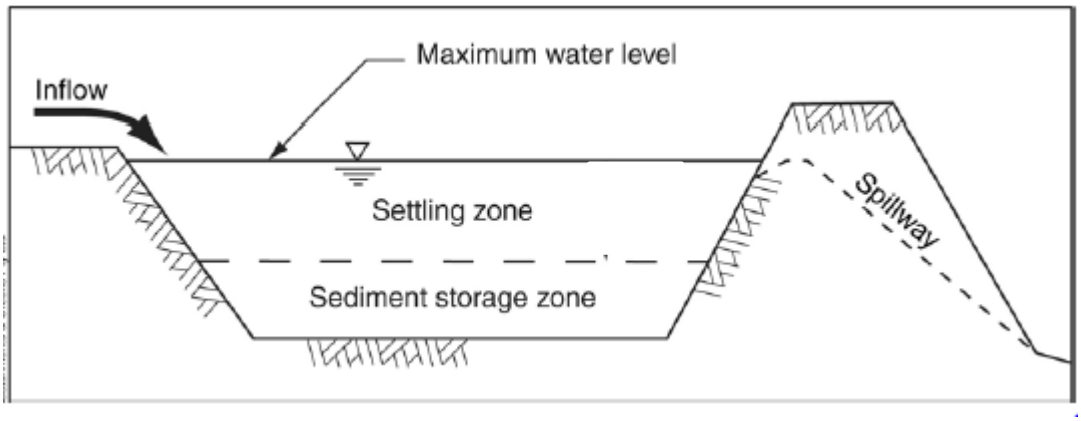
The design parameters of the proposed sediment retention ponds will be based on IECA "Best Practices – Erosion and Sediment Control" (2008). Design parameters will incorporate design requirements outlined by IECA (2008).

Table 2.10 - Basis of sediment retention pond design

Soil Characteristics	More than 10% of soil dispersive*
Settling pond sizing, surface area (A_s), or settling volume (V_s).	$V_s = 10\ R_{(\%,\ 5\text{-day})} C_v\ A$
Length to width ratio	L:W of 3:1
Minimum depth of settling	0.6m
Sediment storage volume	50% of settling volume
Control inflow	Inflow pipe invert is above spillway crest elevation

*The percentage of soil that is dispersive is measured as the combined decimal fraction of clay (<0.002mm) plus half the percentage of silt (0.002-0.02mm), multiplied by the dispersion percentage

The final design of the sediment retention pond will aim to incorporate a length (L) to width (W) ratio between 3:1 and 8:1. Generally, a practical pond depth is 1.2 m. A final design of the proposed sediment retention pond



and pre-treatment basin will be completed prior to construction.

Figure 2.7 – Conceptual sediment retention pond

The design will incorporate the use of calcium carbonate material in the form of crushed and washed limestone in an upgraded pre-treatment basin in order to manage pH and facilitate the precipitation of solid mineral phases, subsequently reducing the metal content in solution. The upgrade design will be finalised prior to construction activities and utilises monitoring data collected from the existing pre-treatment basin in order to optimise the design efficiency of the pre-treatment basin. The pre-treatment basin will be monitored (refer Section 7 and Appendix M) in order to delineate the optimal amount of limestone in order to achieve the desired pH levels of discharge water (refer Appendix M). If monitoring reveals that the required amount of limestone material that is required to achieve optimal pH conditions exceeds the capacity of the pre-treatment basin, additional limestone material may be added to the Sediment Retention Ponds as required. It may prove necessary to agitate or replace this limestone if the iron and other minerals passivate the surface of the limestone particles, gradually reducing the effectiveness of the limestone.

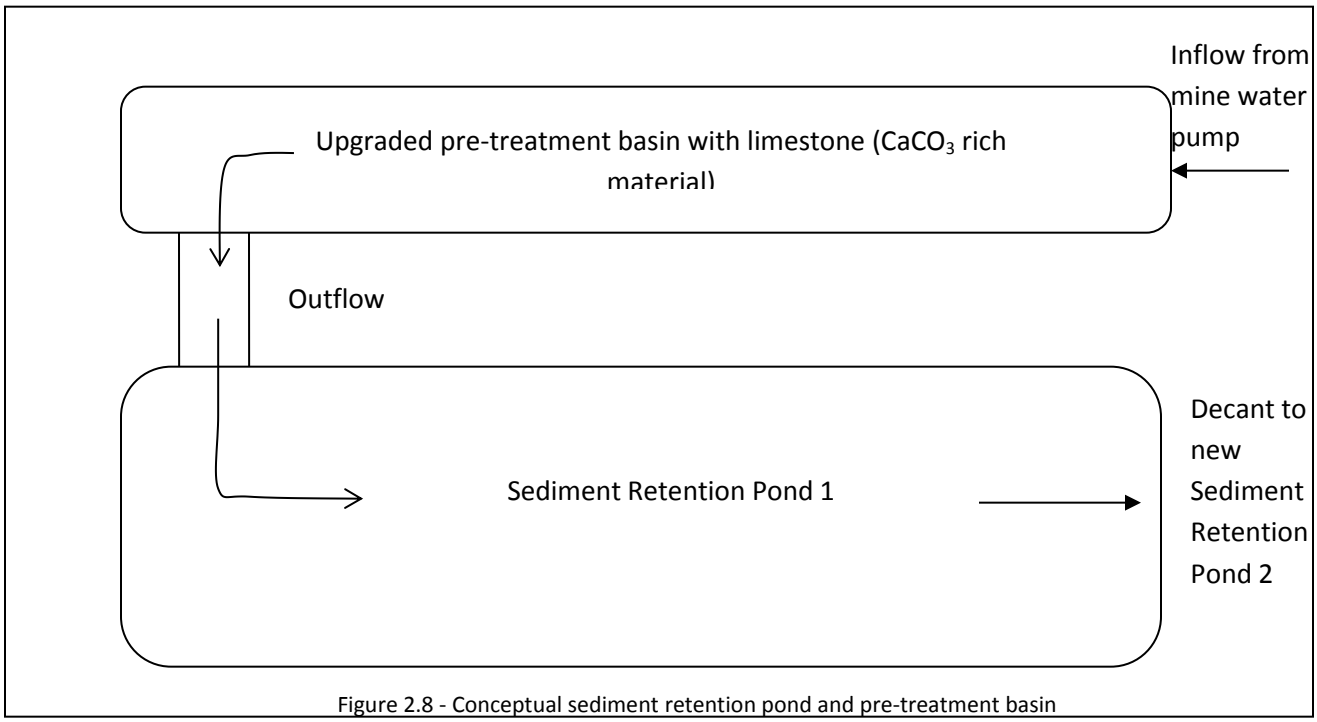


Figure 2.8 - Conceptual sediment retention pond and pre-treatment basin

2.2.5 Surface Water Management Structures

In response to requirements stipulated in Appendix I (PSG section 2.2), a series of surface water management structures will be constructed at GEM in order to control surface water discharge from the proposed WRE and ROM/Crusher pad that is sediment laden, and control storm water runoff. The surface water management structures will direct surface water discharge from the proposed WRE and ROM/Crusher Pad towards the open cut pit, which will then be diverted to the proposed sediment retention ponds. Storm water runoff will also be diverted away from the proposed structures. The structures will be predominantly a series of berms and channels surrounding both the WRE and ROM/Crusher pad. Surface water discharged from the PAF designated area will be separated from the NAF section with a series of berms and diversion channels.

Figure 2.9 illustrates the intended flow direction of surface water discharge.

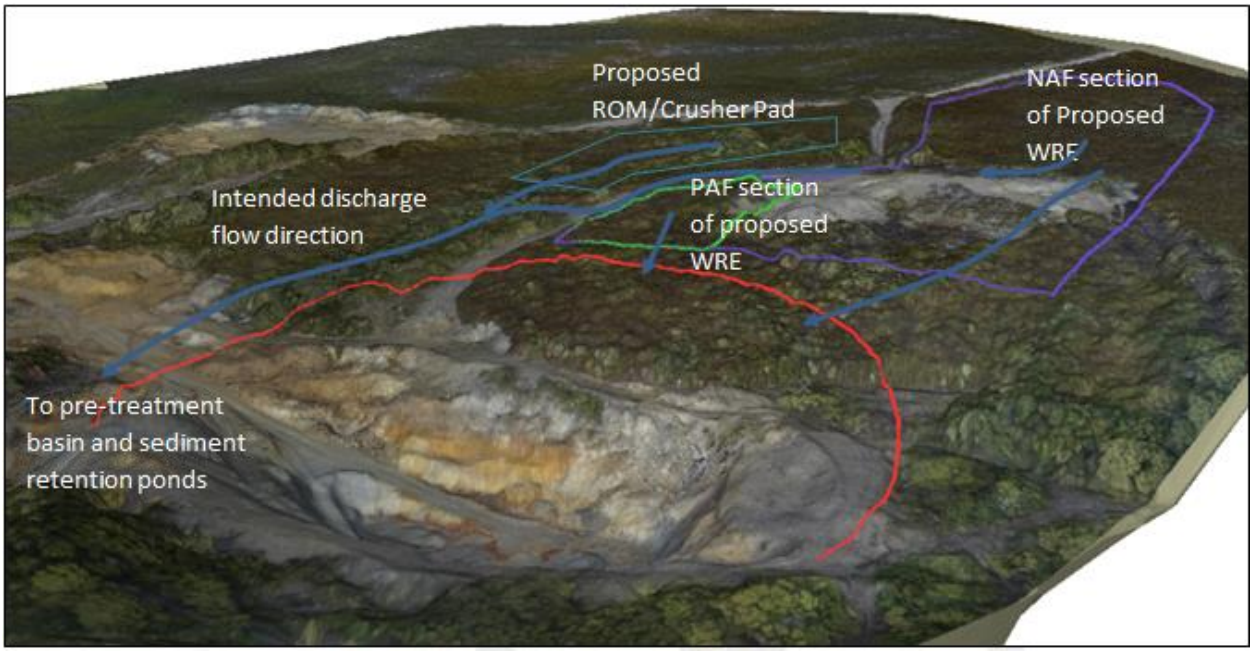


Figure 2.9 – Visualisation of proposed pit extension, WRE ROM/Crusher Pad disturbance area and intended surface water discharge flow direction.

2.3 Construction GPP

Proposed construction for the Granville Expansion at the GPP includes the following;

- Proposed TSF.

Construction plans are detailed in the following subsections.

2.3.1 TSF Design and Construction Plan

The proposed TSF is designed to provide adequate storage of tailings material generated during processing operations over the duration of the Project. A detailed pre-construction report for the first stage of the proposed TSF is included as Appendix N and will be further refined prior to construction activities. The proposed TSF will have a capacity of 40,000 tonnes and cover an area of approximately 11,500m^2 of previously undisturbed *Melaleuca squarrosa* scrub and western wet scrub (refer Section 6.7.2). The design proposes an excavated storage in order to reduce the total required material needed for construction and also to mitigate the consequences in the unlikely event of dam failure. A low embankment is required to confine the proposed TSF to the west and south and will be constructed using suitable excavated material derived from excavations at GPP and material from GEM (Appendix N). Excess material won during excavations of the proposed TSF will be stored on site in accordance with Appendix C1. A high density polyethylene (HDPE) liner is proposed to prevent infiltration of groundwater by water stored in the proposed TSF (Appendix N). Subsoil drainage is provided beneath the liner to collect seepage in the event of liner damage (Appendix N). The drainage will be piped via gravity to a sump for collection or release. Tailings derived from processing operations at GPP reporting to the proposed TSF will be deposited sub-aqueously in accordance with the tailings management plan (refer Section 6.5.5 and Appendix N).

Table 2.11 General details of the proposed TSF

Dam Coordinates	0346691 E,	5368013 N
Dam Type	Offline, excavated and lined storage	
ANCOLD Consequence category	Low	
Catchment area	1.12	Ha
Pond Area	0.78	Ha
Upstream Batter Slope	3.0 (H): 1 (V)	
Downstream Batter Slope	3.0 (H): 1 (V)	
Crest Width	5	m
Crest Level	202.5	m AHD
Maximum embankment height	8.5	m
Crest Length	360	m
Embankment volume	31,400	m^3
Maximum Tailings Storage	33,400	m^3
Maximum Tailings Level	201.2	m AHD
Target Minimum Water Cover	0.8	m
Allowable Minimum Water Cover	0.5	m
Emergency Spillway Invert	202.0	m AHD
Total Storage to Emergency Spillway Invert (Tailings and decant water)	37,300	m^3
Emergency Spillway Type	3 m wide overflow channel	
Emergency Spillway Design Flood	1:1,000 AEP Flood	

Measures will be implemented to reduce the potential risk on the receiving environment from sediment laden surface water discharge during the construction phase of the proposed TSF. The design of the proposed TSF will incorporate surface water and groundwater management structures to minimise this risk.

The design also allows for diversion of the existing TSF spillway to prevent spill into the proposed TSF. The existing TSF spillway crest (1.5m wide overflow) will be maintained, but the existing chute will be blocked to divert flow into a new spillway channel that bypasses the proposed TSF.

Following the cessation of the proposed Granville Expansion, the proposed TSF will be rehabilitated in accordance with the Rehabilitation and Decommissioning Plan (Appendix C).

2.4 Commissioning

Commissioning for the Granville Expansion will generally be limited to mining, crushing and haulage activities owing to the Level 1 operations. Mining, crushing and haulage activities at the GEM will be undertaken by a suitably qualified operator(s) and prior to the commencement of operations a comprehensive HAZOP will be undertaken.

2.5 General Location

The Granville Expansion will be contained with 21M/2003 and 9M/2006 located at two locations northwest of Zeehan (Figure 1.1). Further details, including climatic and ecological descriptions of the Project sites are provided in Section 5.

2.6 Site Plan

The Granville Expansion will be contained with 21M/2003 and 9M/2006 located at two locations northwest of Zeehan, as provided in Figures 2.10 and 2.11.

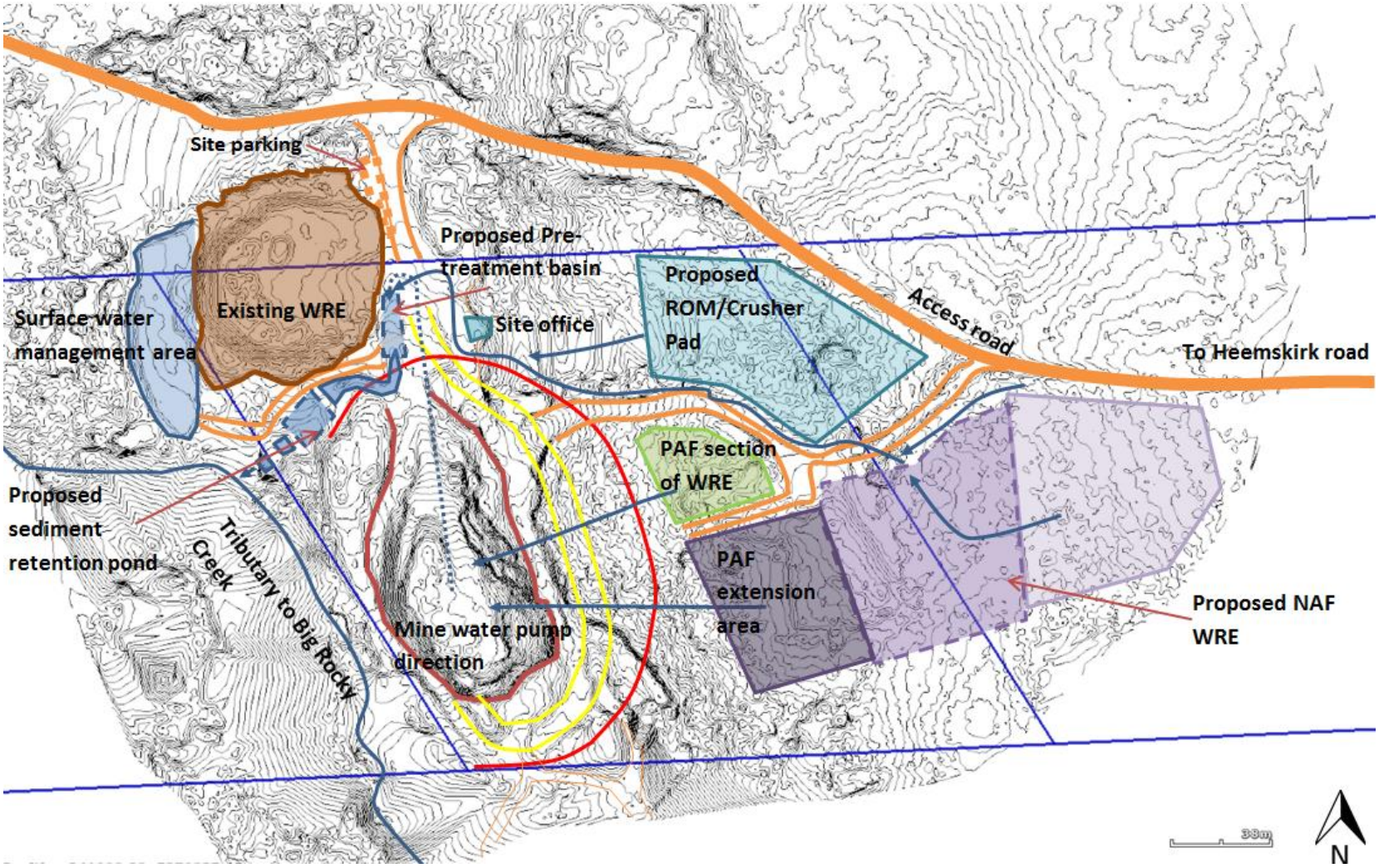


Figure 2.10 – Granville East Mine Site Plan

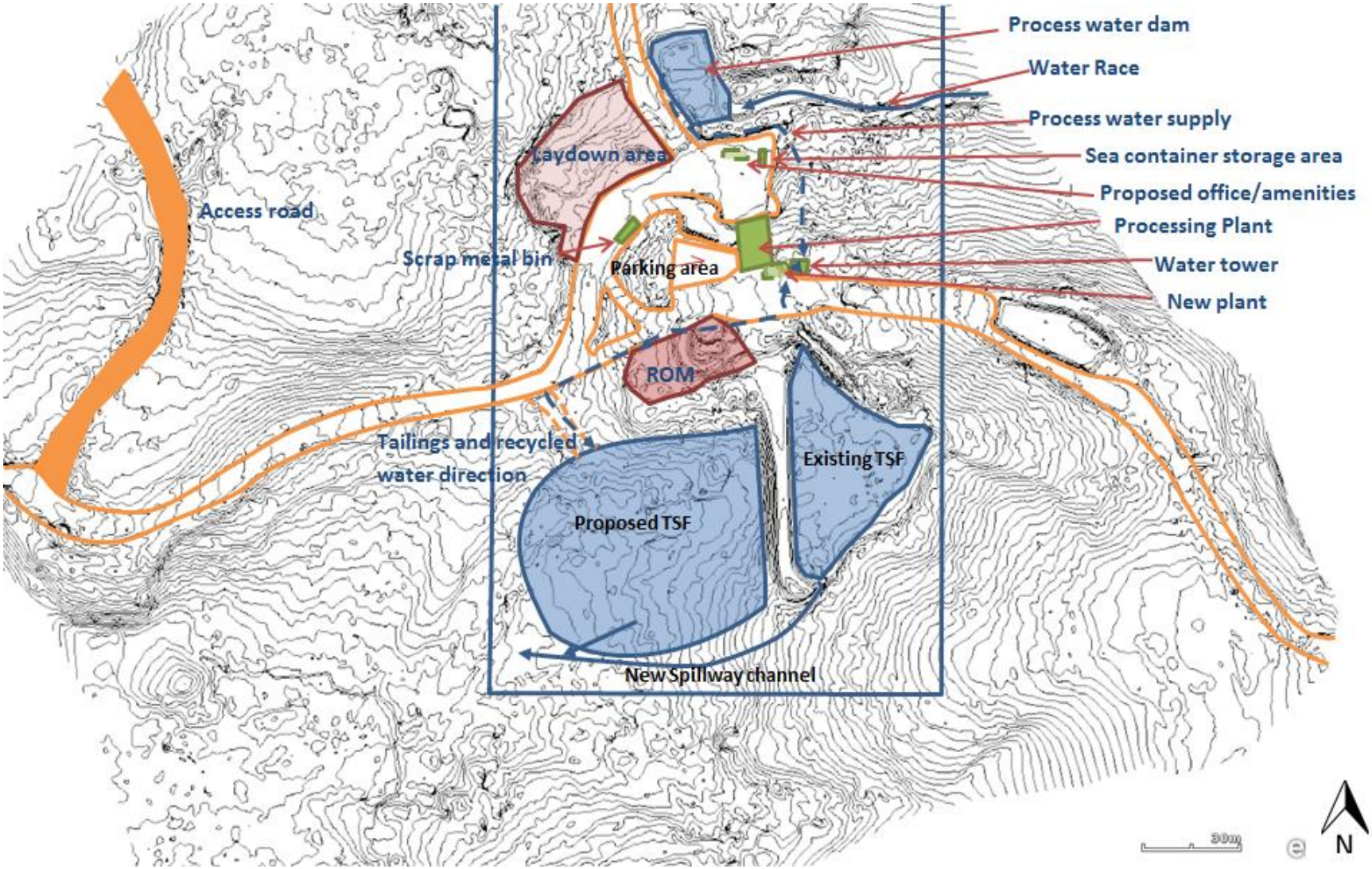


Figure 2.11 – Granville Processing Plant Site Plan

2.7 Off-Site Infrastructure

No off-site infrastructure (apart from existing transport and electricity infrastructure) is required with all activities for the Granville Expansion to be contained within the existing Mining Lease.

If, however, the Proponent seeks to expand the capacity of the proposed TSF, it may be necessary to seek arrangements with various stakeholders and interested parties.

3 Project Alternatives

The Granville Tin Project is an already established mining and processing operation situated in a prospective tin region with an extensive mining history. The identification of a small extension of ore grade material at GEM coupled with existing ore stockpiles at GEM and GPP has led to the desire to further enhance the capability of production, while incorporate better environmental management practices at the Project.

The Granville Expansion proposes to utilise the already existing infrastructure at GEM and GPP, however incorporates additional infrastructure (refer Section 2) along with various management plans (refer Section 6) in order to incorporate better environmental management practices to the already existing project. The continued utilisation of the existing WRE and existing TSF has been determined not of best environmental practices (refer Section 6.2.2, Section 6.5.2 and Appendix J), and subsequently requires the construction of additional infrastructure (Appendix J). The location and design of infrastructure has been investigated in a number of studies and surveys to identify locations which would enhance functionality and limit the impact of the Project to the receiving environment.

Consultation with key stakeholders coupled with studies and surveys ensures that the Project is sustainable from an economic, social and environmental perspective, and that the best alternative with the least impact was put forward. This included;

- Incorporating previously disturbed areas and avoiding dense vegetation in the design of proposed infrastructure where possible;
- construction and management of new WRE and crusher/ROM Pad with surface water management structures and contingency plans on the eastern slope to better manage surface water runoff; and
- upgrading and/or making use of existing infrastructure where possible.

From an economic perspective, the project will provide a number of job opportunities on the Tasmanian west coast. The Proponent expects to provide a positive socio-economic effect in the community due to the creation of a number of jobs, and the positive flow on effect created by the operation.

The decision to extend the pit in an easterly direction is to stabilise the existing pit and provide safe geotechnical conditions for mine workers. The extension of the existing pit is restricted by the resource and the boundary of the mining lease. The extent of resource removed and hence the final size of the pit will be determined by cut-off grades and mining limits. In the event additional resource is identified, the Proponent would conduct additional due diligence in order to determine the viability from an economic, social and environmental perspective before extending the life of mining operations.

The Proponent has considered an alternative design for the management of tailings, however, it would necessitate an extension to the boundary of 21M/2003 and would be contingent upon agreement with third parties. The final proposed TSF has been designed to best manage the largest volume of tailings possible whilst minimising the overall footprint.

4 Public Consultation

Preamble

During the initial planning stages, appropriate emphasis needs to be placed on those issues likely to be of greatest significance to the local environment, neighbouring landowners and the wider community. Identification of these environmental issues has been obtained through consultation with state and local government authorities. The Proponent will continue with public consultation during all operations.

This section details the consultation process undertaken by the Proponent during the completion of this DPEMP. A description of all relevant environmental issues assembled through consultation with local representatives of the community and local and state government agencies is also presented in this section.

4.1 Consultation

The Proponent will continue to maintain a presence in the local community by maintaining a Community Feedback Register. This register is maintained by a local designated staff member. Any issues raised during this process will be examined by this person and an appropriate response will be formulated.

The Proponent has also consulted with local landholders within the vicinity of GEM and will continue to maintain positive relations with landholders. Appendix D has forms provided to landholders during the consultation process.

4.2 Local Government

The Proponent has presented preliminary details of the Granville Expansion to a public meeting of West Coast Council on 19th January 2016. A future site inspection by the WCC was also suggested by the Proponent.

The Proponent has maintained an active dialogue the WCC during the course of resuming Level 1 operations. This dialogue will continue throughout the Granville Expansion.

4.3 State Government

A Notice of Intent was lodged with the Board of the Environment Protection Authority on 17th December 2015 and Project Specific Guidelines were issued by EPA Tasmania on 6th January 2016.

The Proponent is in discussions with EPA Tasmania regarding the various aspects of the proposed Granville Expansion, as well as other state authorities including MRT, DPIPWE and AHT during the preparation of this DPEMP.

5 Site Description and Existing Environment

Preamble

This section details the pre-existing conditions at both the Granville Processing Plant and Granville East Mine. An outline of background information relevant to a number of subsequent issues at both locations is provided. Subsequently, both locations are described in terms of their existing environmental conditions and existing infrastructure. An evaluation of the socio-economic conditions of the surrounding area is also detailed.

Previous operators have constructed a number of buildings, structures and supporting infrastructure at both GEM and GPP. An overview of the main existing infrastructure is outlined here.

Previous operators at GEM have constructed a number of facilities, including;

- A small open cut pit with an exposed area of approximately 4,200m^2;
- WRE thought to contain an estimated 15,000t of waste rock material (see Section 6.5). However, roughly half of this material resides outside of the ML;
- an estimated 2,500m^3 of uncrushed ore material at two separate stockpiles;
- a small modular site office and amenities facility located to the east of the open cut pit. This location is utilised as an onsite administration building. Electricity to the site is also provided at this location; and
- three existing sediment retention ponds with a pre-treatment basin (limestone drain) with a total estimated combined capacity of 80,000L.

Plate 5.1 - Existing open cut pit at GEM (circa 04/12/15)

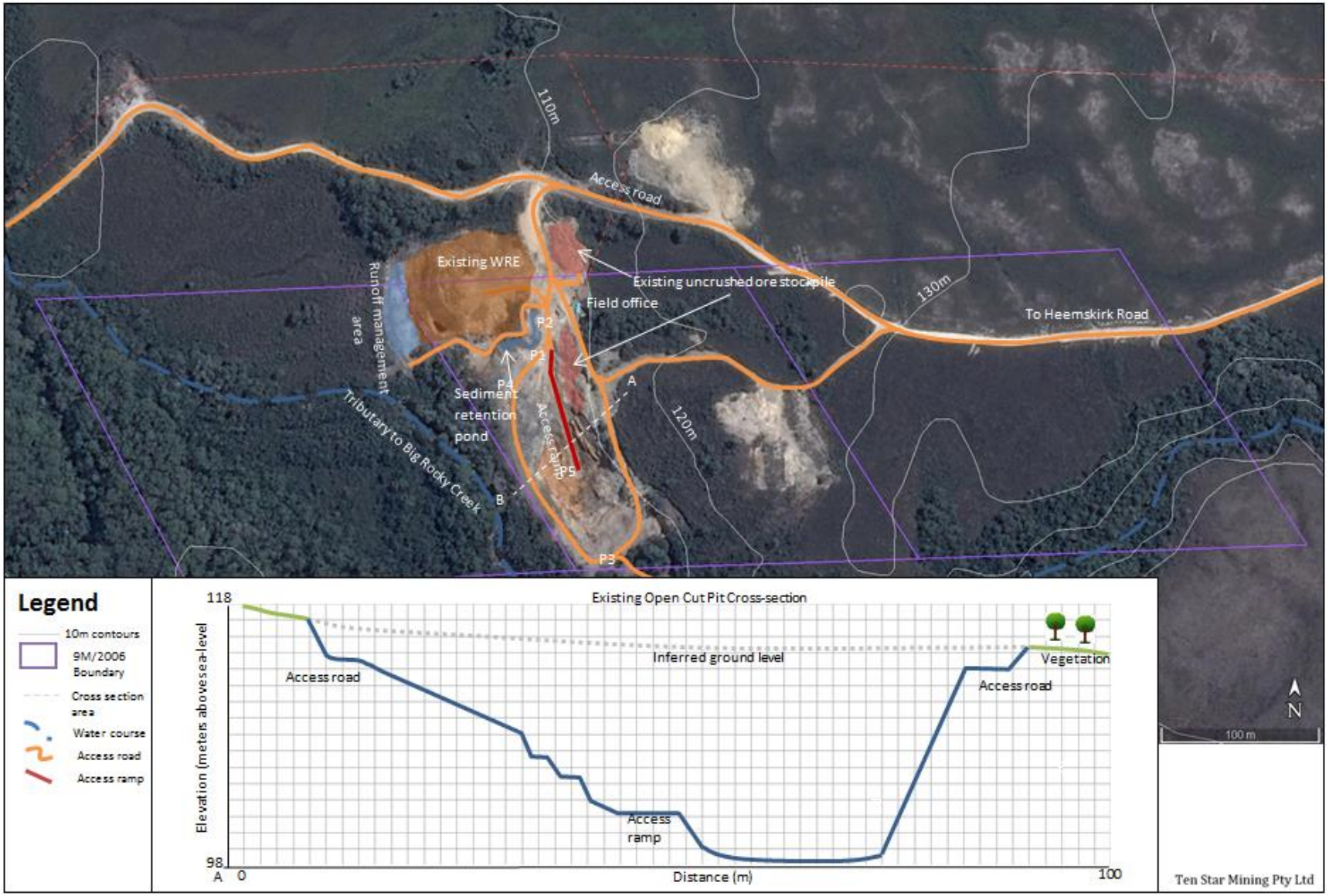


Figure 5.1 - Site map of existing infrastructure at GEM

Previous operators at GPP have constructed a number of facilities, including:

- The processing facility at GPP (Plate 2.2 and Figure 5.2) is situated in the central section of 21M/2003. This facility is approximately 320m^2 and consists of equipment designed to concentrate tin. This facility also contains an onsite administration area, workshop facility and amenities.
- A Water Race which supply water from 12 Mile Creek Dam to the Process Water Dam.
- Process water dam located to the north of processing facility. This dam has an estimated capacity of 2ML and is fed by the 12 Mile Creek Dam via the Water Race (Figure 2.2).
- 12 Mile Creek dam is a small sized dam (estimated capacity of 22.5ML (22,500m^3) in the headwaters of 12 Mile Creek which supplies water to the Process Water Dam via the water race for processing operations.
- Crushed ore stockpile.
- Existing crusher pads from previous operations.
- Magnetite stockpile from previous operations.
- Internal access roads.
- Electricity transmission lines.
- Lay down area.
- Central Big H - a historical open cut pit (mined for tin) that is inundated with water.
- Existing TSF with approximately 11,000 tonnes of tailings (refer Plate 2.2), a geotechnical assessment / dam surveillance report of the existing tailings dam is included as Appendix J).

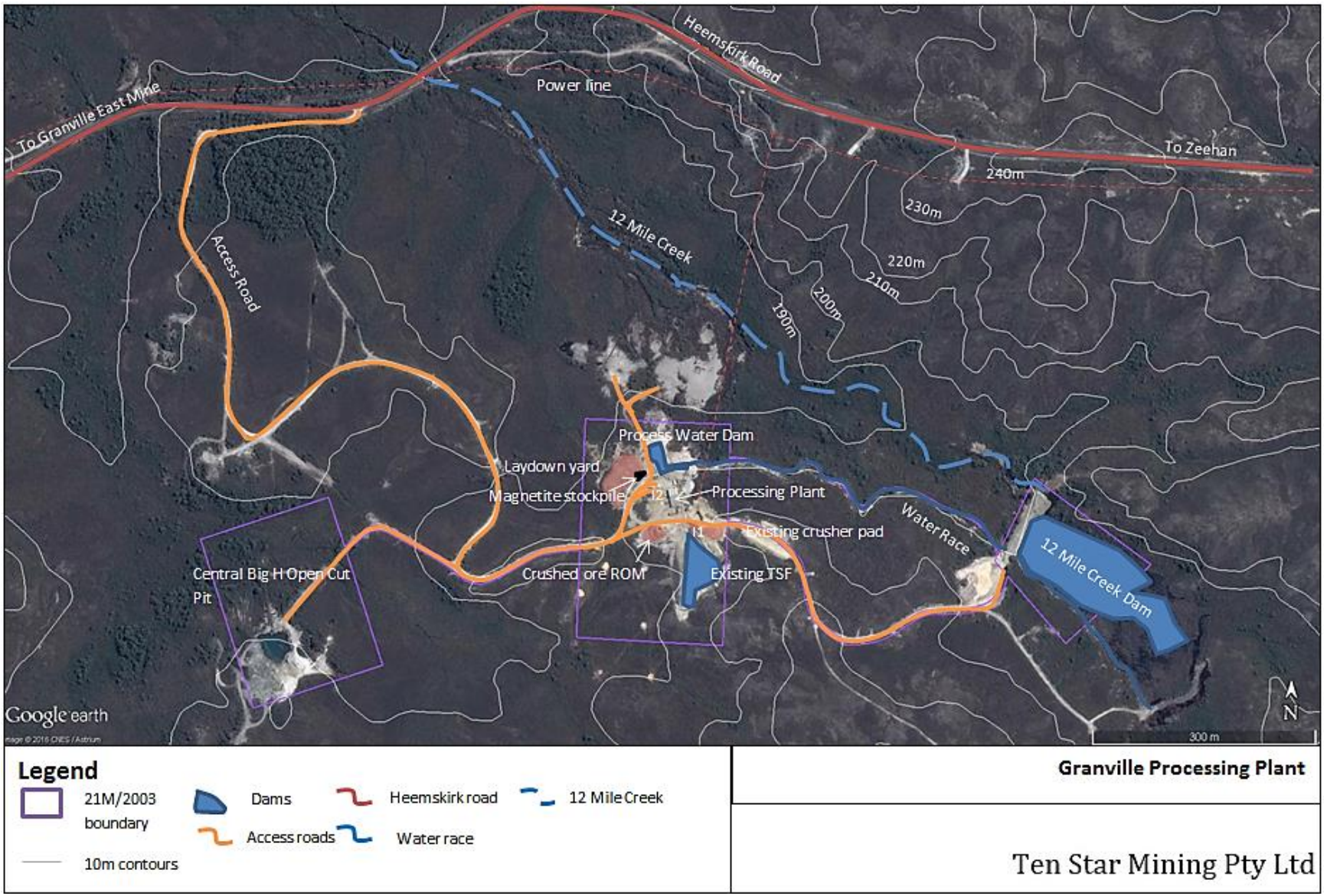


Figure 5.2 – GPP Existing Site layout

a) Looking east from I2 (Figure 2.2) at the processing facility at GPP

Plate 5.2 - GPP processing facility looking east. (circa 04/12/15)

5.1 Planning Aspects

5.1.1 Location

The Granville East Mine (**GEM**) and Granville Processing Plant (**GPP**) are situated over two locations, GEM and GPP, approximately 6km apart from each other and 20km north west of Zeehan (refer Figure 1.1). GEM is the location for open cut mining operations and GPP is the location of processing operations.

5.1.2 Land Tenure

The Granville Tin Project comprises two mining leases (21M/2003 and 9M/2006) that are substantially located over Regional Reserve with a section of 9M/2006 located within the Permanent Timber Production Zone.

The Granville Tin Project has a Level 1 approval from the West Coast Council to treat up to 1,000m^3 of crushed ore per annum. The two mining leases are held by Ten Star Mining Pty Ltd, a subsidiary of ANW.

Table 5.1 - Details of existing Mining Leases

	Area (ha)	Renewal Date	Expiry Date
21M/2003	68	03/03/16	05/03/17
9M/2006	10	03/03/16	05/03/17

The Granville Tin Project is situated on Crown Land. Crown Land Services (CLS) facilitates the appropriate management, use and development of Crown land, including the licensing, leasing and sale of Crown properties. Most land management functions undertaken by CLS are governed by the *Crown Lands Act 1976* and the *Crown Lands Regulations 2011*.

5.1.3 Land Zoning

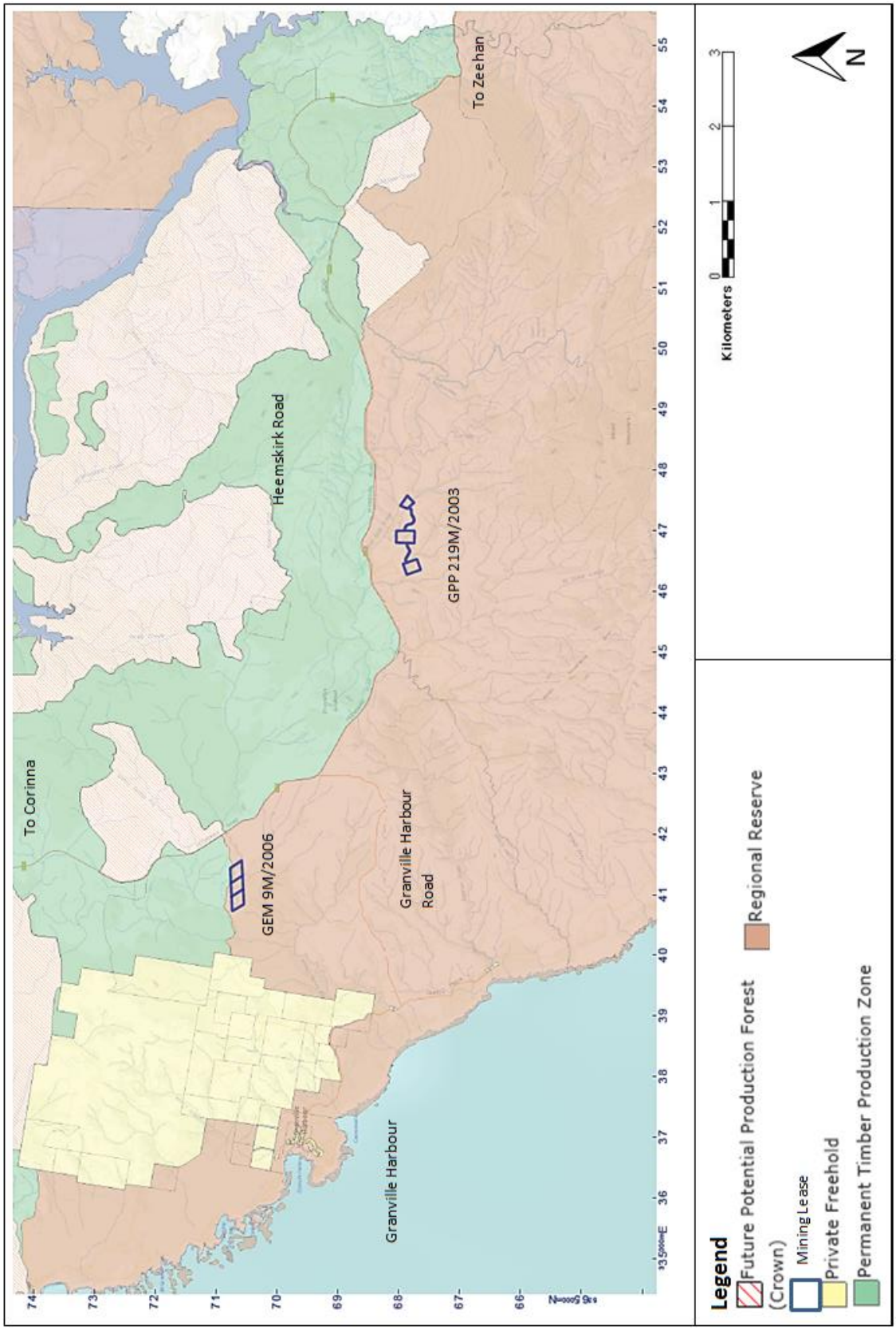


Figure 5.3 - Land Tenure

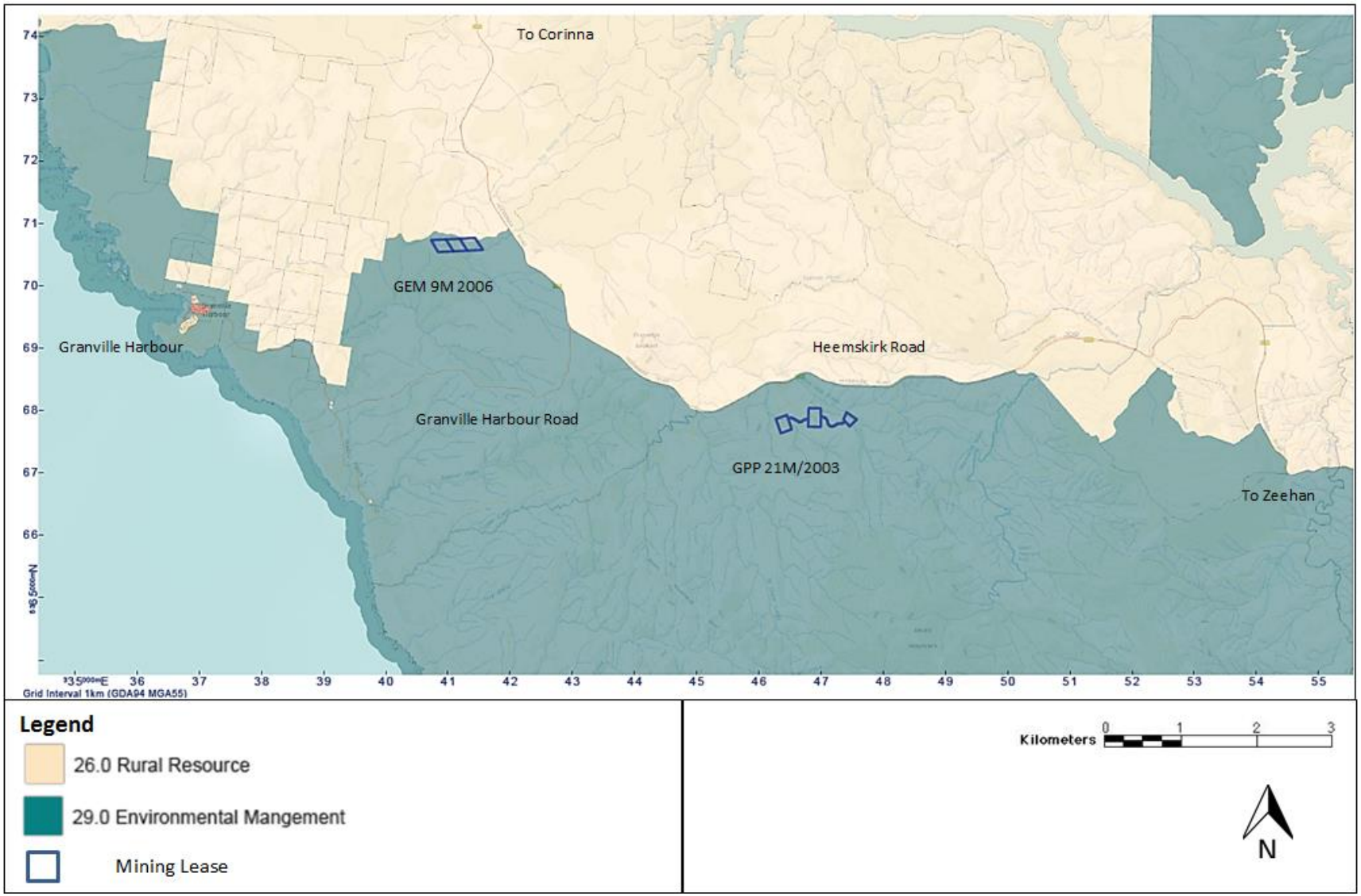


Figure 5.4 - Authorities land parcels at GEM and GPP over 21M/2003 and 9M/2006.

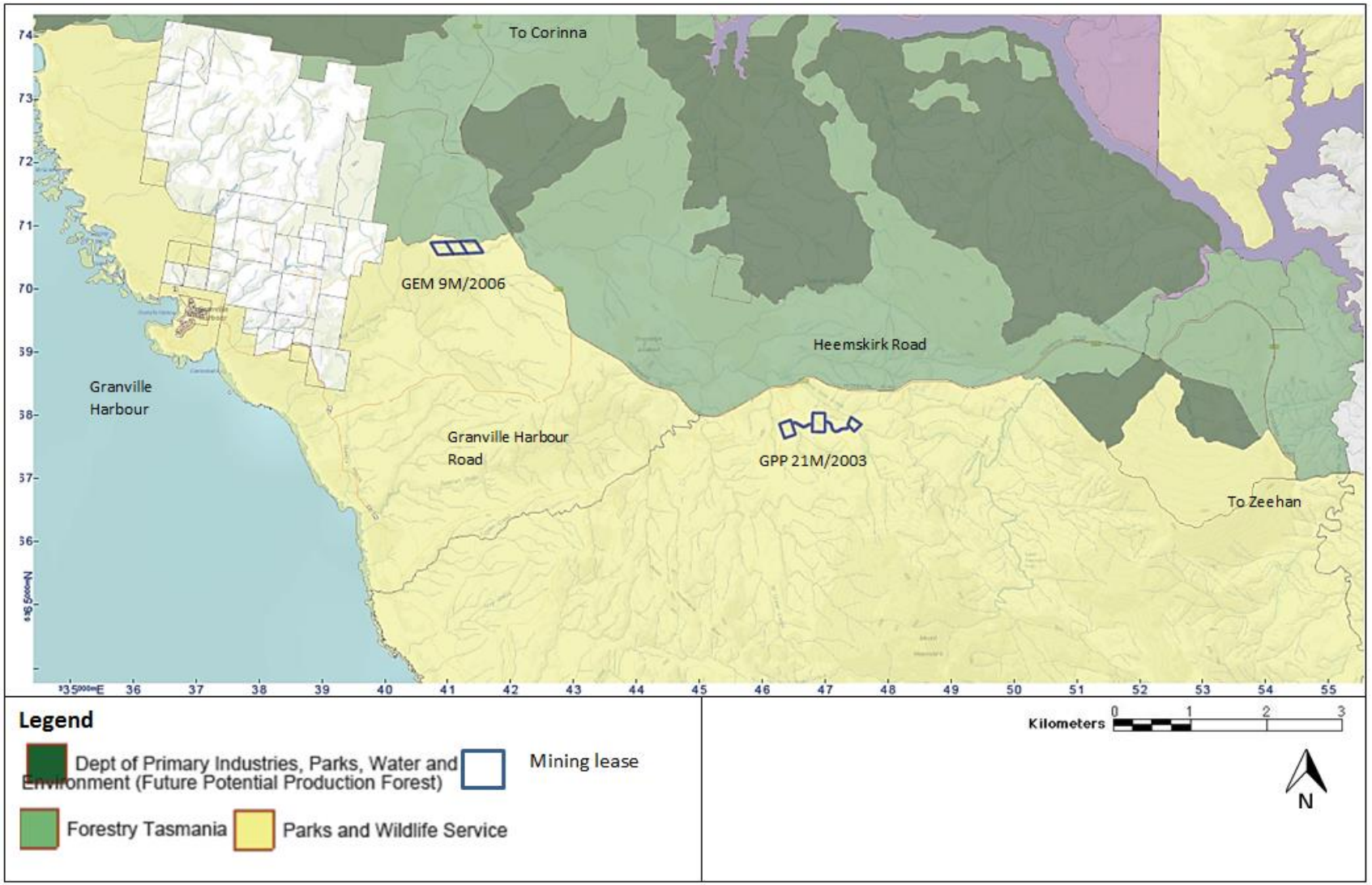


Figure 5.5 - Tasmanian interim planning scheme zoning at GEM and GPP over 21M/2003 and 9M/2006.

Table 5.2 – Land Zoning

Project Name	Granville East Mine – Granville Harbour	Granville Processing Plant – Heemskirk Road
Address	Off Heemskirk Road GRANVILLE HARBOUR, Tasmania, 7469	Off Heemskirk Road WEST COAST, Tasmania, 7469
Land owner	Crown Land, Mount Heemskirk Regional Reserve / Perm. Timber Production Zone Land	Crown Land, Mount Heemskirk Regional Reserve
Property ID	Untitled / 2531446	Untitled
West Coast Interim Planning Scheme 2013	Land Parcel is Zoned 'Environmental Management' / Rural Resource	Land Parcel is Zoned 'Environmental Management'
Mining Lease	9M/2006, 21M/2003	21M/2003
Environmental Permit	The existing activity operates under existing use rights (Appendix K)	

5.1.4 Rights of Way and Easements

Neither the GEM or GPP contain road/access easements. However, electricity is supplied to both sites by overland poles and wires managed by TasNetworks and supplied by AURORA Energy. Existing access roads reside within Crown Land managed by Parks and Wildlife Services.

5.1.5 Previous Land Use and Planning History

Zeehan has an extensive history associated with the minerals industry dating to the 1880's. The region is still home to a number of significant metal resources such as Avebury nickel mine, Comstock Mine and Renison Bell tin mine.

Granville Tin Project has previously been operated by a number of private and publically listed ventures dating back to the 1970s (Renison Limited 1997). Previous exploration and mining operations at both GEM and GPP have facilitated significant potential for contamination from legacy mining and processing operations.

The present use of the sites is in accordance with pre-existing level 1 approval over the mining leases. Existing buildings and significant structures are detailed in Section 5 (preamble).

5.1.6 Description of Land Use and Ownership in the Vicinity of the Granville Expansion

No other private uses of land are within 500m of proposed Granville Expansion.

5.1.7 West Coast Interim Planning Scheme 2013

As detailed in section 1.3.7, the use class is extractive industry, which is discretionary within the environmental management zone. Development approval from Council is required.

5.1.7.1 Discretionary Permit Use (29.3.2 A1)

The Proponent proposes to implement a number of measures to protect, conserve and manage significant ecological, scientific, cultural or aesthetic value as detailed in Section 6 of this DPEMP.

5.1.7.2 Development in a Statutory Conservation Area (29.4.1)

DPIPWE will be provided with details of the Granville Expansion and advise if it is satisfied the proposed development is consistent with the objectives, outcomes and conditions for protection, conservation, or management in accordance with any applicable reserve management plan.

5.1.7.3 Suitability of a Site or Lot For Use For Development (29.4.2)

The Proponent has taken into account the following aspects of the *West Coast Interim Planning Scheme 2013 (29.4.2)*;

- Provide a suitable development area for the intended use; the Granville Expansion is situated within the parameters of granted mining leases (refer Section 2.5);
- provide access from a road; accesses to GEM and GPP is via Heemskirk Road (refer Section 6.5); and
- make adequate provision for a water supply and for the drainage and disposal of sewage and storm water (water will be supplied to all personnel and drainage and sewage is addressed in Sections 6.2 and 6.5 respectively).

5.1.7.4 Location and Configuration of Development (29.4.3)

The Granville Expansion will not dominate or otherwise detract from the performance, appearance, and character of an area of significant ecological, scientific, cultural or aesthetic value or unreasonably intrude onto the occupation of adjacent land (refer Sections 6.7, 6.8, 6.10, 6.11 and 6.12).

5.1.7.5 Bushfire Prone Area Code (E1)

The Granville Expansion will be appropriately designed, located, serviced, and constructed, in order to reduce the risk to human life and property, and the cost to the community, caused by bushfires (refer Section 6.16).

5.1.7.6 Clearing and Conservation of Vegetation Code (E3)

Vegetation to be cleared is defined in section 5.2 and mitigation measures to assist protection and conservation of vegetation and habitat is detailed in section 6.7. A permit will be required from council and DIPIPWE prior to any vegetation clearing activities.

5.1.7.7 Traffic Generating Use and Parking Code (E9)

Traffic generated and parking requirements is outlined in section 6.20 of this DPEMP.

5.1.7.8 Water and Waterways Code (E10)

The Proponent proposes mitigation measures (refer Section 6.2) which aim to minimise risk to the function and values of local water bodies, watercourses and wetlands.

5.2 Environmental Aspects

5.2.1 Terrestrial Environment

5.2.1.1 Climate Data Granville Processing Plant/Granville East Mine

A meteorological station at Zeehan has recorded 80 years of meteorological data from 1890 through to 1968. This data is depicted in Figure 5.6.

The climate of the area is characterised by cool temperatures and high and consistent annual rainfall. Rainfall distribution is generally high throughout the year with an average of 240 days of precipitation per year. However there is a tendency for rain events to occur more regularly in the winter months.

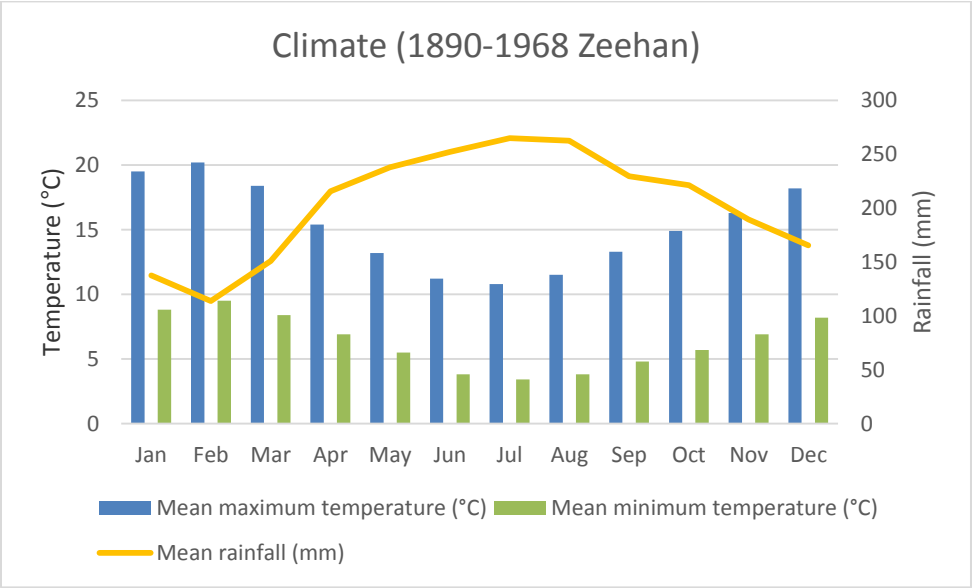


Figure 5.6. - Mean temperature and rainfall in Zeehan

Rainfall, on average, exceeds evaporation in the winter months however rates of evaporation are greater than average rainfall in the summer months as depicted in Figure 5.7 despite this, net yearly average rainfall is almost 2 times as high as net average evaporation.

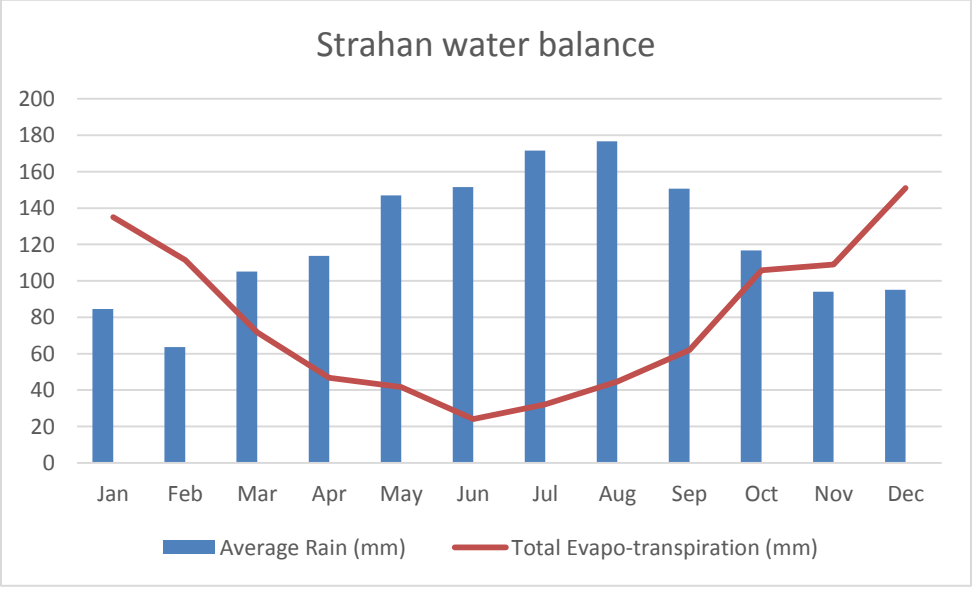


Figure 5.7 - Strahan Water Balance

Weather conditions monitored by the Australian Bureau of Meteorology (BOM 2016) indicate that weather at GEM and GPP is strongly influenced by the passage of westerly fronts, with predominate north west to south west winds. These are strongest between September and March with wind speeds in excess of 30km/hr (BOM 2016). Weather records from the nearest weather station (097072) indicate that the predominant wind

direction (20 percent of the time) and the strongest winds (between 30 and 40 km/hr) come from the north and occur in the morning (BOM 2016). In the afternoon, the strongest winds and predominant wind direction is from the northwest or west (BOM 2016).

5.2.1.2 Granville East Mine Terrestrial Environment

5.2.1.2.1 Topography

GEM is situated on land with moderately low relief. A tributary to the Big Rocky Creek cuts a shallow gully through the land to the west and south. The land generally falls towards Big Rocky Creek to the west. GEM is also situated on the edge of the western Tasmania Blanket Bogs (ID 2527) Geo-conservation feature (refer Figure 5.9).

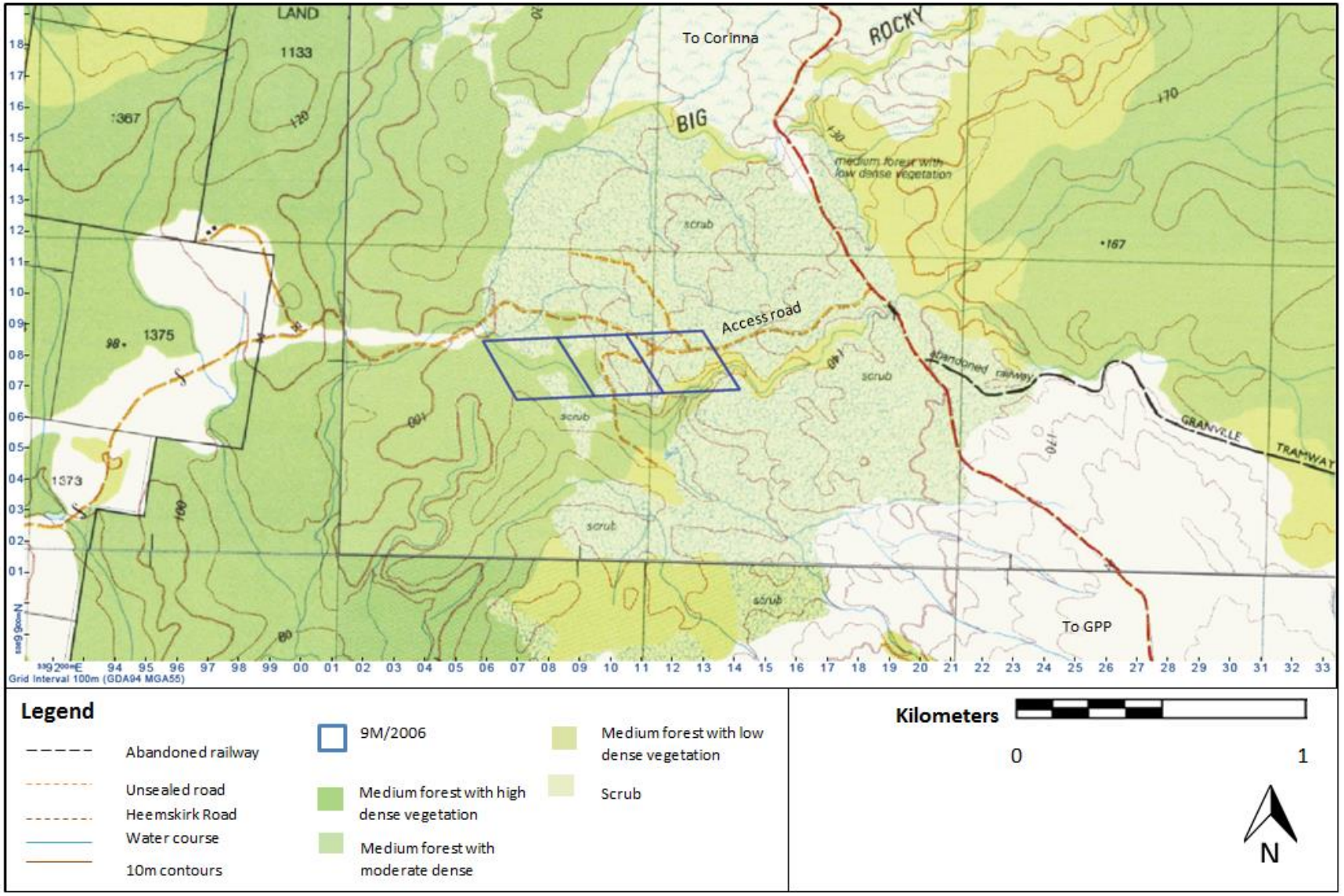


Figure 5.8 - Existing environment and mining lease at GEM Stringer 1:25 000 topographic/cadastral map AGD1966 (1986).

5.2.1.2.2 Geology

The deposit is hosted in metamorphosed Neo-Proterazoic black carbonaceous shale and calcareous quartzite of the Oonah formation overlaid by Tertiary conglomerate, gravel and grit and subsequent Quaternary stream alluvium and swamp and marsh deposits (MRT Digital Geological Atlas Stringer 1:25,000). Mineralisation at GEM is summarised by Geopeko (1983) as occurring in a strata-bound banded magnetite skarn horizon, and concludes that tin occurs as a late stage supergene, low temperature formation, that is post-dating skarn formation and also (in the form of an silicate) released during serpentinisation (Geopeko 1983). The mineralised skarn horizon extends approximately 50 metres long (north-south) and 15 metres wide (east-west) (Geopeko 1983).

5.2.1.2.3 Geomorphology

The type of parent rock/base geology has had a major influence on the soil type and surface geomorphology of the area. The region is characterised by a major structural element, the Arthur Lineament, which impacts the geomorphology throughout the region (Holm and Berry, 2002). The major rivers in the region flow generally west and cut across this with a ridge and valley landscape with steep slopes on drainage lines, high drainage density and a trellis drainage pattern throughout.

5.2.1.2.4 Soil

Most native vegetation is scrub/heath developed on poorly-drained soils on low undulating terrain. Both GEM and GPP are situated on organosols (defined as the geoconservational feature Western Tasmanian Blanket Bogs) which are defined by the CSIRO (Australian Soil Classification (Second Edition) (2016)) as:

- Have *organic materials* extending from the surface to a minimum depth of 0.1 m; these either directly overlie rock or other *hard* layers, partially weathered or decomposed rock or saprolite, or overlie fragmental material such as gravel, cobbles or stones in which the interstices are filled or partially filled with organic material. In some soils there may be layers of *humose* and/or *melacic horizon* material underlying the *organic materials* and overlying the substrate.

Soil profiles are typical of Western Tasmanian Blanket Bogs and are shallow and developed over weathered salacious metasediments. Typically the soil is organic rich, poorly draining and acidic.

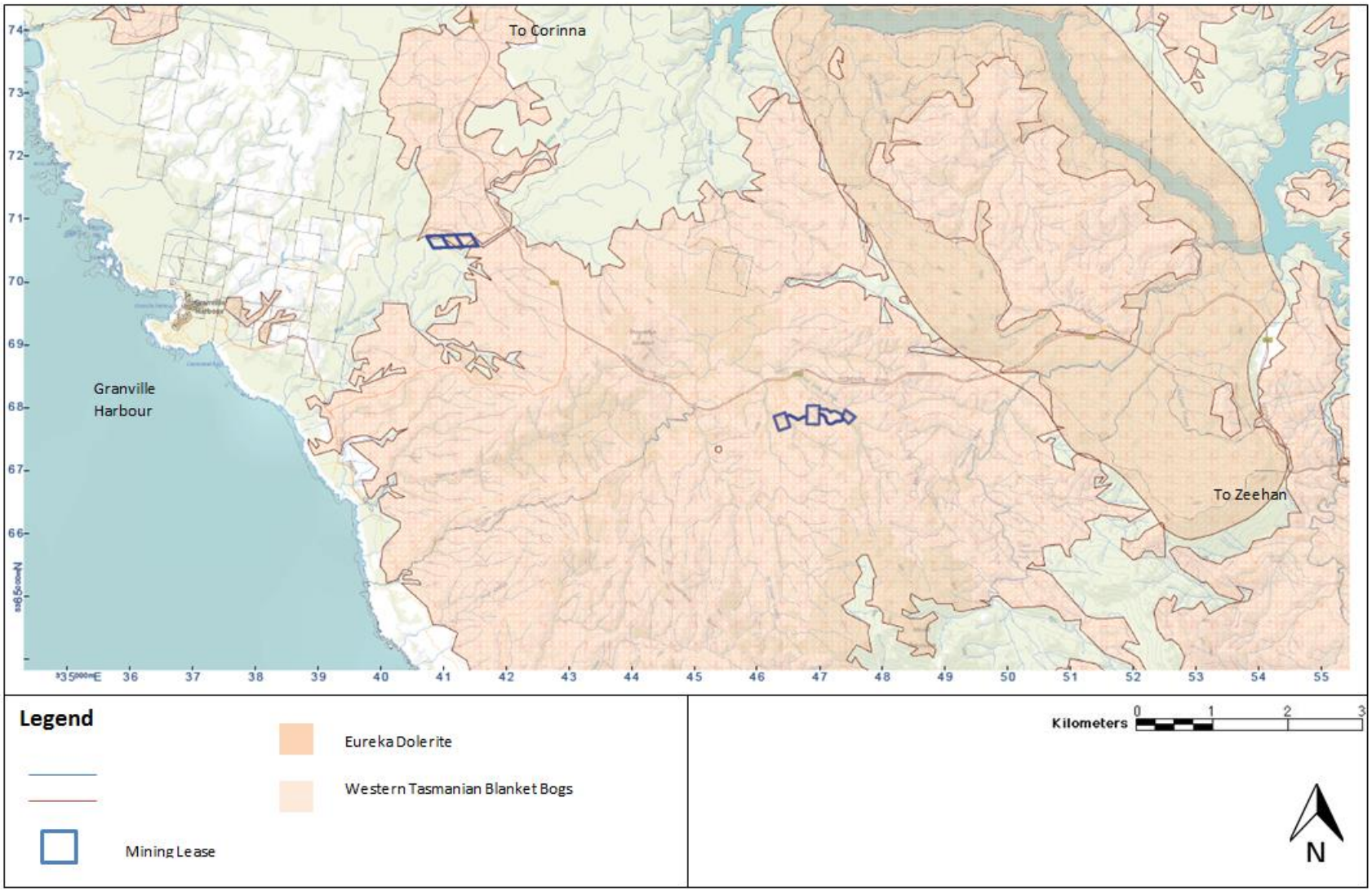


Figure 5.9 - Distribution of Western Tasmania Blanket Bogs relative to GEM (left) and GPP (right). (Natural Values Atlas report)

5.2.1.2.5 Flora

A field investigation was undertaken by ECOtas in February 2016. The report (attached as Appendix B) details the vegetation and fauna present at both sites, and include;

- "extra-urban miscellaneous" (TASVEG code: FUM): small area north of Granville Farm Road (quarry/borrow pit/work area) but not the mine site itself (and none mapped for the mill site, despite obvious and quite extensive clearing);
- "buttongrass moorland (undifferentiated)" (TASVEG code: MBU): extensive across most of the GEM area, excluding the area along Big Rocky Creek;
- "western wet scrub" (TASVEG code: SWW): most of the vegetation along Big Rocky Creek is mapped as SWW, despite being obviously some form of taller forest; and
- "Leptospermum scrub" (TASVEG code: SLW): two patches along western boundary adjacent to Big Rocky Creek and one patch straddling Granville Farm Road (note that this mapping unit has been deprecated under the TASVEG 3.0 revision, now placed in Leptospermum lanigerum scrub, SLL).

These flora communities are well represented on the western coast of Tasmania, and are depicted in GEOTas 2016 (Appendix B - Figure 5a).

5.2.1.2.6 Fauna

No fauna species listed as threatened under the *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 or the *Tasmanian Threatened Species Protection Act* 1995 were detected from the study area (refer Appendix B). However, the study area is within the predicted/known range of several species (refer Appendix B - Figure 10), and supports potential habitat of these species, as follows;

- *Sarcophilus harrisii* (Tasmanian Devil) [TSPA: endangered; EPBCA: Endangered];
- *Dasyurus maculatus* subsp. *maculatus* (Spotted-Tailed Quoll) [TSPA: rare; EPBCA: Vulnerable]; and
- *Accipiter novaehollandiae* (grey goshawk) [TSPA: endangered; EPBCA: not listed].

5.2.1.2.7 Air Quality

There is no quantitative data on regional ambient air quality in the area. However, the study area is far removed from major industries and major road networks, is largely covered by dense scrub and experiences significant meteorological conditions, notably very high rainfall, which serves to provide good air quality.

5.2.1.3 Granville Processing Plant

5.2.1.3.1 Topography

The GPP is located on a low promontory rising above flats on the southern side of Twelve Mile Creek. The processing site is at elevation of approximately 200 metres (AHD).

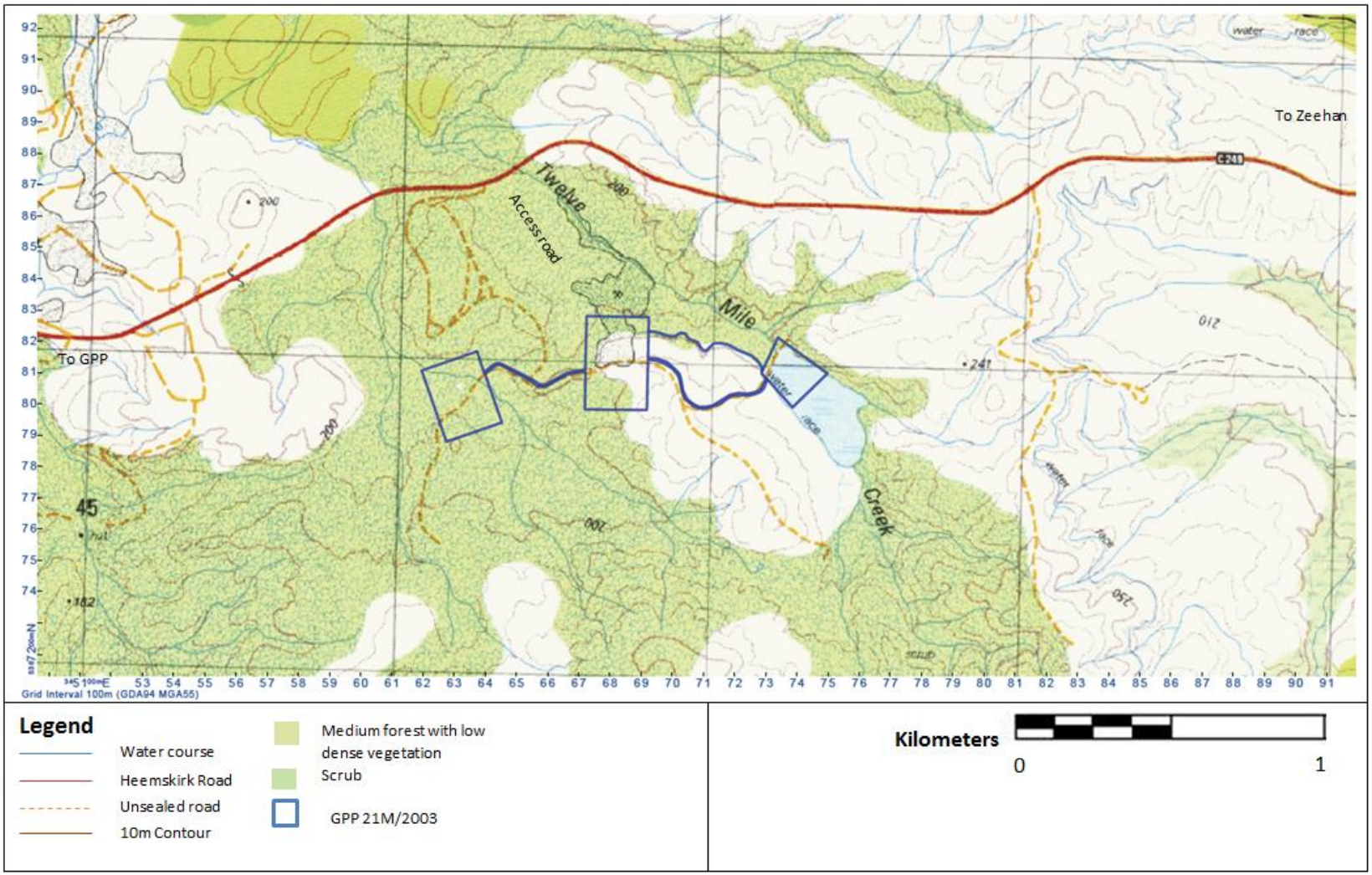


Figure 5.10 - Existing environment at GPP. (Map imagery Heemskirk 1:25 000 Topography/cadastral map 1986 AGD66)

5.2.1.3.2 Geology

The site is situated on Neo- Preoterozoic metamorphosed calc-silicates of the Oonah formation and uncomfortably overlain by Holocene stream alluvium, swamp and marsh deposits. Tin deposits have been worked at Central Big H (skarn) to the west of the processing facility, and immediate north (alluvial tin).

5.2.1.3.3 Geomorphology

The site is situated approximately 3.5km north east of a predominate geomorphological feature of the region, Mt. Heemskirk, which is approximately 740m above sea level.

5.2.1.3.4 Soil

Geoconservation mapping indicates that the geoconservation feature, Western Tasmania Blanket Bog, underlies the entire mill site (Plate 5.3). Site assessment indicated that this feature underlies much of the mill site, most strongly expressed on the slopes above the water race but masked in most other places by a dense sedge/scrub cover.

Plate 5.3 – Example of Western Tasmanian blanket bogs soil profile at GPP (8 Feb, 2016)

5.2.1.3.5 Flora

A field investigation into existing flora communities present at GPP was undertaken by ECOtas in February 2016 (Appendix B - Figure5b) and its main findings are summarised below;

- “buttongrass moorland (undifferentiated)” (TASVEG code: MBU): extensive across most of GPP area;
- “Restionaceae rushland” (TASVEG code: MRR): small patch linking two “tongues” of SWW and surrounded by MBU; and
- “western wet scrub” (TASVEG code: SWW): “tongues” of SWW extend into the northeast, west and southeast of the study area.

5.2.1.3.6 Fauna

No fauna species listed as threatened on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* or the Tasmanian *Threatened Species Protection Act 1995* were detected from the study area (Appendix B). The study area is within the same predicted/known range of several species (refer Appendix B - Figure 10), and supports potential habitat of these species, as described at GEM (as described in Section 5.2.1.1.2 (Fauna));

5.2.1.3.7 Air Quality

The GPP experiences the same air quality at GEM (as described in Section 5.2.1.2.7 (air quality).

5.2.2 Aquatic Environment

5.2.2.1 Granville East Mine

5.2.2.1.1 Surface Waters

A tributary to Big Rocky Creek is located to the south and west of the open cut, approximately 25 metres from the cutting. The creek originates west of Lake Pieman and flows west approximately 10km before entering the Southern Ocean south of Granville Harbour. GEM is situated within the small Big Rocky (5010) sub-catchment, incorporating an area of approximately 830 hectares.

Big Rocky Creek forms part of the western most section of the broader Pieman Catchment. The Pieman catchment drains a land mass of more than 4,100 km^2 stretching from about Lake St Clair in the Central Highlands towards the west to Granville Harbour on the West Coast of Tasmania. The catchment area of Big Rocky Creek forms approximately 0.6percent of the broader Pieman Catchment.

The Department of Primary Industries, Parks, Water and Environment (DPIPWE) provides access to the database of the Conservation of Freshwater Ecosystem Values (CFEV) project. This is a comprehensive audit of freshwater ecosystems around Australia. The Conservation Management Priority for Big Rocky Creek is outlined in Table 5.3.

Table 5.3- Conservation value of the tributary to Big Rocky Creek

Description	Feature ID	Integrated Conservation Value	Representative Conservation Value	Land Tenure Security	Conservation Management Priority Immediate
Tributary to Big Rocky Creek	93 814	Lower to lowest ICV	C*	Low	Moderate CMP

* A = first group of spatial units selected by the spatial selection algorithm (highly representative of its important biophysical class), B = second group of spatial units selected, C = remaining spatial units (least representative of its important biophysical class).
IMPI - Estimate of the relative priority for immediate conservation management to ensure the protection of significant freshwater values.
ICV - The conservation value of an ecosystem spatial unit expressed as the relative importance of that unit where Representative Conservation Value has been combined with its Special Value rating.

The CFEV database indicates that fish are absent or low probability of occurrence and/or at very low densities in drainage systems in the vicinity of Granville East Mine. Most of the river sections are in near-natural condition.

Field observations details the tributary to Big Rocky Creek in the vicinity of GEM as a first order low energy, narrow and shallow creek, with river bed constituents comprised of clay to cobble sized material of the Oonah Formation. The banks are well vegetated and waters appear clear.

Water quality of the tributary of Big Rocky Creek upstream of operations at GEM are typically acidic and contain elevated concentrations of Fe and Al (refer section 6.2). A localised elevation in the metal/metalloid concentrations within the tributary occurs at the confluence of the mine water discharge point, however, conditions downstream of operations at GEM return to those exhibited upstream within 1km. Ambient conditions are presented in Section 5.2.8.

5.2.2.1.2 Groundwater

No site ground water investigations have been undertaken and limited information is available regarding the ground water in this area. A number of drill holes have been completed in the area however available logs (retained by MRT) fail to mention if or where ground water is intercepted (Figure 5.11 and Figure 5.12). A minor inflow of water permeates through the northern and eastern face of the open cut pit. It is unsure at what rate water is entering the pit from these locations. This indicates that a likely shallow surficial aquifer has been intercepted. On the basis of the known geology, the following assumptions can be made in relation to groundwater at GEM:

- The surficial aquifer likely consists of the overlying peats and weathered substrate. This includes permeable talus and colluvium, and the outermost fractured and weathered zone of the bed rock. The high metamorphic grade of underlying bedrock would have limited the permeability of water and subsequently restricted the development of an aquifer at depth.
- A shallow perched water table likely coexists parallel to the slope of the surficial aquifer as evident by the proximity of the tributary to Big Rocky Creek. Recharge rejected by the hornfelsed bedrock would likely enter this perched water table and subsequently enter the tributary to Big Rocky Creek.

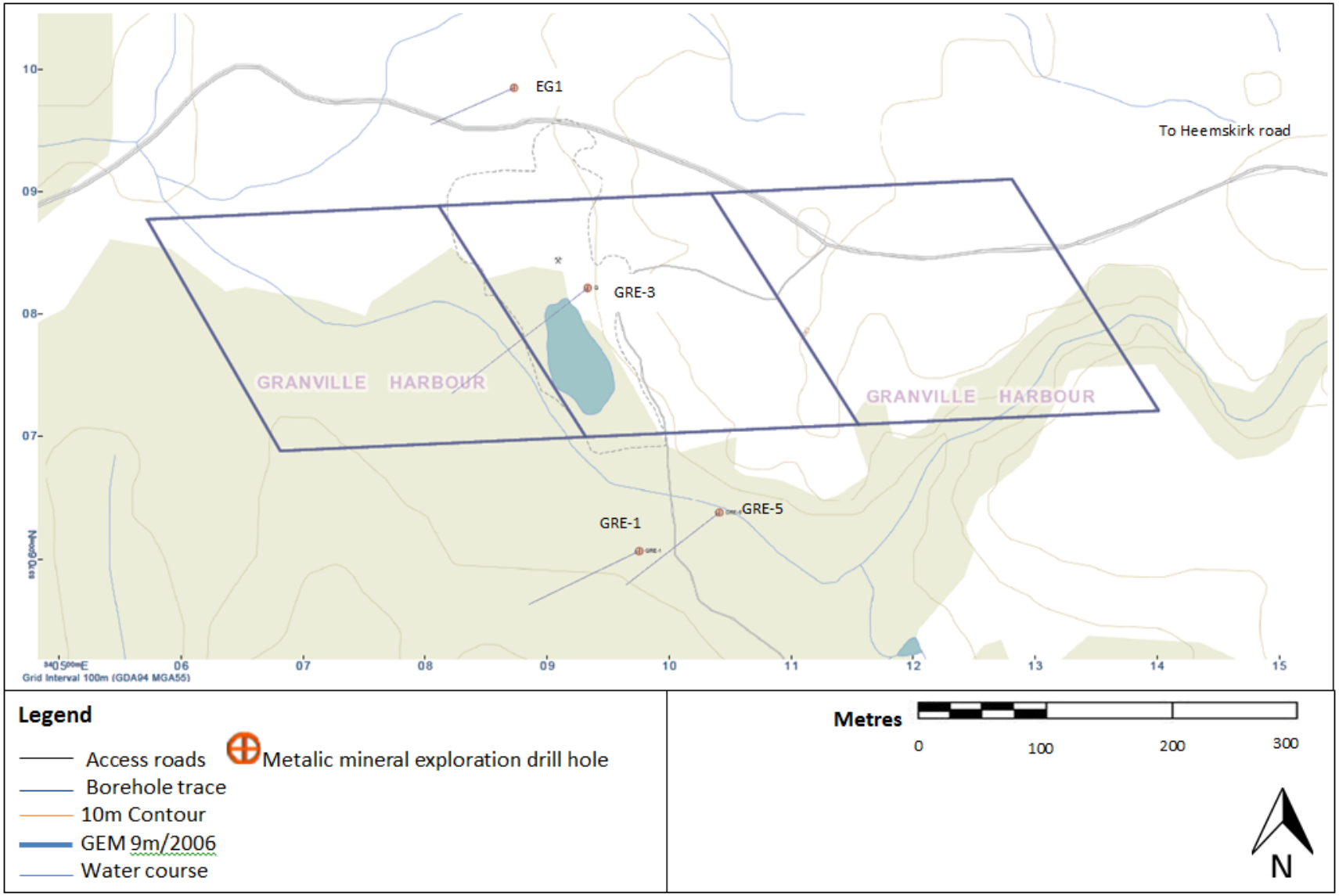


Figure 5.11 - Location of previous drill collars in the vicinity of GEM (MRT LIST map viewer 2016, refer MRT for drill collar information)

5.2.2.2 Granville Processing Plant

5.2.2.2.1 Surface Water

The processing site slopes towards Twelve Mile Creek, about 200 metres distant to the north. The existing TSF constructed to the north of the processing facility is located in a shallow valley which drains towards a tributary to Twelve Mile Creek situated 360 metres away to the north.

Twelve Mile Creek is situated within the Tasman-Twelve Mile-St Dizier (5009) sub-catchment. A smaller catchment of 300ha is considered in relation to the processing site.

DPIPWE provide access to the database of the CFEV project. This is a comprehensive audit of freshwater ecosystems around Australia. The Conservation Management Priority for Twelve Mile Creek is outlined in Table 5.4.

Table 5.4 - Conservation values of 12 Mile Creek

Description	Feature ID	Integrated Conservation Value (ICV)	Representative Conservation Value	Land Tenure Security	Conservation Management Priority – Immediate (IMPI)
Twelve Mile Creek	101730	High ICV	A*	High	Lower CMP

* A = first group of spatial units selected by the spatial selection algorithm (highly representative of its important biophysical class), B = second group of spatial units selected, C = remaining spatial units (least representative of its important biophysical class).
IMPI - Estimate of the relative priority for immediate conservation management to ensure the protection of significant freshwater values.
ICV - The conservation value of an ecosystem spatial unit expressed as the relative importance of that unit where Representative Conservation Value has been combined with its Special Value rating.

The CFEV database indicates that fish are absent or low probability of occurrence and/or at very low densities in drainage systems in the vicinity of Granville Processing Plant.

Twelve Mile Creek is a shallow, narrow, low energy creek originating from Mt. Heemskirk which flows approximately 3km before the confluence with the Tasman River. The fluvial geomorphology of the creek has been significantly altered for historic mining activities.

Three dams, a flooded open pit and water race are also present at the GPP. The Process Water Dam, located 50m to the north of the processing facility, has been established to provide process water for operations. Twelve Mile Creek Dam located to the east of the processing facility, is constructed in a narrow valley of GPP, and provides water through an artificial water race to the Process Water Dam.

Preliminary surface water background data collected (Appendix E and Appendix G) indicates that existing surface water residing in the existing TSF and seepage from the existing TSF exceed ANZECC values for a number of chemical parameters (refer section 6.5.2). Environmental analysis of tailings contained within the existing TSF indicates material is NAF (as determined by the procedures outlined in AMIRA P387A ARD Test Handbook). However analysis of surface water derived from the existing TSF shows a low pH value (field testing pH 3.4). Previous sub-aerial deposition of tailings material may be contributing to lower pH levels (Appendix E). However, notwithstanding management of the existing TSF, baseline data indicates the background value for surface water at GPP of pH of 5.5, (Appendix E) which may be contributing to a lower pH at the existing TSF. Background pH conditions are likely due to surrounding, organic rich (acidic) soils (Refer section 6.2).

5.2.2.2.2 Groundwater

No boreholes are registered in the vicinity of GPP. Exploration drilling at Central Big H to the west of the processing facility do not record the intersection of any groundwater (MRT). As a consequence, existing groundwater conditions can only be speculated based on geological mapping and drill hole data.

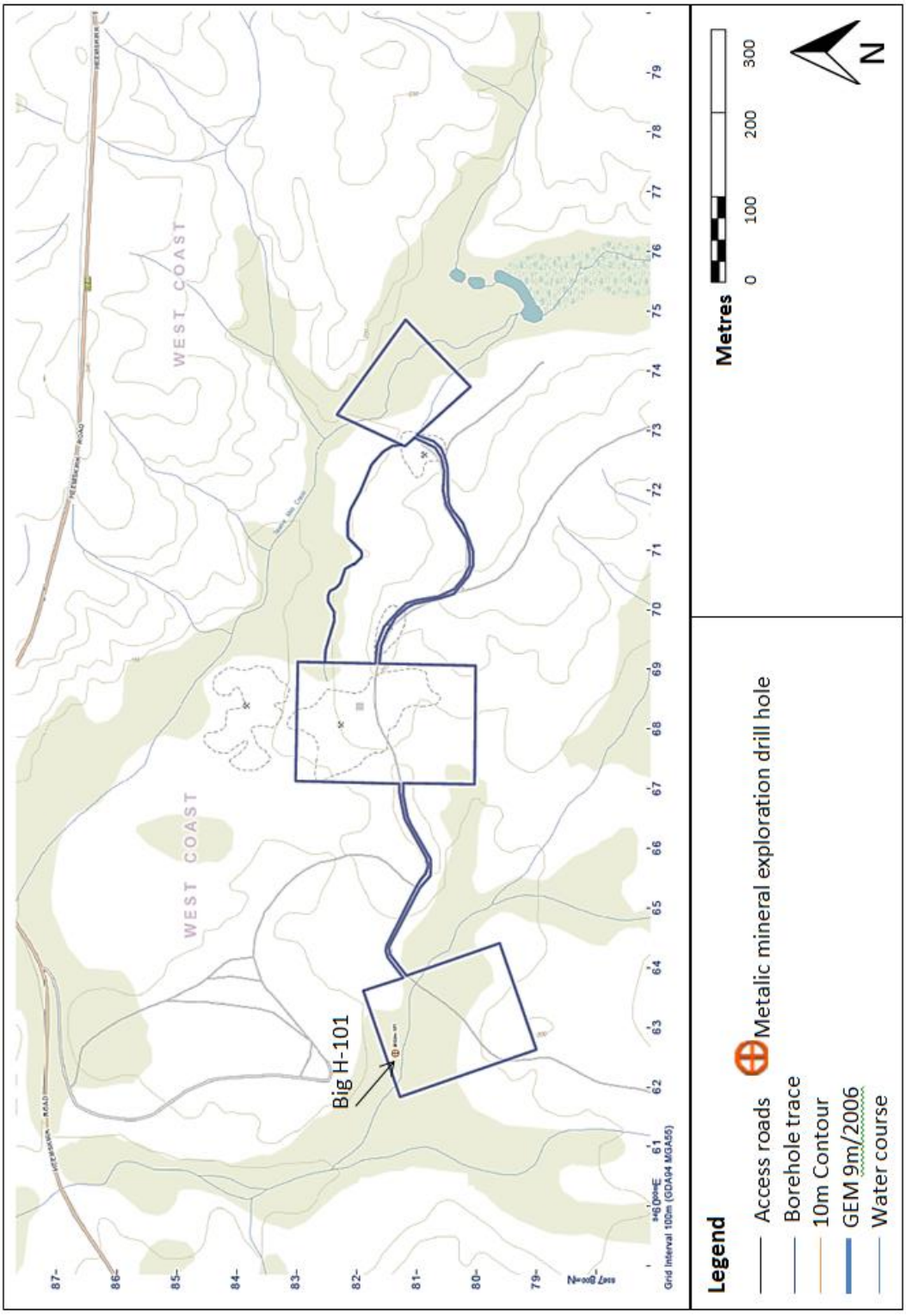


Figure 5.12 – Location of drill holes in the vicinity of GPP (MRT LIST map viewer refer MRT website for drill collar information)

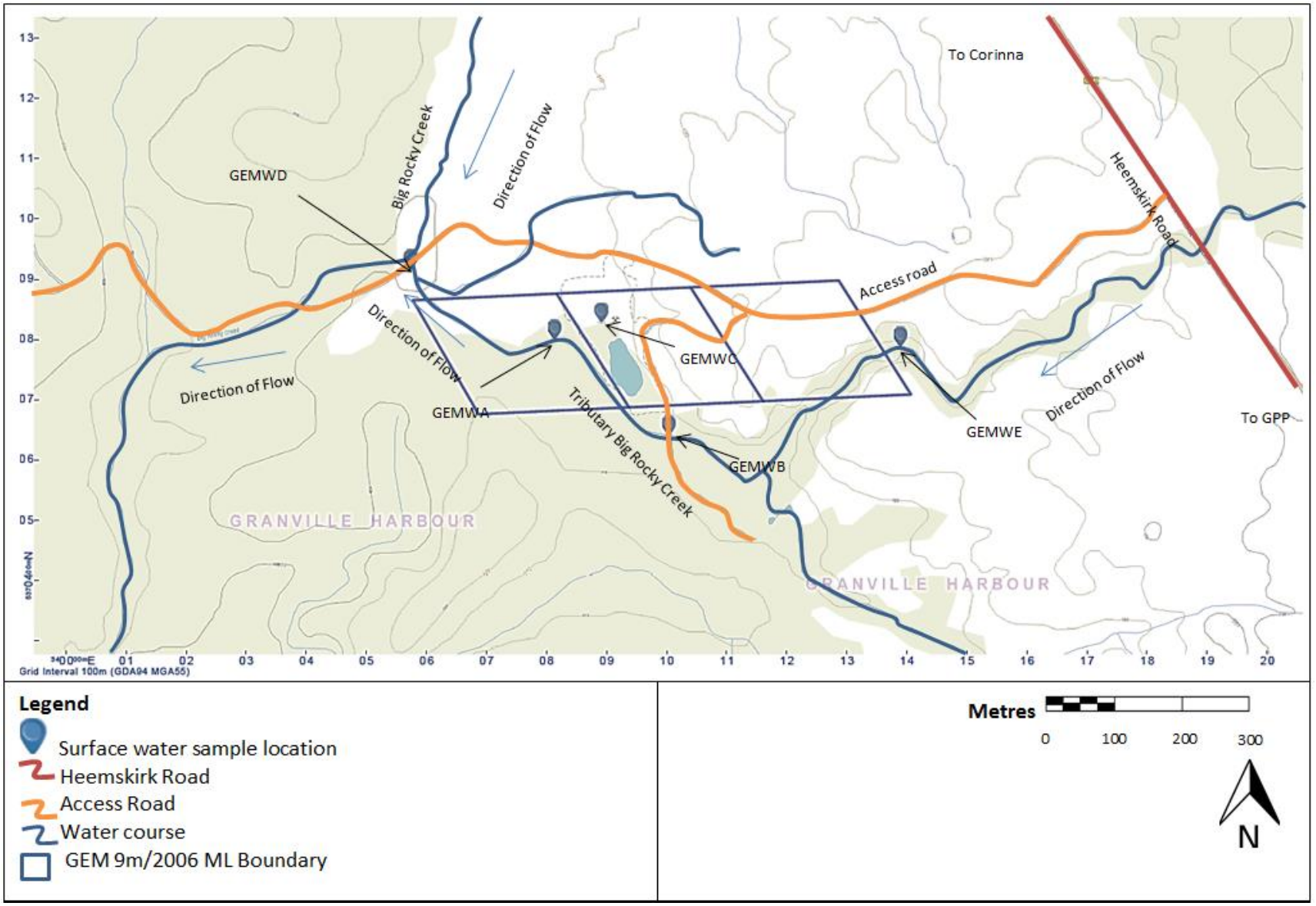


Figure 5.13. - Distribution of surface water samples sites at Granville East Mine

5.2.2.3 Ambient Surface Water Monitoring

The Proponent has undertaken preliminary water sampling to establish baseline water quality for the tributary to Big Rocky Creek at GEM and 12 Mile Creek at GPP. Full details of this monitoring is provided in Appendix E.

Table 5.5 - Results of GEM baseline water quality assessment.

		ANZECC					
		Human	(Aquatic 95th percentile)	GEMWE001	GEMWA001	GEMWB001	GEMWD001
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
pH		6.5-8.5		5.15	2.73	4.67	6.09
SAR				2.72	0.49	2.72	2.37
Conductivity µS/cm				149	1780	158	146
Calculated TDS		1000		97.000	1160.000	103.000	95.000
Hardness				12.000	450.000	12.000	15.000
Alkalinity	Hydroxide			<1	<1	<1	<1
	Carbonate			<1	<1	<1	<1
	Bicarbonate			3.000	<1	<1	3.000
	Total			3.000	<1	<1	3.000
Sulphate		400.000		<1	933	1	<1
Chloride		400.000		39.000	36.000	40.000	37.000
Dissolved Cations	Calcium			<1	32.000	<1	1.000
	Magnesium			3.000	90.000	3.000	3.000
	Sodium			22.000	24.000	22.000	21.000
	Potassium			1.000	3.000	1.000	<1
Total Major Cations	Magnesium			3.000	87.000	3.000	3.000
Total Metals by ICP	Aluminium	0.200	0.055	1.580	15.200	0.490	0.370
	Arsenic	0.050	0.024	0.002	0.271	0.001	<0.001
	Boron			<0.05	0.050	<0.05	<0.05
	Barium	1.000		0.006	0.016	0.003	0.003
	Beryllium			<0.001	0.011	<0.001	<0.001
	Cadmium	0.005	0.000	<0.0001	0.001	<0.0001	<0.0001
	Cobalt			0.001	0.076	<0.001	<0.001
	Chromium	0.050	0.001	0.005	0.009	0.002	0.002
	Copper	1.000	0.001	0.002	0.248	0.002	<0.001
	Manganese	0.100	1.900	0.034	4.260	0.028	0.008
	Nickel	0.100	0.011	0.005	0.127	0.002	0.003
	Lead	0.050	0.003	0.002	0.005	<0.001	<0.001
	Selenium			<0.01	<0.01	<0.01	<0.01
	Vanadium			<0.01	0.020	<0.01	<0.01
	Zinc			0.008	0.520	0.006	<0.005
	Iron	0.300		2.89	224.00	1.42	1.54
Mercury				<0.0001	<0.0001		<0.0001
Silicon				8.000	36.600		7.400
Fluoride				<0.1	0.200		<0.1
Ionic Balance	Total Anions			1.160	20.400		1.100

		ANZECC					
		Human	(Aquatic 95th percentile)	GEMWE001	GEMWA001	GEMWB001	GEMWD001
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Total Cations			1.230	10.100		1.210
	Ionic Balance				33.800		

GEMWE001 is indicative of water quality of the tributary of Big Rocky Creek upstream of operations at GEM where GEMWD001 illustrates the conditions of surface waters immediately downstream. Table 5.5 indicates that the tributary of Big Rocky Creek is naturally moderately acidic (pH 5.15 lab, 4.6 – 4.8 field testing Appendix E) and while there is a localised spike in the metal/metalloid concentrations within the tributary, conditions downstream of operations at GEM return to those exhibited upstream.

Base line data collected by the Proponent indicates that existing surface water residing in the existing TSF and seepage from the existing TSF exceed ANZECC values for a number of chemical parameters (GPPWE001 and GPPWB001). Environmental analysis of tailings contained within the existing TSF indicates the material is NAF, however with an elevated sulphur concentration (refer Section 6.5). Sub-aerial deposition of tailings by previous operators, and interaction of low pH background waters (GPPWC001) may be contributing to lower pH levels in the existing TSF.

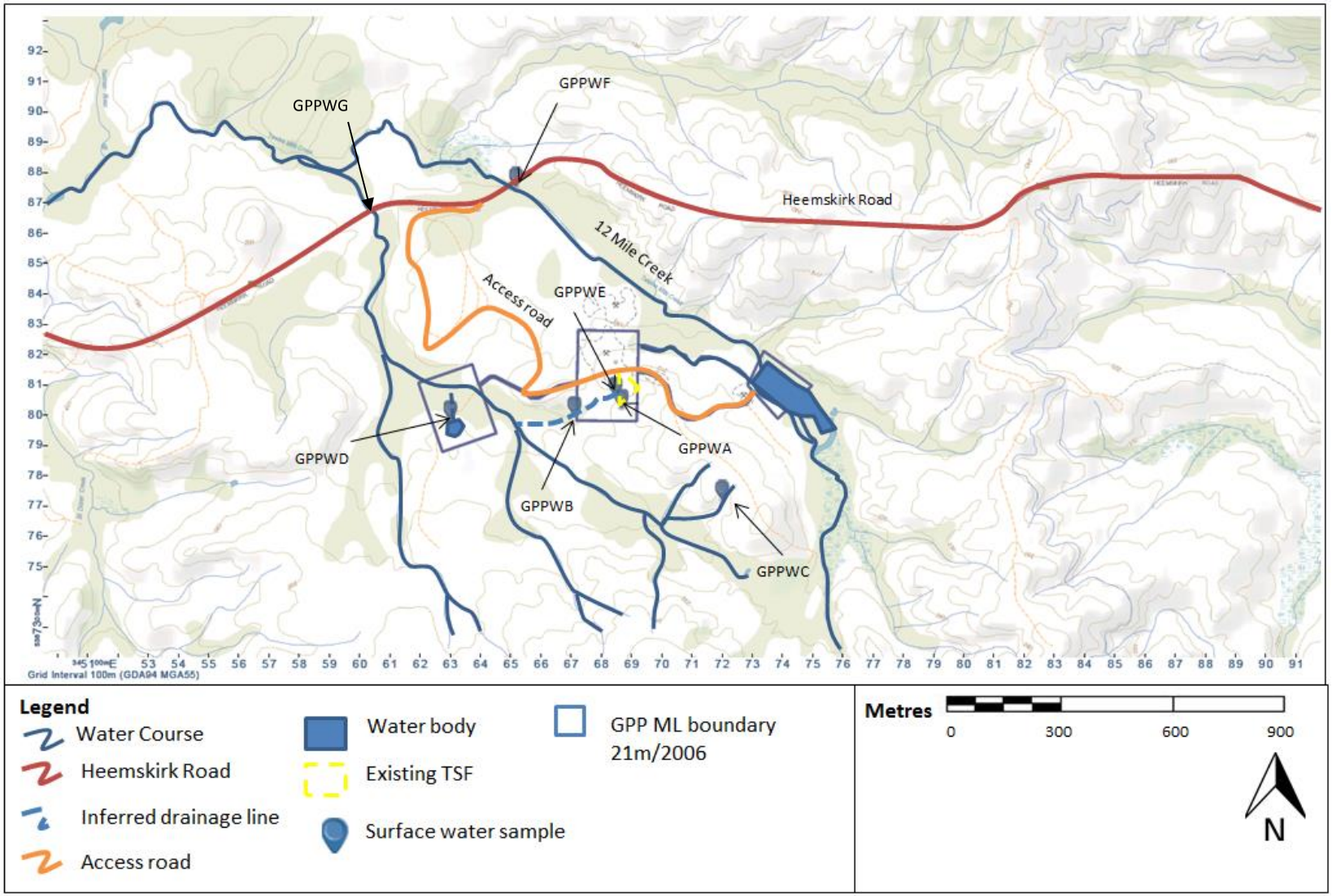


Figure 5.14. - Location of surface water samples sites at Granville Processing Plant

Table 5.6 - Preliminary water sample results at the Granville Processing Plant

		ANZECC						
		Human	(Aquatic 95th percentile)	GPPWA002	GPPWE002	GPPWD002	GPPWC001	GPPWF001
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
pH		6.5-8.5		2.67	2.94	3.88	5.11	4.5
SAR				0.35	0.51	2.73		2.42
Conductivity µS/cm				1660	3030	186	68	121
Calculated TDS		1000		1080	1970	121	44	79
Hardness				438	320	8	<1	8
Alkalinity	Hydroxide			<1	<1	<1	<1	<1
	Carbonate			<1	<1	<1	<1	<1
	Bicarbonate			<1	<1	<1	2.000	<1
	Total			<1	<1	<1	2.000	<1
Sulphate		400.000		634	2000	18	5	3
Chloride		400.000		26.000	28.000	33.000	13.000	30.000
Dissolved Cations	Calcium			14.000	8.000	<1	<1	<1
	Magnesium			98.000	73.000	2.000	<1	2.000
	Sodium			17.000	21.000	18.000	9.000	16.000
	Potassium			4.000	39.000	1.000	1.000	<1
Total Major Cations	Magnesium			94.000	79.000	3.000	<1	2.000
Total Metals by ICP	Aluminium	0.200	0.055	12.000	12.900	0.880	0.140	0.360
	Arsenic	0.050	0.024	0.013	4.570	0.006	0.003	0.004
	Boron			0.050	<0.05	<0.05	<0.05	<0.05
	Barium	1.000		0.007	0.081	0.004	0.002	0.003
	Beryllium			<0.001	<0.001	<0.001	<0.001	<0.001
	Cadmium	0.005	0.000	0.009	0.002	<0.0001	<0.0001	<0.0001
	Cobalt			0.058	0.040	0.002	<0.001	<0.001
	Chromium	0.050	0.001	0.007	0.040	<0.001	<0.001	<0.001
	Copper	1.000	0.001	0.262	0.523	0.003	0.001	0.002
	Manganese	0.100	1.900	3.330	2.590	0.019	0.009	0.012
	Nickel	0.100	0.011	0.079	0.050	0.007	<0.001	0.001
	Lead	0.050	0.003	0.057	0.276	<0.001	<0.001	0.001
	Selenium			<0.01	0.010	<0.01	<0.01	<0.01
	Vanadium			<0.01	0.110	<0.01	<0.01	<0.01
	Zinc			0.763	0.195	0.052	0.012	0.012
	Iron	0.300		24.2	1240	2.61	0.14	1.01
Mercury				<0.0001		<0.0001	<0.0001	
Silicon				16.000		1.400	2.800	
Fluoride				<0.1		<0.1	<0.1	
Ionic Balance	Total Anions			13.900		1.300	0.510	
	Total Cations			9.610		0.970	0.420	
	Ionic Balance			18.400				

5.2.3 Description of Natural Processes

Both sites are situated in areas classified by the West Coast Council as bushfire prone. This is due to the natural flammability of the vegetation and organic rich substrate (refer Section 5.2.1). Fire risk is addressed in section 6.16. No other significant acts of natural processes (such as flooding, volcanic activity) are recorded in the vicinity.

5.2.4 Conservation Reserves and Evidence of Consent

The GPP and the majority of the GEM is situated on the Heemskirk Regional Reserve managed by DIPIPWE as detailed in Section 5.1.2 and Section 5.1.3. A Regional Reserve is crown land set aside under the *Nature Conservation Act 2002* for the purpose of:

> *"Mineral exploration and the development of mineral deposits in the area of land, and the controlled use of other natural resources of that area of land, including special species timber harvesting, while protecting and maintaining the natural and cultural values of that area of land.".*

At the time of writing the Proponent is currently pursuing written evidence of consent (to conduct mining) from the land manager of the Mount Heemskirk Regional Reserve (Parks and Wildlife Services Tasmania) as requested in the Project Specific Guidelines (Appendix I).

5.2.5 High Quality Wilderness

High quality wilderness areas are defined as an area larger than 8000 hectares having National Wilderness Inventory (NWI) ratings 12 or larger, estimated by the methodology used in the NWI. Areas identified as high quality wilderness under the *Tasmanian Regional Forest Agreement* are in the vicinity of both GPP and GEM. However the areas reside in the Heemskirk Regional Reserve which allows mining developments under the *Mining Resource Development Act 1995.*

5.2.6 Areas of Conservational Significance

Both sites are situated on the geoconservation feature 'Western Tasmania blanket bogs' (ID 2527 Natural Values Atlas), which are estimated to extend over 550,000ha (refer Section 6.7).

5.2.7 Site Vulnerability to Natural Hazards

Both sites are susceptible to the natural fire regime. Mitigation measures are presented in Section 6.16 to manage this risk.

The risk of flooding at GEM is greater during the winter months (refer Section 5.2.1.1). In order to mitigate the risk imposed by flooding at GEM it is intended that mining operations occur during the summer months.

5.2.8 Current Regulatory Approvals and Permits

Level 1 approval is current for 21M/2003 and 9M/2006 to treat up to 1,000m^3 of ore per annum (Appendix K). The two mining leases are held by Ten Star Mining Pty Ltd, a subsidiary of ANW.

5.3 Socio-Economic Aspects

5.3.1 Social/Demographic Characteristics

The area has a long history of mining activity and Zeehan's origins and economic base have been associated with the mining industry since the late 1800's.

The Granville Tin project is situated approximately 20km from Zeehan and 5km east of Granville Harbour. Granville Harbour is a small township of approximately 40 people (2011 census) with a median age of 63 years old. Zeehan has a population of 728 people with a median age of 36 (2011 Census).

The small scale of the proposal will not be influenced by or influence any social/demographic characteristic of the population.

5.3.2 Local and Regional Economy

The 2011 census data indicate that the predominate industry types of employment in Zeehan are mining, accommodation, retail and manufacturing. Median rent in Zeehan is $130 per week. Median income is $394 per week and 9.9 percent of the population identify as being unemployed.

The local businesses are well equipped to support a small scale mining operation.

6 Potential Impacts and their Management

Preamble

The potential impacts of this proposal and their management is broken down into key environmental issues. Each subsection commences with a summary of the identified risk and mitigation measures.

For each key environmental issue, the existing environment is described and the performance requirements for the proposed operation of the Granville Expansion are identified. The potential effects the Granville Expansion may have on existing conditions are then identified, and mitigation measures required to manage each issue are then outlined together with the predicted changes to that component of the environment on, and/or surrounding, the Granville Tin Project. The assessment of net impacts is then assessed against statutory criteria, goals or relevant guidelines and/or policies identified as performance requirements.

Risk is the chance of something happening that will have an impact upon the objectives or the task, which in this case is the development and operation of the Granville Expansion. Risk is measured in terms of consequence (severity) and likelihood (probability) of the event happening. For each environmental issue identified in the DPEMP, the potential environmental impacts have been allocated a risk rating based on the potential consequences and likelihood of occurrence, i.e. without consideration of appropriate design and operational safeguards.

The allocation of a consequence rating was based on the definitions outlines in Table 6.1. It is noted that the assigned consequence rating represents the highest level applicable, i.e. if a potential impact is assigned a level of 4 - Major based on impact to the environment and 2 - Minor based on area of impact, the consequence level assigned would be 4 - Major.

Table 6.1 - Qualitative Consequence Rating. Source HB 203:2006

Level	1	2	3	4	5
Severity Level	Insignificant	Minor	Moderate	Major	Severe
Financial	<$20k	20k - $250k	$250k - $1M	$1M-$5M	>$5.0M
Health and Safety	No injury or review required	First aid treatment required but no lost time or restricted duties	Medical treatment leading to lost time or restricted duties	Hospitalisation required leading to permanent injury	Fatality
Natural Environment	Minor impact on biological or physical environment	Short - term impact not affecting ecosystem functions	Short term impairment on ecosystem affecting function	Medium term impairment of an ecosystem	Long-term impairment of ecosystem
Social/Cultural heritage	Minor social issues, repairable damage	Minor medium term social impacts on local population. Mostly repairable	On-going serious social issues, damage to items of cultural significance	Significant social issues, significant damage to structures/items of cultural significance	On-going serious social issues, major permanent impact to cultural and heritage sites
Community/govt./reputation/media	Minor adverse local public or media attention or complaints	Attention from media and/or heightened concern by local community	Adverse media/public/NGO attention	Major public embarrassment/adverse media coverage	Serious public or media outcry (national coverage)/major reputation impact
Legal	Minor complaint/incident	Isolated complaint/incident with a threat of legal action	Significant level of complaints/incidents with a high threat of legal action	Serious breach of regulation leading to litigation	Significant prosecution and fines, litigation including class action
Variance from Business Performance	<2% variance from business plan, Nil or negligible loss of productivity	2% - 5% variance from business plan, minimal loss of productivity	5% - 15% variance from business plan leading to; disruption to productivity	15% - 30% variance from business plan leading to major loss of productivity	>30% variance from business plan with complete loss of productivity

The likelihood or probability of each impact occurring was then rated according to the definitions contained in Table 6.2.

Table 6.2 - Qualitative Likelihood Rating		
Level	**Descriptor**	**Description**
A	Almost Certain	Is expected to occur in most circumstances.
B	Likely	Will probably occur in most circumstances.
C	Possible	Could occur.
D	Unlikely	Could occur but not expected.
E	Rare	Occurs only in exceptional circumstances.
Source HB 203:2006 - Table 4(A)		

The risk associated with each environmental impact was assessed without the inclusion of any operational controls or safeguards in place and based on the qualitative assessment of consequence and likelihood. A risk ranking of low, medium, high or very high has been assigned to each potential impact based on the matrix of Table 6.3.

Table 6.3 – Risk Assessment Matrix

Likelihood	Consequences				
	Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
A (Almost Certain)	M	H	H	VH	VH
B (Likely)	M	M	H	H	VH
C (Possible)	L	M	H	H	H
D (Unlikely)	L	L	M	M	H
E (Rare)	L	L	M	M	H
Note: Rating modified after HB 203:2006 - Table 4(C)					

The four risk rankings are defined as follows;

Low (L): Manage by routine procedures, unlikely to need specific application of resources.

Moderate (M): Manage by specific monitoring or response procedures, with management responsibility specified.

High (H): Senior executive management attention needed, action plans and management responsibility specified.

Very High (VH): Board attention needed, action plans and management responsibility specified.

The following subsections utilise the above described analysis of risk scheme. Summarised risk tables are provided in Appendix A.

6.1 Air Quality

6.1.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (Appendix A), the potential air quality impacts requiring assessment and their unmitigated risk rating are as follows;

Table 6.4 - Unmitigated air quality risk rating

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Rating		
					Consequence	Likelihood	Risk Rating
Dust generation from mining and processing operations	Increased deposited and suspended particulates	Surrounding residence and buildings	Nuisance / amenity impacts from dust deposited on window sills, cars, surfaces etc.	Granville East Mine	1.	D	L
				Granville Processing Plant	1.	E	L
Wind action on disturbed areas and stockpiles			Adverse health impacts (if PM10 levels are excessive)	Granville East Mine	1.	D	L
				Granville Processing Plant	1.	E	L
Dust generation from vehicle movements on unsealed roads			Stress on native vegetation and indirect impacts upon fauna habitat	Granville East Mine	1.	D	L
				Granville Processing Plant	1.	E	L
			Reduced quality of downstream waters				
Vehicle emissions	Increased greenhouse and other gas emissions	Local air shed	Increased contribution to greenhouse effect	Granville East Mine	1.	A	M
				Granville Processing Plant	1.	A	M

Key: Consequence 1 to 5 (Table 6.1); Likelihood A to E (Table 6.2); Risk L to VH (Table 6.3)

The Proponent proposes to undertake a number of measures to reduce the consequence and likelihood of environmental risk to air quality, which in summary includes;

- Dust suppression employed on unsealed access road as appropriate;
- timing of production blasts and clearing may be governed by climatic conditions to reduce to the extent of possible dust emissions from GEM;
- implementation of a transportation "Code of Conduct" that will include *inter alia* permissible speed limits to reduce the potential for dust generation;
- procedures for placement of stockpiles;

- appropriate use of Personal Protection Equipment; and
- preparation and implementation of fibrous mineral management plan in the event asbestiform minerals are identified

The mitigated risk rating to air quality are detailed in Table 6.5.

Table 6.5 - Mitigated air quality risk rating

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Dust generation from mining and processing operations	Nuisance / amenity impacts from dust deposited on window sills, cars, surfaces etc Adverse health impacts (if PM10 levels are excessive) Stress of native vegetation and indirect impacts upon fauna habitat Reduced quality of downstream waters	Granville East Mine	L	• Time production blasts to suit climatic conditions • Dust suppression employed on unsealed access road as appropriate; • Preparation and implementation Fibrous mineral management plan if required • Appropriate PPE	1.	E	L
		Granville Processing Plant	L	• Dust suppression employed on unsealed access road as appropriate	1.	E	L
Wind action on disturbed areas and stockpiles		Granville East Mine	L	• Procedures for placement of stockpiles • Dust suppression employed on stockpiles as appropriate	1.	E	L
		Granville Processing Plant	L		1.	E	L
Dust generation from vehicle movements on unsealed roads		Granville East Mine	L	• Code of Conduct including 40km/hr speed limits • Dust suppression employed on unsealed access road as appropriate;	1.	D	L
		Granville Processing Plant	L		1.	C	L
Vehicle emissions	Increased contribution to greenhouse effect	Granville East Mine	M	• Appropriate maintenance program for vehicles	1.	A	M
		Granville Processing Plant	M		1.	A	M

The following subsections describe the existing air quality surrounding GEM and GPP, performance criteria, potential effects, avoidance and mitigation measures and assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.1.2 Existing Environment

Existing air quality is described in detail in Section 5.2.1. In summary, there is no quantitative data on regional ambient air quality in for either GEM and GPP. However, both sites are far removed from major industries and

major road networks. Both sites are largely covered by dense scrub and experience significant rainfall and wind activity (see Section 5.2.1). Prevailing winds are from the north, north west and west at both GEM and GPP (refer Section 5.2.1).

The closest sensitive receptor to GEM is a rural residence located approximately 2.2km west of the site (Figure 6.1). Granville Harbour is situated approximately 4.4km from GEM.

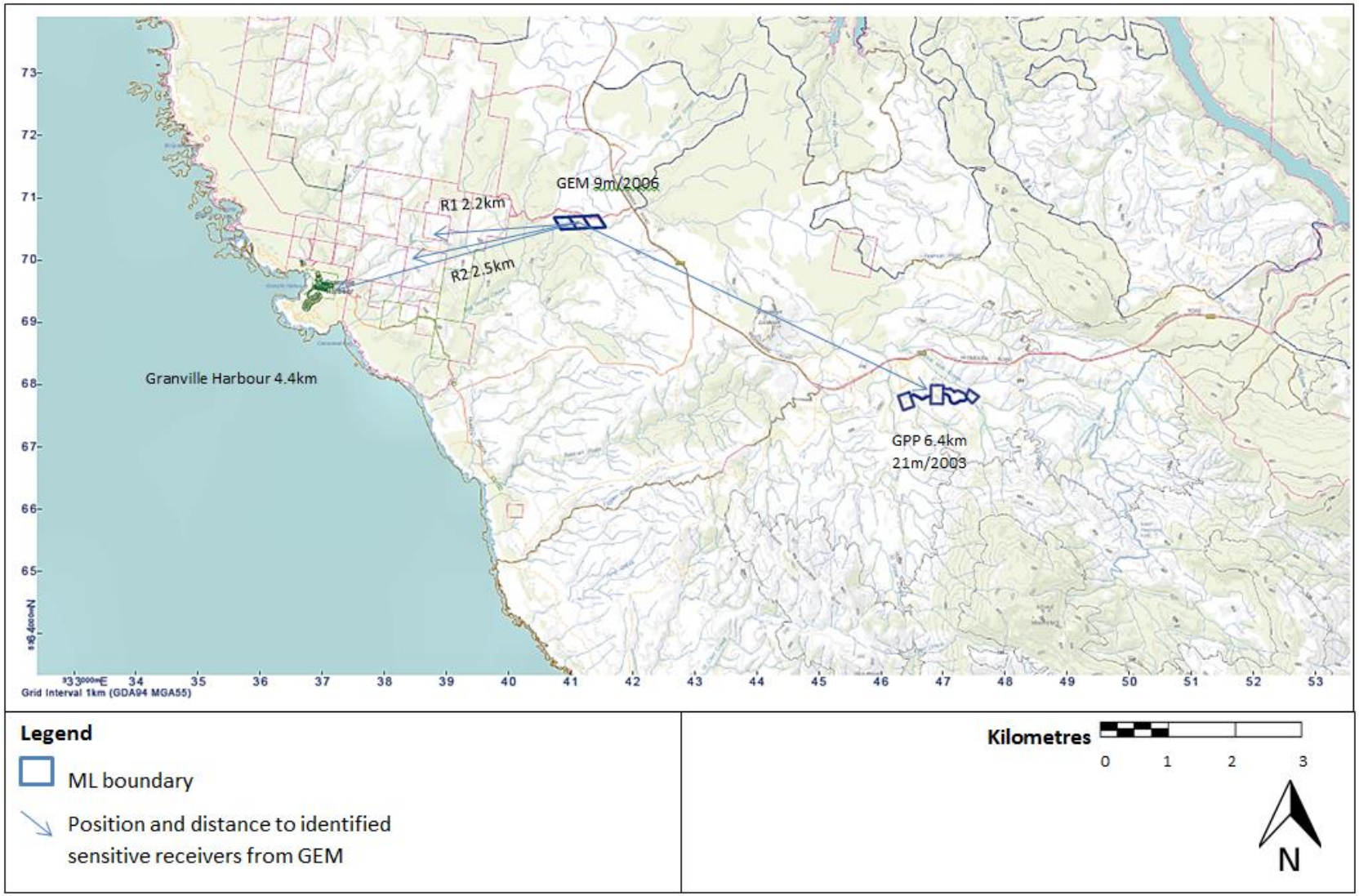


Figure 6.1 - Location of closest sensitive receiver to GEM.

6.1.3 Performance Requirements

Air emissions from the operation of the Granville Tin project must comply with the following;

- *Work Health and Safety Regulations 2012;*
- *National Environment Protection Measure (Air) – PM10 and PM2.5 limits at the boundary of premises;*
- *Tasmanian Environment Protection Policy (Air Quality) 2004;*
- *Tasmanian Quarry Code of Practice 1999;*
- *Tasmanian Environmental Management and Pollution Control 1994 environmental nuisance provisions;* and the
- *West Coast Council Planning Scheme.*

6.1.4 Potential Impacts

Dust can be a significant safety issue during clearing and excavation. It can hinder visibility and reduce efficiency of operations and become an environmental nuisance. It can cause respiratory annoyance and problems, reduce visual amenity and fall onto land or other surfaces in other ownership. It is in the best interests of the operator to maintain safe working conditions and minimise sources of dust and other air contaminants.

The primary sources of air contaminants during operations include;

- Dust generation from clearing and preparation of the ROM/Crusher Pad and PAF/NAF WRE at GEM;
- potential dust generation from stockpiles at both GEM and GPP and the WRE at GEM;
- dust generation from vehicle movements on unsealed roads;
- potential dust generation from crushing and processing operations at both GEM and GPP;
- dust from extraction activities (including blasting, excavation, loading, hauling and transport of materials);
- vehicle emissions from construction, mining, hauling and processing operations; and
- potential presence of naturally occurring fibrous minerals.

The greatest potential impact on air quality is during hot, dry windy periods. If appropriate management measures are not implemented, dust may be carried from site by prevailing winds.

The Proponent intends to undertake further test work to investigate the potential occurrence of fibrous minerals. If test work indicates the presence of naturally occurring, potentially hazardous fibrous minerals, a Fibrous Mineral Management Plan will be developed and implemented.

6.1.5 Avoidance and Mitigation Measures

The following mitigation measures will be utilised to minimise the generation of dust and vehicle emissions during construction and operations;

Dust suppression employed on unsealed roads, stockpiles and conveyer drop points as appropriate. If conditions are determined as facilitating dust dispersion, water suppression will be employed at identified sources of dust.

Timing of production blasts and vegetation clearance. During construction operations, wind and temperature levels will be assessed prior to land clearing. If conditions are deemed inappropriate then clearing activities will not be undertaken in dry hot, and windy conditions. Production blasts may be governed by climatic conditions to reduce to the extent of possible dust emissions from GEM;

Procedures for placement of stockpiles. Operators will be advised on use best practices when constructing stockpiles. (i.e minimising dust dispersion during loading/unloading (tipping height/rate), minimising segregation, height/diameter allowances (of stockpiles), stabilisation techniques (compacting where possible, to reduce fine particles susceptibility to become airborne).

Implementation of a transportation "Code of Conduct". Code of Conduct for all vehicles entering and leaving both GEM and GPP, including 40km/hr speed limits on unsealed roads**.** All persons entering the site will be advised on speed limits.

Appropriate maintenance program for vehicle. Regular upkeep on vehicles will ensure emissions are at their most efficient levels.

Fibrous mineral management plan. A Fibrous Mineral Management plan will be developed and implemented in the event any naturally occurring hazardous fibrous minerals are identified.

Appropriate PPE. The Proponent will provide all employees appropriate PPE as required. Employees will be encouraged to wear appropriate PPE when applicable.

6.1.6 Assessment of Residual Effects

After the implementation of the avoidance and mitigation measures outlined in Section 6.1.5, the Proponent expects that dust generation and other air emissions associated with the Granville Expansion will be kept to a minimum.

Given the distances to receptors, the prevailing winds and high rainfall, it is unlikely that dust and exhaust emissions from the proposed activities would have a detrimental effect on sensitive receptors or cause an environmental nuisance and/or health effects beyond mining lease boundaries.

6.2 Surface Water Quality

6.2.1 Summary

Based on the environmental risk analysis undertaken for Granville Expansion (Appendix A) the unmitigated potential risks, consequences and impacts for surface water are as follows;

Table 6.6 - Unmitigated surface water related risk

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Rating		
					Consequence	Likelihood	Risk Rating
Pollution of surface water due to mobilisation of sediments, hydrocarbon spill etc.	Decreased water quality to downstream water users	Downstream properties, Big Rocky Creeks and local tributaries, local flora and fauna	Reduced quality of downstream waters resulting in stress to (aquatic and riparian) flora and fauna)	Granville East Mine	2.	C	M
				Granville Processing Plant	2.	C	M
Pollution of surface water due to AMD	Decreased water quality to downstream water users	Downstream property, Big Rocky Creek and local tributaries, local flora and fauna	Reduced quality of downstream waters resulting in stress to (aquatic and riparian) flora and fauna)	Granville East Mine	3.	C	H
				Granville Processing Plant	3.	C	H
Reduction in Environmental Flow	Decreased water flowrate to downstream water users	Big Rocky Creek and local tributaries, local flora and fauna	Reduced natural surface water flows resulting in stress to (aquatic and riparian) flora and fauna	Granville East Mine	1.	C	L
				Granville Processing Plant	1.	D	L

The Proponent proposes to undertake a number of measures to reduce the consequence and likelihood of environmental risk to surface water, which in summary includes;

- Proposed construction/upgrade of surface water management structures;
- proposed construction of new WRE;
- classification and management of waste material to reduce the likelihood of generating AMD;
- implementation of management commitments for water monitoring and hydrocarbon spill management;
- upgrade of sediment retention pond to manage pit water discharge at GEM;
- implementation and management of surface water management plan and hydrocarbon spill management plan; and
- implementation and management of a Tailings Management Plan incorporated into operations at GPP.

Incorporating the proposed management controls, the mitigated consequences and impacts for risks to surface water are as follows;

Table 6.7 - Mitigated surface water risk rating

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Pollution of surface water due to mobilisation of sediments, hydrocarbon spill etc	Reduced quality of downstream waters resulting in stress to (aquatic and riparian) flora and fauna)	Granville East Mine	M	• upgrade/construction of surface water management structures • Upgrade of sediment retention ponds • Development and implementation of Hydrocarbon spill management plan • Implementation of surface water management plan	2.	D	L
		Granville Processing Plant	M	• Diversion drain around proposed TSF • Containment bunding at plant with diversion to process water dam. • Containment of hazardous materials including fuel • Implementation of surface water management plan	2.	D	L
Pollution of surface water due to AMD	Reduced quality of downstream waters resulting in stress to (aquatic and riparian) flora and fauna)	Granville East Mine	H	• Classification of waste material for NAF/PAF • New WRE's and Waste rock management plan • upgrade/construction of surface water management structures • Upgrade of sediment retention ponds • Implementation of surface water management plan	3.	D	M
		Granville Processing Plant	H	• Tailings management plan	3.	D	M

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating
Reduction in Environmental Flow	Reduced natural surface water flows resulting in stress to (aquatic and riparian) flora and fauna	Granville East Mine	L	• upgrade/construction of surface water management structures • implementation of surface water management plan	1. C L
		Granville Processing Plant	L	• upgrade/construction of surface water management structures • Implementation of Tailings management plan • Implementation of surface water management plan	1. C L

The following subsections describe the existing surface water environment surrounding GEM and GPP, environmental surface water criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.2.2 Existing Conditions

The receiving waters (including existing water quality) are described in some detail in Section 5.2.2. All available water quality information has been reviewed to identify existing water quality and define water quality objectives and assess possible effects of future mining and processing to surface water.

The Granville Tin Project is located in the sub-catchments of the larger, Pieman River catchment area. Both 12 Mile Creek and Big Rocky Creek are short, (less than 20km in length) low order rivers with a relatively small catchment area. Both rivers are shallow and narrow with a low flow rate. River bed characteristics are typical of low order, low energy creeks and sediments are comprised of material derived from the Oonah Formation.

Surface water infrastructure existing at the site are depicted in Section 2, and are briefly described below:

GPP

- Process water dam located to the north of processing facility. This dam has an estimated capacity of 2ML and is fed by the 12 Mile Creek Dam via the water race (Figure 2.2). Overflow from this dam reports back to 12 Mile Creek.
- The water race supplies water to the process water dam from the 12 Mile Creek Dam.
- 12 Mile Creek dam is a small sized dam (estimated capacity of 22.5 ML (22,500m^3) in the headwaters of 12 Mile Creek which supplies water to for processing operations.
- The existing TSF is thought to contain approximately 11,000 tonnes of tailings material from previous processing operations (Appendix J).
- A proposed TSF has been designed to store 40,000 tonnes of tailings material.
- Central Big H is a historical open cut pit (mined for tin) that is inundated with water.

GEM

- Sediment Retention ponds: a series of three ponds with a combined estimated water storage capacity of 80,000L. The ponds are designed to retain and treat water derived from the open cut pit at GEM prior to discharge to a tributary of Big Rocky Creek.
- Run-off management area: a bunded area designed to capture run off from the existing WRE.

Ambient Surface Water Conditions

The Proponent has conducted baseline water testing at both GEM and GPP to understand the ambient surface water conditions prior to the Granville Expansion. An in-depth overview of existing surface waters are provided in Section 5.2.2 and are briefly summarised here.

The results of an initial sampling event by the Proponent indicate that background surface water quality values at GEM and the GPP naturally exceed ANZECC guidelines in a number of parameters. Surface water results indicate that natural regional pH values are around 4.4 to 5.15 (refer Appendix M). Levels of Fe and Al are also elevated relative to ANZECC guidelines in relation to human interaction in waters upstream of GEM, and Al and Mn in ANZECC 95th percentile values for freshwater ecosystems.

The elevated concentration in metals and a relatively low pH in background surface water is likely due to the local organic and metalliferous rich soils and may also be influenced by reginal scale metamorphism (and subsequent enrichment of metals and metalloids). The interaction of meteoric water with carbon rich soils typically results in the formation of carboxylic and humic acids, which in turn, lowers pH conditions of surface waters. Lower pH conditions (coupled with reducing conditions as a result of microbial decay of organics) are optimal for elements such as Fe and Al to form soluble mineral phases, and subsequently enter solution. These naturally occurring phenomenon may explain why regional background values exhibit elevated concentrations of Fe and Alas well as a lower pH.

Surface waters of Central Big H, existing TSF, existing TSF seepage waters (prior to the construction of the proposed TSF), the Open Cut Pit at GEM and immediately downstream of the discharge point in the tributary to Big Rocky Creek (prior to the sediment retention pond upgrade), all commonly contain elevated concentrations of Al, Fe, As, Ni and Mn relative to ANZECC guidelines in relation to human interaction. However at receiving waters located downstream of discharge points, the concentration of analysed elements return to levels observed in background samples.

6.2.3 Performance Requirements

Regulations and State Policies

Water emissions are regulated by the State Policy of *Water Quality Management 1997*

This policy aims to achieve sustainable development of Tasmania's surface water and ground water by protecting or enhancing their qualities while allowing for sustainable development. The policy covers PEV's derivation of water quality objectives, management of point sources of pollution (including discharge limits and mixing zones), management of diffuse sources, AMD, and water quality management.

Environmental Management and Pollution Control Act 1994 (EMPCA)

This policy aims to manage polluting activities that is likely to be causing serious or material environmental harm or environmental nuisance, or is likely to cause serious or material environmental harm or environmental nuisance in the future if not appropriately managed.

The *West Coast Council Interim Planning Scheme 2013* (E10 water and waterway Code) also applies here.

Surface Water Quality Objectives

Procedures followed to set the water quality objectives have been established by ANZECC (ANZECC,2002) and are summarised as;

- Identify the Protected Environmental Values (**PEVs**) for the water body receiving the discharge;
- identify components in the emission with the potential to degrade water quality;
- establish quantitative water quality objectives for these components; and
- establish the background level of these components in the ambient environment.

PEVs vary according to the relationship of surface waters to state forest and private land. PEVs for 12 Mile Creek and Big Rocky Creek are outlined in the *Environmental Management Goals for Tasmanian Surface Waters West Coast Municipal* Area(2000) (Table 1, p. 18).

The Department of Primary Industries, Parks, Water and Environment (DPIPWE) provide access to the database of the Conservation of Freshwater Ecosystem Values (CFEV) project. The Conservation Management Priority for Big Rocky Creek is low and moderate for 12 Mile Creek.

The CFEV database indicates that fish are absent or have a low probability of occurrence and/or at very low densities in drainage systems in the vicinity of GPP and GEM. Most of the river sections are in near-natural condition.

The Australian National Water Quality Management Plan (NWQMS) aims to achieve the sustainable use of Australia's and New Zealand's water resources by protecting and enhancing their quality while maintaining economic and social development. The approach is based on calculations of a probability distribution of aquatic toxicity end-points. It attempts to protect a pre-determined percentage of species, usually 95 percent, but enables quantitative alteration of protection levels. The 95 percent protection level is most commonly applied in these Guidelines to ecosystems that could be classified as slightly to moderately disturbed and, subsequently, are used as a reference for applicable levels for surface water quality in this study.

Water quality objectives are, at a minimum, to maintain existing up stream water quality and if possible improve water quality downstream so that the receiving environment improves over time. It is proposed that limits for surface water quality downstream of GEM be set as for ANZECC guidelines for freshwater ecosystems (95 percentile) or at levels observed prior to level 2 operations with the exception for pH, manganese, aluminium and iron, which are observed to be naturally in excess of ANZECC recommended guidelines relation to human interaction, and in some cases exceeded the 95 percent for freshwater aquatic ecosystems in background areas (Al, Zn, Mn). Water quality objectives for these elements will instead be set at levels comparable with the upstream environment as outlined below;

Table 6.8 - concentrations and location of background surface water concentrations

	ANZECC guidelines trigger values for human interaction (mg/L)	ANZECC guidelines trigger values for freshwater(South East Australia lowland river) (mg/L) (level of protection 95percent species)	Granville East Mine	Granville Processing Plant
Point of Measurement			GEMWE001 (E341374/N5370843) (mg/L)	GPPWC001 (E347227/ N5367823)
pH	6.5-8.5	6.5-8.0	5.15	5.1
Sulphate	400		39.00	5
Al >6.5	0.200	0.055	1.60	0.14
As III	0.050	0.024	<1	0.003
Co	-	-	0.001	<0.001
Cu	1.0	0.014	0.002	0.001
Cr III	0.050	-	0.005	<0.001
Fe	0.3	-	3.00	0.14
Mn	0.10	1.900	3.0	<1
Ni	0.1	0.011	0.005	<0.001
Zn	5.0	0.008	0.008	0.012

Metals are assumed to be present in an oxidised state in surface waters unless anecdotal evidence suggests otherwise.

6.2.4 Potential Impacts

GPP and GEM operate in areas where on average, evaporation is exceeded by precipitation for the majority of the year (Section 5.2.1). This indicates that a “closed” water circuit cannot be maintained and water discharges must occur.

There will be a limited number of surface water discharge associated with GPP and GEM, including;

- Mine pit dewatering at GEM;
- storm water diversions from proposed ROM/WREs at GEM and ROM at GPP;
- runoff from existing and proposed WREs at GEM and ore stockpiles at both GEM and GPP;
- decant from sediment retention ponds at GEM; and
- decant from proposed TSF at GPP.

The primary potential surface water impact is the potential generation of drainage that is both acidic and contains elevated concentrations of dissolved metals. The characteristics of each potential emission source are described in the following section.

Granville East Mine

Because of legacy management of discharge at GEM, local water quality is poor, being acidic and with elevated metal concentrations due to the interaction of exposed weathered substrate and exposed waste rock material with meteoric and ground waters (Section 5.2.2).

The potential impacts at GEM include the following:

- Pollution of surface water due to sedimentation and/or hydrocarbons and consequential impact on downstream water quality. During construction of ROM/Crusher-pad and proposed WRE, existing soil and vegetation will be disturbed and runoff from these areas and internal access roads may contain elevated suspended solids.
- A reduction in water quality due to AMD resulting in stress to (aquatic and riparian) flora and fauna. Discharge from stockpiles and waste piles at the site have the potential to be of poor quality at times, and typical of existing drainage at the area. Surface water discharge from these locations is largely dependent on precipitation events at the site.
- A reduction in environmental flow and potential stress to downstream flora and fauna due to the operation of the open cut pit which may impact on total water entering the tributary to Big Rocky Creek, subsequently impacting total flow rates down stream.

Granville Processing Plant

Discharge at GPP will be reduced due to the incorporation of water recycling during processing operations. Water from the proposed TSF will be recycled to the Process Water Dam, with any additional water requirements made up from fresh water from the 12 Mile Creek Dam (via the water race). Other water emissions will be limited and will include surface water runoff from the GPP buildings.

The potential impacts at GPP include the following:

- Pollution of surface water due to sedimentation and/or hydrocarbons and consequential impact on downstream water quality resulting in stress to (aquatic and riparian) flora and fauna. Fuel and oil will be contained at site within the processing plant. Inadequate containment within the existing TSF, plant site and/or bunding of hydrocarbons and hazardous materials could detrimentally impact water quality.
- Pollution of water quality due to AMD and consequential impact on downstream water quality resulting in stress to (aquatic and riparian flora and fauna). Discharge of water originating from the existing TSF and stockpiles at GPP may potentially be acidic (due to the breakdown of primary sulphide minerals), and subsequently impact downstream water quality.
- A reduction in environmental flow and potential to stress downstream (aquatic and riparian) flora and fauna**.** Operation of dams impact on total water flow which may impact on native flora and fauna.

6.2.5 Avoidance and Mitigation Measures

Granville East Mine

Upgrade of sediment retention ponds. The Proponent intends to upgrade the GEM retention ponds by constructing a fourth sediment retention pond (refer Figure 2.10), and an extended pre-treatment basin with acid consuming material (crushed and washed limestone) aimed to buffer acidic surface water discharge derived from the open cut pit prior to entering the sediment retention ponds (refer Section 2.2.4). The neutralisation of metalliferous waters will create conditions more favourable for the precipitation of solid mineral phases, subsequently reducing the total dissolved metal content of mine pit water discharge and limiting metal mobility.

Mine pit waters will be pumped to the pre-treatment basin where the water will percolate through limestone material ($CaCO_3$) and flow into the first (eastern most sediment pond) of a series of four sediment retention ponds. The upgraded ponds will have an expanded total combined capacity which will be finalised prior to construction. Water decant via gravity from sediment pond 1 in the east, consecutively through to the fourth sediment pond in the west before discharging into the tributary to Big Rocky Creek (Figure 2.10).

Proposed NAF/PAF Waste Rock Emplacements. The Proponent has identified that the current positioning of waste rock emplacement is not an effective site for the management of waste material, and a new PAF/NAF

WRE will be constructed (see Sections 2.2.2 and 6.5). The purpose of this new PAF/NAF WRE is aimed at better managing potentially acidic and metalliferous point source surface water emissions.

Classification and management of waste rock materials. The Proponent will manage waste rock material derived from GEM in accordance with the preliminary Waste Rock Management Plan (Appendix L and Section 6.5.5). This aims to implement management procedures in order to mitigate potential impacts associated with AMD (refer Section 6.5).

Surface water management structures. A series of diversion banks will be constructed surrounding the proposed ROM/Crusher pad and proposed WRE in order to divert and disperse clean storm water runoff into the surrounding environment, while containing potential AMD (refer section 2.2.5). Appropriate bunding and drainage channels will be constructed at GEM to limit the potential for sediment laden waters to discharge into the surrounding environment.

A series of drainage channels (Figure 2.9) will direct surface water emissions down slope from the PAF section of the proposed WRE and into the open cut pit prior to being pumped to the upgraded sediment retention ponds. In addition, all stockpiles will incorporate drainage channels with the aim of diverting surface water emissions from the stock piles to the open cut pit or sediment retention ponds.

Water Monitoring and Hydrocarbon Spill Management Plan. The Proponent will implement procedures to reduce the likelihood or consequence of surface water contamination and adopt appropriate management protocols should an event arise. Furthermore water monitoring at GEM will be undertaken by the Proponent and is detailed in Section 7 of this DPEMP.

Appropriate containment of hydrocarbons. all fuels and oils will be contained on site within appropriately constructed containment areas in accordance with EPA Tasmania's *Bunding and Spill Management Guidelines 2015*.

Granville Processing Plant

Tailing management commitments. Tailings will be managed in accordance with the preliminary tailings management plan detailed in Section 6.5.5.

Water monitoring and Hydrocarbon Spill Management Plan. The Proponent will implement procedures to reduce the likelihood or consequence of surface water contamination and adopt appropriate management protocols should an event arise. Furthermore water monitoring at GPP will be undertaken by the Proponent and is detailed in Section 7 of this DPEMP.

6.2.6 Assessment of Net Impacts

Granville East Mine

An assessment of net impacts following the implementation of proposed avoidance and mitigation measures at GEM is outlined in Table 6.7. Proposed mitigation measures are aimed at reducing the current sites localised impact on the environment. Following the upgrade of the Sediment Retention Ponds and the construction of the new PAF/NAF WRE and diversion channels, the Proponent will expect to observe (through monitoring programs outlined in Section 7) an improvement in the water quality discharged into the tributary to Big Rocky Creek.

The Proponent does not expect that the proposed Granville Expansion will have any further adverse effects on surface water conditions at GEM, and therefore offsetting unavoidable adverse impacts is deemed not necessary.

Granville Processing Plant

An assessment of net impacts following the implementation of proposed avoidance and mitigation measures at GPP is outlined in Table 6.7. Following the implementation of proposed mitigation measures, the Proponent expects that potential detrimental effects to surface water quality will be negligible. The Proponent does not expect that the proposed Granville Expansion operations will have any further adverse effects on surface water conditions at GPP.

The implementation of proposed avoidance and mitigation measures at GEM and GPP will reduce the potential environmental nuisance imposed by mining and processing operations to surface water quality at both locations.

6.3 Groundwater

6.3.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (Appendix A), the potential groundwater impacts requiring assessment, and their unmitigated risk rating are as follows:

Table 6.9 - Unmitigated Groundwater related risk

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Pollution of ground water due to seepage or hydrocarbon spills	Decreased groundwater quality	Surrounding landholders utilising groundwater bores	Reduced groundwater quality causing reduced availability for existing users	Granville East Mine	3.	C	H
				Granville Processing Plant	3.	C	H
Reduction in groundwater levels due to drawdown	Decrease in availability of groundwater Reduction or cessation of local spring flows Reduction in quantity of water stored in local aquifers	Surrounding groundwater dependent ecosystems Local spring and groundwater aquifers	Reduction in groundwater levels Degradation of groundwater dependent ecosystems	Granville East Mine	3.	C	H
				Granville Processing Plant	3.	D	M

The Proponent proposes to undertake a number of measures to reduce the consequence and likelihood of environmental risk to groundwater water, which in summary includes;

- Upgrade of Sediment Retention Ponds to manage intercepted groundwater entering open cut pit at GEM;
- designing and implementing a hydrocarbon management plan to prevent contamination of groundwater from hydrocarbons;
- appropriate storage of hydrocarbons to further reduce likelihood of hydrocarbon contamination of groundwater;
- final mine rehabilitation to reduce the long term impact on groundwater values;
- incorporating a HDPE liner in the proposed TSF to minimise the potential for seepage to contaminate groundwater; and
- install two ground water monitoring bores (one each at GEM and GPP).

The mitigated risk rating to groundwater are as follows;

Table 6.10 - Mitigated Groundwater risks

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Pollution of ground water due to seepage or hydrocarbon spills	Reduced groundwater quality causing reduced availability for existing users	Granville East Mine	H	• Upgrade of Sediment Retention Ponds • Hydrocarbon spill management plan • Groundwater monitoring prior to mining	2.	D	L
		Granville Processing Plant	H	• Containment of hazardous material including fuel • Appropriate lining of proposed TSF	2.	D	L
Reduction in groundwater levels due to drawdown	Reduction in groundwater levels Degradation of groundwater dependent ecosystems	Granville East Mine	H	• Final mine rehabilitation	3.	D	M
		Granville Processing Plant	M	• Final mine rehabilitation	2.	D	L

The following subsections describe the existing groundwater environment surrounding GEM and GPP, environmental groundwater criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.3.2 Existing Environment

As indicated in Section 5.2.2, no previous on-site groundwater investigations have been undertaken at GEM and GPP. In spite of a large number of drill holes in the vicinity of this site, no available data references groundwater occurrence at both locations. Observations on groundwater can only be made based on the occurrence of groundwater entering the open cut pit at GEM and regional geological mapping provided by Mineral Resources Tasmania.

Granville East Mine

A small amount of water enters the open pit at GEM indicating that groundwater has been intercepted (Plate 6.1).

Plate 6.1 - Open Pit at GEM looking south with groundwater seepage highlighted

This indicates that a likely perched water table has been intercepted. The perched water table likely consists of the overlying peats and weathered, surficial profile. This would have included permeable talus and colluvium, and the outermost fractured and weathered zone of the bed rock. The metamorphic grade of underlying bedrock would have limited the permeability of water and subsequently restrict the development of an aquifer at depth. The proximity of the open pit relative to the tributary of Big Rocky Creek also indicates that this is the likely source of groundwater.

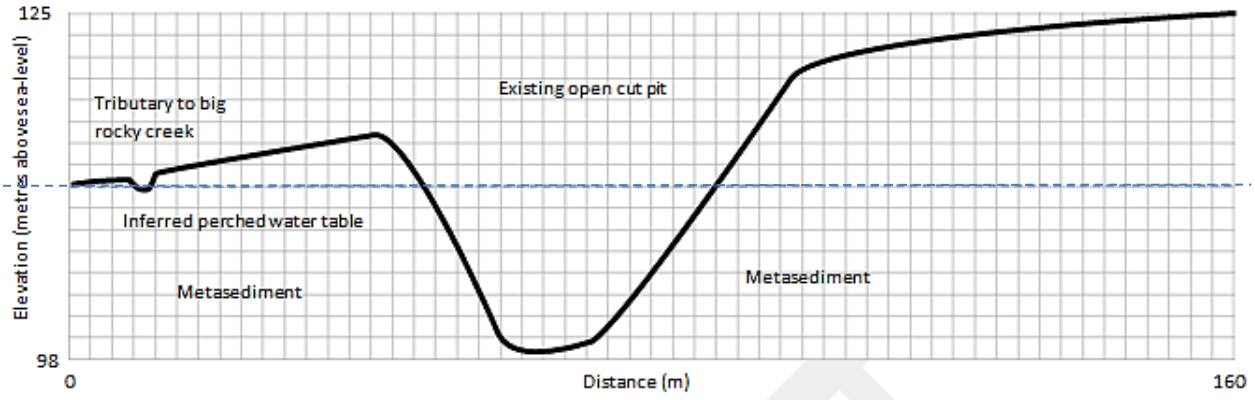


Figure 6.2 - Diagram of inferred perched water table (cross section looking north)

Legacy mining operations have impacted on existing groundwater resources. Initial field test work on this groundwater seepage indicates that water entering the pit has a pH of 6.4. This is likely due to the percolation of groundwater through carbonaceous metasediments in the footwall. The Proponent intends to undertake further geochemical test work to better understand the chemical constituents of groundwater (refer to section 7).

Granville Processing Plant

No on-site investigations into groundwater have occurred at GPP. Proposed level two operations at the Granville processing plant will not affect groundwater conditions.

6.3.3 Performance Requirements

Groundwater emissions must comply with the following;

- *State Policy on Water Quality Management 1997;*
- *Environmental Management and Pollution Control Act 1994;*
- *Water Management Act 1999;* and
- *Groundwater Act 1985.*

6.3.4 Potential Impacts

Potential effects vary from GEM and GPP.

Granville East Mine

Continued unmitigated operation of the open cut pit at GEM will potentially have a detrimental effect on the following;

- reduction in groundwater levels;
- degradation of groundwater dependent ecosystems; and
- potential for potentially detrimental surface water to seep into the local water table.

Granville Processing Plant

Operations at GPP will not directly encounter groundwater (based on evidence from test pits excavated during geotechnical and engineering investigations of the proposed TSF) and thus the potential effects are very limited. However there is the potential for contaminated surface water to seep into the local water table. The design of the proposed TSF (refer Section 2.3) also incorporates a HDPE liner which will mitigate the risk to ground water quality by minimising groundwater infiltration from water stored in the proposed TSF.

6.3.5 Avoidance and Mitigation

The mitigation measures proposed to protect surface waters from fuel/oil, sewage and potentially AMD contamination will also protect groundwater. These are detailed in Section 6.2.5. In addition to mitigation measures outlined in Section 6.2.5, The Proponent also intends to adopt the following avoidance and mitigation measures to protect existing groundwater quality;

Upgrade of Sediment Retention Ponds. The Proponent proposes to upgrade the existing retention ponds which will incorporate an acid neutralising agent to buffer potentially acidic water. The buffering of metalliferous waters will create conditions more favourable for the precipitation of solid mineral phases, subsequently reducing the total dissolved metal content of mine pit water discharge and metal mobility.

Hydrocarbon Spill Management Plan. The Proponent will implement procedures to reduce the likelihood or consequence of groundwater contamination and adopt appropriate management protocols should an event arise.

Final mine rehabilitation to reduce the long term impact on groundwater. Final rehabilitation of the pit will likely benefit the local groundwater levels however will ultimately sterilise the resource. Final mine rehabilitation will only occur following the depletion of existing ore reserves. Finial mine site rehabilitation is discussed in Section 8.

HDPE lined proposed TSF. The proposed TSF will contain a HDPE liner in order to minimise the interaction between aqueous tailings material and groundwater (Appendix N).

Appropriate containment of hydrocarbons. all fuels and oils will be contained on site within appropriately containment areas.

Finalise the location of 2 ground water monitoring bores. (1 at GPP and 1 at GEM) and commencement of groundwater monitoring prior to mining operations.

6.3.6 Assessment of Effects

There is not expected to be any interaction with or impact on the groundwater at GPP and significant environmental impacts are not expected at the site following the implementation of the proposed mitigation measures.

Continued operation of the open pit at GEM will impact on local groundwater conditions. Following exhaustion of resource at the site, final rehabilitation will commence, and groundwater conditions are expected to improve. The implementation of the proposed mitigation measures will minimise the potential impact on groundwater at GEM.

6.4 Noise Emissions

6.4.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (see Appendix A), the potential noise impacts requiring assessment and their unmitigated risk rating are as follows;

Table 6.11 - Unmitigated noise related risk

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Increased noise levels resulting from operations of equipment	Decreased amenity	Surrounding residents, landowners and fauna	Increased noise levels associated with construction and operational activities causing annoyance, distractions and reduced production (livestock) and impact on local flora and fauna	Granville East Mine	2.	C	M
				Granville Processing Plant	1.	D	L
Increased noise levels resulting from product transportation	Health related issues			Granville East Mine	1.	D	L
				Granville Processing Plant	1.	D	L
Increased noise levels from blasts (ground vibration and air blast overpressure)	Decreased land values			Granville East Mine	1.	C	L
				Granville Processing Plant	1.	D	L

The Proponent proposes to undertake a number of measures to reduce the consequence and likelihood of environmental risk from noise emissions, which in summary includes;

- Construction, mining and processing operations to occur during day shift only;
- natural topography and woodlands to be utilised to extent possible to provide a sound barrier to sensitive receivers;
- timing of production blasts may be governed by climatic conditions;
- providing advanced notice of blasting to local, sensitive receptors;
- proposed monitoring for noise associated with blasting at selected locations, to provide reference for manage excessive levels;

- implementation of a drivers "Code of Conduct" that will include *inter alia* permissible noise limits and restricted travel periods; and
- implement and maintain a feedback register.

The mitigated risk rating to noise are as follows;

Table 6.12 - Mitigated risks related to noise emissions

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Rating		Risk
					Consequence	Likelihood	Risk Rating
Increased noise levels resulting from operations of equipment	Increased noise levels associated with construction and operational activities causing annoyance, distractions and reduced production (livestock) and impact on local flora and fauna	Granville East Mine	M	• Construction and mining operations to occur during day shift only; • Natural topography and vegetation to be utilised to extent possible to provide a sound barrier to selected receivers • Proposed monitoring program for noise	2.	D	L
		Granville Processing Plant	L	• Processing operations to occur during day shift only; • Proposed monitoring program for noise	1.	D	L
Increased noise levels resulting from product transportation		Granville East Mine	L	• operations to occur during day shift only; • Proposed monitoring program for blasting • Implementation of a drivers "Code of Conduct" • Implement and maintain a feedback register	1.	D	L
		Granville Processing Plant	L	• operations to occur during day shift only; • Proposed monitoring program for noise	1.	D	L
Increased noise levels from blasts		Granville East Mine	L	• Timing of production blasts may be governed by climatic conditions; • Advanced notification of blasting activities	1.	D	L
		Granville Processing Plant	L	• N/A	1.	D	L

The following subsections describe the existing noise environment surrounding GEM and GPP, environmental noise criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.4.2 Existing Conditions

An Environmental Noise Impact Assessment was undertaken by West Coast Wind Pty Ltd in 2013. The location of this proposed project is approximately 2km from GEM and approximately 7km from GPP. Ten Star Mining considers the information contained within this assessment to adequately detail the existing ambient noise conditions at both GEM and GPP, although no background survey data was completed in West Coast Wind's noise assessment (This report can be accessed at EPA Tasmania on http://epa.tas.gov.au/regulation/document?docid=1313).

Ambient noise levels at GEM are considered to be moderate due to its proximity to the Southern Ocean and strong prevailing winds. Ambient noise levels at GPP can be considered low due to the absence of any consistent noise sources in the area apart from strong prevailing winds and traffic on Heemskirk Road. The closest receiver is situated approximately 2.2km west of GEM and the closest receiver to the GPP is the GEM, over 6km away.

6.4.3 Performance Requirements

Noise emissions from proposed activities at both GEM and GPP must comply with the following;

- *Environmental Management and Pollution Control Act 1994* – environmental nuisance;
- *Environmental protection (Miscellaneous Noise) Regulation 2004;*
- The *Quarry Code of Practice*; and
- *West Coast Council Interim Planning Scheme 2013.*

Criteria for blasting outlined in ANZECC publication *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration 1990* and is summarised as follows;

- The recommended maximum overpressure level for blasting is 115dB;
- the level of 115dB may be exceeded for up to five percent of the total number of blasts over a 12-month period, but should not exceed 120dB at any time;
- the recommended maximum vibration velocity for blasting is 5mm/s Peak Vector Sum (PVS);
- the PVS level of 5mm/s may be exceeded for up to five percent of the total number of blasts over a 12-month period, but should not exceed 10mm/s at any time;
- blasting should generally only be permitted during the hours of 9am to 5pm Monday to Saturday, and should not take place on Sundays and Public Holidays; and
- blasting should generally take place no more than once per day.

6.4.4 Potential Impacts

Noise has the potential to cause environmental nuisance at residential premises and other sensitive uses.

During construction, noise emissions will result from the operation of heavy equipment, including earthmoving equipment and trucks associated with construction activities at GEM and GPP.

During operations, noise emissions will result from heavy equipment during mining, crushing and hauling operations at GEM, and processing equipment, heavy equipment and hauling at GPP.

Table 6.13 identifies the potential sources of noise emissions at both GPP and GEM.

Table 6.13 - Noise Sources Lw dB(A)			
Equipment	Indicative Number	Use	Maximum emissions Lw dB(A)
D8 Bulldozer	1	Trimming proposed WRE	112
Atlas Copco T35	1	Drilling of ore for blasting.	110
WA470-1 Loader	1	Stockpile management/loading blasted rock.	109
320D Cat Excavator	1	Loading of blasted rock to crusher	111
Cat 769 30t Haul Truck	2	Transportation of products to stockpiles.	112
Ball Mill	1	Ore comminution (grinding)	98
HOWCAM Feeder /Trommel / Jig	1	Ore Pre-concentration	98
McCloskey J50 crusher	1	Primary crushing	112
10 000L Water truck	1	Dust suppression.	108
5 000L Mini tanker	1	Refuelling of mobile and fixed plant.	108

Noise emissions will also result from blasting at GEM, however, no receiver is within 1km of the site and will not be affected. Noise monitoring will be conducted during initial blasting events to ascertain air blast overpressure and ground vibration results at various distances.

6.4.5 Avoidance and Mitigation Measures

The Proponent proposes a series of management controls to reduce the consequence and likelihood of environmental impacts or risks from noise which in summary include:

Construction and mining operations to occur during day shift only. Operations will be conducted between 06:00 and 19:00 to minimise the impact of any noise or vibration emissions during the night.

Natural topography and vegetation to be utilised to extent possible to provide a sound barrier to selected receivers. The location of GEM and GPP are such that topographical features provide a natural sound barrier to sensitive receives. Also the dense vegetation to the east of the open cut pit at GEM will be retained and further aid in the reduction of noise from the site.

Timing of production blasts may be governed by climatic conditions. In consultation with the blasting contractor, climatic conditions including wind direction and strength may be assessed for suitability to reduce the impact of noise and dust emissions.

Advanced notification of blasting activities. neighbouring residents or those potentially affected would be notified prior to production blasts. In conjunction with the blasting contractor, a specified window for blasting activities will be nominated (likely between 10:00 and 14:00) with blasting to occur between Monday and Friday only.

Proposed noise monitoring at selected locations. Monitoring of noise will occur at selected receivers during initial blasting to ascertain blasting overpressure and vibration levels. These results will be retained and made available on request from an appropriate staff member. In the event that monitoring exceeds applicable criteria, investigations into additional management measures would be undertaken, with additional monitoring undertaken to verify the success of these measures.

Implementing a "Code of Conduct" for transport activities that will include inter alia permissible noise limits. Speed limits at site will be 40km/h to reduce noise levels associated with vehicle movement. Drivers will also be encouraged to utilise noise reducing driving techniques.

Implement and manage a community feedback register. The Proponent will be responsible for the implementation and management of the feedback register. The register will be available to all members of the public.

6.4.6 Assessment of Residual Effects

Adherence to the mitigation measures as outlined above, will ensure that any noise effects from construction, mining and processing operations at GEM and GPP will be kept to acceptable levels. As a result;

- Noise from equipment will meet the requirements of the *Environmental Management and Pollution Control (Miscellaneous Noise) Regulations 2004;*
- The occupational health and safety requirements of the *Work Health and Safety Act 2012 and the Workplace Health and Safety Regulations 2012* will be met; and
- Environmental nuisance caused by noise from extractive and processing operations will be minimised following the implementation of proposed mitigation measures.

6.5 Waste Management

6.5.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (Appendix A) the unmitigated potential risks, consequences and impacts for waste management are as follows;

Table 6.14 - Unmitigated waste material related risk

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Rating		Risk
					Consequence	Likelihood	Risk Rating
AMD/metalliferous drainage generated from Waste Rock Material	Decreased soil and water quality in surrounding environment	Immediate vicinity of WREs, local tributaries, local flora and fauna	Reduced quality of local ecosystem	Granville East Mine	3.	C	H
				Granville Processing Plant	3.	C	H
AMD/metalliferous drainage generated from Tailing material	Decreased soil and water quality in surrounding environment	Immediate vicinity of WREs, local tributaries, local flora and fauna	Reduced quality of local ecosystem	Granville East Mine	N/A	N/A	N/A
				Granville Processing Plant	3.	C	H
Environmental nuisance or harm from solid municipal waste	Decreased habitat value. Decrees in site safety	Immediate vicinity of Granville East Mine and Granville Processing Plant	Reduced quality of local ecosystem	Granville East Mine	1.	C	L
				Granville Processing Plant	1.	C	L

The Proponent proposes to undertake a number of measures to reduce the consequence and likelihood of environmental risk imposed by waste material, which in summary includes;

- Proposed construction of PAF/NAF Waste Rock Emplacement (WRE) to the east of the open pit at GEM;
- preparation and implementation of a Waste Rock Classification Management Plan;
- preparation and implementation of a Tailings Management Plan;
- provide municipal waste management strategies along with appropriate waste disposal facilities; and
- proposed construction and operation of proposed new TSF.

Incorporating the proposed management controls, the mitigated consequences and impacts for risks to waste management are as follows;

Table 6.15 - Mitigated potential risk from waste material

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
AMD/metalliferous drainage generated from Waste Rock Material	Reduced quality of local ecosystem	Granville East Mine	H	• Waste rock classification management plan • Construction of new PAF/NAF WRE • Upgrade of sediment retention pond	3.	D	M
		Granville Processing Plant	H	• Tailings management plan	3.	D	M
AMD/metalliferous drainage generated from Tailing material	Reduced quality of local ecosystem	Granville East Mine	N/A		N/A	N/A	N/A
		Granville Processing Plant	H	• Tailing management plan • Proposed TSF	2.	D	L
Environmental nuisance or harm from solid municipal waste	Reduced quality of local ecosystem	Granville East Mine	L	• Management of municipal waste • Provide refuse facilities	1.	C	L
		Granville Processing Plant	L	• Management of municipal waste • Provide refuse facilities	1.	C	L

The following subsections describe the existing waste material at GEM and GPP, environmental waste criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.5.2 Existing Environment

Legacy operations across both GPP and GEM have resulted in a significant accumulation of waste material. Ineffectual management of rock and tailing waste material as well as stockpile management has had a detrimental effect on the surrounding environment.

6.5.2.1 Waste Rock Material

Waste rock material is defined as all non-ore material that must be excavated to gain access to ore. Waste will be removed using excavators and dump trucks and transported to the proposed WRE. Waste rock material will be identified and emplaced according its geochemical properties and the Waste Rock Management Plan (refer Section 6.5.5).

The primary factor that controls waste rock management is the potential of material to produce acid, with the consequent generation of drainage that is both acidic and contains elevated concentrations of dissolved metals.

The composition and variability of the waste material from the pit were therefore evaluated in terms of their geochemistry, with a focus on acid-forming potential.

Key geological material extracted from the open cut pit include,

- Banded magnetite-carbonate (skarn) (including 'massive clay-magnetite' mineralised horizon)
- H/W Quartzite
- F/W Shale
- H/W Shale

a b

Plate 6.2 - GEM pit a) south end hanging-wall material and b) north end foot wall material with blast collars for next mine bench in mineralised skarn

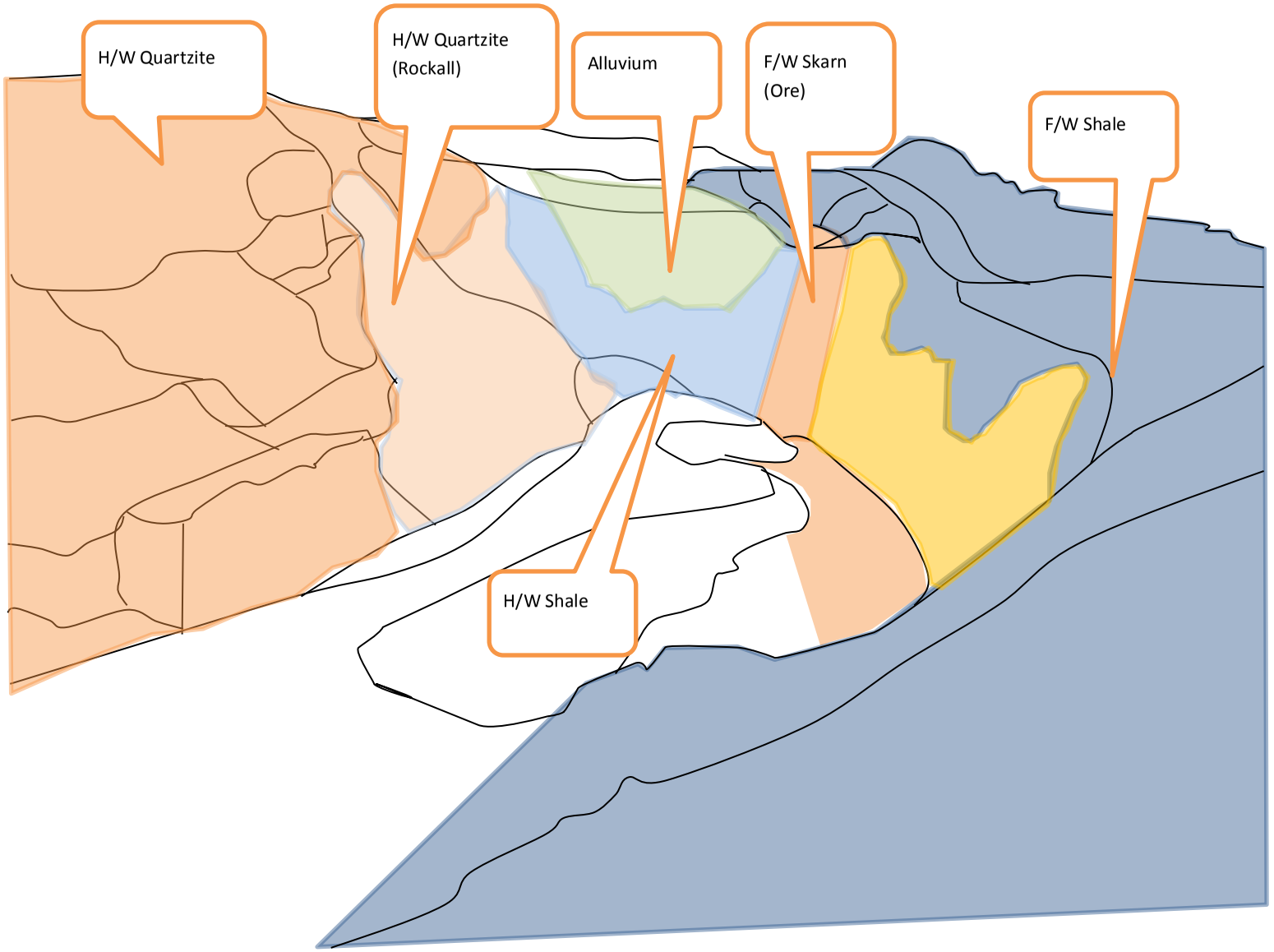


Figure 6.3 – Simplified geological face map of existing GEM open cut pit looking south with key identified lithologies highlighted

Waste Rock Classification

The Proponent has undertaken a preliminary geochemical characterisation assessment of the key identified lithologies. The objectives of this test work were to;

- Determine the acid forming characteristics and acid forming potential of samples; and
- develop an 'in the field waste rock classification and management system' based on the geochemical properties of geological material.

A preliminary assessment of the acid producing potential was carried out on material from the key identified major lithologies. These materials have been classified on the basis of their acid-forming potential.

Table 6.16 - NAPP/NAG testing of selected rock types

	H/W Quartzite					F/W Shale		H/W Shale		Skarn
	GEMNAG 005A	GEMNAG 006A	GEMNAG 008A	GEMNAG 012A	GEMNAG 001	GEMNAG 010A	GEMNAG 003	GEMNAG 013A	GEMNAG 004	GEMNAG 002
NAPP (kg H2SO4 /t)	-2.2	-0.8	0.9	<0.5	0	-3.1	43.6	563	1410	-11.2
pH oxidation	6.8	6.4	6.9	6.7	6.5	6.3	7.4	1.8	1.5	6
NAG (pH 4.5) (kg H2SO4 equiv./t)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	338	<0.1	<0.1
NAG (pH 7.0) (kg H2SO4 equiv./t)	0.2	0.7	0.2	0.2	0.5	0.3	<0.1	380	811	1
ANC as H2SO4 (kg H2SO4 equiv./t)	2.2	1.4	<0.5	0.5	2	4.6	49.4	<0.5	<0.5	28.7
ANC as CaCO3 (% CaCO3)	0.2	0.1	<0.1	<0.1	0.2	0.5	5	<0.1	<0.1	2.9
Fizz Rating (Fizz	0	0	0	0	0	0	2	0	0	1
Sulphur - Total as S % (LECO)	<0.01	0.02	0.03	0.03	0.05	0.05	3.04	18.4	46	0.57
ARD Characterisation	NAF	NAF	UC	NAF	NAF	NAF	UC	PAF	PAF	NAF

*ARD Characterisation based on AMIRA P387A ARD Test Handbook, UC is Uncertain

^ Tonnages for the Granville Expansion are estimates only and a JORC Reserve has not been completed

The results of the preliminary geochemical characterisation assessment using procedures outlined in AMIRA P387A Project ARD Test Handbook indicate that the majority of waste rock samples tested are classified as NAF based on their acid forming potential (refer Appendix H for full details). The total sulphur contents of the waste rock samples varied significantly and ranged between a low of <0.01%S and a high of 46.0%S where all H/W quartzite material sampled have <0.06 %S content. The sulphur content of the lithology identified as 'H/W shale' consistently exhibited an elevated concentration of S in previous dill core assays (Geopeko 1983), with an average concentration of 24 %S (n=9 Median 21.8). 75 percent of samples other than F/W shale did not exhibit a total concentration of sulphur in excess of 0.35 %S. The total sulphur content of each major identified lithology did not vary significantly (range total S for H/W quartzite samples =0.05 and 2.99 for F/W shale samples). Acid Neutralising Capacity (ANC) varied between the major identified lithologies. Average ANC for the hanging-wall shale is 27 kg H_2SO_4 equiv./t and is 1.525 H_2SO_4 equiv./t for the hanging-wall quartzite. Most samples had a NAG pH above 6.3.

Due to the highly variable ANC of these material's there is some overlap between the material classifications and as such there may be over or under estimation of the material type quantities. The preliminary geochemical test work shows that the total sulphur content can be used to differentiate the geochemical material classification based on the materials potential to produce acid.

Based on the above geochemical classification Table 6.17 shows a preliminary type classification using sulphur concentration.

Table 6.17 - preliminary waste type classification

Waste type	Total S Range (S %)	Geochemical Type
Type 1 (Low S)	<0.6	NAF, UC
Type 2 (Moderate S)	0.6 to 12.0	UC
Type 3 (High S)	<12.0	PAF

Notes:
UC = uncertain
NAF = non-acid forming
PAF = potentially acid forming

A plot of the total sulphur content plotted against NAGpH for the different geochemical material types provides a preliminary classification for waste rock types, using sulphur cut off grades. This classification has been used to develop a preliminary Waste Rock Management Plan discussed in Section 6.5.5. However due to the overlap of analysed material, the Waste Rock Management Plan will incorporate in the field sampling to coincide with mining production. This method will be used to produce infill data to confirm or refine the proposed total sulphur cut-off values, as samples have an uncertain classification. This will also enable more precise characterisation and management of waste material as it is produced.

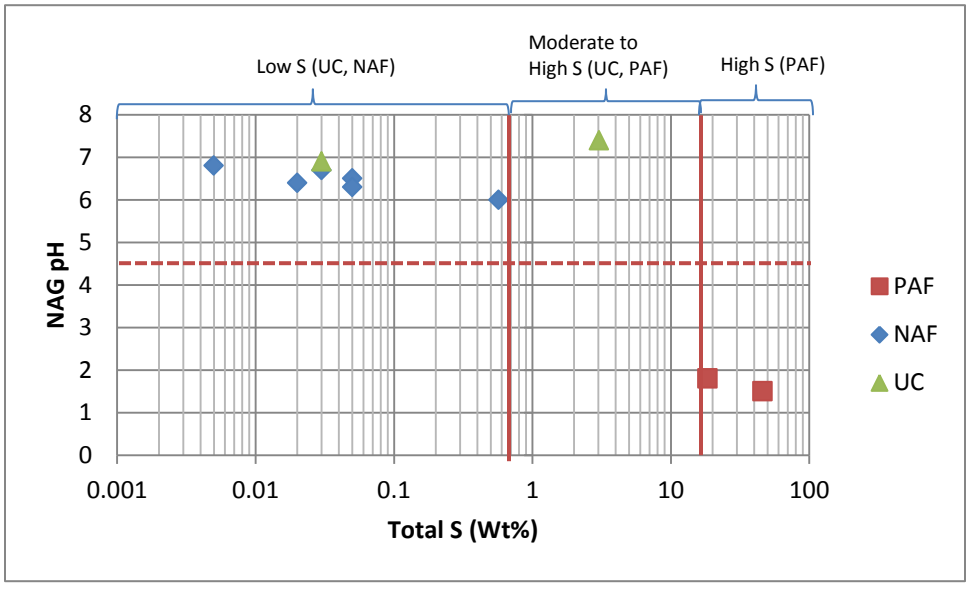


Figure 6.4 - NAG vs total S(%) of samples of major lithologies

The information depicted in Figure 6.4 indicates that classification of waste material can be achieved by using total sulphur content to delineate the different potential acid forming potential of the material. The sulphur content of the waste rock samples showed all samples that had a sulphur content less than 0.03%S were NAF and all samples with more than 3.5%S were UC or PAF. The similarities in geochemical properties of the UC

sample GEMNAG008 (pH 6.9, S % 0.03, ANC <0.1) to NAF sample GEMNAG0012 (pH 6.7, total S, 0.03, ANC <0.1) is justification to consider this UC sample as NAF in order to delineate sulphur cut off values. Classifying this sample from UC to NAF justifies the 0.6 % S cut-off grade.

Mining at GEM will comprise the removal of approximately 185,000tonnes of material from the existing open cut pit. Figure 6.5 is a simplified geological cross section from work undertaken by Geopeko (1978). Similarities in the geochemical properties of the identified major lithologies (such as total S, S:$CaCO_3$) available geological data (Figure 6.3) make it possible to make rough estimates of the quantities of the types of material to be extracted.

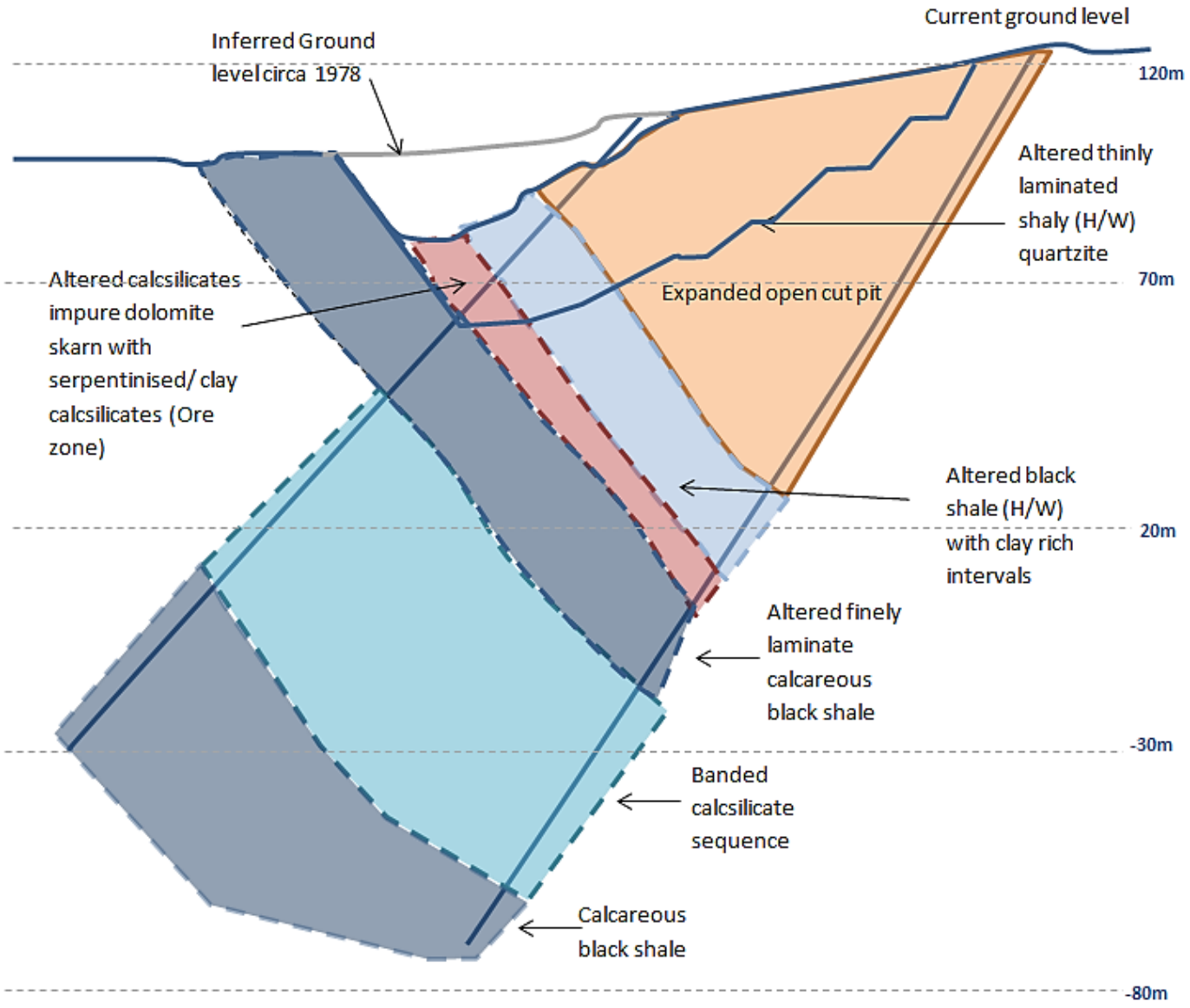


Figure 6.5 - Simplified geological cross section at GEM (after Geopeko 1987). (It should be noted that the presented geological interpretation is an over simplification of the complex geology, and a more in depth geological interpretation is presented in Geopeko 1983)

Based on previous geological investigations (Geopeko 1983) the majority of material expected to be encountered during level 2 mining activates is H/W quartzite material with a lesser amount of H/W shale material and minor amount of F/W shale (Figure 6.5). Analysis of H/W quartzite shows consistently low sulphur content and may be classified as NAF. It is anticipated that mining will extract 40,000 tonnes of ore material

(skarn) and an estimated total 145,000 tonnes of waste rock (H/W quartzite, H/W and F/W shale material with an ore to waste strip ratio of 1:4). Based on previous geological assessments and the preliminary pit design, it is estimated that approximately 10 percent of waste material to be extracted will comprise of H/W shale material (Figure 6.5). Preliminary geochemical assessment of nine samples (eight drill core and one surface rock chip samples) of H/W shale material indicates that all quantities of this material is likely to be PAF, and subsequent Waste Rock Management Plan have incorporated this into its design.

Based on the estimated quantities of waste rock material to be extracted, and preliminary geochemical assessment of the major identified lithologies, the total acid production of waste rock material can be estimated.

Table 6.18 – estimated acid balance for GEM waste rock

	HW Quartzite	F/W Shale	H/W Shale	Total
Tonnes	116,000	14,500	14,500	145,000
NAPP (average kg H_2SO_4/t)	-0.525	20.25	987	
Acid Production (kg H_2SO_4)	0	293,625	14,311,500	14,605,125
ANC (average kg H_2SO_4 equiv/t)	1.52	27	0.0	
Acid Neutralisation (kg H_2SO_4 equiv/t)	176,320	391,500	-	
Net Acid Balance (kg H_2SO_4)	-136,800	-97,875	14,311,500	1,196,475

* Calculated from average data presented in Appendix H

A summary acid balance highlights that the majority of acid will be generated by the H/W shale. The composition of existing waste rock material at GEM is likely a culmination of the identified lithologies, and subsequently, it is intended that this material plus the H/W shale will be returned to the open pit void at the conclusion of mining and stored under water to reduce the potential for oxidation. Of the remaining material on the WRE (H/W Quartzite and F/W Shale) the neutralising capacity (567,820t H_2SO_4 kg equivalent) is calculated to exceed the acid production (293,625 kg H_2SO_4).

Waste Rock Characteristics

The composition and variability of the waste material from the pit were evaluated in terms of their metals and other chemical elements or ions of environmental concern. The levels of enrichments of chemical elements of environmental concern vary between the major identified lithologies. Typically the level of enrichment is spatially associated to the source of mineralising fluids, and subsequent chemical alteration and degree of weathering of the host lithology (Filipee and Plumlee 1984, Geopeko 1983). Because of this and the complex geology, it is difficult to determine the precise level of enrichment of total extracted material. Identification of anomalies concentrations of elements can be made based on previous geological investigations, and geochemical test work.

Table 6.19 depicts petrographic mineralogical assessment and mineralogical assessment of core samples (Geopeko 1983) and the associated elements of environmental concern in the major identified lithologies.

Table 6.19 – Mineralogical assessment of major identified lithologies (source from Geopeko 1983 and ANW drill logs)

Lithology	Skarn	H/W Quartzite	H/W Shale	F/W Shale
Enriched Elements	Sn, Fe, Cu, As, Zn, Mg, S	Minor S, Fe	Fe,S, trace Cu, Pb, Zn, As	Trace Zn
Major Associated mineral	Cassiterite, hydrocassiterite, Stanite, siderite, Magnetite, Geothite, pyrite, pyrrhotite, chalcopyrite, sphalerite, pseudo-serpentenised, Mg – clay serpentine minerals	Pyrite, quartz	Pyrite, pyrrohotite, tremolite,	Tremolite, minor irregular occurrences of sphalerite

Previous geochemical surveys (Geopeko 1983) indicate the anomalous values of Sn, Cu, Zn, As and Pb occur at GEM. Geochemical analysis of drill core obtained by the Proponent further confirm elevated concentration of Fe and S in H/W shale and skarn material. Geochemical analysis of surface water samples also indicates the additional elevation of Mg. The source of these elements is likely derived from mineralised and altered host rock lithologies.

The solubility of these elements, and subsequently mobility, is largely determined by pH. Therefore control of acid generation will effectively control element leaching and dispersion into the receiving environment.

6.5.2.2 Tailings Material

All waste rock material generated as a by-product of processing operations at GPP is classified as tailings material. Tailings is generated at either the gravity circuit stage or the dressing stage during mineral processing. Two types of tailings material will be generated from the gravity circuit, either coarse rejects or fine rejects. Coarse rejects will be temporarily stockpiled on the ROM at GPP before being transported to GEM where it will be treated in accordance with the Waste Rock Management Plan (Appendix L). The rate at which tailings material is generated from these two stages is defined in Section 2.1.7.

The composition of the final tailings material depends on the source of the material undergoing processing. Material that will undergo processing during Level 2 activities includes existing tailings material derived from the existing TSF and ore material from GEM. The rate at which this material will be processed is detailed in section 2.1.7.

Level 2 activities have yet to commence and subsequently, analysis of tailings expected to be generated will occur during level 2 activities. However, analysis of material to undergo processing and existing tailings material will provide some information to appropriately develop a preliminary tailings management plan. Subsequent geochemical analysis of tailings material during level 2 activities will be utilised to further refine the tailings management plan.

The existing TSF contains an estimated 11,000 tonnes of tailings material. The source of this tailings material is derived from previous processing operations at GPP and is considered representative of proposed operations for the Granville Expansion. The Proponent has completed preliminary static and kinetic test (refer Appendix H) work in order to better understand the characteristics of the existing tailing material.

Table 6.20 - Static testing of material within existing TSF

Description	Tailing Sub aerial	Tailings Sub Aqueous
NAPP (kg H2SO4 /t)	-20.8	-137
pH oxidation	8.1	8.6
NAG (pH 4.5) (kg H2SO4 equiv./t)	<0.1	<0.1
NAG (pH 7.0) (kg H2SO4 equiv./t)	<0.1	<0.1
ANC as H2SO4 (kg H2SO4 equiv./t)	50.8	234
ANC as CaCO3 (% CaCO3)	5.2	23.9
Fizz Rating (Fizz	2	3
Sulphur - Total as S% (LECO)	0.98	3.16
	NAF	NAF

*ARD Characterisation based on AMIRA P387A ARD Test Handbook
From Appendix H

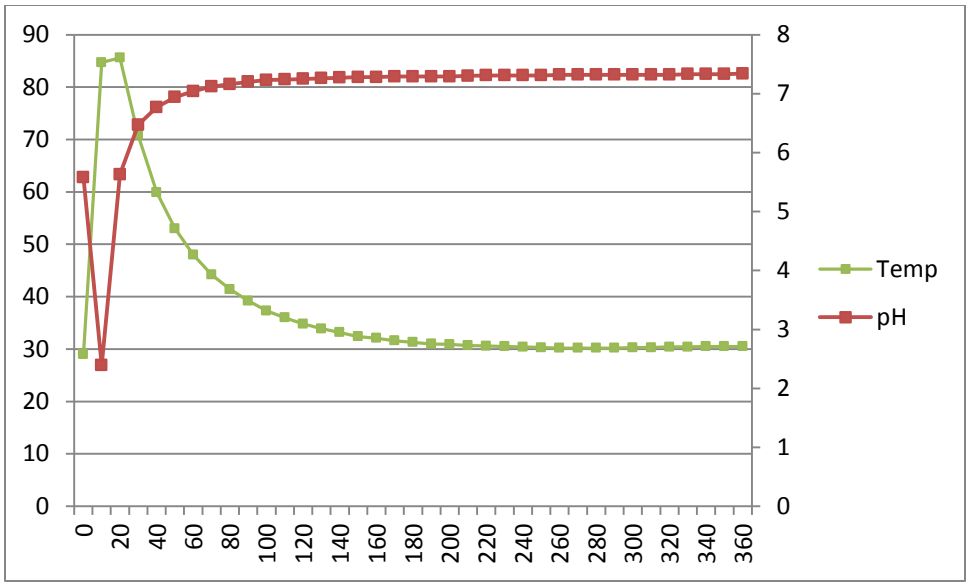


Figure 6.6 – Kinetic NAG testing on subaqueous tailing material (Appendix H)

Geochemical analysis of tailings material indicates that ARD characterisation of existing tailings material is uncertain. Kinetic testing also indicates that acid production from tailings material is rapid, however is quickly neutralised by available acid consuming material. Analysis of surface water samples obtained from the existing tailings dam consistently return pH readings of between 3.3 and 3.4(refer section 6.2) which indicates that the ANC of tailings material is not sufficient in neutralising acid derived from primary sulphides. As a result all tailings will be classified as PAF and stored sub-aqueously to reduce the potential for oxidation of primary sulphides.

Multi element testing was also conducted in order identify elements of environmental concern.

Table 6.21 – Concentrations of elements of environmental concern in existing tailings material

Analyte ICP - MS	Concentration subaerial tailings	Concentration subaqueous tailings
Al (%)	1.38	1.94
Fe (%)	10.95	8.23
S (%)	2.55	1.30
Ag	0.33	0.32
As	1245	794
Cr	15	24
Cu	137	104.5
Mn	1910	812
Pb	33.8	28.5
Sb	16.30	14.25
Zn	93	101

The solubility of these elements, and subsequently mobility, is largely determined by pH and oxidation conditions. Therefore control of acid generation, oxidation state and appropriate containment will effectively control element leaching from tailings material and dispersion into the receiving environment.

6.5.2.3 Waste Other

Both GEM and GPP have accumulated a large amount of scrap material from legacy operations. A re-cycling program of scrap steel has commenced and will continue during the level 2 operations.

6.5.3 Performance Requirements

Solid and controlled waste from mine sites must comply with the following;

- *Quarry Code of Practice 1999;* and
- *Environmental Management and Pollution Control (Waste Management) Regulations 2010.*

6.5.4 Potential Impacts

The potential effects of ineffective management of waste rock and tailings of could result in the production of acid and metalliferous drainage. Based on test work undertaken by the Proponent, it is estimated that a total of 145,000 tonnes of waste material will be generated during Granville Expansion of which approximately 10 percent of this material is estimated to be PAF. Also, over the duration of operations, the Proponent intends to generate 40,000 tonnes of tailings material from the processing facility. Improper management of this material may also have an adverse effect on the surrounding environment.

Refuse generated on site can cause environmental nuisance or harm and is a workplace occupational and safety issue if not properly contained.

6.5.5 Avoidance and Mitigation Measures

The Following mitigation measures are proposed;

Construction of proposed PAF/NAF WRE at GEM. The Proponent intends to construct a new NAF/PAF WRE to the east of the pit and will operate in accordance with the preliminary Waste Rock Management Plan (appendix L). The proposed NAF/PAF WRE will be designed to accommodate waste circa 145,000 tonnes over an area of approximately 2ha. NAF waste material will be retained for future site rehabilitation. PAF waste will also be stored east of the pit, and drainage directed to the pit. Topsoil removed during construction of the WRE will be stored for later rehabilitation works at the site.

Preliminary Waste Rock Management Plan

The primary objective of waste rock management is to ensure that mine waste, particularly material with a potential to produce acid, is managed safely and in an environmentally appropriate manner to minimise acid generation and potential contamination to the aquatic environment.

Based on previous geological investigations and preliminary geochemical analysis, the following preliminary Waste Rock Management Plan (Appendix L) has been developed and includes;

- In the field identification and sampling of material derived from blast hole drilling and geochemical analysis of material in order to classify material based on its potential to produce acid prior to blasting;
- segregation of NAF and PAF material based on its geochemical properties in the proposed WRE with the incorporation of contingency measures to accommodate additional PAF material;
- temporary storage of PAF material for the duration of level 2 activities, and during final site rehabilitation, return of PAF material (and approximately 15,000tonnes of material stored on the existing WRE) to the open cut pit at GEM as per the Rehabilitation and Decommissioning Plan (Appendix C); and
- management of surface water discharge derived from waste rock material as described in Section 2.2.5 and Section 6.2.

The Waste Rock Management Plan has been developed based on the preliminary geochemical characterisation work, and previous geological investigations carried out to date and will incorporate in the field sampling of waste material in order to precisely classify NAF and PAF waste rock material. This will be achieved by obtaining samples of production drill hole material immediately following drilling. Samples will then be analysed at a local accredited laboratory for their S content. Waste material will then be stored in the WRE according to its S content. This method will also be used produce infill data to confirm or refine the proposed waste rock management plan. This will occur concurrently to blasting at GEM (refer Appendix L). Material determined to be PAF will be returned to the open cut pit and stored sub aqueously during final mine rehabilitation.

Geochemical analysis of material prior to blasting at GEM will coincide with in the field identification of waste rock material (Appendix L). Preliminary geochemical analysis of material identified as 'H/W Shale' indicates that this waste material has elevated concentration of S % and is likely all PAF. Subsequently all material identified as H/W shale during in the field identification will be classified as PAF material. Preliminary pit designs coupled with previous geological investigations and a small drilling program undertaken by the Proponent indicates that approximately 11,000m^3 of this material will be extracted during mining operations, and the proposed WRE has been designed to accommodate the temporary storage of this quantity of material. PAF waste material will also be temporarily stored on designated benches within the open cut pit (Refer section 2.2.2 and Section 2.6).
The Proponent estimates there to be approximately 15,000t of historic waste rock material stored at GEM. This material is not sorted and is likely comprised of a mixture of the hanging and foot wall shale and hanging-wall

quartzite. For this reason all historic waste rock material at the site is considered by the Proponent as PAF, albeit diluted by NAF material. It is proposed the historic waste rock material will be relocated directly to the open pit void at the conclusion of mining.

Existing TSF and proposed TSF management. The proposed TSF would provide additional tailings capacity (refer section 2.2.1). No tailings produced during level two operations will be directed to the existing TSF. Instead a water cover will be maintained over the existing TSF throughout Level 2 activities and rehabilitated in accordance with the Preliminary Rehabilitation and Decommissioning Plan.

The Proponent will manage tailings in accordance with the preliminary Tailings Management Plan which aims to reduce oxygen availability, minimise water percolation and control alkalinity/acidity.

Preliminary Tailings Management Plan

The tailings management plan is included in Appendix N and will be further refined and updated as additional information on the nature of tailings material becomes available. The primary objective of tailings management is to ensure that tailing material is managed safely and in an environmentally appropriate manner to minimise acid generation and potential contamination to the aquatic environment. The preliminary tailings management plan incorporates initial geochemical testing on existing tailings material and ore material as well as preliminary surface water analysis. The plan also incorporates the use of the Proposed TSF, detailed in Section 2.3.1.

The tailing management plan has been prepared with the following practices;

- Reducing oxygen availability, by storing tailings material under water; and
- minimising water percolation, e.g., clay (soil) cover and encapsulation of proposed TSF during final mine rehabilitation.

Tailings material derived from GPP will be stored subaqueously in the proposed TSF. Material will be pumped directly to the proposed TSF at an estimated rate of 100 tonnes per day. Subaqueous deposition of tailings material will reduce oxygen availability, subsequently minimising oxidation of sulphides and acid generation. This in turn will limit the solubility of elements of potential environmental harm (Section 6.5.2.1), and subsequent mobility of these elements into the receiving environment. The design of the proposed TSF also utilises material which will reduce potential seepage of contained water into groundwater.

An estimated 15,000tonnes of gravity circuit rejects (coarse rejects) over the life of the mine (average estimate as 12,500 tpa based on 18 month LOM) will be transported to GEM where the material will be treated in accordance with the Waste Rock Management Plan (Appendix L) and possibly used in rehabilitation works.

Monitoring of surface water at the proposed TSF will occur as detailed in Section 7 and Appendix M. Management procedures in relation to surface waters contained or discharged from the proposed TSF are outlined in appendix M.

Other waste management and refuse facilities. The Proponent will continue to provide appropriate refuse disposal containers at both GEM and GPP. A scrap metal bin will be located at GPP throughout level 2 operations. The scrap metal bin will be collected on an as needs basis by a suitably qualified contractor. The Proponent also intends to provide a number of rubbish bins at appropriate locations across both sites and all staff will be required to avoid littering, and to collect and bin any rubbish and litter that they observe on site. Rubbish bins will be disposed of at an appropriate off-site licenced facility on an as needs basis. Any hydrocarbon waste generated will be disposed of to an appropriate site or treatment facility.

Upgrade of Sediment Retention Pond. The Proponent intends to upgrade these retention ponds by constructing a fourth sediment retention pond, which will incorporate a pre-treatment basin aimed to buffer acidic surface

water discharge derived from the open cut pit prior to entering the sediment retention ponds (refer Section 2.2.4). The targeted neutralisation of metalliferous waters will create conditions more favourable for the precipitation of solid mineral phases, subsequently reducing the total dissolved metal content of mine pit water discharge and limiting metal mobility.

6.5.6 Assessment of Net Impacts

Granville East Mine

An assessment of net impacts following the implementation of proposed avoidance and mitigation measures at GEM is outlined in Table 6.15. Proposed mitigation measures are aimed at reducing the current sites localised impact on the environment. Following the implementation of proposed avoidance and mitigation measures outlined in Section 6.5.5, potential adverse impacts on the local environment at GEM as a result of Level 2 operations will be minimised.

Granville Processing Plant

After the application of mitigation measures detailed in section 6.5.5, the Proponent expects to see potential improvement to the existing management of the environment at GPP.

6.6 Dangerous Goods and Environmentally Hazardous Materials

6.6.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (Appendix A), the potential dangerous goods and environmentally hazardous materials impacts requiring assessment and their unmitigated risk rating are as follows:

Table 6.22 - Unmitigated risks related to dangerous goods and environmentally hazardous materials

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Accidental release of chemicals, such as hydrocarbons into the environment	Reduced quality of local ecosystem Detrimental health effects to workers	Immediate surrounding vegetation and waterways	Nuisance / amenity impacts from hydrocarbon spill Stress to native vegetation and indirect impacts upon fauna habitat Reduced quality of downstream waters	Granville East Mine	2.	D	L
				Granville Processing Plant	2.	C	M

The Proponent proposes to undertake a number of measures to reduce the consequence and likelihood of environmental risk in relation to dangerous goods and environmentally hazardous substances, which in summary includes;

- Appropriate training of staff and contractors;
- implementation of Hydrocarbon Spill Management Plan;
- appropriate management of workshop and refuelling sites;
- safe storage of Hazardous substances; and
- no storage of explosive at GEM.

The mitigated risk rating to dangerous goods and environmentally hazardous materials are as follows;

Table 6.23 - Mitigated risks associated with dangerous goods and environmentally hazardous materials

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Accidental release of chemicals, hydrocarbons, fuel and oil into the environment	Nuisance / amenity impacts from hydrocarbon spill Stress to native vegetation and indirect impacts upon fauna habitat Reduced quality of downstream waters	Granville East Mine	L	• Appropriate training of staff and contractors • Implementation of Hydrocarbon Spill Management Plan • appropriately managed refuelling and repair sites • No explosives stored at GEM or GPP	2.	D	L
		Granville Processing Plant	M	• Safe storage of dangerous goods and environmentally hazardous materials • Appropriate training of staff and contractors • Hydrocarbon Spill Management Plan • appropriately managed refuelling and repair sites	2.	D	L

The following subsections describe the existing environment in relation to dangerous goods and environmentally hazardous materials surrounding GEM and GPP, environmental criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.6.2 Existing Environment

Fuel and oil will be transported to GEM and GPP on an as per needs basis. Temporary storage of these materials will occur at the GPP and GEM in appropriate containers and within appropriately bunded areas.

The processing facility at GPP is designed with appropriate hydrocarbon management controls such as bunded areas and hydrocarbon spill clean-up equipment in accordance with EPA Tasmania *Bunding and Spill Management Guidelines 2015*.

6.6.3 Performance Requirements

The legislative and policy requirements relating to dangerous goods are;

- *Dangerous Substances (Safe Handling) Act 2005*;
- Australian Code for the Transport of Dangerous Goods by Road and Rail;
- *Dangerous Goods Act 1998;*
- *Dangerous Goods Regulations 1998;* and
- *Australian Standards AS 1940, AS 3780 and AS 3961*.

6.6.4 Potential Impacts

Loss of fuel or oil during construction, mining and processing activities may occur during refuelling or from spillage and breakdown during normal construction or operational mining activities.

Loss of fuel or oil may reduce the quality of the drainage systems, degrade aquatic habitat and cause reductions/loss of aquatic populations. Any fuel or oil spilled may also be absorbed by soils and vegetation.

Contamination of the environment through the accidental discharge of flotation reagents may degrade aquatic habitat and cause reductions/loss of aquatic populations. The Proponent intends to utilise flotation reagents used elsewhere in Tasmania, which may include Potassium Amyl Xanthate (PAX) and Polyfroth 57. PAX is a hazardous material (HAZCHEM CODE 2X) and if discharged to waterways may persist for several days whilst hydrolysing slowly. Polyfroth 57 has a moderate toxicity but low bioaccumulation level. Further details are provided in Appendix F.

Inventory of dangerous goods and environmentally hazardous materials are summarised in Table 6.24

Table 6.24 - Inventory of dangerous goods and environmentally hazardous materials

Dangerous good or environmentally hazardous material	Quantity	Storage location	Handling	Duration
Polyfroth 57	1000l	GPP processing facility	GPP processing facility	During processing operations
Potassium Amyl Xanthate (PAX)	2 tonnes	GPP processing facility	GPP processing facility	During processing operations
Ferrous Sulphate	100kg	GPP processing facility	GPP processing facility	During processing operations
HCL	10ml	GPP processing facility	GPP processing facility (used in small quantities, 1 drop approx. 0.05ml) in a laboratory environment for Sn examination)	During processing operations
Lubricants (Oil)	Temporary storage on an as per needs basis	GPP processing facility or sea storage container. GEM site administration area	GPP processing facility, ROM/Crusher Pad/ Proposed WRE or open cut pit	Throughout operations
Fuels (Diesel)	Temporary storage on an as per needs basis	GPP processing facility or sea storage container. GEM site administration area	GPP processing facility, ROM/Crusher Pad/ Proposed WRE or open cut pit	Throughout operations

All quantities are estimates only and subject to change

6.6.5 Avoidance and Mitigation Measures

Safety training. Training for safe handling practices of hazardous substances will be provided to members of staff. First aid training with a focus on the specific conditions, equipment and chemicals along with PPE and first aid equipment will also be made available to staff on site.

Hydrocarbon Spill Management plan. A spill management plan will be adopted in accordance with the *Dangerous Substances (Safe Handling) Act 2005* which will entail appropriate spill clean-up, management and disposal procedures. All workers will be trained to respond to spills and leaks.

Safe Storage of hazardous material. All hazardous materials will be stored on self bunding pallets, a bund will be constructed around the flotation cell and all flotation reagents will be contained within. Any spillage will be cleaned up with an appropriate spill kit.

No explosives stored on site. explosives will be transported in by a suitably qualified contractor on an as per needs basis.

6.6.6 Assessment of Effects

The measures outlined above will ensure that any potential dangerous goods and environmentally hazardous materials used during the construction, mining and processing operational phases are properly controlled, monitored and managed, and present a negligible risk to the environment.

6.7 Biodiversity and Natural Values: Flora and Fauna

6.7.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (Appendix A), the potential impacts for biodiversity requiring assessment and their unmitigated risk rating are as follows;

Table 6.25 - Unmitigated risk to biodiversity and natural values

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Removal of native vegetation due to land clearing activities	Removal of habitat and disturbance of threatened species	Vegetation within Granville East Mine	Disruption or fragmentation of existing habitats. Direct impacts upon species.	Granville East Mine	4.	A	VH
				Granville Processing Plant	4.	A	VH
Disturbance of flora and fauna habitat as a result of Project operations, eg noise, dust	Reduction in biodiversity in surrounding habitat	Vegetation within Granville East Mine	Disruption or fragmentation of existing habitats. Direct impacts upon species.	Granville East Mine	2.	D	L
				Granville Processing Plant	2.	D	L

The Proponent proposes to undertake a number of measures to reduce the consequence and likelihood of environmental risk to biodiversity and natural values, which in summary includes;

- Measures to be undertaken to minimise the level of habitat disturbance by utilising previously disturbed areas where possible, in designing proposed infrastructure;
- developing and applying a Tasmanian Devil Management Plan;
- clearly defining the nature and extent of vegetation to be removed during construction; and
- develop and apply a noxious weed and hygiene management plan.

The mitigated risk rating for biodiversity and natural values are as follows;

Table 6.26 - Mitigated risks to biodiversity and natural values

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Removal of native vegetation due to land clearing activities	Disruption or fragmentation of existing habitats Direct impacts upon species	Granville East Mine	VH	• Develop and apply a Tasmanian Devil management plan. • Develop and apply a noxious weed and hygiene management plan • minimise the extent of habitat disturbance • define the nature and extent of vegetation to be removed	1.	A	M
		Granville Processing Plant	VH		1.	A	M
Disturbance of fauna and fauna habitat as a result of Project operations, eg noise, dust		Granville East Mine	L		1.	D	L
		Granville Processing Plant	L		1.	D	L

The following subsections describe the existing biodiversity and natural values at GEM and GPP, environmental criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.7.2 Existing Conditions

Flora

Flora was examined in an ecological survey at GEM and GPP by EcoTAS on eighth and ninth of February 2016 and is attached as Appendix B. Both GPP and GEM lease areas supports several TASVEG mapping units, as follows;

- *Eucalyptus nitida* forest over Leptospermum (WNL);
- *Melaleuca squarrosa* scrub (SMR);
- western wet scrub (SWW); and
- extra-urban miscellaneous (FUM).

One plant species listed as threatened (rare) on the Tasmanian *Threatened Species Protection Act 1995* was detected at GEM:

- *Comesperma defoliatum* (leafless milkwort): locally common and widespread in recently burnt scrub/heath north of Granville Farm Road and southeast of Big Rocky Creek (sites unlikely to be materially affected by the project); occasional within part of project area to be disturbed; also found at two other locations well away from project area as part of deliberate and targeted extension surveys.

None of these vegetation types are classified as threatened under Schedule 3A of the *Tasmanian Nature Conservation Act* 2002 or equate to threatened ecological communities under the *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999.

The lease area is virtually weed-free and supports a very low diversity of exotic plant species. One species classified as a "declared weed" within the meaning of the *Tasmanian Weed Management Act* 1999 was detected:

- *Cytisus scoparius* (english broom): single non-fertile heavily-browsed individual within mill site workings; plant was excavated, making the whole project area now apparently weed-free.

Fauna

Fauna was examined in an ecological survey at GEM and GPP by EcoTAS on eighth and ninth of February 2016 and is attached as Appendix B. No fauna species listed as threatened on the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* or the *Tasmanian Threatened Species Protection Act* 1995 were detected, or are known from database records, from the lease area.

The project area is within the predicted/known range of several fauna listed as threatened on the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* or *the Tasmanian Threatened Species Protection Act 1995*, and supports potential habitat of these species:

- *Sarcophilus harrisii* (Tasmanian Devil): numerous records in vicinity (including one from the mine site); no direct evidence detected but surveys limited to habitat assessment only; most areas of vegetation unsuitable for denning (scrub/heath) but forested areas along Big Rocky Creek (mine site) are suitable.
- *Dasyurus maculatus subsp. maculatus* (Spotted-Tailed Quoll): as above but far fewer records in area.
- *Dasyurus viverrinus* (eastern quoll): as above but only one record in area.
- *Accipiter novaehollandiae* (grey goshawk): potential habitat along Big Rocky Creek (mine site).
- *Alcedo azurea subsp. diemenensis* (azure kingfisher): potential habitat along Big Rocky Creek (GEM).

Western Tasmania Blanket Bogs

Both GEM and the GPP are situated on the geoconservation feature Western Tasmania blanket bog. It is estimated that both GEM and the GPP cover up to 20ha of this geomorphological feature. The total extent of Western Tasmania Blanket Bogis estimated at 550,000ha.

6.7.3 Performance Requirements

Flora and fauna management must comply with the following statutes:

- *Environment Protection and Biodiversity Conservation Act 1999;*
- *Threatened Species Protection Act 1995;*
- *Nature Conservation Act 2002;*
- *Forest Practices Act 1985;*
- *Forest Practices Code 2000;*
- *Crown Lands Act 1976; and*
- *Weed Management Act 1999.*

A permit to take under the *Tasmanian Threatened Species Protection Act* 1995 will be required to disturb one flora species through application to the Policy and Conservation Advice Branch (PCAB, DPIPWE).

6.7.4 Potential Impacts

Flora

No plant species listed as threatened on the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* were recorded from the project area.

It is estimated that the project may affect 18 individual plants *of Comesperma defoliatum*, which represents approximately five percent of the locally detected population. However, this proportion is likely to be a vast over-estimate because only limited areas of potential habitat, which is extremely widespread, have been searched.

Although no signs of *Phytophthora cinnamomi* are evident at both GEM and GPP, several species present are susceptible to this disease.

Fauna

Clearing of vegetation may impact on existing habitats and affect some species. However, only a relatively small amount of habitat will be removed and will not have an impact on the broader habitat. For this reason, a referral under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* should not be required.

Western Tasmanian Blanket Bogs

Construction activities will require the removal of up to 5ha of topsoil and vegetation at GEM and GPP. This material will be stockpiled and utilised during final site rehabilitation.

6.7.5 Avoidance and Mitigation Measures

No vegetation types identified by ECOtas at GEM and GPP require special management under State or Commonwealth legislation and policy. However the Proponent intends to minimise, where possible, disturbance to existing vegetation and topsoil.

Implementation of a weed and hygiene management plan. The Proponent will implement appropriate measures in accordance with Weed and Disease Planning and Hygiene Guidelines - Preventing the Spread of Weeds and Diseases in Tasmania (DPIPWE 2015), to minimise the risk of introducing weeds and diseases to the project area.

Implementation of Tasmanian Devil Management Plan. The Proponent will implement appropriate measures to minimise the risk of adversely affecting potential Quoll and Tasmanian Devil populations. These measures include restriction of traffic movements and reporting of any sightings of Tasmanian Devil and quoll to the appropriate member of staff.

Measures to be undertaken to minimise the level of habitat disturbance. By utilising previously disturbed areas where possible, in the design and construction of proposed infrastructure.

Clearly define the nature and extent of vegetation to be removed during construction. Vegetation to be retained will be clearly defined and marked prior to commencing site establishment to ensure that native vegetation clearing is confined only to those areas required for construction operations.

6.7.6 Assessment of Residual Effects

6.7.6.1 Flora

Considering the small percentage of native vegetation clearance required for the project in comparison to existing native vegetation in the area, the loss of native vegetation is considered to be not significant.

The impact on the leafless milkwort due to clearing proposed at GEM is estimated at being five percent of the local population. However, this proportion is likely to be a vast over-estimate because only limited areas of potential habitat, which is extremely widespread, have been searched. The Proponent expects that a permit to take this species should be issued without restrictions based on the localised distribution of the species and the small proportion of individuals to be taken.

Table 6.27 - distribution of *Comesperma defoliatum* in the vicinity of GEM (from ECOtas Appendix B)

Site	Point locations	Abundance	Proportion of recorded population	Impact from project
Outside project area – extension surveys				
Heemskirk Road	6	c. 50 (approximate estimate only)	Not applicable.	Not applicable.
Granville Harbour Road	13	c. 100-200 (approximate estimate only)	Not applicable.	Not applicable
Total	**19 (nominal points only)**	**c. 150-200**	**Not applicable.**	**Not applicable**
Within and close to project area				
Within nominal lease area (south of Granville Farm Road, north of Big Rocky Creek)	15	18	5.13%	Likely that all individuals will be affected (possibility of a few roadside specimens to be undisturbed).
Within nominal lease area (southeast of Big Rocky Creek)	7	19	5.41%	Nil – within nominal lease area but on opposite side of creek in area not proposed for any works.
Outside nominal lease area (southeast of Big Rocky Creek)	4	7	1.99%	Nil – outside nominal lease area.
Within nominal lease area (north of Granville Farm Road)	52	131	37.32%	Nil – within nominal lease area but on north side of Granville Farm Road, which is not proposed for any works (see Notice of Intent design diagrams that show all works to south of this road).
Outside nominal lease area (north of Granville	75	176	50.14%	Nil – outside nominal lease area.
Total	**153**	**351**	**100%**	**5.13%**

A permit to take *Comesperma defoliatum* (leafless milkwort) will be submitted by the Proponent as required under Section 51 of the Tasmanian *Threatened Species Protection Act 1995* but this should be issued without restrictions based on the localised distribution of the species and the small proportion of individuals to be taken.

6.7.6.2 Fauna

The primary risk to fauna imposed by the Granville Expansion is the increase in vehicle numbers on Heemskirk Road. The development and implementation of a devil management plan will restrict the majority of traffic movements to daylight hours to minimise the risk to long term decrease to the number of nocturnal species

(specifically the Tasmanian Devil or Spotted-Tailed Quoll). With the mitigation actions proposed the risk of road kill is diminished to negligible levels.

6.7.6.3 Western Tasmania Blanket Bogs

The proportion of proposed Western Tasmania Blanket Bog to be removed is insignificant compared to the total estimated extent of the geoconservation feature. However, stripped topsoil will be appropriately stored on site and utilised during final site rehabilitation. Only a minuscule amount of the total area defined as Western Tasmania Blanket Bog will be affected.

6.8 Marine and Coastal

The location of the proposed Granville Expansion activities are 5km and 10km east of the western coastline of Tasmania. The proposed activities will not impact on any marine or coastal areas.

6.9 Greenhouse Gases and Ozone Depleting Substances

6.9.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (Appendix A), the potential impacts from greenhouse gases and ozone depleting substances requiring assessment and their unmitigated risk rating are as follows:

Table 6.28 - Unmitigated risk related to greenhouse gases and ozone depleting substances

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Release of greenhouse gases from vehicles	Contribute to overall greenhouse gas levels	Broader environment	Addition to greenhouse gas effect	Granville East Mine	1.	A	M
				Granville Processing Plant	1.	A	M

The Proponent proposes to implement the following avoidance and mitigation measures to minimise the detrimental environmental effects from greenhouse gas emissions at the Granville Expansion, including;

- All mining equipment, machinery and vehicles will be well maintained in order to minimise the generation of greenhouse gases;
- no ozone depleting substances will be used or generated during construction and operation of the Granville Expansion; and
- site power requirements to be preferentially sourced from the local power grid.

A revised risk environmental risk analysis undertaken for the Granville Expansion (Appendix A) incorporating avoidance and mitigation measures is summarised below.

Table 6.29 - Mitigated risks related to greenhouse gasses and ozone depleting substances

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Release of greenhouse gases from vehicles	Addition to greenhouse gas effect	Granville East Mine	M	• Regular vehicle maintenance • Source of electricity preferentially sourced from power grid • No use of ozone depleting substances	1.	A	M
		Granville Processing Plant	M		1.	A	M

The following subsections describe the existing greenhouse gasses and ozone depleting substances surrounding GEM and GPP, environmental criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.9.2 Existing Conditions

Currently, generation of greenhouse gases on the site occurs as a result of direct emissions from level 1 activities at GEM and GPP. Emission sources are restricted to the operation of vehicles. Processing equipment draws on electricity sourced off-site.

No ozone depleting substances are currently used during activities on the site.

6.9.3 Performance Requirements

There are no reporting requirements relating to the *National Greenhouse and Energy Reporting Act 2007* as the total energy produced or consumed is estimated as less than 200 terajoules and emission of greenhouse gases that have a carbon dioxide equivalence of less than 50 kilotonnes.

6.9.4 Potential Impacts

Greenhouse gases (predominantly carbon dioxide) will be generated during both the construction phase and throughout operations at both GEM and GPP. During the construction phase, greenhouse gas emissions will be generated by the operation of vehicles and construction machinery equipment.

Construction operations will also see the removal of up to 5ha of vegetation at GEM and GPP. This represents only a small amount of total existing biomass in the surrounding areas and is not expected to influence the broader total carbon inventory.

During the operational phase greenhouse gas emissions will be generated by light vehicle transport activities, hauling, and mining.

Off-site transport for general consumables and transportation of concentrate material will also generate vehicle emissions.

6.9.5 Avoidance and Mitigation Measures

All mining equipment, machinery and vehicles will be well maintained in order to minimise the generation of greenhouse gases. A regular maintenance schedule will be adopted on all equipment. This will ensure that all equipment is running at optimum efficiency, reducing fuel and electricity consumption and limiting greenhouse gas emissions.

No ozone depleting substances will be used or generated during construction and operation of the Granville Expansion. Substances such as hydrofluorocarbons will be banned from use on site.

Electricity will be preferentially sourced from the local electricity grid. Electricity generated off-site is substantially more efficient and emits much less greenhouse gases than on site generators.

6.9.6 Assessment of Residual Effects

The estimated annual carbon dioxide emissions and energy consumption of the proposed Granville Expansion is summarised below

Table 6.30 – estimated annual carbon dioxide equivalent emissions and energy consumption for the Granville Expansion

Operation	Amount	Carbon factor	Calculation	Carbon dioxide emissions tonnes CO_2-e/yr
Electricity purchase	250kWh	0.12 $kgCO_2$-e/kWh(NGER)	250kWh x 12hr/dayx6days/weekx52 weeks x (0.12/1000)	112.32
Excavation	103,000m^3	0.219$kgCO_2e/m^3$(Stripple,2001)	103,000m^3x0.219	22.6
Hauling	12.3kL* diesel/yr	Energy content factor = 38.6GJ/kL(NGER) CO_2= 69.9 $kgCO_2e$ (NGER) CH_4 = 0.1 $kgCO_2e$ (NGER) N_2O = 0.5 $kgCO_2e$ (NGER)	CO_2= (12.3kLx 38.6GJ/kL x 69.9)/1000 + CH_4 =(12.3kLx 38.6GJ/kL x 0.1)/1000 + N_2O = (12.3kLx 38.6GJ/kL x 0.5)/1000	33.6
Off-site transportation	3.2kL* diesel/yr	Energy content factor = 38.6GJ/kL(NGER) CO_2= 69.9 $kgCO_2e$ (NGER) CH_4 = 0.1 $kgCO_2e$ (NGER) N_2O = 0.5 $kgCO_2e$ ^	CO_2 kL total diesel x 38.6 x69.9)/1000 + CH_4([3.2]kl total diesel x 38.6 x 0.1)/1000) + N_2O (([3.2]kl total diesel x 38.6 x 0.5)/1000	8.7
Total				177.22

*kL diesel/yr calculated based on heavy vehicle (over 15 000kg) average energy efficiency (41L/100km) (source U.S. Department of Energy – Transportation Energy Data Book 2015) x estimated annual km travelled
NGER National Greenhouse Accounts Factors. Department of the Environment, 2015
Stripple, 2001: Life Cycle Assessment of Roads. A pilot Study for Inventory Analysis

The total emissions as a result of operations at GEM and GPP are relatively small and will not significantly contribute to the Greenhouse gas effect.

6.10 Heritage

6.10.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (Appendix A), the potential impacts on heritage requiring assessment and their unmitigated risk rating are as follows;

Table 6.31 - Unmitigated risk heritage related

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Unanticipated discovery of a site of cultural significance	Depravation of site of cultural significance	Local community	Loss or damage of heritage record	Granville East Mine	2.	E	L
				Granville Processing Plant	2.	E	L

The Proponent proposes to implement the following avoidance and mitigation measures to minimise the detrimental environmental effects to heritage during Granville Expansion operations including;

- Utilising an Unanticipated Discovery plan.

A revised environmental risk analysis undertaken for the Granville Tin Project (Appendix A) incorporating avoidance and mitigation measures is summarised below;

Table 6.32 - Mitigated risks related to heritage

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Unanticipated discovery of a site of cultural significance	Loss or damage of heritage record	Granville East Mine	L	• Utilise an Unanticipated Discovery Plan	2.	E	L
		Granville Processing Plant	L		2.	E	L

The following subsections describe the existing heritage surrounding GEM and GPP, environmental criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.10.2 Existing Conditions

A desktop search of the National Heritage List, Register of the National Estate, Tasmanian Heritage Register and the Tasmanian Historic Places Inventory (searched on the 11/04/2016) indicated that no heritage sites, and / or values exist in the area of proposed Granville Expansion.

A request was made to Aboriginal Heritage Tasmania on the 17/05/2016 to complete a desktop survey for both GEM and the GPP. The Proponent was advised that there are no Aboriginal heritage sites recorded within or close to the property and no further investigations are required.

6.10.3 Performance Requirements

The Granville Tin Project must comply with the *Historic Cultural Heritage Act 1995* and *Aboriginal Relics Act 1975.*

6.10.4 Potential Impacts

Operations at GPP and GEM will not have any impact on any listed heritage sites.

No sites of archaeological significance have previously been recorded by previous operators during construction and operational phases of GEM and GPP. The Proponent expects that the small footprint of proposed construction works at GEM and GPP will not intrude on any sites of archaeological significance.

6.10.5 Avoidance and Mitigation Measures

Unanticipated Discovery Plan. In the event that previously undetected archaeological sites are located during construction phases at GEM and GPP, the Proponent will implement a Unanticipated Discovery Plan, which will indicate how and when to;

- Temporarily cease operations and establish a buffer zone;
- contact local authorities and Tasmanian Land and Sea Council and Aboriginal Heritage Tasmania;
- contact a suitably qualified professional to appropriately identify and subsequently advise on the significance of the unanticipated discovery; and
- induct employees and mining contractors concerning unanticipated archaeological discoveries.

6.10.6 Assessment of Residual Impacts

The Proponent does not expect that Granville Expansion operations will have any detrimental effects on European or Aboriginal heritage. The implementation of an Unanticipated Discovery Plan will mitigate any detrimental effects to any sites of archaeological significance uncovered through construction activities.

6.11 Land use Development

6.11.1 Summary

Examination of potential impacts on other land uses and developments in the vicinity of both GEM and GPP indicates that with the implementation of appropriate procedures, Granville Expansion operations will not adversely impact on any other land uses or developments.

This following section evaluates existing land uses and developments, performance requirements that need to be adhered to, the potential effects of proposed Granville Expansion operations and a final assessment of the mitigated effects.

6.11.2 Existing Conditions

The Granville Tin Project comprises two mining leases (21M/2003 and 9M/2006) that are substantially located over Mt Heemskirk Regional Reserve with a section of 9M/2006 located within a Permanent Timber Production Zone (refer Section 5.1.1).

Both leases are covered by EL46/2006. Level 1 mining activities terms and conditions are currently in effect over both mining leases.

Both GEM and GPP are situated within the Mount Heemskirk Regional Reserve. A Regional Reserve is crown land set aside under the *Nature Conservation Act 2002* for the purpose of:

> *"Mineral exploration and the development of mineral deposits in the area of land, and the controlled use of other natural resources of that area of land, including special species timber harvesting, while protecting and maintaining the natural and cultural values of that area of land."*

The continued development of the mineral deposit located at Granville East mine is consistent with the express purpose of the land and with the objectives of the Local Government planning scheme.

No other significant activities occur within the footprint of the proposed Granville Expansion operations.

6.11.3 Performance Requirements

The project must comply with the requirements of the West Coast *Interim Planning Scheme 2013* and *Nature Conservation Act 2002*.

6.11.4 Potential Impacts

Granville Expansion operations will slightly increase traffic volumes in the surrounding area and is discussed in section 6.20. The Granville Tin Project will not affect any other land uses in the vicinity.

6.11.5 Avoidance and Mitigation Measures

No other significant activities occur within or nearby the footprint of the proposed Granville Expansion operations. Subsequently, no avoidance and mitigation measures are required.

6.11.6 Assessment of Residual Effects

There are no other major developments or proposals in the vicinity of the Granville tin project that Granville Expansion operations will impact.

6.12 Visual Impacts

6.12.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (see Appendix A), the potential visual impacts requiring assessment and their unmitigated risk rating are as follows;

Table 6.33 - Unmitigated risks to visual amenities

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Changes in visual characteristics due to extraction and processing activities	Changed visual outlook during operation and prior to final rehabilitation	Surrounding landowners	Decreased Visual amenity	Granville East Mine	1.	C	L
				Granville Processing Plant	1.	C	L

The Proponent proposes to undertake a number of measures to reduce the impact on visual amenity, which in summary include;

- Natural topography and existing habitat will be used to the maximum extent possible to provide a visual barrier to selected receivers;
- GEM and GPP will be maintained in a clean and tidy condition at all times;
- air quality controls will be implemented (see Section 6.1) to reduce visible dust;
- day shift only operations to reduce the requirement for lighting;
- implement and manage a feedback register; and
- progressive rehabilitation at GPP.

The mitigated risk rating concerning visual amenity are as follows;

Table 6.34 - Mitigated risks to visual amenities

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Changes in visual characteristics due to extraction and processing activities	Decreased visual amenity	Granville East Mine	L	• Air quality controls such as dust suppression (Section 6.1) • Routine site clean up • Retention of habitat and landforms for natural screening where possible • Day shift only to reduce light pollution	1.	C	L
		Granville Processing Plant	L		1.	C	L

The following subsections describe the existing visual environment surrounding GEM and GPP, environmental visual criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.12.2 Existing Conditions

Granville East Mine

The existing infrastructure at GEM is not visible from Heemskirk Road, and is only visible from the existing access road. This road only supports a very limited number of local vehicles, and impact on visual amenity is limited by access, topography, and dense vegetation (section 6.7) to the south and west.

Plate 6.3 - Looking south west from Heemskirk Road towards Granville East

Looking south over proposed WRE from P5 (Figure 2.1) (16/05/16)

looking south over proposed ROM/Crusher Pad from P6 (Figure 2.1) (16/05/16)

Plate 6.4 - (Top) Looking south over proposed WRE (Middle) looking south over proposed ROM/Crusher Pad (Bottom) Looking south west over proposed WRE

Granville Processing Plant

GPP is situated approximately 1km south of Heemskirk Road. It is possible to glimpse the northern part of GPP from topographical high points and through thinner sections of vegetation on the side of the road.

Plate 6.5- Looking south from Heemskirk Road towards GPP from L3 (Figure 2.2)

6.12.3 Performance Requirements

The project must comply with the requirements of the West Coast Interim Planning scheme.

6.12.4 Potential Impacts

No proposed infrastructure at GPP will be visible to the public from Heemskirk Road due to topographical layout of the site. No newly constructed infrastructure will diminish the existing visual amenity of the site.

The proposed PAF/NAF WRE and Crusher pad at GEM will be exposed on the access road to the mine. However this road is only utilised by a small number of people (Granville Farm access and mine employees) and will not impact greatly on the larger amenity of the area. Vegetation will be retained in places to provide screening of the crusher pad.

Topographical features and vegetation restrict visibility of the open cut pit at GEM.

6.12.5 Avoidance and Mitigation Measures

The Proponent intends to implement the following avoidance and mitigation measures to further reduce the impact to visual amenity at both GPP and GEM;

Natural topography and existing habitat retained. To the extent possible to provide a visual barrier. Retention of vegetation along the side of Heemskirk Road restricts visibility of the GPP to the general public. GEM is situated such that the natural topography restricts the view of the majority of the site. Vegetation will be retained where possible to restrict the view of the proposed ROM/Crusher pad.

GEM and GPP will be maintained in a clean and tidy condition at all times. Refuse facilities will be provided at both sites and staff will be encouraged to keep both sites in a tidy condition.

Air quality controls As described in Section 6.1, measures will be undertaken to minimise dust emissions. This will also mitigate dust related visual impacts.

Implementation of a community feedback register. Any feedback regarding the visual amenities raised by the local community will be registered and considered by a local designated staff member.

Day operations only. Day shifts reduce the requirements for lighting at GEM and GPP which will mitigate light pollution.

6.12.6 Assessment of Effects

Following the implementation of avoidance and mitigation measures outlined in section 6.12.5, the Proponent expects that no additional stresses will be imposed on the existing visual amenity at both GEM and GPP.

6.13 Socio-Economic Issues

6.13.1 Summary

Based on the risk analysis undertaken for the Granville Expansion operations (see Appendix A), the potential socio-economic impacts requiring assessment and their unmitigated risk ratings are as follows;

Table 6.35 - Unmitigated risks for socio-economic issues

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Rating		Risk
					Consequence	Likelihood	Risk Rating
Perceived or real impacts on local amenity	Reduced quality of life (actual or perceived)	Surrounding residents/landowners	Reduced quality of life (actual or perceived)	Granville East Mine	2.	D	L
			Reduced property values	Granville Processing Plant	1.	D	L

The Proponent proposes to undertake a number of measures to reduce any negative (actual or perceived) impacts to local socio-economic circumstances through the following;

- To the extent possible, employ personnel based on the west coast;
- to the extent possible, procure goods and services from west coast businesses;
- manage all other risks (Sections 6) such as to minimise the impact on the broader community; and
- implement and manage a feedback register.

The mitigated risk rating for socio-economic issues is as follows;

Table 6.36 - Mitigated risks for socio-economic conditions

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Perceived or real impacts on local amenity	Reduced quality of life (actual or perceived)	Granville East Mine	L	To the extent possible, employ personnel and procure goods and services locally Implement and manage a feedback register	2.	D	L
		Granville Processing Plant	L		1.	D	L

The following subsections describe the existing socio-economic environment surrounding GEM and GPP, environmental socio-economic criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.13.2 Existing Conditions

Existing socio-economic conditions in areas surrounding the Granville Tin Project are described in Section 5.3 and only a summary is provided here.

The Granville Tin Project is located in a region where farming, mining and electricity generation are the principal economic activities, and hence Granville Expansion will be consistent with the existing social fabric of the region.

Zeehan has considerable infrastructure, including housing, to support substantial demand generated from mining activities in the region, albeit its utilisation is low at the current time. The scale of the Granville Tin Project is small enough that it is not expected to influence housing affordability in Zeehan or Granville Harbour.

6.13.3 Potential Impacts

Granville Expansion would result in a range of socio-economic benefits to the local and wider community including a number of employment opportunities for supervisory, technical and operational staff. In addition there will be roles for local contractors including crushing, ore haulage, plant maintenance and mining. Direct injection of approximately $500,000 to $750,000 annually into the local and regional economy is expected through payment of wages to on site personnel and purchase of consumables etc. A further approximately $200,000 in annual wages would also be paid through the generation of employment for truck drivers carting crushed ore and tin concentrate. Cash flow on effects from employees of the Proponent procuring local goods and services is also likely to occur during the life of the operation.

The Proponent aims to continue positive support and involvement in the local community, and remain a socially responsible company.

6.13.4 Avoidance and Mitigation Measures

The Proponent intends to implement the following avoidance and mitigation measures

To the extent possible, employ personnel based on the west coast. Subject to the availability of suitably qualified and/or experienced personnel, the Proponent intends to employ west coast based personnel.

To the extent possible, procure goods and services from west coast business. Subject to the availability of suitable local goods and services providers, such goods and services will be procured from west coast businesses.

Manage other risks (Appendix A) such as to minimise the impact on the broader community.

Implement and manage a feedback register. All complaints will be reviewed by a local designated staff member.

6.13.5 Assessment of Residual Effects

The Proponent expects to provide a positive socio-economic effect in the community due to the creation of a number of jobs, and the positive flow on effect created by the operation of Granville Expansion operations.

6.14 Health and Safety Issues

6.14.1 Summary

The Proponent is preparing a "Health Safety Environment and Risk Management" system manual to meet the requirements of Worksafe Tasmania. This document will incorporate policies and procedures aimed at reducing risks to health and safety.

Safety management systems will be consistent with the requirements of Work Safe Tasmania. Any requirements attached to the approval of Granville Expansion operations, will be applied during the construction and operation of the Project.

6.14.2 Performance Requirements

All operations, maintenance, health and safety management during Granville Expansion operations will comply with;

- *Work Health and Safety Act 2012;*
- *Work Health and Safety Regulations 2012*, the *mines work health and safety (supplementary requirements) Act 2012;* and
- *Mines Work Health and Safety Regulations (supplementary Requirements) 2012*.

6.14.3 Potential Impacts

Qualities consequence rating has been assigned to health and safety during the development of the draft risk assessment attached as Appendix A.

6.14.4 Avoidance and Mitigation Measures

All operations, maintenance, health and safety management at GEM and GPP will be compliant with the *Work Health and Safety Act 2012*, the *Work Health and Safety Regulations 2012*, the *Mines Work Health and Safety Act 2012* and *Mines Work Health and Safety Regulations 2012*.

6.14.5 Assessment of Residual Effects

The completion and implementation of the "Health Safety Environment and Risk Management" system manual and adherence to regulations outlined by Worksafe Tasmania will reduce the risks to health and safety associated with Project operations.

6.15 Hazard analysis and risk assessment

6.15.1 Summary

A detailed risk (hazard) assessment will be undertaken as part of the final design of the Project components. A preliminary analysis is included as Appendix A and preliminary identification of hazards and assessment of risk is summarised below.

6.15.2 Existing Conditions

The Proponent has undertaken a preliminary risk assessment attached as Appendix A to aid in the development of this DPEMP.

6.15.3 Performance Requirements

A risk/hazard assessment is required by Part 2, Section 4.1 of Tasmanian *Mines work Health and Safety (supplementary requirements) Regulations 2012*.

6.15.4 Potential Impacts

The key potential impacts associated with the identified risks for the Granville Tin Project are listed below;

- Injuries;
- damage to infrastructure;
- pollution of surface waters;
- pollution of the groundwater;
- operations shut down for an extended period;
- electrocution; and
- fire.

6.15.5 Avoidance and Mitigation Measures

The following measures will be implemented to reduce the potential for risks during the construction and operation of Granville Expansion.

Implementation and adherence to commitments. Commitments aimed at reducing hazards and risks identified throughout this document and is outlined in Section 9 of this document.

Fire prevention measures. A fire management plan will be implemented in accordance with regulatory requirements

An emergency action plan will be developed. All staff will be advised of an emergency action plan. This will be utilised in the event of any emergency.

Preparation of WH&S plans where required. All staff will be advised on all WHS plans during induction. Plans will adhere to all relevant regulatory requirements

Implementation of regular checks and maintenance schedules. Staff will perform required safety checks prior to operation of all equipment in order to identify any potential issues.

Develop and upgrade the closure strategy in consultation with the EPA. A draft rehabilitation and decommissioning plan is provided in Appendix E. This document will evolve as new challenges and obligations arise.

6.15.6 Assessment of Residual Effects

The application of avoidance and mitigation measures to identified potential hazards reduces the qualitative consequence and qualitative likelihood of the potential risk. This subsequently lowers the risk ratings as described in Appendix A.

6.16 Fire Risk

6.16.1 Summary

Based on the risk analysis undertaken for the Granville Expansion (see Appendix A) the potential fire risks requiring assessment and their unmitigated risk ratings are as follows;

Table 6.37 - Unmitigated risks associated with potential fire

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Fire originating from mining and processing operations **Fire escaping from mining and processing operations** **Fire originating from outside the operations**	Damage to infrastructure Increased health and safety risk to operators Reduction of immediate surrounding habitat	Processing and mining equipment Mining and processing operators Surrounding ecological communities	Reduction of immediate surrounding habitat Decrease in air quality Increase in CO_2 emissions	Granville East Mine	5.	D	H
				Granville Processing Plant	5.	D	H

The Proponent proposes to undertake a number of measures to reduce the consequence and likelihood of environmental risk imposed by fire, which in summary includes;

- Implementation of a Fire Management Strategy; and
- all facilities maintained to all relevant standards.

The mitigated risk associated with Fire are as follows;

Table 6.38 - Mitigated risks associated with potential fire

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Fire originating from mining and processing operations **Fire escaping from mining and processing operations** **Fire originating from outside the operations**	Reduction of immediate surrounding habitat Decrease in air quality Increase in CO_2 emissions	Granville East Mine	H	• Implementation of a Fire Management Plan • Facilities maintained to all relevant standards	5.	E	H
		Granville Processing Plant	H		5.	E	H

The following subsections describe the existing fire risk surrounding GEM and GPP, environmental fire criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.16.2 Existing Conditions

Bush fire fuel levels are managed by the Zeehan Community Bushfire Mitigation Plan which are implemented by Parks and Wildlife Service Tasmania. The most recent series of control burns were undertaken on the 02/06/2016 and have substantially reduced fuel levels surrounding GPP. Recent fire affected areas indicate that control burns occurred recently at GEM also.

6.16.3 Performance Requirements

Legislative and regulatory requirements are outlined below;

- The *Fire Services Act 1979;*
- *Work Health and Safety Act 2012;*
- relevant Australian Standards; and
- *West Coast Council interim planning scheme 2013* (E1 Bushfire prone Code).

6.16.4 Potential Onsite Sources

Both sites contain potential sources which could potentially result in a fire, including;

- Electrical fire;
- explosion from fuel vapours (storage or equipment);
- oil/fuel fire;

- dry vegetation;
- equipment exhaust on flammable material and vegetation;
- discarded cigarettes and dry vegetation;
- lightning strike;
- building fire; and
- arson.

6.16.5 Potential Risks

The potential fire risk associated with this proposal is considered to be moderate for the following reasons;

- Moderate level of natural fuel surrounding both sites, although both locations receive very high levels of rainfall;
- no explosives stored on site;
- large amount of available water and earth moving equipment on site which would enable rapid and effective response in the event of a fire; and
- large permanent water bodies nearby ensure emergency supply in summer should a major fire develop in the area.

6.16.6 Avoidance and Mitigation Measures

GEM and GPP will be maintained in accordance with all relevant standards. to ensure fire protection systems and equipment are installed and operational at all times. This includes;

- All buildings will have properly installed electrical equipment and safety earth and/or leakage detection devices;
- site vigilance/monitoring;
- regular housekeeping and site safety audits;
- mobile equipment to have elevated and protected exhaust systems;
- smoking to be restricted to low fire risk areas;
- smoke detectors in all buildings; and
- fire alarm and appropriate extinguishers installed.

Fire Management Plan. the project site clearance (where required), construction, commissioning and operations will be conducted in accordance with the Fire Management Plan. The Fire Management Plan will be reviewed and updated as part of regular reviews.

6.17 Infrastructure and Off-Site Ancillary Facilities

Existing infrastructure at GEM and GPP are described in detail in Section 5 off-site infrastructure include the road network which is detailed in Section 6.20.

Electricity supply to the sites will utilise pre-existing transmission lines. Granville Expansion operations will not require any new off-site electricity transmission infrastructure.

6.18 Environmental Management Systems

This DPEMP outlines the significant environmental issues, management prescriptions and commitments that the Proponent has made to ensure that risks to human health and the environment from Granville Expansion operations are minimised.

The short duration of operations of the Granville Expansions renders the development of an extensive Environmental Management System (EMS) impractical. The Proponent will assign a designated staff member to oversee implementing and development of the various management plans and commitments outlined in this document. These plans and commitments will be audited through an internal reporting system to ensure commitments are clearly identified, roles and responsibilities are defined with an underpinning framework of transparency, accountability and continuous improvement.

6.19 Cumulative and Interactive Effects

At the time of preparing this DPEMP, a number of other developments have been identified in the region which are approved by the EPA or have issued a Notice of Intent (NOI) which may have a cumulative and interactive effect.

A DPEMP for a wind farm and transmission line at Granville Harbour has been submitted by West Coast Wind Pty Ltd. Traffic estimates included in this DPEMP have not considered the additional traffic conditions the development of this project may have on existing infrastructure. However West Coast Wind indicates that additional traffic created by construction and operation of the wind farm at Granville Harbour will not significantly impact local traffic conditions. Coordination with traffic movements associated with this development, particularly on the access road to GEM, will be sought prior to operations of the wind farm.

6.20 Traffic Impacts

6.20.1 Summary

Based on the environmental risk analysis undertaken for the Granville Expansion (see Appendix A), the potential traffic impacts requiring assessment and their unmitigated risk rating are as follows;

Table 6.39 - Unmitigated traffic related risks

Unmitigated Risk Source / Potential Incident	Potential Consequence	Receptor/ Surrounding Environment	Potential Environmental Impacts	Site	Unmitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Increased traffic levels due to the movement of workforce	Increase in the frequency of light and heavy vehicle movements on public roads	Surrounding road network Existing and future road users	Increased risk of road accidents	Granville East Mine	5.	C	H
				Granville Processing Plant	5.	C	H
Increased heavy vehicle movements for product transportation			Deterioration of road pavement Increased risk of road accidents	Granville East Mine	5.	C	H
				Granville Processing Plant	5.	C	H

The Proponent proposes to undertake a number of measures to reduce the consequence and likelihood of risk from mine traffic, which in summary includes:

- Implementation of a drivers "Code of Conduct" that will include *inter alia* permissible speed limits, restricted travel periods;
- installation of appropriate signage at the intersection of Heemskirk Road with site access roads at both GEM and GPP;
- identification of all potential road restrictions (eg bridges) and ensure vehicles do not exceed weight or width limits;
- completion of appropriate risk assessments and Job Safety Analysis (JSA) by transport contractors; and
- implement and maintain a feedback register.

If required, the Proponent will complete a traffic impact assessment (TIA) at the direction of the West Coast Council.

The mitigated risk rating to traffic are as follows;

Table 6.40 - Mitigated risks associated with traffic

Unmitigated Risk Source / Potential Incident	Potential Environmental Impacts	Site	Unmitigated Risk Rating	Mitigants	Mitigated Risk Rating		
					Consequence	Likelihood	Risk Rating
Increased traffic levels due to the movement of workforce	Increased risk of road accidents	Granville East Mine	H	• Implementation of a drivers "Code of Conduct" • Installation of appropriate traffic signs at specific locations • Identification of all potential road restrictions • Completion of appropriate risk assessments and Job Safety Analysis (JSA) by transport contractors; and • Implement and maintain a feedback register.	5.	D	H
		Granville Processing Plant	H		5.	D	H
Increased heavy vehicle movements for product transportation	Deterioration of road pavement Increased risk of road accidents	Granville East Mine	H		5.	D	H
		Granville Processing Plant	H		5.	D	H

The following subsections describe the existing traffic environment surrounding GEM and GPP, environmental traffic criteria, proposed operational safeguards and mitigation measures and an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

6.20.2 Existing Conditions

General traffic volume and traffic counts were obtained from data published for the Granville Harbour Wind Farm Development Proposal and Environmental Management Plan (2013) at Granville Harbour. Traffic data from the Provision and Professional Services Western Tasmania Industry Infrastructure Study (2012) is also incorporated.

Concentrate material is expected to be dispatched from GPP as 25 tonne batches transported three to four times a month to Burnie Port. The expected route is via Rosebery, Mount Black and the Ridgley Highway and is depicted in Figure 6.7.

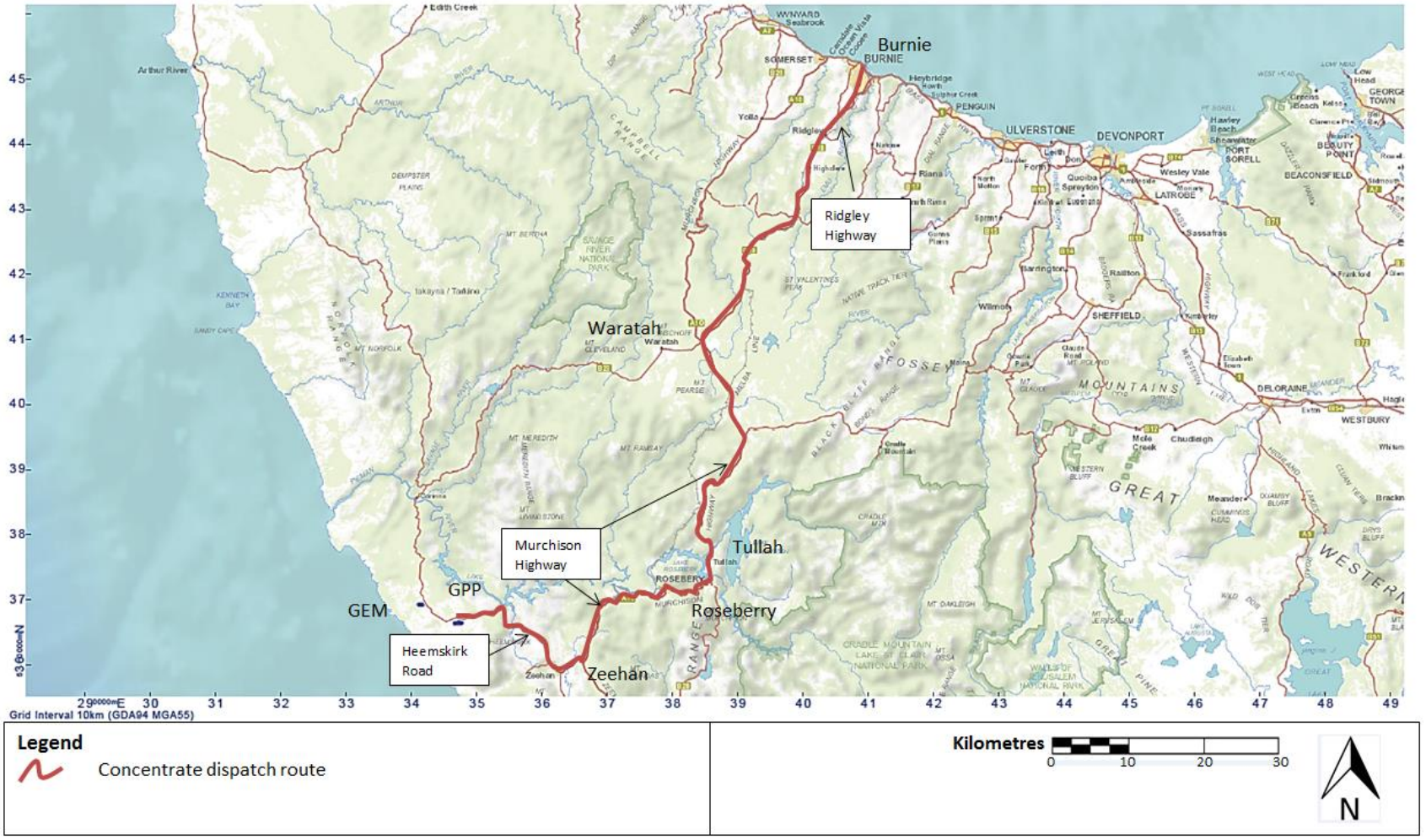


Figure 6.7 - Proposed concentrate dispatch route (source MRT LIST)

Table 6.41 - Summary of roads to be utilised during concentrate dispatch

Road Section	From	To	Percent Heavy Vehicle	Current annual Average Daily Traffic (AADT)	Lane Width	Sealed Shoulder Width
Bass Highway	Burnie	Old Surrey Road	8	12 600	3.0m – 3.3m	Varying from 0.1m – 1.0m+Both gravel and seal
Old Survey Road	-	-	-	-	-	-
Massey Green Drive	-	-	-	-	3.5m – 3.7m	0.3m – 0.6m
Ridgley Highway	Murchison Hwy (Guilford)	Hampshire	28	1 322	3.0m – 3.1m	0.1m – 1.0m Sealed/gravel
	Hampshire	Burnie	20	2 432		
Murchison Highway	Zeehan Hwy	Melba Flats	-	901	2.8m – 3.1m	0.0m – 0.5m Sealed/gravel
	Melba Flats	Rosebery	17	701	No data	No data
Zeehan Highway	Murchison Hwy	Zeehan	14	846	2.8m – 3.6m	0.3m – 0.7m Variable surface
Heemskirk road	Zeehan	Granville	No data	No data	No data	No data

Source: Provision and Professional Services (SKM) Western Tasmania Industry Infrastructure Study (2012)

Vehicles entering both GPP and GEM will be on unnamed unsealed roads via the Heemskirk road from Zeehan. Heemskirk road is classified as a Category 5 – Other Roads according to the Tasmanian State Road Hierarchy. The road traverses typical West Coast terrain and has a number of tight curves. It has a sealed width varying between 6.2m and 6.6m, a curved alignment and varying grades. The default rural speed limit of 100km/hr applies to Heemskirk road. The road carries low traffic volumes and is not HPV gazetted.

Space for parking is located to the west of the mill at GPP and at the site entrance at GEM.

6.20.3 Performance Requirements

Assessment of the potential risks associated with traffic for the Granville Tin Project was completed in accordance with the following requirements;

- *Dangerous Goods (Road and Rail Transport) Act 2010;*
- *Dangerous Goods (Road and Rail Transport) Regulations 2010;*
- *Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development;* and
- The *West Coast Interim Planning Scheme 2013 (E9 Traffic Generating Use and Parking Code).*

6.20.4 Potential Impacts

The key potential effects relating to transportation for the Granville Tin Project identified for management are;

- The increased potential for accidents (including the potential for an uncontrolled release to the environment of dangerous goods and environmentally hazardous material during transportation);
- the potential for increased noise;
- the potential deterioration on existing roads; and
- transportation of dangerous goods

During the operation of the Granville Tin Project, traffic levels will fluctuate depending on the various phases of the project. Estimated traffic levels over various phases of operations are displayed in Table 6.42.

Table 6.42 - Granville Tin Project – Commercial Traffic Movements (Monthly estimates)

	Establishment/Construction (up to eight weeks)			**Operations**		
	Granville East Mine	Granville Processing Plant	percent Contribution on Total Traffic	Granville East Mine	Granville Processing Plant (18-24 months)	percent Granville Expansion Contribution on Total Traffic
Bass Highway	20	10	<0.1%	8	8	<0.1%
Ridgley Highway	20	10	<0.1%	8	8	<0.1%
Murchison Highway	20	10	<0.1%	8	8	<0.1%
Zeehan Highway	20	10	<0.1%	8	8	<0.1%
Heemskirk road	40	42	Unknown	148*	148*	Unknown

*Total of 280 movements per month related to haulage on a 15km stretch of Heemskirk road between Granville Processing Plant and Granville Harbour. (14 movements per day). Source: Granville Harbour Wind Farm Development Proposal and Environmental Management Plan (TIA) (2013) at Granville and also incorporates traffic data from the Provision and Professional Services (SKM) Western Tasmania Industry Infrastructure Study (2012).

The data provided in Table 6.42 indicates that heavy vehicle movements from deliveries and concentrate dispatch from the Granville Expansion will not contribute significantly to the broader transportation infrastructure network (Section 6.20.2). Hauling operations however, will significantly contribute to traffic volumes on a localised section of Heemskirk Road.

6.20.5 Avoidance and Mitigation Measures

The following measures are proposed to minimise traffic related impacts described in section 6.20.4.

Implementing a "Code of Conduct" for transport activities that will include *inter alia* permissible speed limits, restricted travel periods. The Code of Conduct, to be developed in conjunction with the transport contractors will stipulate that drivers of all vehicles;

i. Complete relevant site inductions (Both GEM and GPP, Burnie Port and others as applicable);

ii. maintain a BAC of 0.00ug/L and zero drug level at all times;

iii. travel at a maximum speed of 40km/hr on all unsealed roads;

iv. comply with all Tasmania road rules and regulations;[1]

In addition, drivers of heavy vehicles will be required to;

i. Ensure loads are adequately secured;

ii. give way to all vehicles on Heemskirk road and unsealed access roads (Granville Farm access road towards GEM);

iii. adhere to Heavy Vehicle National Laws (HVNL);

iv. restrict travel through Zeehan and Rosebery township between 06:00 to 19:00 Monday to Saturday, and at all times to limit the level of noise; and

v. the Code Of Conduct will be developed in accordance with performance requirements outlined in Section 6.6.3 in order to mitigate the risks associated with the transportation of dangerous goods.

Installation of appropriate signage at the intersection of Heemskirk road and access roads. Appropriate signage is to be installed at the intersection of the Heemskirk road and access roads to GPP and GEM warning motorists for potential trucks to enter the road. Appropriate signage will also be erected on internal access roads restricting speed limits and controlling the movement of traffic.

Completion of appropriate risk assessments and Job Safety Analysis (JSA) by transport contractors. Prior to the commencement of operations, all staff will undertake a team based risk assessment (TBRA) of all heavy vehicle movements. The recommendations from the TBRA will be documented and implemented as applicable.

Identification of all potential road restrictions. Ensure vehicles do not exceed weight or width limits. Concentrate dispatch route accounts for all restrictions (e.g bridges).

Implement and maintain a feedback register. Any feedback made by the community regarding traffic issues will be addressed by the local designated staff member.

6.20.6 Assessment of Effects

Following the implementation of avoidance and mitigation measures outlined in section 6.20.5, the Proponent expects that the small amount traffic generated by the Granville Expansion will not materially affect the existing operation of the roads on the transport route.

[1] Tasmanian road rules can be accessed at http://www.transport.tas.gov.au/__data/assets/pdf_file/0009/109566/Tasmanian_Road_Rules_2015_for_web1.pdf

7 Monitoring and review

Preamble

This section details the Proponent's monitoring, review and reporting programs for each section of the proposal. General objectives are provided with a description of the approach undertaken by the Proponent in order to meet standards and performance requirements stated in this DPEMP. Details of the monitoring plan are subsequently provided.

7.1 Monitoring Program Design Objectives

7.1.1 Compliance With Emission Standards and Other Performance Requirements Identified Within this DPEMP

The suggested monitoring program is aimed at addressing all relevant standards and performance requirements detailed in Section 1.2 and subsections of Section 6. The monitoring program is also designed to provide initial base line data in order to manage impacts the proposed Granville Expansion has on the surrounding environment.

The NWQMS aims to achieve the sustainable use of Australia's and New Zealand's water resources by protecting and enhancing their quality while maintaining economic and social development. The approach is based on calculations of a probability distribution of aquatic toxicity end-points and adopting guidelines based on these studies. It attempts to protect a pre-determined percentage of species, usually 95 percent, but enables quantitative alteration of protection levels. The 95 percent protection level is most commonly applied in these ANZECC Guidelines to ecosystems that could be classified as slightly to moderately disturbed and, subsequently, are used as a reference for applicable levels for surface water quality in this study.

7.1.2 Assessing Effectiveness of the Performance Requirement and Environmental Safeguards in Achieving Environmental Quality Objectives

The suggested monitoring program is aimed to provide information to determine the effectiveness environmental safeguards and performance requirements.

7.1.3 Assessing Compliance with Commitments Made in this DPEMP

The monitoring program is aimed at providing information on commitments stated in Section 9 and assessing the effectiveness of proposed avoidance and mitigation measures.

7.2 Monitoring program

7.2.1 Approach

The monitoring program is designed to achieve the following objectives;

- Provide information which will determine the adequacy of environmental management; and
- detect and measure trends or environmental changes, and enable analysis of their causes.

In the context of the Granville Expansion this includes in particular;

- Monitoring of aqueous discharges and the surface receiving waters;
- monitoring of groundwater;
- monitoring management of acid generating waste rock; and

- monitoring of community complaints.

All monitoring is aimed at assessing compliance with performance requirements and commitments outlined in this DPEMP. An assessment of the effectiveness of the performance requirements and environmental safeguards in achieving environmental quality objectives will be on-going. Monitoring will be modified as required to react to changing circumstances and monitoring findings.

7.2.2 Operations Monitoring

Comprehensive routine records will be kept for operations at the Granville Tin Project for a variety of reasons including cost control, technical efficiency and safety, as well as for environmental reasons.

Examples of operations monitoring which will take place on a routine, day-to-day basis will include the following;

- Ore and waste rock (during mining production);
- open cut pit (during mining operations);
- ore stockpiles (during mining operations);
- mine pit dewatering;
- proposed and existing waste rock emplacement;
- processing equipment;
- tailing discharge;
- existing TSF and proposed TSF and sediment retention ponds;
- fuel and other consumables usage rates; and
- ore transport details (number of trucks etc).

7.2.3 Discharge Monitoring

Discharge monitoring provides direct information concerning the concentrations and loads of contaminants being discharged from the mine, and provides a link between ambient monitoring results and the operation itself.

7.2.4 On-going Surface Water Monitoring

Surface water will continue to be collected and tested for various metals and metalloids, as well as pH, EC, TDS and TSS on a quarterly basis. Monitoring sites will be consistent with samples obtained in previous surface water surveys.

7.2.4.1 On-Going Monitoring Program

Results of historical/on-going monitoring programs are provided in Appendix E and Appendix G. Monitoring at these locations will be on-going. Existing monitoring measures surface water for turbidity, pH, EC, SAR, conductivity, calculated TDS, hardness, alkalinity (hydroxide, carbonate, bicarbonate) sulphate, chloride, dissolved cations (O, Mg, Na, K,) metals/metalloids (Al, As, B, Ba, Be, Ca, Co, Cr, Cu, Mn, Ni, Pb, Se, V, Zn, Fe, Hg, Si, F) and ionic balance.

7.2.4.2 Site Establishment, Sampling Procedures and Method

Methodology for water quality monitoring will continue be conducted in accordance with NWQMS *Australian Guidelines for Water Quality Monitoring and Reporting (2000)* and Appendix M.

7.2.4.3 List of Sites to be Sampled, Location, Frequency and Parameters Summary Table

Table 7.1 - List of Sites to be Sampled					
Sample description	**Sample Name**	**Location**		**Frequency**	**Parameters**
		Easting	**Northing**		
Surface Water Background					
GEM					
Upstream tributary of Big Rocky Creek	GEMWE	341861	571011	Quarterly	turbidity, pH (monthly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
Upstream of Pit	GEMWB	340987	5370685	Quarterly	turbidity, pH (weekly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
GPP					
Background 12 Mile Creek stream	GPPWC	347311	5368157	Quarterly	turbidity, pH (weekly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
Surface Water Source Emissions					
GEM					
Pit Discharge (Top of pre-treatment basin)	GEMWC	340878	5370850	Quarterly	turbidity, pH (weekly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
Sediment retention pond discharge point (downstream of pond 4 discharge)	GEMWA	340797	5370811	Quarterly	turbidity, pH (weekly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.

Sample description	Sample Name	Location	Frequency	Parameters	Sample description
		Easting	**Northing**		
Sample description	**Sample Name**	**Location**	**Frequency**	**Parameters**	**Sample description**
GPP					
existing TSF	GPPWA	346848	5368062	Quarterly	turbidity, pH (weekly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
Proposed TSF	GPPWB	346693	5368036	Quarterly	turbidity, pH (weekly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
Central Big H discharge	GPPWD	346284	5368013	Quarterly	turbidity, pH (monthly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
Surface Water Receiving Environment					
GEM					
Big Rocky Creek confluence	GEMWD	340539	5370914	Quarterly	turbidity, pH (monthly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
GPP					
12 Mile Creek (Downstream)	GPPWF	346456	5368764	Quarterly	turbidity, pH (weekly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
Downvalley of existing TSF, Proposed TSF and Central Big H	GPPWG	346025	5368963	Quarterly	turbidity, pH (weekly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.

Sample description	Sample Name	Location	Frequency	Parameters	Sample description
GEM					
Groundwater Monitoring					
GEM					
Receiving Environment (down likely flow direction of Open Cut Pit)	GEMGWA	To be finalised	To be finalised	Quarterly	turbidity, pH, EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
GPP					
Receiving Environment (downstream of proposed TSF)	GPPGWB	To be finalised	To be finalised	Quarterly	turbidity, pH, EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.
Noise Monitoring					
GEM					
Receiving Environment	GEMNA	To be defined	To be defined	Blasting	dB(A), L_{90}, $L_{eq(15\ min)}$
Source Emission	GEMNB	To be defined	To be defined	Blasting	dB(A), L_{90}, $L_{eq(15\ min)}$

7.2.5 Noise Monitoring

Noise emanating from GEM and will be measured as blasting occurs. Monitoring will aim to measure if sound levels exceed the recommended maximum levels of exposure at selected receivers.

7.3 Review and Reporting

This Development Proposal and Environmental Management Plan (DP(EMP)) will be reviewed at a period as agreed with MRT or EPA. A major component will be the review of waste rock management and surface water discharge management.

Subsequent reviews will be made as necessary after this time. The reviews will assess the environmental performance and establish the on-going strategies for environmental management for the Granville Tin Project, based on the performance to that time.

During the period between reviews, the Proponent will provide reports every six months on environmental performance. These reports will include a summary of the environmental monitoring information, an interpretation of these results based on the operation activities and ambient conditions (eg. weather, river flows), a review of environmental management activities for the previous period and an outline of proposed environmental activities for the next six months.

8 Decommissioning and Rehabilitation

The Decommissioning and Rehabilitation Plan (DRP) (Appendix C) will adjust as the project is progressed. The DRP aims to retain and where possible, facilitate the return of the Granville Tin project to a state evident prior to proposed operations, without however, sterilising future possible resources.

The DRP may change over time if requirements and expectations of the regulators, key stakeholders and interested parties change or if the project changes of time.

8.1 Conceptual Mine Closure and Rehabilitation Plan

The DRP (Appendix C) contains the Proponent's conceptual mine closure and rehabilitation plan.

9 Draft Statement of Commitments

This section presents a compilation of the actions and initiatives the Proponent commits to implement if the Granville Expansion receives approval. These commitments are designed to effectively manage, mitigate, guide and monitor the Project through site establishment, construction and operation.

All parties involved in the design, establishment and operational phases of the Granville Expansion will be required to undertake their work in accordance with the commitments.

For each draft commitment, the desired outcomes are provided together with the intended actions and timing for the implementation.

Table 9.1 - Draft Statement of commitments			
Desired Outcome	**Action**	**Timing**	**Responsible Person**
Area of Activities			
All approved Granville Expansion components are constructed and activities are undertaken in the area(s) nominated on the approved plans and figures (unless moved slightly to avoid individual trees).	1 Survey and mark the boundaries of the areas of disturbance.	During construction phase and prior clearing campaign.	Mine Manager/Relative contractor or employee
Air Quality (Section 6.1)			
Air emissions remains within parameters specified by appropriate legislation	2 Dust suppression employed on unsealed access road as appropriate	During Operations	Mine Manager/Relative contractor or employee
	3 Timing of production blasts may be governed by climatic conditions to reduce to the extent possible dust emissions from GEM.	During Operations	Mine Manager/Relative contractor or employee
	4 Implementation of a transportation "Code of Conduct" that will include *inter alia* permissible speed limits to reduce the potential for dust generation.	During Operations	Mine Manager/Relative contractor or employee
	5 Preparation and implementation Fibrous mineral management plan (if applicable)	Following identification of asbestiform minerals	Mine Manager/Relative contractor or employee
Surface Water (Section 6.2)			
Minimisation of poor quality surface water discharged into surrounding environment.	6 Proposed construction/upgrade of surface water management structures	During construction phase.	Mine Manager/Relative contractor or employee

	7 upgrade/construction of sediment ponds at GEM during construction works to limit the potential for sediment laden waters to discharge into the surrounding environment;	During construction phase	Mine Manager/Relative contractor or employee
	8 Implementation of management commitments for water monitoring and hydrocarbon spill management.	During Operations.	Mine Manager/Relative contractor or employee
Implementation of a comprehensive surface water monitoring program.	9 Monitor surface water quality of surface water at selected monitoring points for turbidity, pH (monthly), EC, SAR, conductivity, calculated TDS, TSS, hardness, alkalinity sulphate, chloride, selected dissolved cations, selected metals and metalloids.	During Operation	Mine Manager/Relative contractor or employee
Ground water (Section 6.3)			
Minimise impact on existing groundwater quality	10 The proposed TSF will contain a HDPE liner in order to minimise the interaction between aqueous tailings material and groundwater	During construction phase	Mine Manager/Relative contractor or employee
	11 Finalise the location of 2 ground water monitoring bores (1 at GPP and 1 at GEM) and commencement of groundwater monitoring	During construction phase	Mine Manager/Relative contractor or employee
	12 Appropriate storage of hydrocarbons	On-going	Mine Manager/Relative contractor or employee

Noise (Section 6.4)			
Noise emitted from site do not exceed guideline levels	13 Construction, mining and processing operations to occur on day shift only	Throughout all operations	Mine Manager/Relative contractor or employee
	14 Timing of production blast to be governed by climatic conditions	During operations	Mine Manager/Relative contractor or employee
	15 advanced notification of production blasts	During operations	Mine Manager/Relative contractor or employee
	16 Monitoring of noise will occur at selected receivers during initial blasting to ascertain blasting overpressure and vibration levels	Initial blasting event	Mine Manager/Relative contractor or employee
Waste Management (Section 6.5)			
Appropriate management of all waste product generated during Level 2 actives	17 Proposed construction of PAF/NAF Waste Rock Emplacement (WRE) to the east of the open pit at GEM.	During Construction activities	Mine Manager/Relative contractor or employee
	18 The implementation of a PAF/NAF waste rock classification system as per the preliminary Waste Rock Management Plan to better manage AMD generating material at both GEM and GPP;	During operation	Mine Manager/Relative contractor or employee
	19 construction of proposed TSF and implementation of tailings management plan	During construction activities	Mine Manager/Relative contractor or employee

	20 Provide appropriate waste disposal facilities	During operations	Mine Manager/Relative contractor or employee
Dangerous goods and environmentally hazardous material (Section 6.6)			
Appropriate management of all Dangerous goods and environmentally hazardous material	21 appropriate storage of hazardous materials	During Operation	Mine Manager/Relative contractor or employee
	22 Training for appropriate safe handling practices of hazardous substances and provisions of appropriate PPE	During Operation	Mine Manager/Relative contractor or employee
	23 No storage of explosives at site	During operations	Mine Manager/Relative contractor or employee
Biodiversity and natural values: Flora and Fauna (Section 6.7)			
Minimisation of short and long-term impacts on flora and fauna within the Project Site.	24 incorporate a Tasmanian Devil and quoll management plan.	During operations	Mine Manager/Relative contractor or employee
	25 Noxious weed and hygiene management plan	During operations	Mine Manager/Relative contractor or employee
	26 Minimise the level of habitat disturbance by utilising previously disturbed areas where possible, in designing proposed infrastructure	During operations	Mine Manager/Relative contractor or employee
	27 Clearly define extent of vegetation to be removed during construction phase	During Construction phase	Mine Manager/Relative contractor or employee
Greenhouse gases and ozone depleting substances (Section 6.9)			

Minimise contribution to greenhouse gas levels and ozone depletion	28 All mining equipment, machinery and vehicles will be well maintained in order to minimise the generation of greenhouse gases.	During operations	Mine Manager/Relative contractor or employee
	29 No ozone depleting substances will be used or generated during construction activities and operations.	During construction and operations	Mine Manager/Relative contractor or employee
Heritage (Section 6.10)			
Site activities are undertaken without impacting upon any Aboriginal heritage items.	30 Utilising an Unanticipated Discovery Plan.	During Construction	Mine Manager/Relative contractor or employee
Land Use and Development (Section 6.11)			
Operations at the Granville Tin Project will not adversely impact other operations in the surrounding area	31 The Proponent will undertake further investigations into increased traffic volumes in the event approved development proposals are undertaken in the area.	Prior to commencement of conflicting development proposals	Mine Manager/Relative contractor or employee
Visual Impact (Section 6.12)			
Limit the visibility of operational areas from nearby residences and landholdings.	32 Ensure the GEM and GPP is maintained in a clean and tidy condition at all times	On-going	Mine Manager/Relative contractor or employee
	33 Ensure Air quality controls are implemented to reduce visible dust	During construction and operations	Mine Manager/Relative contractor or employee

	34 Natural topography and/or existing habitat to be utilised to extent possible to provide a visual barrier	During construction	Mine Manager/Relative contractor or employee
	35 Day shift only operations to reduce the requirement for lighting;	During construction and operations	Mine Manager/Relative contractor or employee
Socio – economic issues (Section 6.13)			
Continued dialogue with the local community and rectification of issues of community concern, where possible.	36 Maintain a community feedback register	On-going	Mine Manager/Relative contractor or employee
	37 Manage all other risks to minimise impact on the community	On-going	Mine Manager/Relative contractor or employee
Minimise real or perceived impacts on local amenity	38 to the extent possible, employ personnel from the west coast	On-going	Mine Manager/Relative contractor or employee
	39 to the extent possible, procure locally goods and services from the west coast	On-going	Mine Manager/Relative contractor or employee
Health and Safety (Section 6.15)			
Compliance with all relevant legislations	40 All operations, maintenance, health and safety management on the mine site will be compliant with the *Work Health and Safety Act 2012* and the *Work Health and Safety Regulations 2012* and *Mines Work Health and Safety (Supplementary Requirements) Act 2012* and *Mines Work Health and Safety Regulations (Supplementary Requirements) 2012*	On-going	Mine Manager/Relative contractor or employee

Hazard analysis and Risk assessment (Section 6.15)			
Incorporate risk analysis into final operations	41 A detailed risk/hazard assessment will be undertaken prior to commencement of construction actives	Prior to Level 2 Activities	Mine Manager/Relative contractor or employee
Fire Risk (Section 6.16)			
Fire associated risk is appropriately managed through the implementation of safety procedures	42 Implementation of a Fire Management Strategy	On-going	Mine Manager/Relative contractor or employee
	43 All facilities maintained to all relevant standards	On-going	Mine Manager/Relative contractor or employee
Environmental management systems (Section 6.18)			
Adherence to all environmental notices outlined by the EPA	44 all mine and processing operations will be undertaken in accordance with commitments outlined in the DPEMP and various environmental management plans	During construction and operations	Mine Manager/Relative contractor or employee
Traffic impacts (Section 6.20)			
Achieve safe and efficient transport operations.	45 Prepare and supply a “code of conduct” or similar to all drivers outlining the required conduct during the delivery of materials	On-going	Mine Manager/Relative contractor or employee

	46 Implementation of 40km/hr speed limit for trucks whilst travelling along the site access road (including the right of carriageway).	On-going	Mine Manager/Relative contractor or employee
	47 Installation of appropriate signage at the intersection of the Heemskirk roads with site access roads at both Granville East Mine and Granville Processing Plant;	During construction phase	Mine Manager/Relative contractor or employee
	48 Identification of all potential road restrictions (eg bridges) and ensure vehicles do not exceed weight or width limits;	On-going	Mine Manager/Relative contractor or employee
	49 Completion of appropriate risk assessments and Job Safety Analysis (JSA) by transport contractors.	On-going	Mine Manager/Relative contractor or employee

10 Conclusion

This Development Proposal and Environmental Management Plan (DPEMP) has been developed in accordance with the EPA's General Guidelines for preparing a Development Proposal and Environmental Management Plan for Level 2 activities and 'called in' Activities and the EPA's Development Proposal and Environmental Management Plan Project Specific Guidelines for Ten Star Mining Pty Ltd Intensification of use – Granville tin upgrade operations off Heemskirk Rd, near Zeehan February 2016.

The DPEMP has identified and assessed the potential impacts associated with the proposed Granville Expansion.

The specific commitments contained in the DPEMP demonstrate that appropriate operational and management measures will be in place to minimise any potential impacts and to minimise any risks to the environment and human health. With these measures in place, there are no significant risks of significant residual environmental impacts.

The DPEMP demonstrates that the proposal will be compliant with applicable Commonwealth and Tasmanian policies, legislation and regulations.

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Appendix

Appendix A	Draft Risk assessment table
Appendix B	Ecological Assessment of Proposed Tin Mining Operation, Granville Farm Road and Heemskirk Road, Western Tasmania ECOtas (2016)
Appendix C	Draft Decommissioning and Rehabilitation Plan
Appendix D	Community Consultation Documents
Appendix E	Granville Baseline surface water results
Appendix F	MSDS Safety Data Sheet
Appendix G	ILMP Granville Mine Water Quality Report
Appendix H	Granville Expansion NAG Testing
Appendix I	Development Proposal and Environmental Management Plan Project Specific Guidelines for Ten Star Mining Intensification of use – Granville Tin upgrade operation off Heemskirk Rd, near Zeehan
Appendix J	GHD Granville Tin Project Water Dam and Tailings Storage Facility Inspection
Appendix K	Level 1 Existing use Rights (add appropriate title)
Appendix L	Preliminary Waste Rock Management Plan
Appendix M	Surface water management plan
Appendix N	GHD TSF Preconstruction report