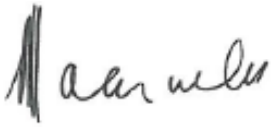
OM (MANGANESE) LTD

2020 - 2030

Bootu Creek Manganese Mine
Mining Management Plan

OM (Manganese) Ltd

Authorisation 0011-04

MMP Document Construction and Authorisation			
	Originator	Reviewed by	Approved by
Title	Environmental Officer	Chief Operating Officer	Managing Director
Name	Lana Civelle	Trevor Cook	Fanie Van Jaarsveld
Date	17 June 2020	17 June 2020	17 June 2020
Signature			

Issue Date	Title	Approval Date
20 December 2013	Mining Management Plan – Bootu Creek Manganese Mine	28 February 2014
12 November 2014	Operational Performance Report – Bootu Creek Manganese Mine	19 August 2015
20 November 2015	Operational Performance Report – Bootu Creek Manganese Mine	
20 October 2016	Mining Management Plan – Bootu Creek Manganese Mine	
3 January 2017	Mining Management Plan 2017 – Bootu Creek Manganese Mine	14 June 2017
15 October 2017	Mining Management Plan 2017/2018 – Bootu Creek Managanese Mine	1 June 2018
31 October 2018	Mining Management Plan 2018/2019 – Bootu Creek Managanese Mine	23 December 2019
14 December 2019	Mining Management Plan 2020-2030 – Bootu Creek Manganese Mine (Draft)	Withdrawn
17 June 2020	Mining Management Plan 2020-2030 – Bootu Creek Manganese Mine	TBD

Declaration

I FANIE VAN JAARSVELD (Managing Director) declare that to the best of my knowledge, the information contained in this Mining Management Plan is true and correct. I commit to undertake works detailed in this plan in accordance with all relevant Local, Northern Territory and Commonwealth Government legislation.

Signature:

Date: 17th June 2020

Mining Management Plan Checklist

The Mining Management Plan (MMP) Checklist must be completed. Cross reference page numbers from the MMP and provide comments or reasons for No (N) answers. If 'No' is answered to any of the sections below without adequate reason the department may reject the MMP and require re-submission.

Y/N	Page	Requirement	Department's Comment
Y	2	Has the plan been endorsed by a senior representative of the company?	
Y	13	**Introduction:** Have Operator details been included?	
Y	14	Is the company structure described?	
Y	15	Are title details included?	
Y	17	Is there a project summary and description improvements?	
Y	18	**Site Conditions:** Have all the physical environment conditions for the site and surrounds been identified?	
Y	22	Have the current land uses and users and stakeholders been identified?	
Y	29	Have Community Affairs been described?	
Y	31	**Statutory and Non-Statutory Requirements:** Has all legislation relevant to the operation and associated permits and approvals been identified? Have all non-statutory obligations been identified and included?	
Y	32	Have Aboriginal and heritage sites been identified?	
Y	33	**Operational Activities:** Have all operational activities relating to mining, processing, exploration and any related activities for the site been addressed in the MMP?	
Y	62	**Waste Rock Characterisation:** Have results of waste rock characterisation been included and discussed? Has a waste characterisation report been included? Does the MMP include a waste rock management plan?	
Y	72	**Environmental Management:** Has the Environmental Management structure and responsibilities been outlined?	
Y	74	Has the Environmental Policy been included?	
Y	74	Has a register of environmental commitments been included? Has a summary of all recommendations from the Environmental Impact Assessment been included and addressed if the project has been formally assessed?	
Y	77	Has training and induction been addressed?	

Y/N	Page	Requirement	Department's Comment
Y	77	Is there an Environmental Emergency and response plan?	
Y	78	Have all environmental aspects and potential impacts been identified? Has a risk assessment been carried out?	
Y	86	Have Environmental Management Plans (EMP's) for identified risks been developed and included?	
Y	88	**EMPs:** Do all EMP's include: • objectives and targets • management and mitigation strategies • monitoring and measurement • discussion and analysis of results • non-conformances and corrective actions?	
Y	93	**Water Management:** Has a comprehensive description of surface water conditions been included?	
Y	94	Has a comprehensive groundwater model been described?	
Y	95 – WMP/EMR	Have information or knowledge gaps been identified and described for water management?	
Y	97	Are there comprehensive details (including scopes of work) on actions proposed to be taken to respond to any identified information or knowledge gaps?	
Y	96	Have hazards been identified that could result from activities related to the operation and rank the associated risks of impacts to both surface and groundwater?	
Y	98	Are all strategies and actions that will be undertaken to manage any risks identified included?	
Y	98	Has the water monitoring program been detailed?	
Y	115 – WMP/EMR	Has all monitoring data been included?	
Y	115 - WMP/EMR	Has an interpretation of data by a suitably qualified person been included?	
Y	115 - WMP/EMR	Has a discussion of trends over time been detailed?	
Y	100	Have details of remedial/corrective strategies and scopes of work been included?	
Y	100	Have proposed actions been detailed?	
Y	101	**Incident Reporting:** Has a table of all incidents recorded on site been included and discussed?	
Y	101	**Closure Planning:** Has a Life of Plan – Unplanned Closure plan been included? Are all disturbances described? Are remediation activities that would be required in the event of unplanned closure described?	

Y/N	Page	Requirement	Department's Comment
		Are activities required to achieve end land use objectives, described?	
Y	103	Does the MMP include a detailed costing of closure activities for the life of plan? Have all past disturbances and those proposed for the next reporting period been identified and included?	
Y	40	**Maps and Plans:** Maps and plans have scale, scale bar, legend and north point? Datums used are MGA94 or GDA 94 (expressed in decimal degrees) with elevations based on AHD?	

Ammendments

As per Section 41(3) of the *Mining Management Act*, an MMP reviewed and amended under Section 41(1)(a) is to clearly identify amendments made.

Summary of Key Ammendments		
Reference	**Amendment**	**Section**
MR2017/0394 Comments on 2018 OMM Mining Management Plan	Updated MMP and EMPs to address comments provided in Variation of Authorisation	ALL
MDOC2018/05190 MMP Compliance Audit Report	Sections updated to address comments and findings.	ALL
MMP Project Summary	Tailings facility updated.	1.3.2
MMP DPIR Audits & Inspections	Updated to refer to Environmental Mining Report (EMR) for annual performace.	1.3.3
MMP Climate	Updated graphs and tables with relevant 2020 data.	2.1.1
MMP Operational Activities	LOMP, Mine designs, WRDs, Mining Performance, TSF, Processing performance all updated.	4
MMP Mine Design	Maps updated to be more legible and reflect current LOMP.	4.3
MMP Key Environmental Activities for the Current MMP period	Updated to refer to EMR and EMP for annual reporting performance from 2020.	5.6.5
MMP/ WMP Water Account	Updated to refer to EMR and WMP for annual statistics.	6.2.1
MMP/ WMP Actions and Strategies	Updated to refer to EMR and WMP for annual performance.	6.3.2
EMP/WMP Data Review and Interpretation	Updated to refer to EMR and WMP.	6.4.2
MMP Security Calculation	Removed from document to present as an annual figure with MCP.	8.3
MMP Incident Reporting	Table removed, detail updated to refer to EMR and AER for annual statistics.	7
MMP Detailed Pit Plans	Updated to reflect expected designs, now situated in 4.3 “Mine Plan”	4.3
MMP Security Estimate	Updated to refer annually to the EMR and MCP.	8.3

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1. Introduction

The structure and content of this Mining Management Plan (MMP) has been revised from previous versions to represent planned activities at the Bootu Creek Manganese Mine (BCMM) for the Life of Mine (LOM). Should any further changes to this MMP be required, an amendment will be submitted to the Department as per Section 41(2) of the Mining Management Act 2001.

An annual report on mining and environmental management activities will be submitted as an Environmental Mining Report (EMR). The EMR will address high risk issues identified in the LOM plan and assess and discuss performance against identified performance criteria, trigger levels, objectives and targets.

OMM will continue to prepare and submit an Annual Environmental Report (AER) for key stakeholders. The AER provides a summary of mining activities and environmental operations which occurred during the preceding calendar year.

This MMP has been prepared to report on all the high-risk issues and planned activities at the BCMM. The MMP is submitted to the Department of Primary Industry and Resources (DPIR) for approval as per Section 41 of the Mining Management Act (NT) and Variation of Authorisation 0011-04.

1.1. Operator Details

The business details and key contacts for the Bootu Creek Manganese Mine are:

Table 1: Ownership details

Ownership Details	
Trading /registered name:	**OM (Manganese) Ltd.**
ABN:	60 097 091 506
ACN:	097 091 506
Phone:	(08) 6311 1500
Commencement Date of Business:	June 11, 2001
Trading Address:	Level 3 8 Colin Street, West Perth WA 6005
Parent Company:	OM Holdings Ltd. (ASX Code: OMH)

Table 2: Key onsite contacts for the Bootu Creek Manganese Mine

Name	Role	Email
Trevor Cook	Chief Operating Officer	Phone: (08) 8962 0201 A/Hrs Phone: (08) 8962 0248 Mobile: 0437 901 757 Email: trevor.cook@ommanganese.com.au
Grant Delahey	Process Manager	Phone: (08) 8962 0201 A/Hrs Phone: (08) 8962 0248 Email: grant.delahey@ommanganese.com.au
Andre de Villiers	Administration Manager	Phone: (08) 8962 0201 A/Hrs Phone: (08) 8962 0248 Email: andre.devilliers@ommanganese.com.au
Riaan Van Jaarsveld	Mining Manager	Phone: (08) 8962 0201 A/Hrs Phone: (08) 8962 0248 Email: riaan.vanjaarsveld@ommanganese.com.au

OM Holdings Ltd controls 100% of the Bootu Creek Manganese Mine (BCMM) through its wholly owned subsidiary, OM Manganese Ltd (OMM). OMM has a corporate head office located in Perth, WA.

Table 3: Key corporate contacts for OM (Manganese) Ltd

Name	Role	Phone	Email
Fanie Van Jaarsveld	Managing Director	08 63111 500 (office) 0407 425 272 (mobile)	Fanie.vanjaarsveld@ommanganese.com.au

1.1.1. Organisational Structure and Responsibility

The organisational structure for the BCMM is shown in Figure 1 below.

The Chief Operating Officer (COO), or delegate in his absence, is responsible for compliance with regulatory requirements. The HSE Superintendent is accountable for ensuring that the MMP and Environmental Management Plans are updated, implemented, and complied with whilst undertaking approved activities. Work group managers are responsible for ensuring staff are aware of and comply with the commitments under the various Management Plans.

Environmental management at the BCMM is coordinated, and primarily undertaken, by the site Environmental Officer. A range of environmental management aspects are undertaken with the support of other staff or contractors as required. This will include, but is not limited to weed treatment, sediment and erosion control works, hydrocarbon management, and water quality sampling. All support staff are appropriately trained by the site Environmental Officer, with training records maintained, to ensure consistency and quality control. The HSE Superintendent is responsible for reviewing the outcomes of assisted work and supervising where practical. Land management and earthwork related tasks will be coordinated by the Mining Manager / Superintendent and undertaken by suitably trained operators with guidance from the HSE Superintendent.

The typical number of OMM employees and contractors operating at the mine site is approximately 200. Approximately 40% of the workforce is represented by contractors.

Contractors are used to run the accommodation village, manage the transport of Run of Mine (ROM) ore, product load outs to the rail, and explosive supply. Mining, processing and maintenance of fixed and mobile mining plant are undertaken using OMM personnel.

OMM provides appropriate resources for the supervision of all activities on site. OMM awards contracts based on safety, reliability, environmental performance and cost. The contracts are reviewed and retendered as necessary and at the end of contracted periods. Where necessary, technical, support, or works outside of planned scopes works will be outsourced to suitably experienced and or qualified contractors.

The mine workforce operates on either a fly in/fly out or drive in/drive out style roster. The current roster panels include a 14 on / 7 off and a 14 on / 14 off roster depending on work and task requirements.

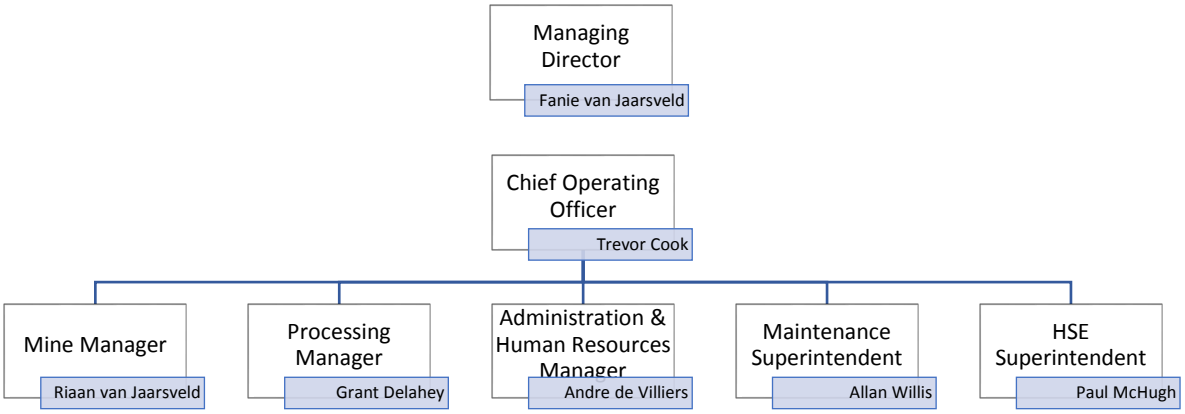


Figure 1: Lead team organisational structure – Bootu Creek Manganese Mine

1.2. Title Details

Tenements within the project area and covered by this MMP are detailed in the table below.

Table 4: Tenements held by OMM under Authorisation 0011-04

Tenement	Title Holder	Status	Grant Date	Expiry Date
ML24031	OM Manganese Ltd	Granted	20/09/2004	20/09/2029
EL31665	OM Manganese Ltd	Granted	03/08/2017	02/08/2023

Exploration Licence EL31665 was granted in August 2017 and now replaces the previously combined exploration licences EL28662 and EL30913.

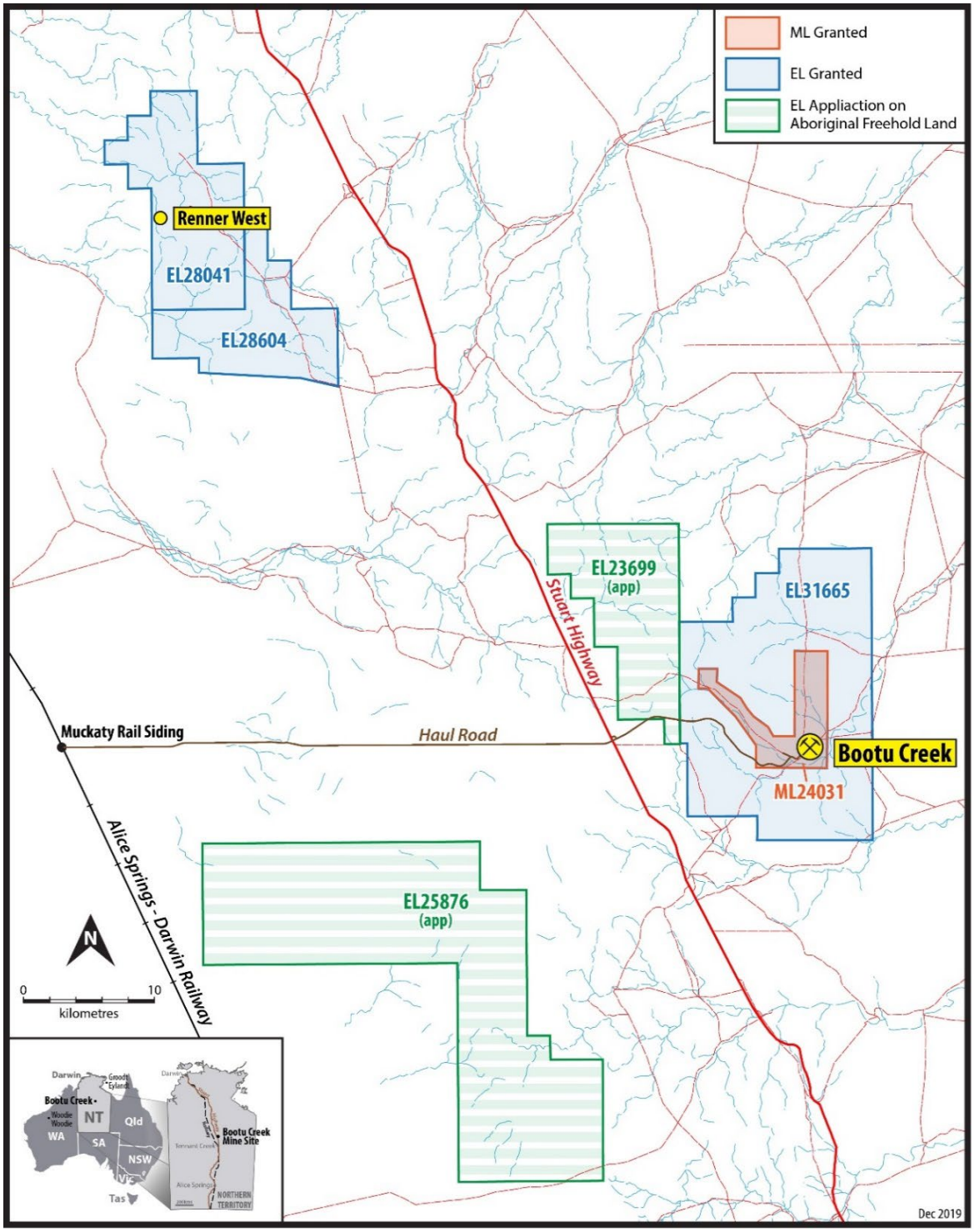
1.3. Project Description

1.3.1. Location

The BCMM is located on Mining Lease 24031, situated within the Banka Banka pastoral station, approximately 850 kilometres south of Darwin; 125 kilometres north of Tennant Creek; and 18 kilometres' east of the Stuart Highway (Figure 2). Access to the site is via a two-lane bitumen access/haul road off the Stuart Highway which culminates at the administration offices. All mining operations are conducted within Mining Lease 24031.

Satellite imagery, tenement area and site layout feature in Appendix 3.

Figure 2: Site location plan of the BCMM



1.3.2. Project Summary and Improvements

Bootu Creek Resources submitted a Notice of Intent (NOI) document to the then Department of Business, Industry, and Resource Development on 20 November 2003. The project was considered by a Project Review Committee in April 2004, and subsequently it was determined that the project warranted assessment using the Public Environmental Report (PER) process. The PER was submitted in July 2004 and placed on public display for three weeks. An Authorisation under the Mining Management Act was granted, and construction commenced in October 2004 and was completed on 31 October 2005.

Mining commenced in November 2005 and development has progressed within the granted ML24031 and several pits have been developed along the Eastern and Western limbs of the ore body.

Between 2015 to 2016, due to unfavourable economic circumstances, the BCMM entered into voluntary care and maintenance. Market conditions enabled mining to recommence at the start of 2017 allowing operations to continue to the present day.

A prohibition notice served by the DPIR ceased all in-pit operations following a fatal incident at Tourag pit on 24th August 2019. The prohibition was lifted in specific pits over a course of geotechnical investigation for dewatering and specific operations over the proceeding four months. Two pits remain in-operational (Tourag and Yaka 4) due to geotechnical review.

Ore is processed on site and beneficiated using a Heavy Media Separation plant (HMS). A secondary Processing Plant (SPP) was approved, and subsequently commissioned in December 2009, to reprocess and recover manganese contained in initial treatment rejects. A Tailings Retreatment Plant (TRP) has been commissioned in 2020 and will reprocess existing deposited tails and the heavy media floats crushed to minus 2.0mm.

The TRP evaluation was first completed 2014-2015 and progressed into the design stage in late 2017. The project was approved by the OMH board in 2018 with a modular processing facility being constructed offshore and shipped to Bootu where assembly was undertaken within house. The reflux classifier circuit relies on a density differential between the valuable mineral (Manganese) and the waste where a controlled up-flow of water achieves separation.

Tailings material produced in the processing plant was historically delivered to a 3 cell Tailings Storage Facility (TSF). The TSF has been filled to design capacity and various open pits have subsequently been utilised as the TSF including the mined-out Xhosa, Zulu, and the recently approved GoGo pits.

Manganese lump, fine and ultra-fine product is transported via road train to the Muckaty rail siding, located to the west of the site. An extension to the rail siding was approved and subsequently completed in November 2009, which enables the loading and transport of larger quantities of product.

Exploration activities within the Mineral Lease have been restricted to infill drilling and resource delineation drilling to assist with pit design and schedule development. No rehabilitation of these drill holes will be conducted until cessation of operations as they will largely be consumed by pit and dump development. Drill collars, tracks, gridlines, and sample piles remaining at mine closure will be rehabilitated in accordance with rehabilitation works completed on exploration licences held by OM Manganese and with guidance notes available on the DPIR website.

All exploration drill holes and disturbance, outside of the existing ML24031, have been rehabilitated. Drill holes and exploration disturbance, which have not been excavated by the mining of pits, have been included within the site security calculation. These areas will be rehabilitated as part of the mining rehabilitation program.

The rehabilitation status of Waste Rock Dump (WRD) areas is presented in a Progressive Rehabilitation Report (PRR) to be submitted to the DPIR on an agreed basis. The detailed WRD program is included in the Mine Closure Plan. All WRDs are at final capacity and all future material is scheduled to be deposited in-pit. As such, rehabilitation of the WRDs is scheduled to be undertaken progressively across the life of mine and into the extended tails processing phase and closure period until closure criteria has been satisfied.

1.3.3. Regulatory Audits & Inspections

The outcome of audits and inspections conducted by regulatory agencies and any identified non-compliances and corrective measures implemented and planned are detailed in the Environmental Mining Report.

2. Site Conditions

2.1. Physical Environment

Detailed descriptions of the land use, geology and baseline environmental conditions are contained in the Bootu Creek Manganese Project PER (July 2004). Key information is summarised below.

2.1.1. Climate

Bootu Creek is located in an arid environment. The rainfall is unreliable and is usually associated with tropical cyclones, or summer thunderstorms, occurring mainly during the period December to March.

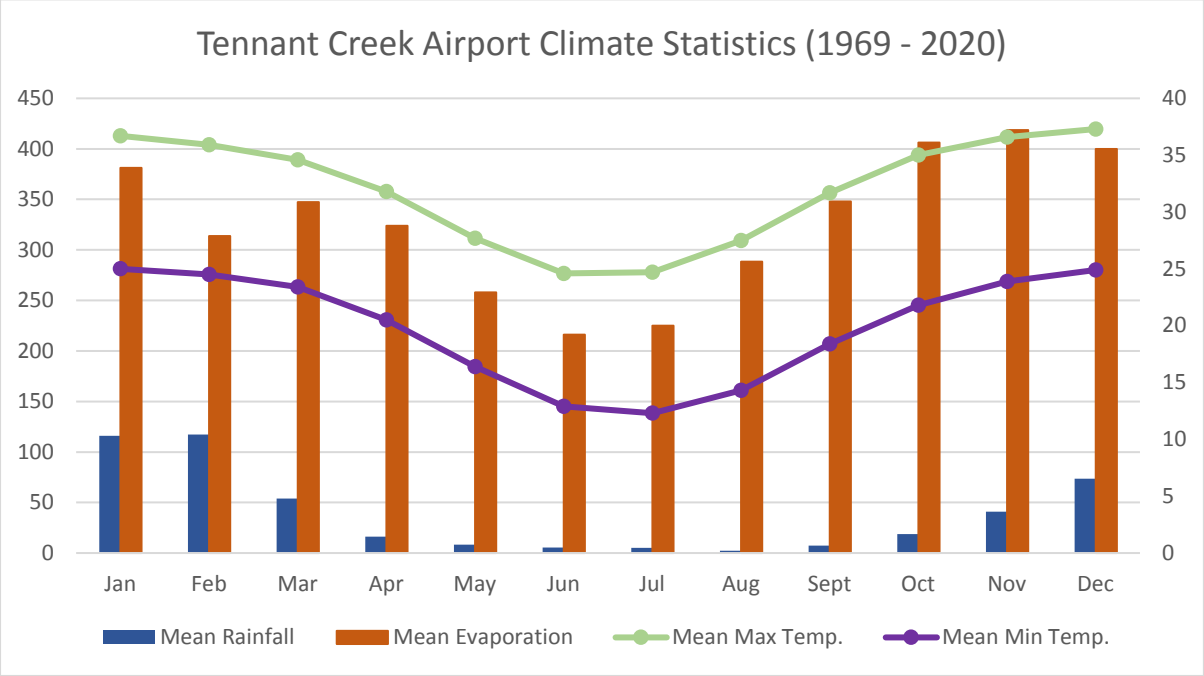


Figure 3: Graph of long term climate averages for the Tennant Creek Region as recorded at the Tenant Creek Airport Source:

Source: Australian Bureau of Meteorology.

Figure 3 presents the long-term average climate data from 1969 – 2020. There are no months of the year where rainfall exceeds evaporation. This has significant implications for water management over the site as water loss through evaporation is substantial. The station has been recording climate data since 1969. The average annual evaporation rate of 3,940mm[1] exceeds the average annual rainfall (497.1 mm). Figure 4 illustrates the rainfall received at the BCMM during operational periods 2006 – 2020.

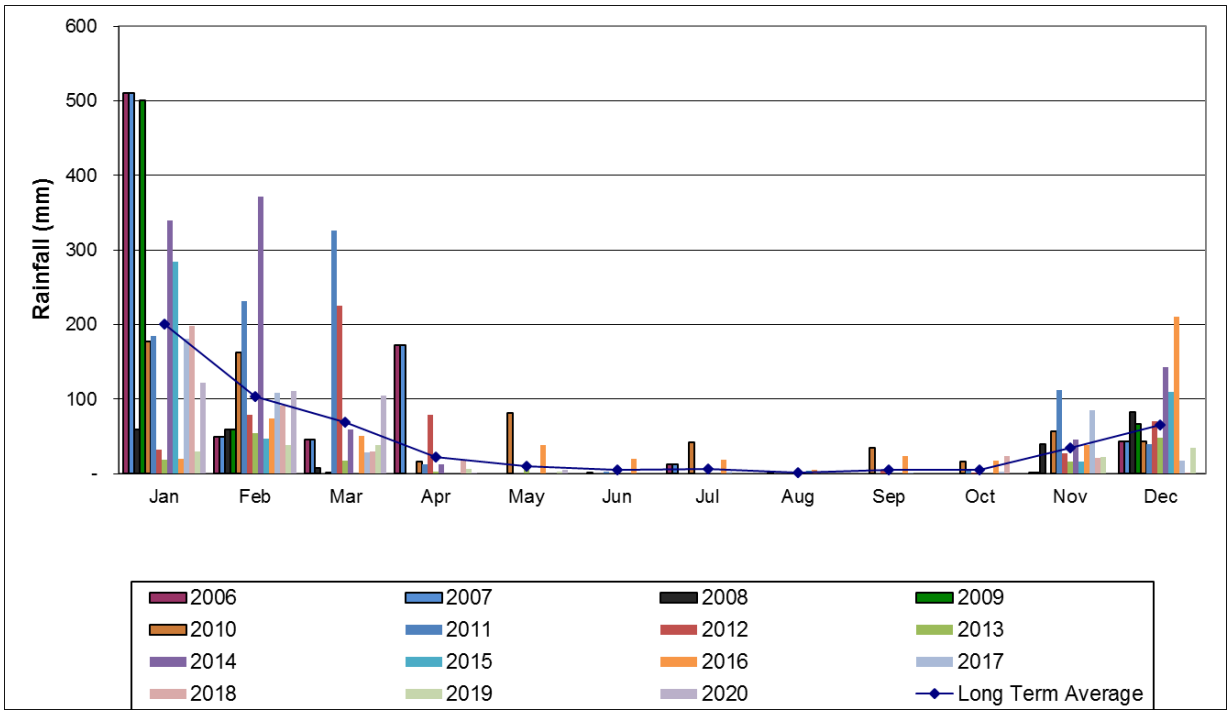


Figure 4: Graph of rainfall recorded at the BCMM for all years of operations (2006 – 2020)

Winds are predominantly west to south westerly as recorded at the Tennant Creek Airport and illustrated in Figures 5 and 6 below.

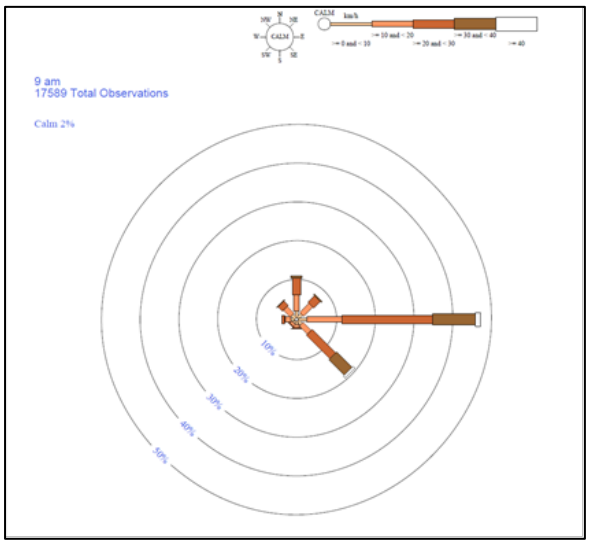


Figure 5: Plot of wind speed vs. direction at 9am.

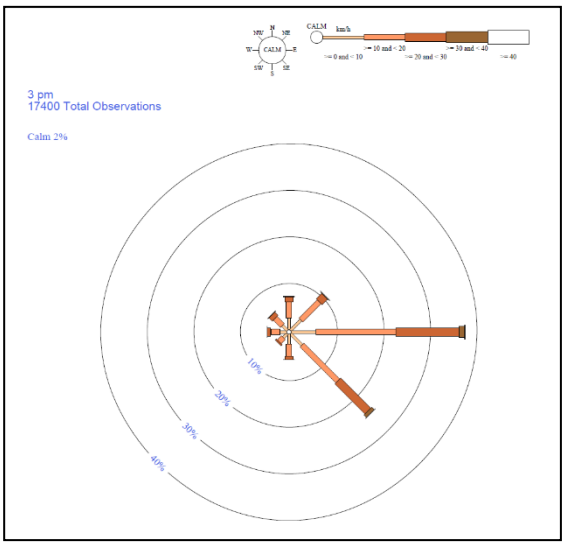


Figure 6: Plot of wind speed vs. direction at 3pm.

[1] Obtained from Bureau of Meteorology for Station No. 015135, Tennant Creek Airport

2.1.2. Land Systems

The project lies within the boundaries of the Banka Banka pastoral station. The highest point in the project area is 382 metres, which occurs on the crest of the Ashburton Range. The lowest point is around 250 metres in height and is located near the eastern boundary of the project near the Barkly Tablelands.

The Conservation Commission of the Northern Territory (1983) found the Banka Banka pastoral lease to be generally stable and identified no major land management or erosion problems.

Three land systems are found within the mineral lease and haul road, namely the Ashburton, Elliott and Helen Springs Land Systems. These land systems merge into one another throughout the majority of the project area. The hilly country (Ashburton Land System) incorporating the western project area is described by Christian et al. (1952) as having a naturally low stock carrying capacity, a low pastoral potential and the absence of any agricultural potential.

The Elliott Land System occurs to the east of the mine area and also west of the Ashburton Range along the haul road west of the Stuart Highway where the Elliott and Ashburton Land Systems interdigitate. It is characterised by gently undulating relief with skeletal and lateritic red sands with low pastoral potential and a low stock carrying capacity. Helen Springs Land System occurs in a zone west of the Ashburton Range along the mutual boundary of Muckaty and Banka Banka Stations. It is characterised as gently undulating to low hilly country with skeletal soils, volcanic calcareous desert, and heavy pedocal soils.

2.1.2.1. Topsoil and Subsoil

The hilly Ashburton land system is characterised by stony skeletal soils in the west of the project areas. Rocky creek beds and depression areas in these regions contain pockets of alluvial soils, lateritic red earths and deep yellow sands.

The Elliot land system is characterised by gently undulating relief with skeletal and lateritic red sands and generally light textured soils. Open flood plain regions of the lease area contain areas of loamy sands to several metres depth.

2.1.2.2. Topography and Geology

Bootu Creek forms part of the Ashburton Province consisting of Proterozoic platform cover of fluvial to shallow marine sandstone with minor volcanic rocks, siltstone, and carbonate rocks of the Tomkinson Creek Subgroup conformably overlying the Flynn Subgroup. A recessive sequence of calcareous siltstone and stromatolite dololutite, comprising the Attack Creek Formation, is overlain by a predominantly ridge-forming sandstone sequence, the Bootu Formation, containing an extensive manganese horizon near the base, within dolomitic siltstone and medium grained sandstone.

The Bootu Creek manganese horizons occur in the lower part of the Bootu Formation. The Bootu Formation is folded around a faulted syncline that plunges gently to the north-north-west. Bedding dips at low to moderate (10 to 45°) angles and averages about 30 degrees. Several north trending faults have been mapped along the western limb of the Bootu Syncline with lateral displacements of up to 300 metres. The manganiferous horizon can be discontinuously traced 24 kilometres around the syncline as a series of black ridges and knolls.

At Bootu Creek, the manganese ore horizon exposed in the open cut pits is up to 12 metres in thickness and averages six metres. Metallurgical grade (>38% Mn) manganese ore is up to 2.7 metres thick and averages around 1.2 metres. The material is grey to black, massive or reinform in

texture and found toward the base of the ore zone where the manganese completely replaces siltstone. Pyrolusite is present as veinlets through the massive psilomelane ore. Medium grade ore is grey to black, with numerous medium to fine grained, quartz grains and found above the metallurgical grade ore where the manganese replaces quartz sandstone or partially replaces siltstone. Gangue minerals include quartz, barite, chalcedony, calcite and gypsum.

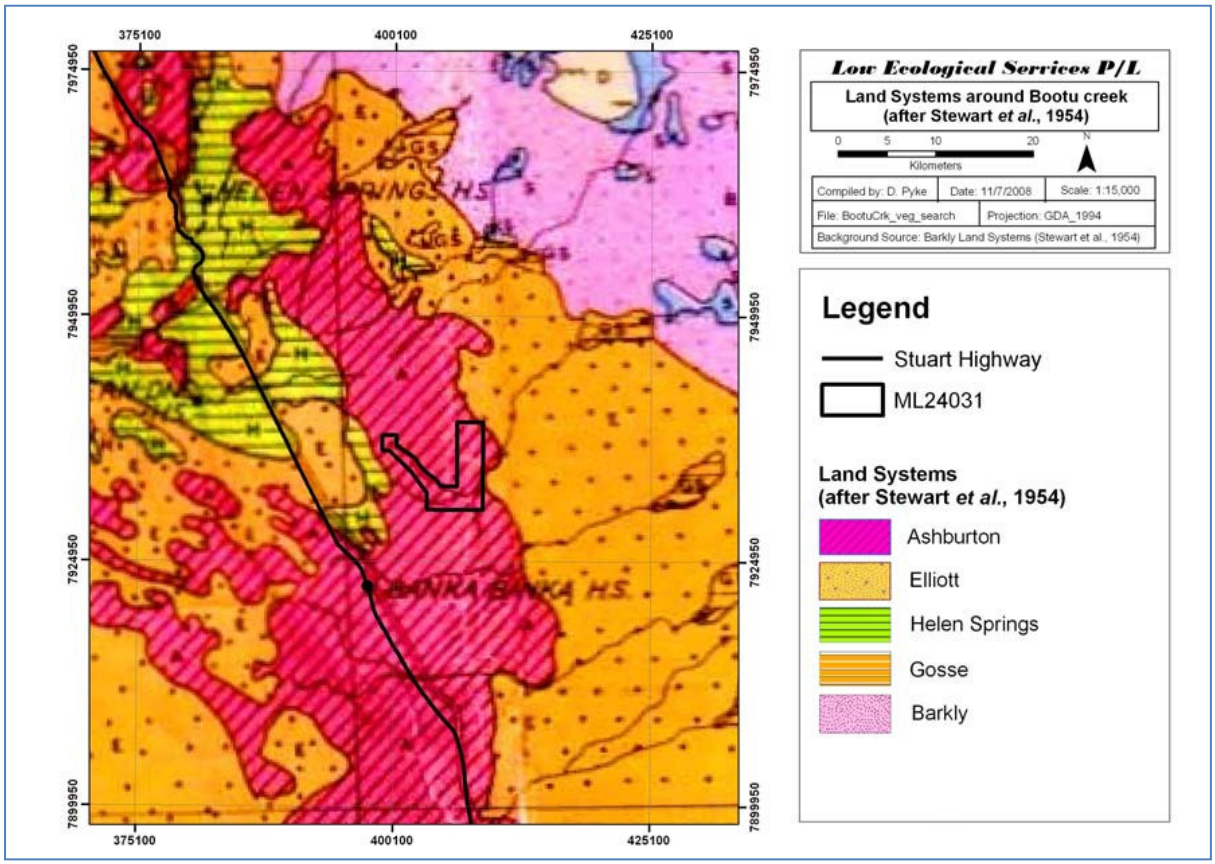


Figure 7: Location of ML24031 within land classification system of Stewart et al. Reproduced from Flora and Fauna report conducted for OM Manganese by Low Ecological Services.

2.1.2.3. Vegetation

In the 1:1,000,000 vegetation classification system of Wilson *et al*. (1990) the majority of the area of ML24031 occurs within vegetation unit 39, described as "low open woodland with hummock/tussock grassland understorey. It is characterised by co-dominant upper stratum of *E*, *L* and *C*. An open shrub layer consists predominantly of *A* and *C*, and the ground layer is a mix of hummock (*P* and *T*) and tussock (*C* and *E*) grasses. This community occurs on gently undulating plains, with lateritic red earths and deep yellow sands.

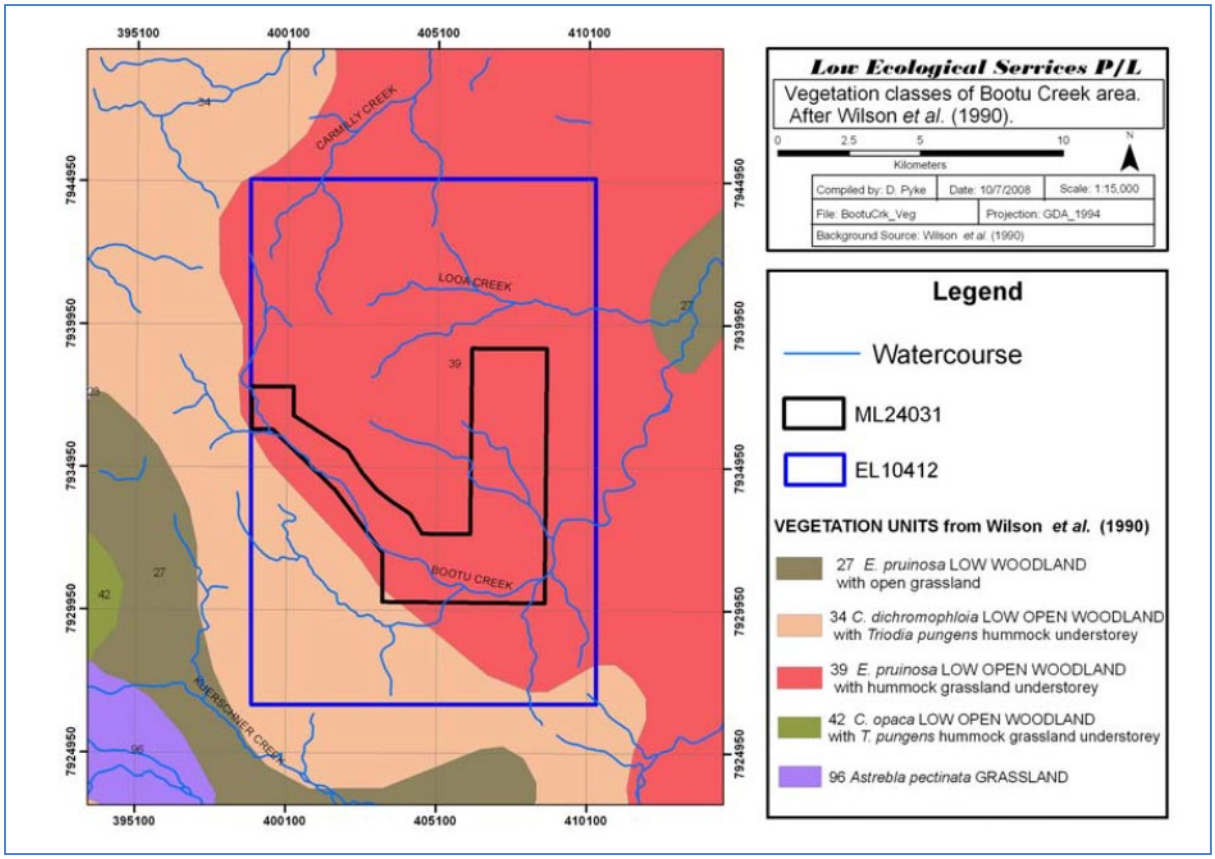


Figure 8: Location of ML24031 within vegetation classes of Wilson et al. Reproduced from Flora and Fauna survey report conducted for OM Manganese by Low Ecological Services.

2.1.3. Flora and Fauna

2.1.3.1. Flora

The project area is located in the extreme south of the Ashburton Ranges and abuts the Barkly Tablelands to the east. The project area borders the Mitchell Grasslands to the north-east and the Eucalypt savannah and desert areas to the south-west. The vegetation consists of open Eucalypt savannah with large grassed plains. Trees are typically concentrated around the creek lines and lower lying flood plains adjacent to these creeks.

Baseline vegetation surveys were conducted in the mine lease and haul road corridor in November 2004 by Low Ecological Services. The survey identified 121 plant species on the Bootu Creek mineral lease and its associated haul road. All species were native to Australia. No species listed under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999 was identified during the ground survey. A further flora survey was conducted by Low Ecological Services in May 2008, during which 140 plant species were identified including three significant weed species.

A search of the Bootu Creek Manganese Mine project area for species and habitats of environmental significance under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999 was conducted on the Commonwealth Department of Environment, Water, Heritage, and Arts website most recently in January 2017. According to this search, the Bootu Creek area contains no World Heritage Properties, National Heritage Places, Wetlands of International Significance, or Threatened Ecological Communities. This landscape is characterised by sandy soils dominated by hummock (Triodia spp.) grasslands with an overstorey of low shrub cover dominated by Acacia and Melaleuca species. Broadscale surveys of bilbies in the NT in the 1990s indicated that laterite and drainage line

land systems were occupied more frequently than sand plain and dune systems (Southgate et al. 2005).

A review of the Territory Parks and Wildlife Conservation (TPWC) Act also indicated that there are no species of conservation concern likely to occur within the project area. The 2008 baseline report identified that the invasive species listed in within the table below and may occur or have suitable habitat within the project area.

Table 5: Invasive species identified, and/or with the potential to occur in the BCMM project area.

Species name	Common name (s)	Occurrence in the project area
Cenchrus ciliaris	Buffel Grass	Identified 2008 survey.
Calotropis procera	Rubber Bush	Identified 2008 survey.
Hyptis suaveolens	Hyptis	Identified 2008 survey.
Acacia nilotica subsp. indica	Prickly Acacia	Habitat may occur in project area.
Parkinsonia aculcata	Parkinsonia, Jerusalem thorn, Jelly Bean Tree, Horse Bean	Habitat may occur in project area.
Tamarix aphylla	Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarix, Flowering Cypress	Habitat may occur in project area.

2.1.3.2. Fauna

The project area lies on the boundary between the Tanami Desert and the tropics and the fauna that are expected to occur on the site are a compilation of native species from both regions. Non-native species known to occur on the project area include Donkey, Cattle, Cat, Dog and Rabbit. While the aerial distribution of the feral camel in the Northern Territory; as available on the NT Government (Environment) website; does extend over the operational area no camels have been identified within Mineral Lease 24031. Similarly, wild horses or signs of their presence have not been sighted within the lease area.

A search of the EPBC database conducted most recently in January 2017 indicated that no world Heritage properties, wetlands of international significance, or threatened ecological communities occurred within the project area or within a 20 kilometre radius of the project area.

Baseline fauna and habitat surveys were conducted in the mine lease and haul road corridor in November 2004 by Low Ecological Services. A further survey was conducted in May 2008 over the complete Mining Lease ML24031 in conjunction with the flora survey noted above.

No species listed under the EPBC Act 1999 were identified during the survey. Three threatened species listed under the EPBC Act 1999 may occur in the area; Australian Painted Snipe, Mulgara, Greater Bilby as described within the table below. The Southern Marsupial Mole (*Notoryctes typhlops*) was also identified as potentially occurring within the project area however was delisted from the EPBC Act in 2015.

Table 6: EPBC listed fauna species which may use suitable habitat within the BCMM project area.

Species Name	Common Name	EBPC Conservation Status	NT Conservation Status
Rostratula australis	Australian Painted Snipe	Endangered	Vulnerable
Macrotis lagotis	Greater Bilby	Vulnerable	Vulnerable
Dasycercus cristicauda	Crest-tailed Mulgara	Vulnerable	Vulnerable

A few species listed under NT legislation that may occur with habitat present on site, and within the region have been included in Table 7.

Table 7: NT Parks and Wildlife Conservation Listed Species

Species Name	Common Name	EBPC Conservation Status	NT Conservation Status
Varanus panoptes	Yellow-Spotted Monitor	Not listed	Vulnerable
Falco hypoleucos	Grey Falcon	Not listed	Vulnerable

Eight migratory bird species are listed as potentially occurring in the area but were also not encountered during the survey.

Table 8: Migratory species which may utilise suitable habitat within the BCMM project area.

Species name	Common name (s)	Species classification
Apus pacificus	Fork tailed swift	Migratory Marine Bird / Listed Marine Species
Ardea alba	Great Egret, White Egret	Migratory Marine Bird / Migratory Wetlands Species / Listed Marine Species
Ardea ibis	Cattle Egret	Migratory Marine Bird / Migratory Wetlands Species / Listed Marine Species
Haliaeetus leucogaster	White-bellied Sea-Eagle	Migratory Terrestrial Species / Listed Marine Species
Merops ornatus	Rainbow Bee-eater	Migratory Terrestrial Species / Listed Marine Species
Charadrius veredus	Oriental Plover, Oriental Dotterel	Migratory Wetlands Species / Listed Marine Species
Glareola maldivarum	Oriental Pratincole	Migratory Wetlands Species / Listed Marine Species
Rostratula benghalensis s. lat. (Vulnerable)	Painted Snipe	Migratory Wetlands Species / Listed Marine Species

2.2. Socio-Economic Environment

Tennant Creek is the nearest population centre to the BCMM project located on the Stuart Highway between Katherine and Alice Springs. Tennant Creek has a population of approximately 3,332 (Australian Bureau Statistics, 2006). It is considered to be the hub of the Barkley Tablelands serving a diverse range of Indigenous communities, outstations, large pastoral properties and mines. The region also has a large number of tourism sites featuring the unique and beautiful landscape, flora and fauna.

The BCMM site is located 18 kilometres off the Stuart Highway, with the nearest residence being Banka Banka station approximately 15 linear kilometres from the site.

2.2.1. Current Land Use

The Mineral Lease lies within the boundaries of the Banka Banka pastoral station, with access and haul roads established on Banka Banka and Muckaty stations. Current land use is primarily pastoral although some historical mining for manganese occurred at the Muckaty Mine in the mid 1950`s to the late 1960`s. These mining operations which included some disturbance to the then undeclared sacred site areas are now abandoned and fall within the mineral lease area. The mine site area is not currently used for grazing cattle, although cattle may be present from time to time.

2.2.1.1. Existing Facilities

2.2.1.1.1. Site Access and Haul Road

An 18-kilometre-long, seven-metre-wide sealed two-lane site access road has been constructed. This road meets the Stuart Highway approximately 12 kilometres north of Banka Banka station.

At the Stuart Highway crossing the land is controlled by Department of Planning and Infrastructure. At this point there is a transition from the site access road to the haul road to Muckaty Siding, 40 kilometres away. The haul road becomes a four-metre-wide, sealed, single lane road and passes under the Stuart Highway.

The access road/haul road crosses pastoral leasehold land held by Banka Banka Station and freehold land owned by the Muckaty Aboriginal Land Trust, as well as a small portion of land the subject of the Mineral Lease and Exploration Leases. Agreements are in place with each stakeholder for land access, including an agreement to cross the existing NT Gas pipeline.

2.2.1.1.2. Railway Siding

The construction of the railway siding and product stockpile areas at Muckaty on the Alice Springs to Darwin Railway was completed in February 2006. An extension to the railway siding underwent the necessary feasibility and approval processes and construction was completed by Freightlink in 2009. A plan of the railway siding constructed as per approvals is presented in Figure 9.

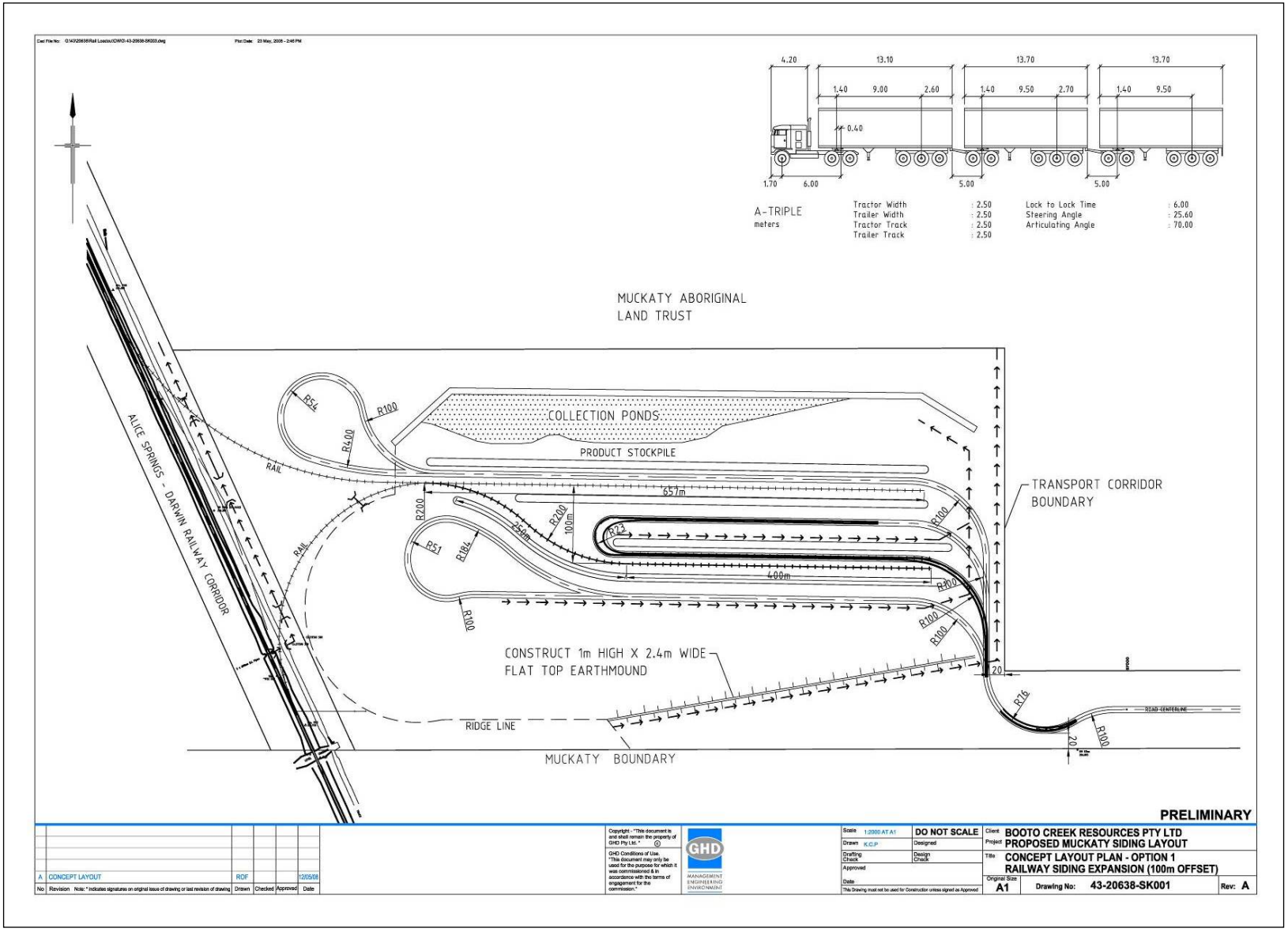


Figure 9: Layout plan of the Muckaty Railway siding.

2.2.1.1.3. Airstrip

The runway surface is compacted natural gravel. It is maintained and inspected to the requirements of the Civil Aviation Safety Authority (CASA) regulations. During operations there are flights on 2 days of the week. Trained Aerodrome Reporting Officers (AROs) inspect the airstrip prior to each flight arriving into Bootu Creek. An upgrade to the refuelling facility was completed in June 2011 to provide greater storage capacity and decreased refuelling times. The refuelling facility comprises a purpose built self-bunded bulk fuel tank of 20,000 litre capacity with a generator and electric pump.

A safety inspection and audit of the aerodrome facility was conducted in accordance with the CASA requirements for airstrips of this kind and is revisited on an annual basis. The principle findings of the safety inspection in October 2019 were:

- Continue drum rolling of the runway strip to push all large rocks into the surface.
- Remove the vegetation that is growing toward the outer edge of the runway strip.
- Remove the trees that infringe into the transitional surface at the northern end of the runway.

In 2015 the airstrip was substantially upgraded and improved. The airstrip was approved in 2017 for use of aircraft to 30 seat capacity. A plan of the aerodrome constructed at the BCMM and apron facility appears below (Figures 10 & 11).

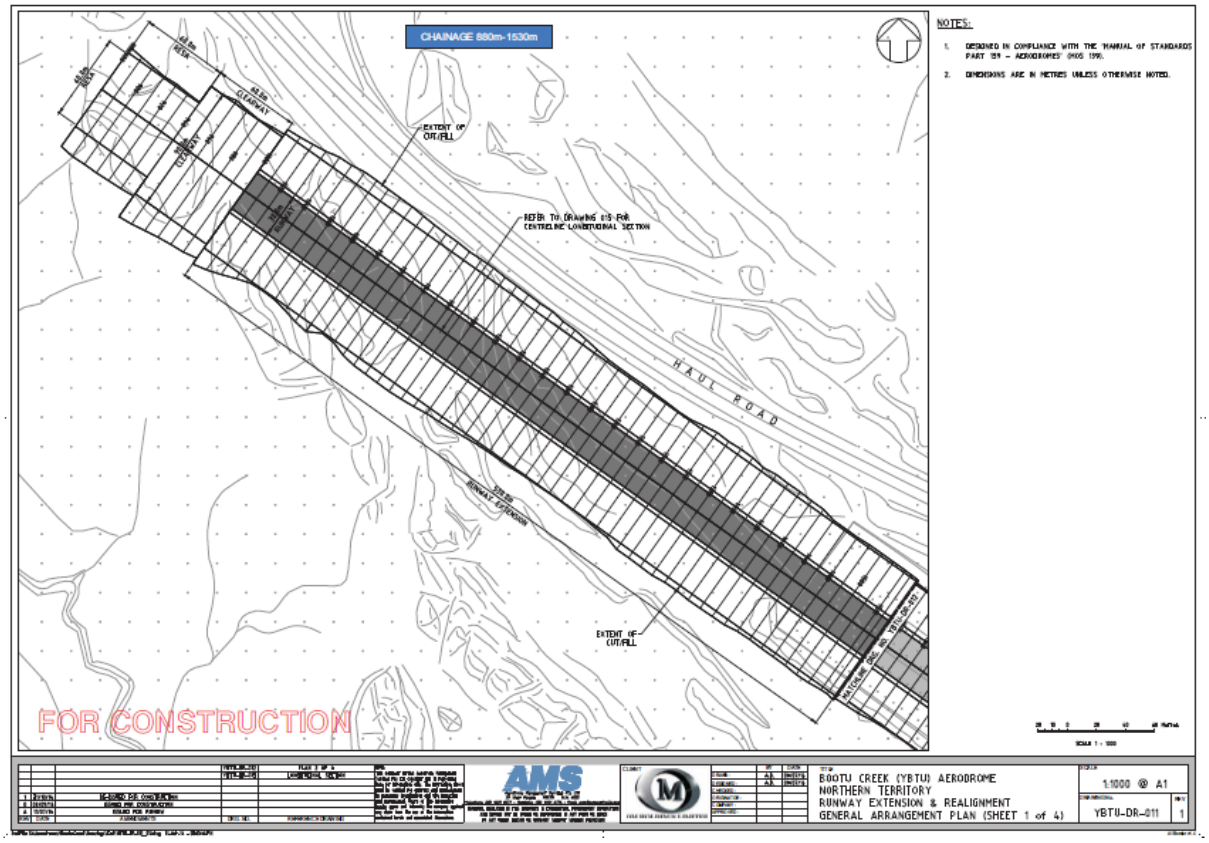


Figure 10: Plan of the aerodrome constructed at the BCMM. The drawing depicts the constructed runway.

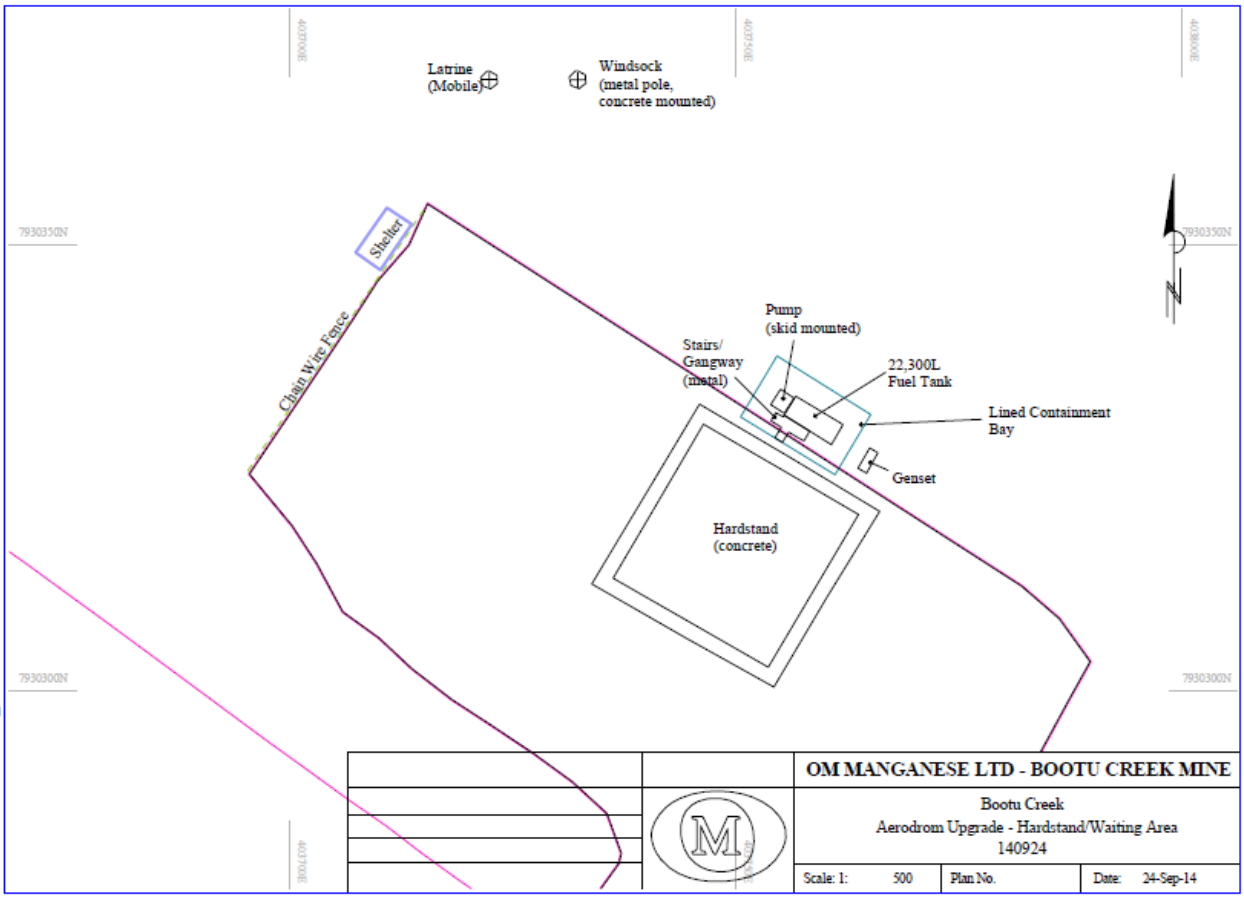


Figure 11: Plan of the aerodrome hardstand waiting area as constructed at the BCMM.

2.2.1.1.4. Accommodation Village

The accommodation village is located approximately 1.8 kilometres west of the mine site. The village is a standard type of transportable pre-fabricated units comprising approximately 260 single rooms, each with ensuite. Kitchen, dining and recreational facilities are also available for use by camp occupants.

A water bore and reverse osmosis treatment system has been commissioned to provide water for the village. A packaged sewage treatment system located adjacent to the camp is used for treatment of camp waste water. The final effluent is chlorinated, as part of the waste treatment process, prior to being mixed with reverse osmosis wastewater and grey water from the laundries and pumped to the Xhosa Waste Dump rehabilitation.

Monitoring of the sewage treatment plants (STP) has been extended to include laboratory analysis for residual chlorine, microbiology, reactive and total Phosphorous, free and organic ammonia, and Biological Oxygen Demand (BOD) as per guidelines established in the Standard Methods for the Analysis of Water and Wastewater.

Less than four 250g chlorine blocks are added to the wastewater weekly. Chlorine levels in the decant water pond have not exceeded 300mg/L. These low chlorine levels do not warrant the development of an emergency action plan as the levels are lower than those found in many of the naturally occurring groundwater bores. Such low levels are not expected to pose any rehabilitation problems. Using the minimum standards set out in Section 7.2 of the NT Government Department of Health, "Code of Practice for Small Onsite Sewage Treatment Systems and Disposal or Reuse of

Sewage Effluent", the treated effluent being deposited onto the Xhosa Waste Dump Rehabilitation is:

- Not injurious to health.
- Does not result in effluent pooling,
- Is not expected to enter or pollute potable water supplies, reservoirs or ground water aquifers.

Power is supplied to the camp via the existing power line to the main power station. A back-up power station is positioned on the original camp power station site.

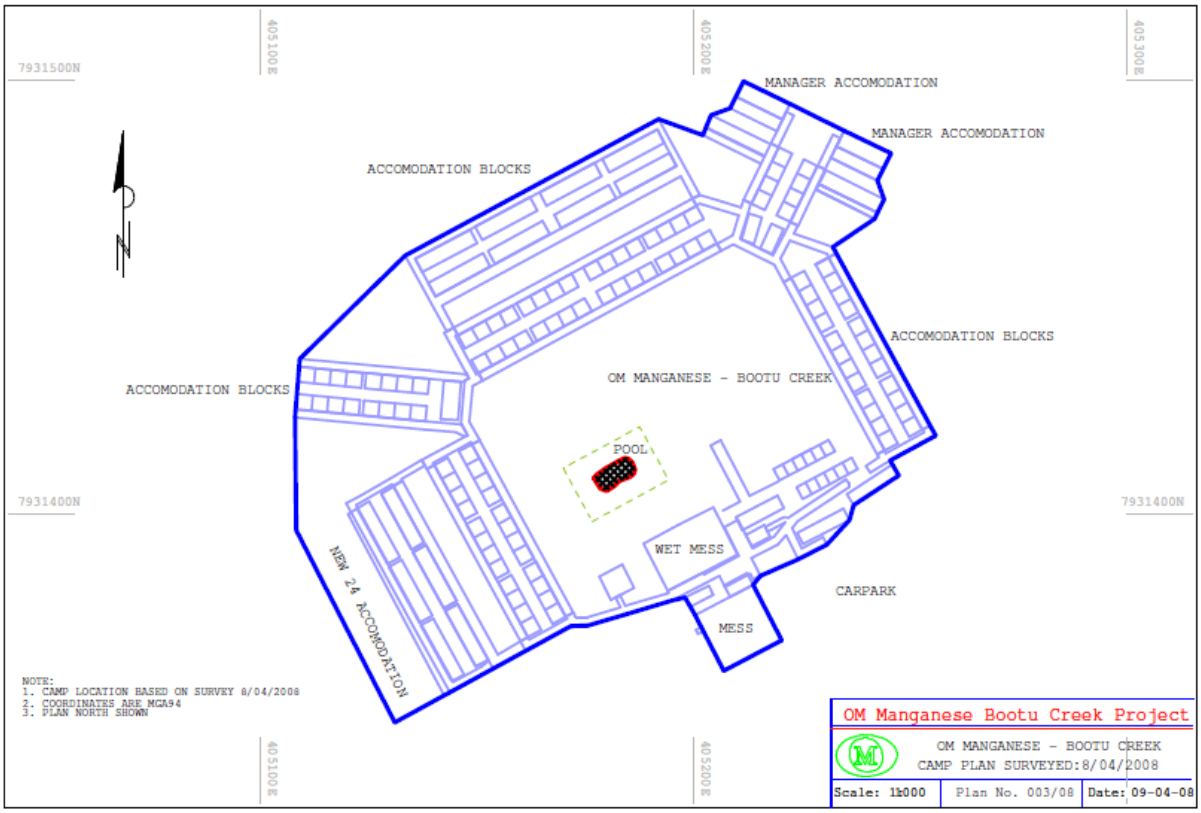


Figure 12: Plan of the accommodation village layout.

2.2.1.1.5. Dewatering Network

Dewatering bores and in pit pumps are used to lower the groundwater level in advance of mining to allow dry mining to occur on the pit floor. The majority of dewatering water is pumped to the process water dam for use in the process plant with the remainder pumped to turkey nest dams located adjacent to haul roads along the Eastern and Western limbs. These storages are utilised for efficient filling of water trucks for dust suppression around the site. There are currently no groundwater abstraction bores in use for in-pit dewatering. Dewatering during this period will be undertaken using floating submersible abstraction pumps.

A detailed list of active and decommissioned groundwater bores is described in the Water Management Plan (WMP).

In-pit sumps and trailer mounted pumps are also used to ensure a dry mining surface and to minimise the water content of ore delivered to the ROM pad.

Camp water is supplied via a single bore located in close proximity to the camp and to the camp RO system and reticulation.

2.2.1.2. Maintenance and Refuelling areas

The mining fleet workshop has a concrete apron extending 20 metres beyond the service bays. Servicing of wheeled machinery is undertaken on the concrete aprons. Tracked machinery is serviced on the compacted earth apron immediately in front of the workshop. Surface water runoff from these area reports to a sump excavated behind the road haulage workshop area and is pumped into the adjacent process water pond. During large rain events where runoff volumes exceed pump capacity the water is directed around the tailings dam into a further two sumps. Neither of these sumps has filled beyond capacity.

The OM Maintenance Workshop has an apron of compacted earth which is used for light vehicle parking and metal fabrication. Servicing of light vehicles and small plant is undertaken within the light vehicle workshop. Surface Water runoff from the compacted earth area reports to the intercept drain behind the administration buildings and is retained within two sediment traps.

Refer to the Hydrocarbon Management Plan for active mitigation of potential contaminants.

2.2.1.3. Administration buildings

The administration facilities at the BCMM are comprised of 10 demountable buildings equipped as office space, clinic, training rooms, lunchrooms, and ablution facilities. During 2012 an additional shipping container was placed alongside the exploration containers to house environmental consumables and equipment.

Archive storage capacity was increased during 2013 with an additional shipping container installed at the rear of the administration buildings.

2.2.2. Identified Stakeholders

Stakeholders with interests in the project include:

- OM (Manganese) Ltd;
- Native Title Claimants;
- Traditional Owners;
- Banka Banka and Muckaty Station Owners;
- Northern Territory Government Department of Primary Industry and Resources (DPIR);
- Northern Territory Environmental Protection Agency (NT EPA);
- Northern Land Council (NLC);
- Aboriginal Areas Protection Authority (AAPA);
- Tennant Creek Town Council;
- Barkly Region Chamber of Commerce;
- Shareholders; and
- Employees of OM (Manganese) Ltd and Contractors.

Consultation with Indigenous parties is through a Liaison Committee set up as part of the Land Use Agreement signed at the beginning of the project. As far as practical, quarterly meetings are held to discuss the previous period and future matters for both the traditional owners and OMM. An active dialogue is maintained with Traditional Owners through the NLC office in Tennant Creek. The dialogue and open relationship are forged by the meetings and constant contact with the traditional owners. This has fostered a close relationship that has enabled frank and open discussion.

A Stakeholder Consultation Register of previous meetings is reported in the AER.

The Meetings with the TO's and NLC representatives are typified by the following agenda items:

- Site inspection.
- Update on operational activities and status.
- Issues pertaining to sacred sites.
- Cultural training of OMM employees.
- Work opportunities.
- Rehabilitation developments.
- Water storage.

The station owners, whilst not having a formal consultation process, do call in and discuss issues as they arise. A portion of the Bank Banka station has recently been purchased by the Manangurra Aboriginal Corporation (MAC) association. The MAC have engaged the services of a variety of consultants to develop post closure land usage proposals; and identify measures which can be commenced now in conjunction with OMM to expedite those processes. The MAC is an important stakeholder in the BCMM and continues to have positive input to operational matters and closure planning.

Government agencies are kept informed through reporting and auditing processes, as required by legislation and or audit timetables, as presented and requested by the governing body.

2.2.3. Workforce demography

The employment strategy is to engage the majority of the work force from the labour pool in the Northern Territory. This has a positive local community impact as well as reducing transportation cost.

2.2.4. Community Affairs

OMM is active within the Barkly region through sponsorships, mentoring and active participation in community programs and sponsorships.

A Memorandum of Understanding was signed between the Barkly College and OMM to formalise the engagement that OMM has with the local schools. The local high school has previously visited the BCMM to give students an idea of what working on a mine site means and to see the opportunities that exist for them to drive towards in their academic endeavours. OMM is continuously assessing opportunities for work placements for students wishing to become tradesmen, which would then link to an apprenticeship. OMM work with the NLC, the MAC, and the Barkly College to identify students who have the aptitude and interest in undertaking an apprenticeship.

Traditional Owners and OMM are also active with cultural training. A cultural awareness package was put together by the Traditional Owners and OMM to be able to show the culture of the local indigenous people and how as Miners can better respect the land.

OMM have become involved in the Barkly executive Committee of the chamber of commerce. This committee aims to increase the local participation for supply of goods and services to the Mine.

Following resolution of the court case relating to Sacred Site 5760-21, work has commenced on rebuilding relationships; rehabilitating the immediate surrounds; and identifying long term stabilisation works required for this area.

2.2.5. Community Planning

Discussions with the Traditional Owners continues to assess the potential for the retention of infrastructure for post-closure endeavours. The Traditional Owners have shown interest in OMM leaving roads and tracks in place along with purchasing the Camp and associated infrastructure for use. Any decisions and agreements will be added to the Decommissioning and Closure Plan. The transfer of assets by agreement is likely to include but not be limited to the following:

- Camp as built and complete.
- RO Plants.
- Camp Genset.
- Camp bores, gensets, pumps and reticulation.
- Bores as agreed.
- Water pipeline reticulation as agreed.
- Administration Buildings.
- Main Workshop stores and Office buildings.
- Powerhouse with gensets removed;
- Electrical network, powerhouse, camp, workshop and administration reticulation.
- Fuel Farm.
- Waste oil storage.
- Road Network, Highway to camp, Camp to Masai 4, Camp to Chugga North.
- Road Network Highway to Muckaty siding.
- Muckaty siding.
- Airstrip complete and fuel storage facility.

Several meetings with the NLC and MAC since 2015, have occurred since the recommencement of operations. OMM continues to engage with the Traditional Owners on a regular basis, in order to assist in the planning process for post-closure land use; and to further discuss matters regarding intended post closure horticultural projects and mine infrastructure likely to assist in these ventures. Where practical for both parties, OMM will coordinate quarterly Community Liaison meetings, however biannual meetings will be held as a minimum.

OMM have entered into an agreement with WA Skills, a West Australian training organisation, to enable trainers on site to deliver training packages and for personnel to receive nationally accredited certification, verification of competency (VOC). There are several qualified trainers on site who have had their qualifications endorsed by WA Skills; and training of personnel in qualifications ranging from First Aid certification to machinery operation is normal practice.

The cultural training conducted by the Traditional Owners will continue to be delivered annually. The next stage will be to develop work opportunity and training for indigenous employment sourced from areas in and around the NT and Barkly region. Through supporting training initiatives and programs OMM aims to employ mine site ready people from the local area. By having field trips from the primary and high schools and then looking at work placements and apprenticeships OMM aims to have a local sustainable workforce in the future years.

3. Statutory and Non-Statutory Requirements

3.1. Statutory Requirements

Mining operations will be carried out in accordance with all relevant acts and regulations, in particular the following:

- Aboriginal Land Act 2013
- Bushfires Management Act 2016
- Bushfires Management (General) Regulations 2018
- Crown Lands Act 2014 and Regulations
- Dangerous Goods Act 2012 and Regulations
- Environmental Assessment Act 2013
- Environmental Offences and Penalties Act 2011
- Environment Protection and Biodiversity Conservation Act 1999
- Heritage Act 2016
- Mining Management Act 2018 and Regulations
- Mineral Titles Act 2016 and Regulations
- Northern Territory Aboriginal Sacred Sites Act 2013 and Regulations
- Native Title Act 1993
- Public and Environmental Health Act 2020 and Regulations
- Soil Conservation and Land Utilisation Act 2016
- Waste Management and Pollution Control Act 2016
- Weed Management Act 2013
- Water Act 2019 and Regulations
- Water Supply and Sewerage Services Act 2020 and Regulations
- Work Health and Safety (National Uniform Legislation) Act 2011 and Regulations

3.2. Non-Statutory Obligations

Relevant Northern Territory guidelines and codes of practice are used to direct management activities at the BCMM. Where guidelines are not available for the Northern Territory, guidance notes and considered industry best practice from other jurisdictions and regulatory bodies such as the West Australian Department of Mines and Petroleum are used. The following documents have been used in the development of site procedures and management plans.

3.2.1. Commonwealth Government

- Mine Closure and Completion.
- Mine Rehabilitation.

3.2.2. Northern Territory Government

- Advisory note – Mining Management Plan.
- Water Management Plan (WMP) Structure Guide.
- Weed Management Advisory Note.
- Groundwater sampling methodology.
- Surface Water sampling methodology.
- Code of Practice for the operation of small onsite sewage treatment systems.
- Waste management guidelines for small communities in the Northern Territory; and
- Mining Management Plan for Care and Maintenance (C&M) Structure Guide for Mining Operations Draft Advisory Note.

3.2.3. West Australian Department of Mines and Petroleum

- Tailings Storage Facility High Impact Function Audit Tool.
- Protection of ground and surface water during exploration drilling guidance note.
- Development of an operating manual for a tailings storage facility guideline.
- Geotechnical Audit Template (DME).
- Guideline for Preparing Mine Closure Plans.
- Safety Bund Walls Around Abandoned Open Pit Mines Guideline.

3.3. Sacred, Archaeological and Heritage Sites

The Bootu Creek project is on lands traditionally used by Kunapa, Kurtinja, Mangirriji, Jalajirrpa, Yapa Yapa and Pirrtangu peoples. A number of sacred sites have been identified within the mine operational areas. These have been demarcated as per directions contained in relevant Authority Certificates and entry is forbidden to OMM personnel, contractors and visitors.

There are no identified significant archaeological or heritage sites within the mine operational areas. Mining of manganese outcrops occurred within the mining lease area in the 1950s and 1960s with some scrap metal and signs of mining and exploration remaining. These areas have largely been consumed in the development of the Masai ore body.

3.3.1. Heritage and Archaeological Sites

A search of the heritage register has been undertaken. There are no declared heritage places or objects present within the mining lease.

An archaeological survey was conducted in December 2004 prior to the commencement of mining operations. The survey identified three areas of light scatters of artefacts indicative of historic use and occupation within the mining area. A further two locations of artefact scatters were recorded along the Muckaty haul road, but are sufficiently removed from the road and users, and do not require additional protection.

4. Operational Activities

4.1. Mining Activities

Mining activity recommenced in February of 2017 following a one-year administration period during 2016.

4.1.1. Mine Safety

Mining activity is undertaken in accordance with the requirements of the BCMM Safety Management Plan (SMP) and the Risk Management Plan (RMP).

In addition, an activity-based Risk Register for Mining Operations has been developed and assessed by members of the mining crews who participated in a critical risk assessment workshop (CRAW) for all perceived normal activities undertaken on the BCMM site.

Normal routine mining activities are covered by mining procedures. Activities that fall outside of these procedures are then covered by the SMP requirements that govern the use of a Job Hazard Analysis (JHA) and other risk assessment tools as appropriate.

4.1.2. Mine Design

All planning, engineering, and mining of the Bootu Creek resources is undertaken in accordance with standard mining practice as designated in legislation or guidelines applicable at the time of mining and BCMM mining procedures, Risk Management Plan (RMP) and its associated Trigger Action Response Plan (TARP).

The following step process shall be followed from conceptual, through design, construct and review stages.

- Geotechnical design parameters shall be provided by the independent geotechnical consultant.
- Preliminary designs based on economic Whittle shells shall be constructed.
- Preliminary designs will undergo a Geological review.
- The Independent Reviewing Engineer (IRE) will review the final designs as suitable for construction.
- Once designs are approved by the IRE they are submitted for review and approval by the DPIR.
- The BCMM Mining Manager will then approve the designs for construction.
- During and post construction regular audits shall be undertaken to confirm construction conforms to the approved designs.

Each stage of design approval phase shall follow the BCMM Mine Design Approval process and be signed off internally.

4.1.3. Clear and Grub

Clear and grubbing of vegetation and topsoil is undertaken prior to commencing mining operations in an area. Most of the topsoil material is recovered and stockpiled for later use in rehabilitation activities. The operating philosophy at the BCMM is to limit clearing activities to that area which is strictly necessary to conduct operations safely. No further clearing is planned for the construction of new WRDs as all future mined waste is either being deposited to finalise construction of existing waste rock dumps or into existing pits.

4.1.4. Mining

4.1.4.1. Methodology

Mining of the Bootu Creek ore bodies is undertaken by conventional open cut methods of drilling, blasting, and excavation using a hydraulic excavator and dump trucks. Ore and waste are mined from the pits using multiple mining passes (stages). The first mining pass removes ore to an approximate depth of 30 metres (Starter pit). Subsequent mining passes remove ore to a depth of between 90 to 110 metres. Exit ramps are constructed at approximately 300-600 metres spacing within the pits to allow haul trucks to transport waste to the adjacent mined out pit and the ore directly to the ROM pad.

Drilling and blasting is required to enable excavation of the ore and as necessary when waste rock becomes too hard to dig efficiently. All mining activities are subject to the controls as established in Section 4.2 Geotechnical Control.

Ore is transported from the pits either directly to the main ROM stockpile area or to an adjacent ROM pad near the ramp exit. The remote stockpiled ore is transported from the satellite ROM pad to the main ROM adjacent to the processing plant using either road trains or dump trucks. Feed to the processing plant is via a front end loader optimising blend from multiple stockpiles on the ROM pad.

4.1.4.2. Equipment

The mining fleet at the BCMM currently consists of:

- 3 x Hitachi EX1900 hydraulic excavators.
- 1 x Hitachi EX1200-6 hydraulic excavators.
- 1 x Hitachi EX330-3 hydraulic excavator.
- 6 x Komatsu HD985-5 dump trucks.
- 3 x Komatsu HD785-5 dump trucks.
- 9 x Komatsu HD785-7 dump trucks.
- 3 x Kenworth Triple road trains.
- 3 x Caterpillar D10 dozers.
- 1 x Komatsu 785-7 water cart.
- 1 x Caterpillar 773B water cart.
- 1 x Caterpillar 769B water cart.
- 1 x Western Star Prime Mover Watercart/Float.
- 1 x Caterpillar 14H Grader.
- 1 x Caterpillar 14M Grader.
- 1 x John Deere 872GP Grader.
- 3 x Atlas Copco L7 drill rigs.
- Miscellaneous support equipment, such as lighting plants and trailer mounted dewatering pumps.

The mining methods in use at the BCMM will not change for the duration of the reporting period 2020-2030.

4.1.4.3. Dewatering

Operating pits will be maintained in a dewatered state by in pit sumps. Water will be pumped to the process water or dust suppression water ponds.

If required, and on advice from the geotechnical consultant, depressurisation holes (weep holes) will be drilled as per advice instructions.

4.2. Geotechnical Control

All activities will be subject to the BCMM's standard Mining Procedures and if applicable Job Hazard Assessment (JHA) and will include the use of spotters, Manual Prism Survey, Robotic Total Stations Prism survey (RTS) and Slope Stability Radar (SSR). The SSR will be used to scan domains above or below mining activity and prior to entry into uncontrolled work areas.

***Note** The SSR cannot be used on a domain level that has active mining equipment due to interference with background velocity data.*

The following steps shall be undertaken:

- Construction of a long-term survey base pillar on a pit's footwall slope outside the planned mining perimeter, opposite to the planned stage of in-pit mining activity.

  This is to facilitate monitoring the newly developed highwall cutback slope above the mining activity.

- Installation of survey monitoring prisms on a pit's highwall crest at ±50m spacing as soon as no further blasting which could damage prisms is required.

  Additional prisms will be installed on any observable anomalies and on either side and as close as possible to suspected water seepage etc.

- Manual survey monitoring shall commence as soon as practical to develop baseline data from which any undue slope displacement can be detected.
- Installation of survey monitoring prisms along the pit ramp, staggered between the crest and toe at ±50m spacing,
- Installation of survey monitoring prisms on all berms at similar spacing to the above in a staggered fashion.
- Once the first highwall and footwall benches are established, construction of a long-term survey base pillar on the highwall slope crest, opposite the footwall mining shall occur. This is to facilitate monitoring the newly developed footwall slope above mining activity.
- If a pit is a new development, installation of survey monitoring prisms on the footwall crest at ±50m spacing shall occur as soon as no blasting which could damage prisms is required.
- Installation of survey monitoring prisms on all berms along the footwall slope at similar spacing to the above in a staggered fashion.
- Manual survey monitoring shall commence as soon as practical to develop baseline data from which any undue slope displacement can be detected.
- When the telemetry data transfer system is functional and robotic total station (RTS) instruments can monitor the slopes 24/7, survey the cutback slopes at least once every 3 days and graph and interpret the results.

It is anticipated that normal processes will result in detectable and measurable displacement of pit wall slopes from ground relaxation as mining progresses due to gravitational unloading. The location of the survey pillars on the pit crest will result in an exacerbation of the relative displacement between pillar and prism as both slopes relax inwards and upwards. Displacement graphs produced by monitoring will typically show very minor cyclical acceleration followed by settling to constant or zero displacement rates.

As a component of monitoring and interpretation of data, the following actions will be undertaken:

- Any downward (-Z) displacement must be investigated.
- Consultation will occur with the geotechnical engineer if any undue slope displacement is detected.
- A mine geologist must regularly map the newly exposed slopes for geological faults and model any such major weak structures in 3D.
- The IRE will be provided with the 3D models if and as soon as a fault is detected, for incorporation in stability analyses to confirm the slope design, or to facilitate timely mitigating action should a fault pose geotechnical hazard.
- A mining supervisor, surveyor or mine geologist shall regularly inspect the pit crest for cracks or subsidence and inspect the newly developed faces and old faces below mining for signs of instability. One person must be appointed on every roster to do geotechnical hazard inspections.
- Any cracks or signs of instability shall immediately be demarcated and pointed out to the mining supervisor for appropriate action.
- Areas above and below any fall of ground of any scale must be vacated and demarcated or barricaded a safe distance away, and appropriate action determined.
- A register (Mine Record Book) shall be kept of inspection dates and times and of observations and follow-up actions, and of progression or regression of geotechnical hazards.
- All inspections shall be recorded in the register, even if nothing untoward or no changes in conditions are observed.
- Inspection findings must be discussed at production planning meetings and communicated to the geotechnical consultant.
- Interpretation shall occur of survey monitoring results from prisms in proximity to any cracks or minor falls of ground in detail, for signs of larger displacement. Additional prisms shall be installed on such zones if it is safe to do so and as early as possible after crack detection. Alternatively, the zone must be scanned at intervals for adequate duration with the GeoRadar. (Mining equipment movement may preclude this, hence the need for good spatial coverage with a network of survey monitoring prisms).

4.2.1. Geotechnical Trigger Action Response Plan (TARP)

A telemetry system has been installed that (via microwave to the BCMM administration office) that allows real time monitoring of potential wall or established domain movement to trigger the appropriate action response.

Alarms are triggered by an exceedance of agreed geotechnical TAR settings and are broadcast over all mining radio channels on site. Alarms initiate total pit evacuation. At this point the system is reviewed for what alarm and which location. Once identified all non-impacted activities can resume but no entry will occur to the alarmed site until it is fully investigated and cleared. The TARP will be reviewed on an annual basis.

4.2.2. Pit Inspections

4.2.2.1. Daily

The mining shift supervisor will undertake a daily pit inspection of the work areas as part of the shift prestart and record their findings recorded in the daily Pit Inspection Book. Communication of the pit conditions will be part of the shift prestart advice.

The surveyors will survey all manual prism reading locations and along with the mine geologist/geotechnical engineer download all data plots from the SSR and RTS and review as soon as practical with the findings reviewed at the morning mine production meeting. Any anomalies are to be analysed and assessed immediately.

The geologist and all mine workers will continuously assess wall conditions for indications of potential failures and any adverse observations are to be communicated immediately to the Mining Superintendent. All personnel will complete basic training as to what to look for when looking for Geotechnical Hazards.

4.2.2.2. Weekly

The surveyors will undertake a weekly survey for quantities and design check against plan. In addition, a drone survey will be flown to enable viewing of all crests, walls and berms for obvious developing anomalies. Any adverse anomalies are to be communicated to the Mining Superintendent immediately.

4.2.2.3. Monthly

The surveyors will undertake a monthly survey for quantities and design check against plan. In addition, a drone survey will be flown to enable viewing of all crests, walls and berms for obvious developing anomalies and progress reporting in the monthly report. Any adverse anomalies are to be communicated to the Mining Superintendent immediately

4.2.2.4. Quarterly

A site visit by the geotechnical consultant will be undertaken at a minimum quarterly frequency or on demand to review:

- Historical data trends from all sources.
- Pit wall stability.
- Geotechnical conditions.
- As built deviations and required corrective actions.
- Mine plans current and future.
- The pits and mining activity will be audited against a monthly inspection checklist.

4.2.3. Rock Fall Hazard Map

The consulting geotechnical expert in conjunction with the BCMM geologists and geotechnical engineer will construct for each pit a Rock Fall Hazard Map for each wall of the pit. This will enable a higher risk assessment of zones within a pit so that appropriate behaviours and strategies can be established and communicated to all personnel.

4.2.4. Ground Control Management Plan

The GCMP will be reviewed throughout the LOM by BCMM and in consultation with a geotechnical consultant and an Independent Reviewing Engineer (IRE).

4.3. Mine Plans

4.3.1. Western Limb

Open cut pits and associated waste rock landforms on the Western Limb of ML24031 include the pits established to develop the Masai, Tourag, and Yaka ore bodies. Detail of each of these pits is presented in the following sections.

4.3.1.1. Masai

The Masai ore body is located to the north of Tourag and is at the northern end of the western limb ore bodies (Yaka, Tourag & Masai). Due to environmental considerations (maintaining existing creek systems) and heritage exclusion zones, Masai has been designed with a separate pit and waste landform to the adjacent Tourag operations. The total disturbed area of the Masai pits is approximately 29.5ha.

Combined the total length of the Masai open cut voids is approximately 1,915m in length, 300 m in width and 100m in depth. The second Masai pit was designed to be contiguous with Pit 1 and will attain a length of approximately 1430m. The third pit of the Masai ore body development is offset from pits 1 and 2 due to faulting of the ore body. Pit 3 of the Masai pit will be approximately 300 metres in length and Pit 4 approximately 170m. The fifth pit to be established accessing the Masai 5 ore body is planned to be approximately 100m in length and will be separate from the Masai 4 pit.

Mining activities to be completed for the life of mine, for this ore body includes cutbacks to the Masai 2, 3, and 4 pits and the development of the Masai 5 pit. Waste material generated from mining the Tourag 8 cutback was utilised to partially backfill the Masai 1 pit void to improve long term stability of the footwall buttress of Sacred Site 5760-21 during 2019-2020. Waste material mined during the development of the Masai pits during the life of mine will be used to complete the backfill of the Masai 1 pit. Waste material mined during the sequential development of the Masai 2, 3, 4, and 5 pits will be utilised to backfill the Yaka 4 and Masai 4 pits. No additional waste rock landforms will be constructed during the life of mine.

Figure 13 depicts the planned development of these areas with detail provided in sections below.

Figure 13: Mine features and plans for the development of the Masai ore body at the BCMM.

Masai 1 Pit

A buttress was installed to encapsulate the eastern pit crest of the Masai 1 pit to enable the stabilisation of the adjacent Sacred Site 5760-21 during 2015. A secondary buttress was constructed at the toe of the original buttress to further increase the stability of the pit wall. A geotechnical assessment was performed in October 2019 to assess the feasibility to mine the footwall flank of ore within the outer restricted work area (RWA), subsequent application was submitted to the AAPA for review. Due to delays in assessment of the submission this application was withdrawn in April of 2020. Waste material generated from mining the Tourag 8 cutback was utilised to partially backfill the Masai 1 pit void to improve long term stability. Mined waste will be deposited within the Masai 1 pit to further support the stabilisation of Sacred Site 5760-21.

There are no mining activities planned or proposed for the Masai 1 pit for the life of the mine.

Masai 2 Pit

A cutback of the Masai 2 pit commenced in May 2019 with the Stage 2a cutback of the Eastern pit wall and subsequent ramp de-stack. A further cutback of this pit as Stage 2c is planned to occur following assessment of commercial viability and review of proposed designs by the Independent Reviewing Engineer. Waste material generated during mining activities is used to backfill the northern end of the Masai 2 pit, complete the backfill of the Masai 1 pit, and extend the backfill in the Yaka 4 pit.

The cutback of the pit will progress until development enables access to the pit floor and exit from the pit via the southern ramp. A de-stack of the development ramp will be undertaken to attain design width and maximise ore development.

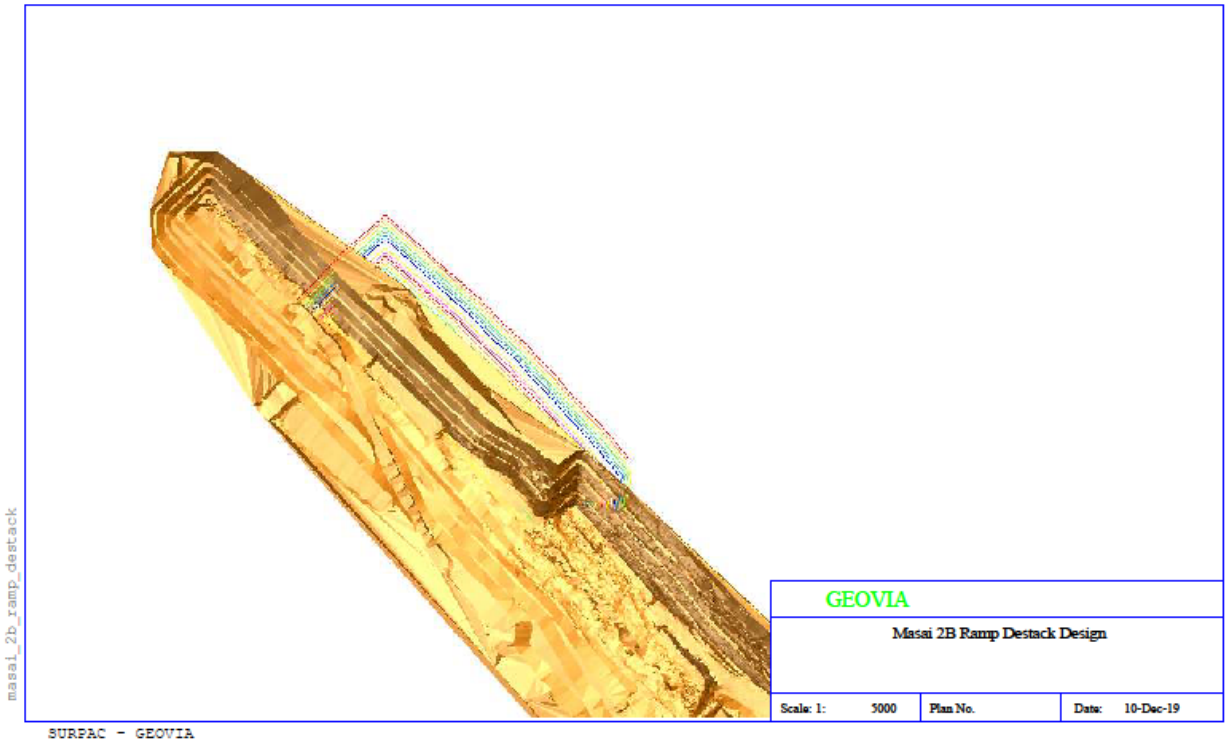


Figure 14: Masai 2B ramp de-stack design

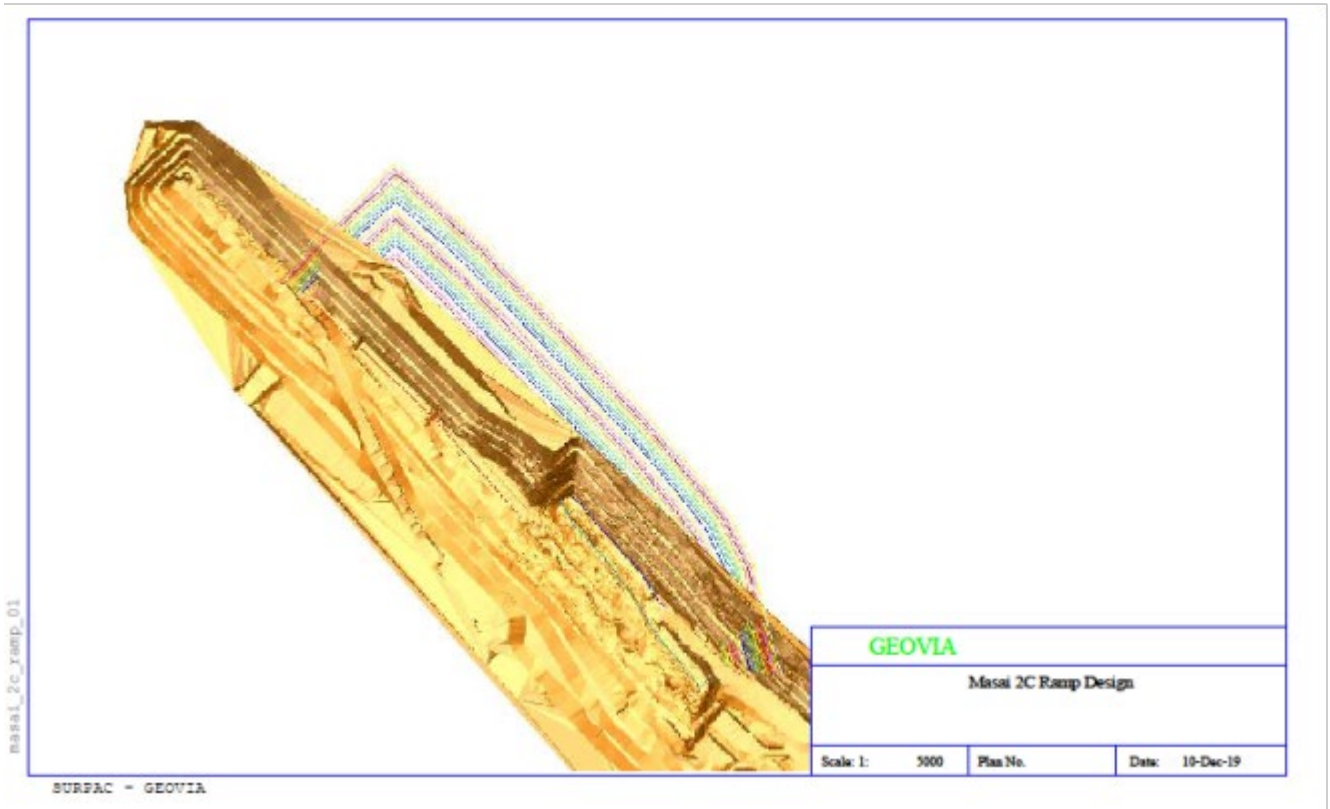


Figure 15: Masai 2C pit design.

Masai 3 Pit

The mining of the Masai 3 pit has been substantially developed and the northern end has been partially backfilled. The pit is used as a water storage when mining is not operational in pit. A cutback to the pit commenced in March 2020 and waste material mined will be used to backfill the northern end of Masai 2, Masai 4, and the Yaka 4 pit. The total approximate disturbance area for Masai 3 was originally 4.8ha. The development of the cutback and partial backfill of the pit will extend this disturbance area to 8.25ha.

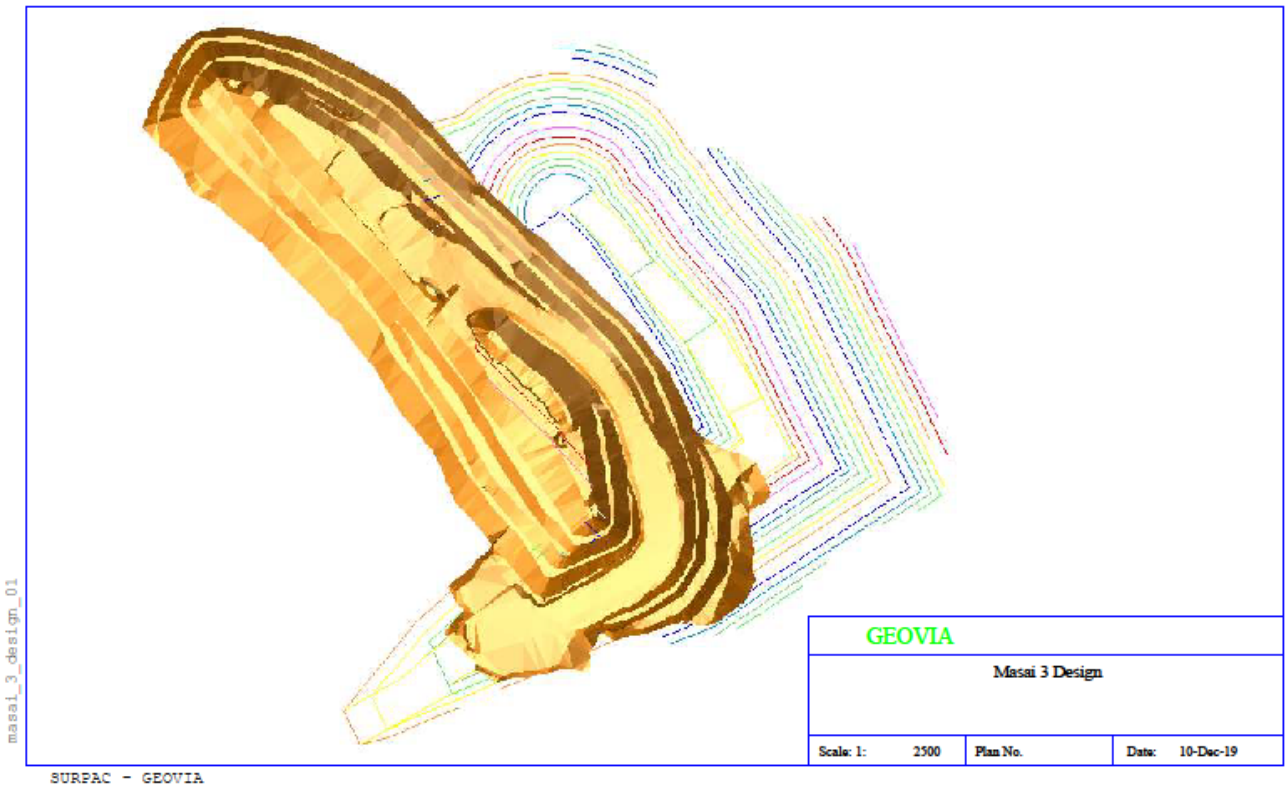


Figure 16: Masai 3 Stage 2 pit design.

Masai 4 Pit

A cutback of the Eastern wall of the existing Masai 4 pit will be completed during 2020.

The Masai 4 cutback is planned to mine out a total of 0.7Mbcm of material. Overburden removed from Masai 4 will be deposited into the southern end of the Masai 1 and Yaka 4. Once mining is complete, the Masai 4 pit will remain as an open void until it is completely backfilled by the proposed Masai 5 pit and waste material generated during the completion of the Masai 3 cutback.

The total disturbance area for the Masai 4 pit development will increase to approximately 6.06ha on completion of the Stage 2 cutback.

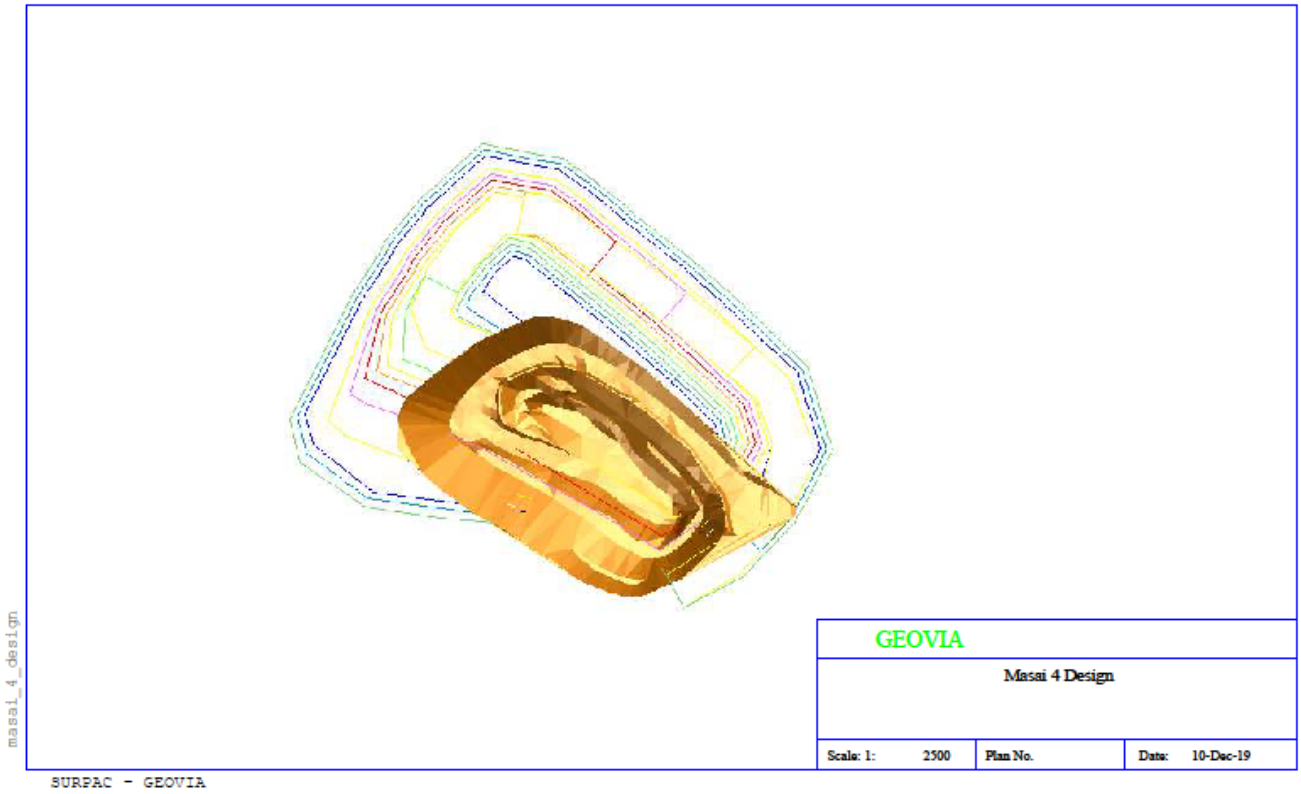


Figure 17: Masai 4 Stage 2 pit design.

Masai 5

The Masai 5 pit will be located to the north west of the Masai 4 pit. As the Masai 5 pit design is in close proximity to Bootu Creek, the mining and back fill of the pit will occur over the dry season of 2021. Waste material generated during the mining of the Masai 5 pit will be placed as backfill into the Masai 4 and 3 pits. The pit design under review by the IRE will not impact Bootu Creek.

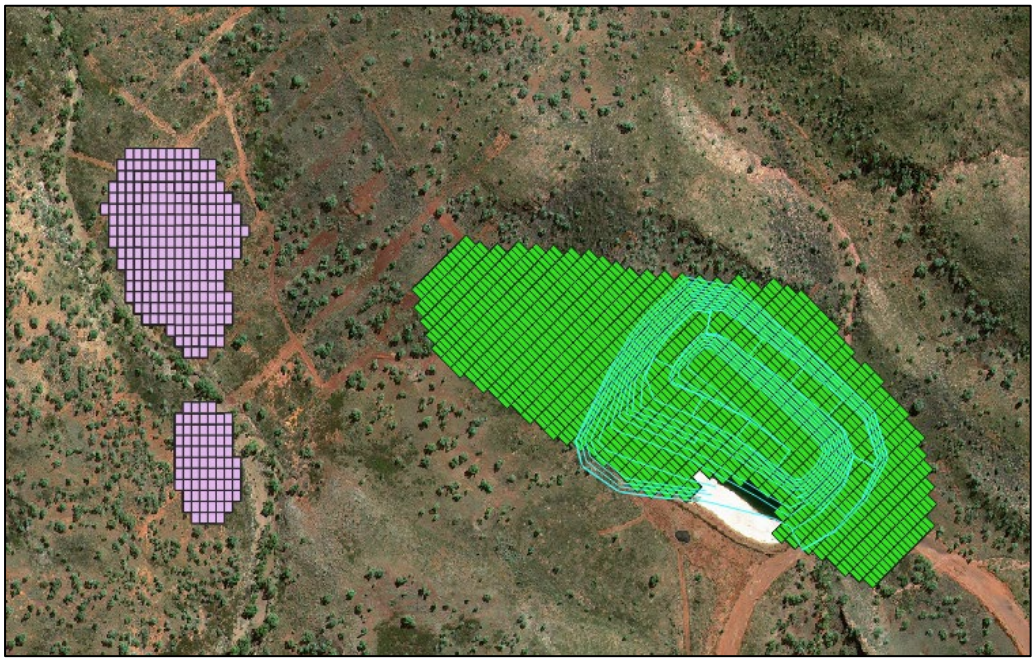


Figure 18: Optimised resource shell (pink) for the Masai 5 pit.

4.3.1.2. Tourag

The Tourag pit has been mined using conventional methods as described previously in this document. The pit is located north of the camp on the western limb of the mining lease. The pit has been developed via a series of staged pits designated Tourag 2, 3, 4, 5, 6 and 7 that lie within the designed perimeter.

Ore has been transported from the pit to a ROM pad constructed on the southern side of the pit, between the Tourag Haul road and Bootu Creek. Stockpiled ore is transported to the processing circuit ROM pad using road trains equipped with side tipping trailers.

The Tourag waste rock dump has been constructed in accordance with the procedures in place elsewhere on the site. While operations are ongoing runoff water is directed via toe drains to natural drainage areas via sediment traps and then into Bootu Creek.

Backfilling of the Tourag 6 Pit void was undertaken with the development of the Yaka Stage 4 pit during 2019.

Mining of the Tourag Stage 8 pit commenced in 2018 and ceased in 2019, overburden was deposited to Masai Stage 1 Buttress area. It is proposed that mining and completion of the Stage 8 design will recommence during this planning period. This is proposed to occur following further review and approval of the design by the Independent Reviewing Engineer (IRE) and subsequent approvals granted by the DPIR.

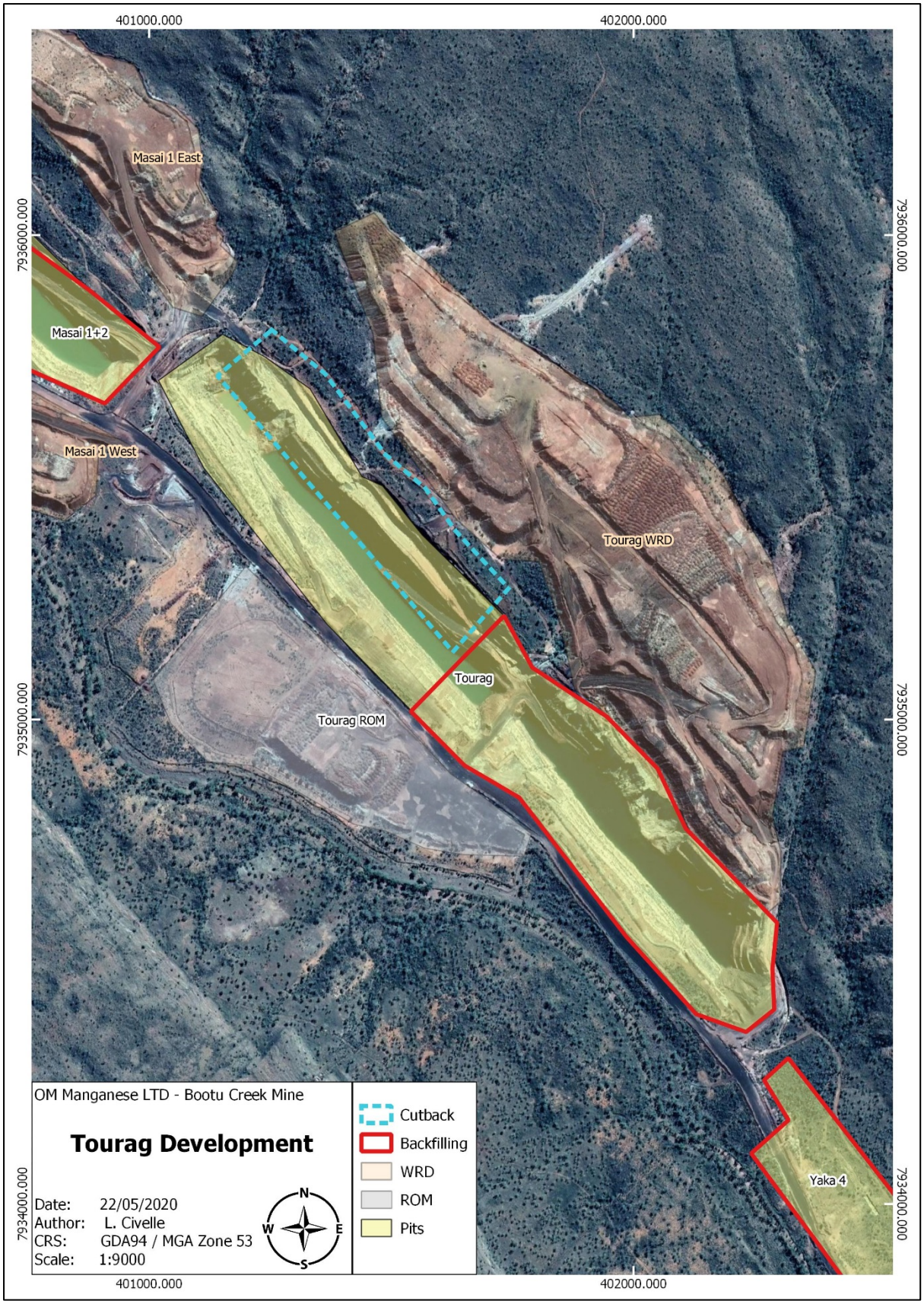


Figure 19: Open cut developments and waste rock landforms associated with the Tourag resource.

4.3.1.3. Yaka

The Yaka ore body is located to the South end of Tourag and is at the southern end of the western limb ore bodies (Tourag & Masai). The Yaka pit has been excavated in stages via conventional open cut methods of drilling, blasting, and excavation using a hydraulic excavator and dump trucks. Progressive mining of the ore body has enabled the backfilling of completed stages. The development of the Yaka ore body commenced during 2013 and ceased in 2019. The Yaka pits have been substantially developed with Stages 1 - 4 now completed. Waste material from Stages 2 to 3 were used to backfill the preceding pits to minimise waste rock dump development. The original mined pit disturbance area was approximately 22 ha. This has been reduced to approximately 10.6ha since backfilling Stages 1 and 2.

It is anticipated that approximately 75% of the final open cut void will be backfilled upon completion of mining. The remaining void space will be used for water storage to meet mining and processing needs during the mining of the remaining western limb ore bodies, and remain as a sediment trap and containment structure for surface water runoff from the Yaka waste rock landform.

Due to the proximity of the landform to the operational area it was been designed to be a water shedding structure. Incidental rainfall was directed via designated drainage lines away from the pit and into sediment traps. Mining operations have now ceased at Yaka and drainage channels will be redirected to the pit void

Yaka 4 was mined and partially backfilled in 2019. As the Yaka 4 pit design was in close proximity to the Bootu Creek, the mining and backfill of this pit occurred over a full dry season to provide a supporting buttress to the now rehabilitated Bootu Creek bank. The waste generated from the mining of the Yaka 4 pit was used to backfill Tourag Stage 6 south end and re-stablish the existing Tourag East creek system. This was completed in November 2019.

Waste from the Tourag ROM and Masai 1 West WRD was used to backfill the western footwall. Backfill will continue upon commencement of the Masai Stages 2, 3 and 4 cutbacks throughout 2020. The existing disturbance footprint of Stage 4 is 10.7 ha. However, due to the complete backfilling and surface rehabilitation, this will result in a final disturbance of 0 ha by December 2020.

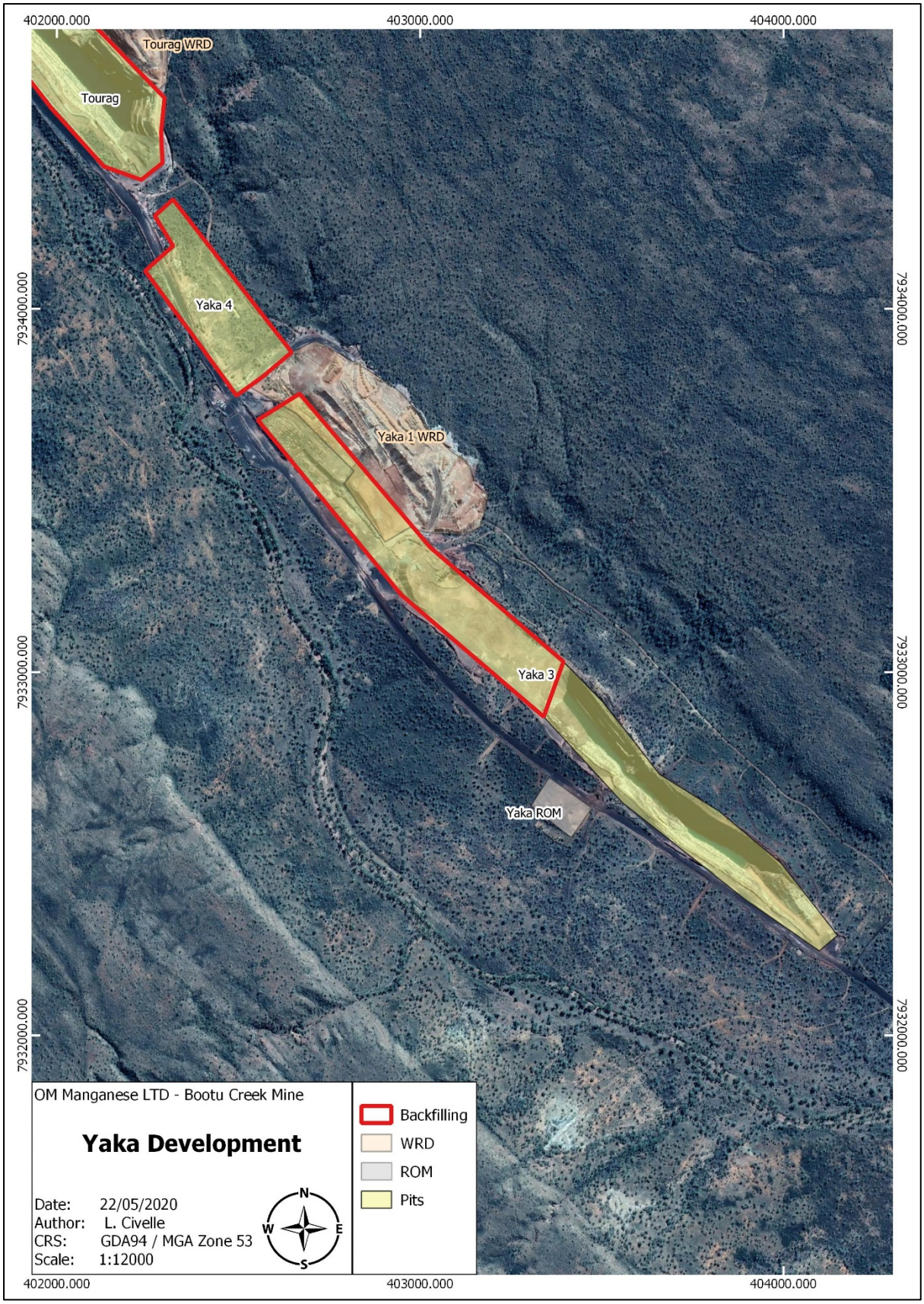


Figure 20: Open cut pits and associated waste rock landforms of the Yaka development.

4.3.2. Eastern Limb

Open cut pits and associated waste rock landforms on the Eastern Limb of ML24031 include the pits established to develop the Xhosa, GoGo, Shekuma, Chugga, Zulu, and Foldnose ore bodies. Detail of each of these pits is presented in the following sections.

4.3.2.1. Shekuma

The length of the Shekuma pit is approximately 1,700 metres with a disturbance area of 38 hectares. Stages 1, 2, 3, 4, 5, 6 and 7 have been completed. Stage 8 commenced operations following MMP amendment authorisation in 2019 however was paused in August 2019 pending geotechnical review. Works are anticipated to recommence in July 2020.

The Shekuma pit is being mined using conventional methods as described earlier in this document. The wall of the completed pit will leave sufficient space to ensure the waste dump will not affect the stability of the pit walls and to enable completion of perimeter bunding upon closure. Various wall monitoring controls such as SSR, spotters and prism monitoring are applied to check wall stability during mining activities. The southern end of the Shekuma pit intersects the south creeks system and was mined during the dry season. This section has since been backfilled and a channel cut to re-establish flow. This channel still requires scalloping and further shaping, cobbling and compaction.

Stage 8 cutback involved modification of an existing small creek system ("North Creek" as named by OMM), which originally overlapped the disturbance surface of Shekuma Stage 6 and Gogo Stage 5. Modifications are intended to be permanent and were completed in November 2019. Stage 8 is expected to be complete in 2021. A Shekuma South pit development is possible however not yet planned, any plans and designs will be submitted to the regulator as an MMP amendment.

Waste material mined during Stage 8 of Shekuma pit is planned to be deposited in two locations, the Gogo Stage 7 pit, the GoGo Stage 5 pit and the completed Shekuma Stage 6 cutback.

Upon completion of mining the remaining pit void will be utilised for containment of surface water and to enable recharge of groundwater resources.

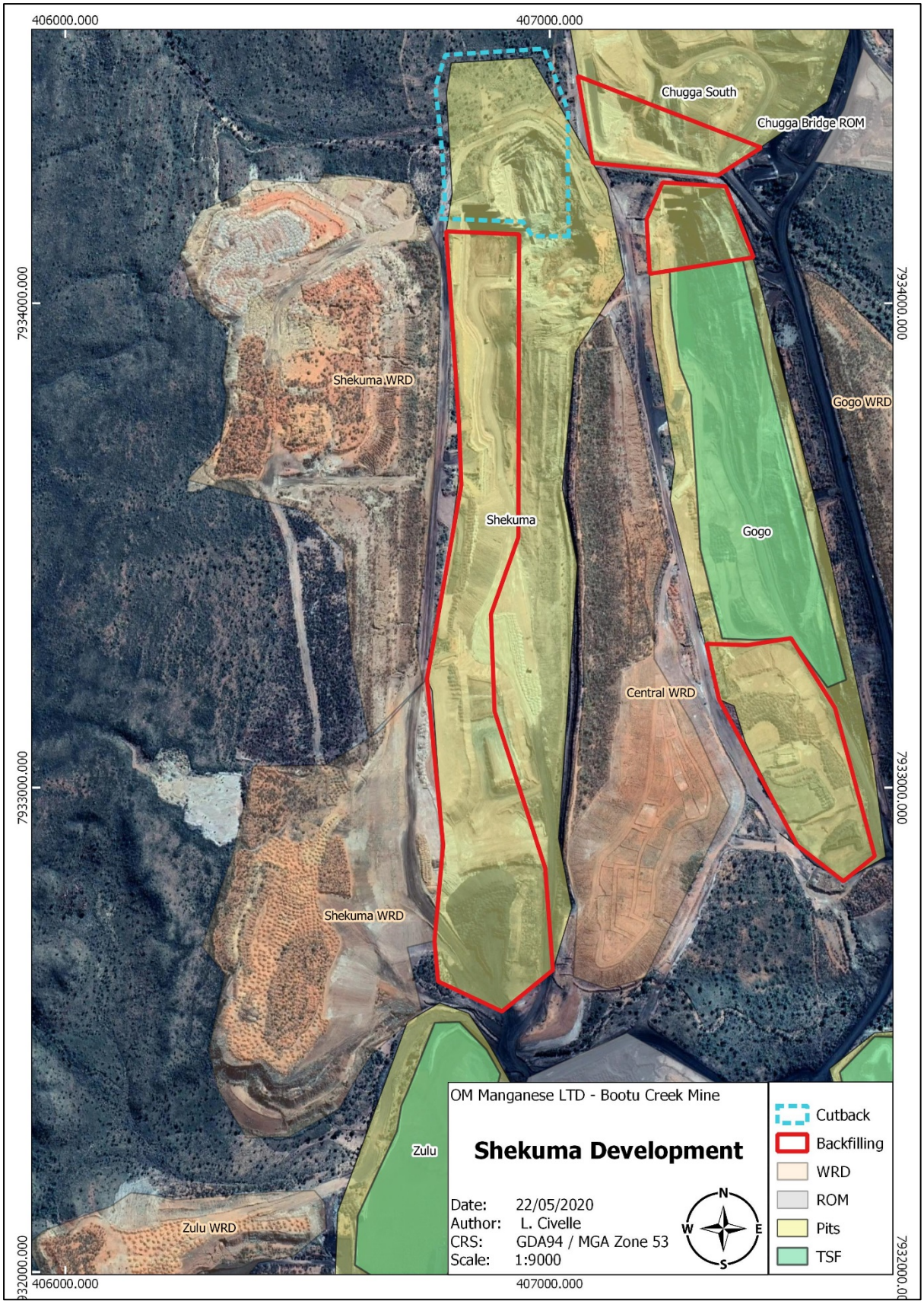


Figure 21: Shekuma open cut development and associated waste rock landforms.

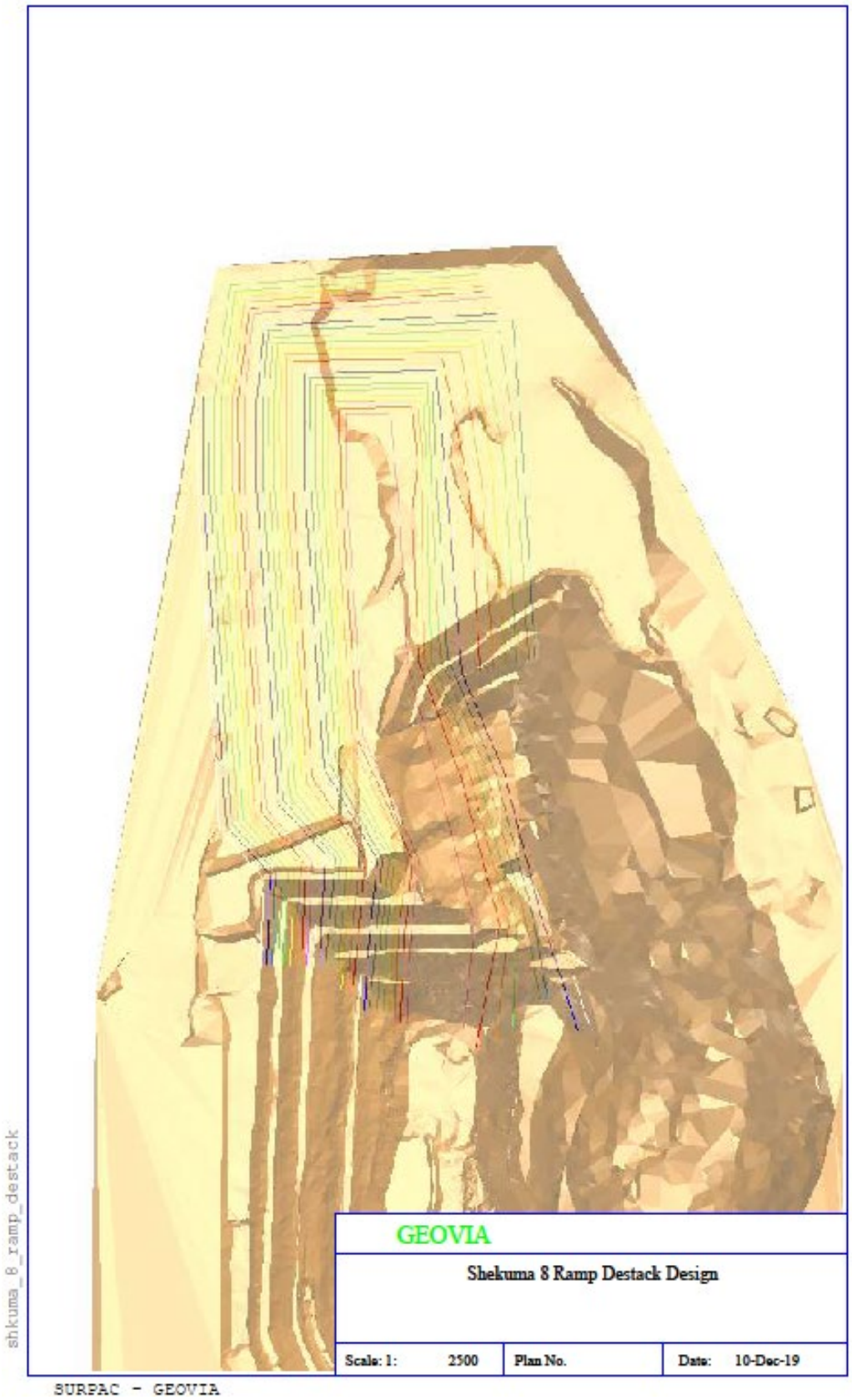


Figure 22: Shekuma Stage 8 ramp de-stack design.

4.3.2.2. Xhosa

The Xhosa ore body was an extension of the southern end of the progressively developed Gogo ore body. Due to environmental considerations (maintaining existing creek systems) and heritage exclusion zones, Xhosa was been designed as a separate pit and waste landform to the Gogo operations. The Xhosa pit was excavated via conventional open cut method of drilling, blasting and excavation using a hydraulic excavator and dump trucks. Haul trucks transported waste to the adjacent waste rock dumps and the ore directly to the ROM pad.

The completed Xhosa waste landform is located approximately 60 m to the east of the Xhosa open cut void and is approximately 390 m in length and 20 m in height (290 m RL) and has been contour designed to blend with the surrounding terrain. Additional waste material generated from this pit was used to construct the adjacent TSF cell 3 which limited the amount of waste put on the waste dump. Rehabilitation work was completed on the Xhosa dump prior to the 2009/2010 wet season. Ongoing monitoring of the efficacy of revegetation efforts will continue to demonstrate successful rehabilitation and direct any necessary remediation works required.

A sacred site (5760-24) was identified by an anthropology survey in 2004 and is situated inside the perimeter of the Xhosa ore body. This sacred site is protected by the Aboriginal Areas Protection Authority and is not to be entered or destroyed. A buffer has been established around the heritage site to ensure that the site will be protected from all operational activities. A permit for the destruction of the sacred site was lodged with the AAPA in December 2007. Conference with traditional owners was undertaken at the site in June 08 and request was rejected, however a compromise was reached to allow some mining through a section to allow us to straighten the pit wall. The pit was modified to suit the new Sacred site boundaries once approved. The drawings attached reflect pre conference dimensions and the wall that is currently within Sacred site boundaries will be redesigned to be outside the sacred site once coordinates are approved by the Minister for Indigenous Policy.

Cracking of the Xhosa pit crest adjacent to the Sacred Site (5760-24) was noted during the 2011/12 reporting period. Following consultation with Traditional Owners and regulatory agencies permission was sought to construct a buttress of waste material along the eastern pit wall of Xhosa pit to ensure that no damage to the sacred site ensued. The completed buttress envelops the area of cracking and ongoing monitoring continues to confirm stability of the Eastern pit crest. Tailings material was deposited into the Xhosa pit between August 2012 and December 2014. A total of approximately 2.7M m^3 of tailings material was deposited into the pit during this period. The contained tailings will be recovered for processing through the Tailings Retreatment Plant during the remainder of Life of Mine.

Tailings will be redirected to the Xhosa pit in 2020, in conjunction with TRP commissioning, to relieve the near-complete Zulu TSF from non-final tailings material in stage with Gogo TSF (final tails) commissioning.

Figure 23: Xhosa pit void TSF and associated waste rock landforms.

4.3.2.3. GoGo

The GoGo pit is approximately 1,500 metres in length with a surface area of 30 hectares.

Waste material mined during the development of the GoGo pit was used to construct the GoGo Waste Rock Landform and the Central Waste Rock Landform.

The GoGo waste rock landform was rehabilitated prior to the 2009/10 wet season. The dump was shaped to a batter angle of approximately 18 degrees prior to coverage with available topsoil. Berms have been shaped to direct incident rainfall inward and control runoff. Seed was applied at a rate of 4 kg/ha and comprised of local provenance species. Monitoring of the effectiveness of rehabilitation efforts is ongoing and any remedial work required will be undertaken

The Central waste rock landform was rehabilitated partially during 2009 and the remainder during the 2017/2018 wet season. The dump was shaped to a batter angle of approximately 18 degrees prior to coverage with available topsoil. Seed was applied at a rate of 5kg/ha and comprised of local provenance species.

All mining activity in the GoGo pit has ceased as the pit will be converted to an in-pit TSF in 2020 and operated in accordance with the GoGo TSF Operations Manual.

Figure 24: GoGo open cut pit and associated waste rock landforms.

4.3.2.4. Chugga

The Chugga deposit has been mined via two separate open cut pits using conventional methods as discussed in mining section previously. Mining of the Chugga South pit was completed in 2018. Access to the Chugga North ore body is gained via a staged series of open cuts occurring sequentially to optimise mining ratios. Waste material generated during mining of the Chugga North deposit was historically deposited on the adjacent Chugga waste rock dumps. The Chugga dumps have been constructed in accordance with the principles in use elsewhere at the BCMM, and while designated Chugga North and Chugga South dump the dumps are contiguous.

Chugga North dump will be progressively extended to the North as the mining front progresses along the ore body. The Chugga North dump will attain a maximum height of 30 metres with waste material placed in such a manner as to enable rehabilitation earthworks to occur

Waste material generated during the further development of the Chugga North ore body will be used to backfill pit voids where possible. Mining the Chugga North pit void in stages allows for considerable backfilling opportunities. It is estimated that up to 65% of the Chugga waste will be returned to the pit void if mining conditions permit.

A cutback of the existing Chugga North pit was completed during 2018. Chugga Far North A/B and C/D were completed during 2018-2019 and subsequent overburden was deposited to backfill the Chugga North Pit and destack areas. Further development of the E/F pit is planned for 2020 while Stage G/H is expected to be complete in 2021. The final pit disturbance area is anticipated to be 36.8ha.

Figure 25: Chugga North ore body development.

4.3.2.5. Zulu

Mining of the Zulu pit was partially completed during 2013. Waste material generated during the development of this pit was used to construct a small waste rock dump abutting the adjacent ridge line. Waste material was also utilised to finalise the southern end of the Shekuma waste rock dump, and to backfill a portion of the Shekuma and GoGo pits.

Tailings deposition into the partially completed Zulu pit commenced in January 2015 following receipt of necessary approvals. The Zulu pit has attained a final top surface area of 11.95ha and a final pit volume of 4,201,173m^3. Material stored within Zulu pit will be reprocessed using the Tailings Retreatment Plant which was commissioned in 2020.

The Zulu pit was not mined to completion during 2013 due to the very fine nature of the ore body. Once tailings re-processing from the Zulu pit has been completed the pit will be mined to completion of the earlier design.

The development and commissioning of the Tailings Retreatment Plant has enabled a re-evaluation of fine (sand) ore bodies at the BCMM. An extension of the Zulu resource will be developed as a distinct pit at Zulu South. All pit designs and plans will be submitted to the DPIR for assessment once finalised and prior to undertaking any works.

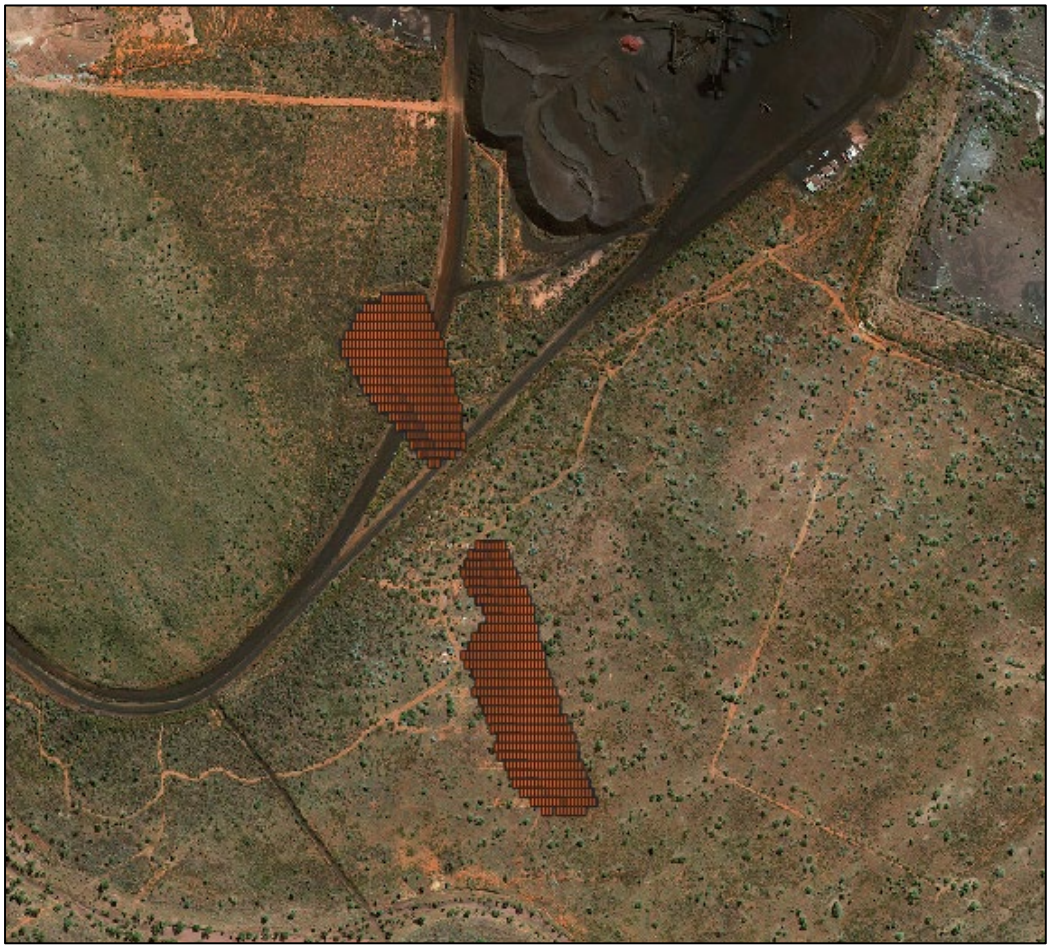


Figure 26: Zulu South resource location.

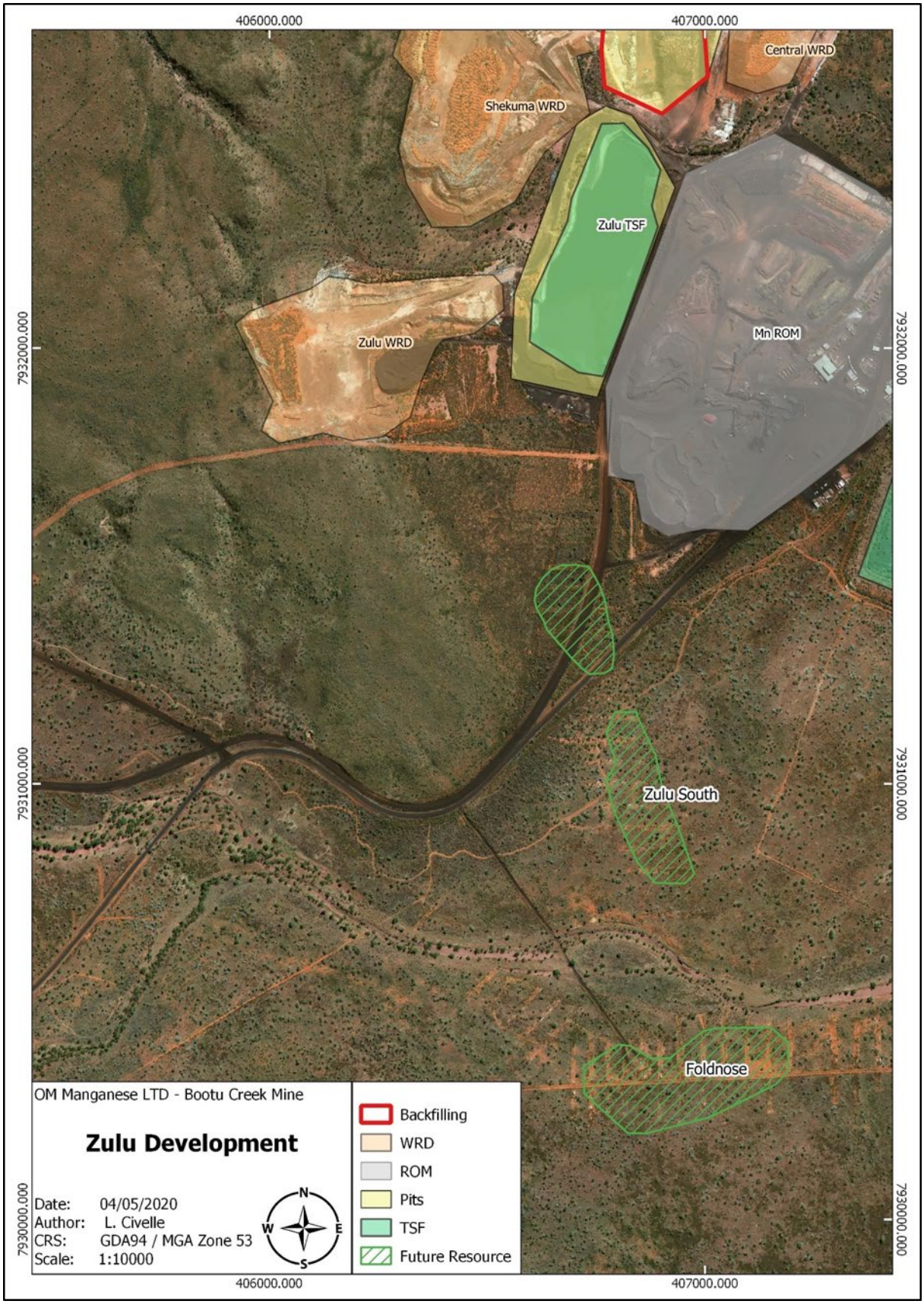


Figure 27: Zulu ore body development.

4.3.2.6. Fold Nose

The development and commissioning of the Tailings Retreatment Plant has enabled a re-evaluation of fine (sand) ore bodies at the BCMM. A discreet ore body located adjacent to Bootu Creek at Bore 17 will be developed during the life of mine as a distinct pit at Fold Nose. All pit designs and plans will be submitted to the DPIR for assessment once finalised and prior to undertaking any works. The Fold Nose pit will be designed to ensure that there is no impact to Bootu Creek.

Figure 28: Fold Nose resource

4.3.3. LOMP Mine Schedule

The life of Mine Schedule is currently planned to operate until FY2022. Should the strong economic conditions continue beyond 2020 it will likely result in further extension to the mine life.

In addition, following the introduction of the retreatment plant, a review of targets such as Zulu South and Fold Nose will be undertaken to assess the viability of mining an economic fine (sand) orebody for inclusion into and to extend the LOMP further. All pit designs and plans will be submitted for DPIR assessment accordingly should developments be economically viable.

4.3.4. Waste Rock Dump

The disturbance surface area, current status and planned timeframes for rehabilitation of the BCMM waste rock dumps (WRDs) are reviewed annually and presented in Mine Closure Plan.

Since 2015 there have been no new WRDs constructed. Sections of the Masai WRDs were mined out during 2019 to either reclaim mineralised waste for processing, or to progress the in-pit backfill of Yaka 4 pit in order to stabilise Bootu Creek prior to wet season flows. Areas excavated have now been replenished with waste from mining operations during 2020. All WRDs are at capacity and all future mined waste is scheduled to be deposited in expired pits as backfill. Rehabilitation will be implemented progressively on each of the WRDs in tandem with scheduled mining operations over the remaining LOM. This will continue into the closure period until evidence demonstrates that WRDs are stable; and not requiring further management; or contributing to environmental impacts. The table below includes the planned timeframe for the commencement of these works.

Waste Rock Dumps have been constructed to replicate surrounding topography. Where WRDs abut natural ridgelines, they are constructed so as to blend into the adjacent ridge height. Free standing dumps are constructed to attain a maximum height of 30 metres and where possible are designed to achieve a final profile of 18-20 degrees.

Table 9: Approximate waste rock dump footprints at the Bootu Creek Manganese Mine

Waste Rock Dump (WRD)	Total WRD Area (ha)
Chugga East	92
Chugga West	19
GoGo	50
Central	26
Shekuma	69
Zulu	14
Xhosa	15
Yaka	16
Tourag	45
Masai 1 East	16
Masai 1 West	22
Masai 2 Water Diversion	4
Masai 2 West	12
Masai 3 West	9
Masai 3 Water Diversion	14

The timeframe and strategy for the rehabilitation of mining pits converted to TSF is to be determined. These areas will not be available for rehabilitation until the completion of tails processing (~2028).

The image below identifies the layout of the WRDs across the BCMM.

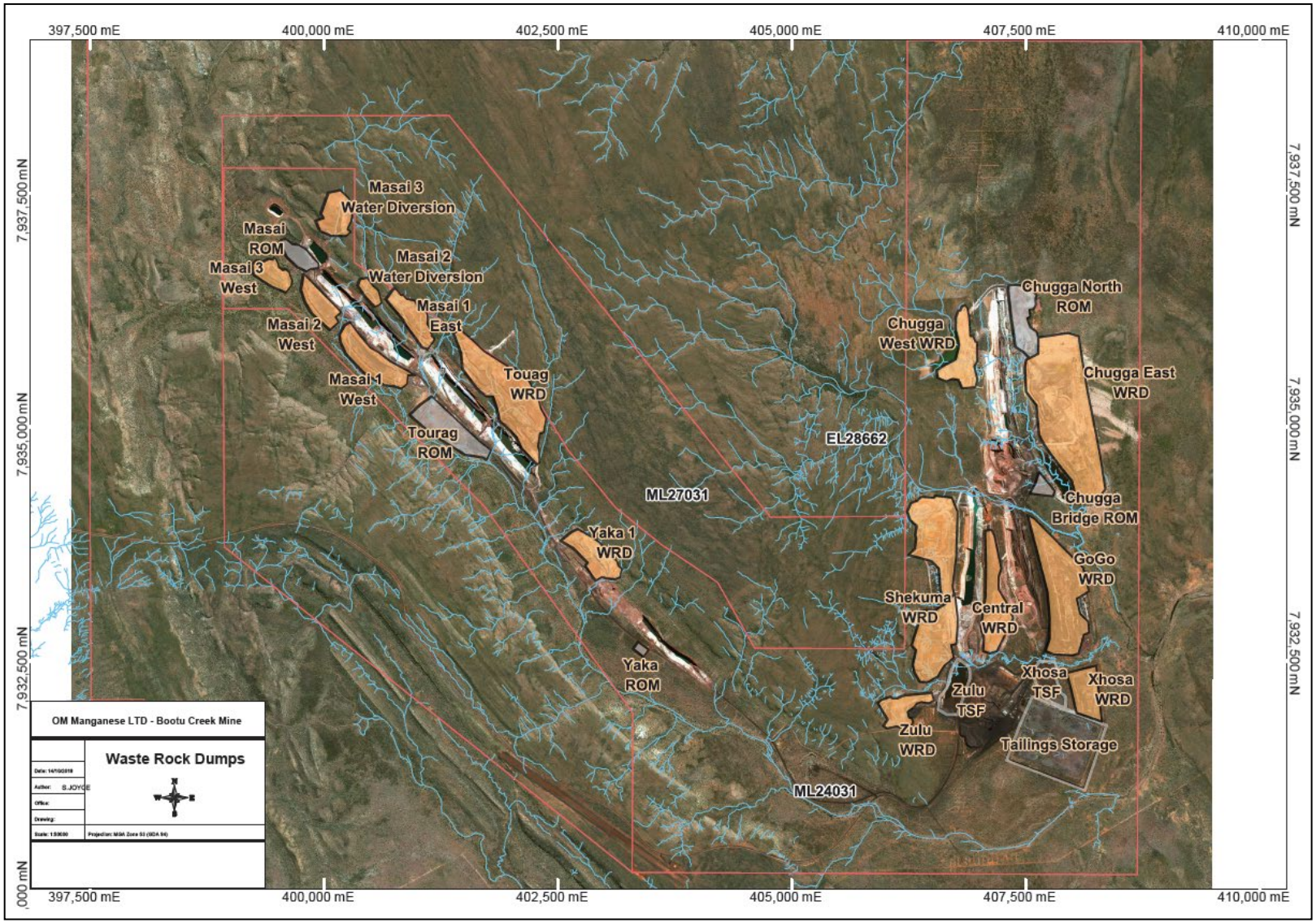


Figure 29: Bootu Creek Mine waste rock dumps.

4.3.5. Mining Reserves and Geology

The Bootu Creek area forms part of the Ashburton Province of the Tennant Creek Inlier, which consists of Proterozoic platform cover of fluvial to shallow marine sandstone with minor volcanic rocks, siltstone and carbonate rocks of the Tomkinson, Namerinni and Renner groups, in part overlain by Cambrian volcanic and sediments (Hussey *et*, 2001).

The favourable horizon for manganese deposits at Bootu Creek occur on the contact between the underlying dolomite-siltstone of the Attack Creek Formation and the overlying ridge forming sandstone of the Bootu Formation of the Tomkinson group. The contact is folded around the gentle NNW plunging Bootu Syncline and can be traced discontinuously for up to 24km.

The west limb manganese deposits (Masai, Tourag and Yaka) dip around 300 degrees to the north east while the deposits on the more structurally complex east limb dip around 300 degrees to the west. The Foldnose deposit dips between 150 and 30 degrees to the north and northeast.

The manganese is hydrothermally concentrated in shallow marine sediments which locally retain a relic stromatolite texture. The unweathered protore is generally located greater than 90m below surface and consists of Rhodochrosite ($MnCO_3$) and Braunite. The supergene altered “ore zone” consists of a high grade massive and heavy disseminated footwall ore zone (>15%Mn), which typically varies from 2m to 12m in width may be overlain by similar widths of low grade (10-15%Mn) manganese bearing sandstone. Individual mineralised deposits are generally strata-bound in character and can persist over strike lengths of several km.

The Renner West deposit is located 70km northwest of the Bootu Creek mine site within the siltstone, dolostone and sandstone of the Shillinglaw Formation in the Namerinni Group. The deposit style is multiple thin manganese rich seams hosting wider manganese rich near surface breccia nodes. The north-south striking manganiferous horizons dip around 25° to the east. Other manganese accumulations in the Renner Springs project area remain to be delineated.

The principal ore minerals of both project areas are:

Pyrolusite – MnO_2 and varying amounts of quartz, goethite and clay gangue

Cryptomelane – $K(Mn^{2+}Mn^{4+})_8O_{16}(OH)_4$ equivalent to 60%Mn and 5%K, plus minor

Psilomelane – $Ba(Mn^{2+}Mn^{4+})_8O_{16}(OH)_4$ being around 50%Mn and 15%Ba, and

Braunite – $3(Mn_2O_3)$-$(MnSiO_3)$ being around 62%Mn

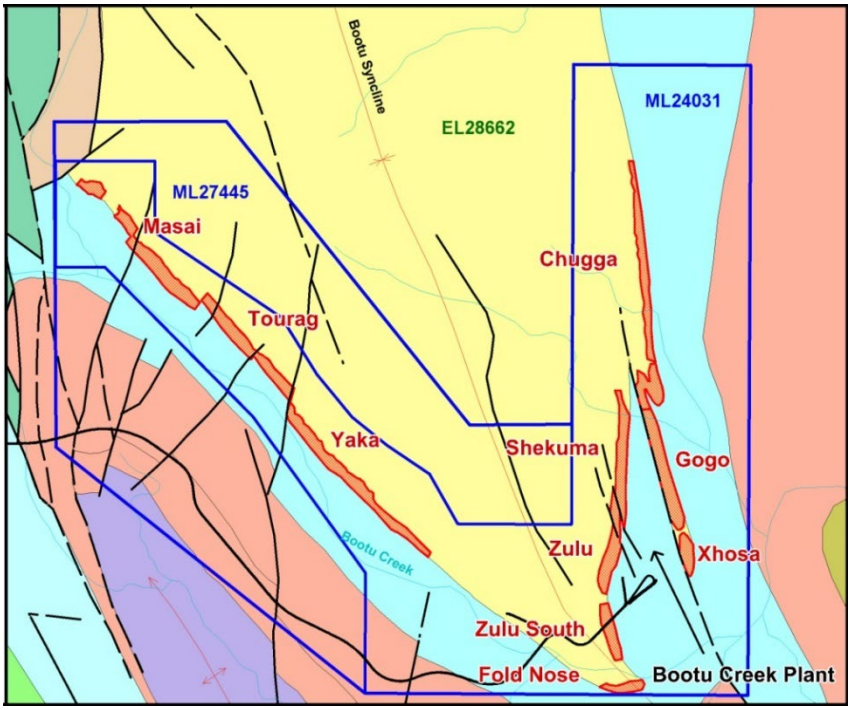


Figure 30: Interpreted Geology Plan of the Bootu Creek Project.

The term Mine Plan is used as a proxy for "Ore Reserve" and is not intended, nor authorised for publication in any form. The Mine Plan has been estimated as per previous Ore Reserve procedures and methodology. The term Ore Reserve and Mine Plan are used on an interchangeable basis. No warranty is offered and any user of this information will need to verify the numbers quoted with their own due diligence.

The Mine Plan (Ore Reserve) is reported at a 15%Mn cut-off with tonnes rounded to the nearest 10,000 and %Mn grades quoted at two decimal places. Rounding gives rise to apparent unit discrepancies for subtotals in the above table.

The Proven component is limited to the Measured Resources contained within Ore Reserve pit designs and restricted to material within a 15 metre vertical extent of pit floors at the end of 2015.

The Probable component is limited to Indicated Resources contained within Mine Plan (Ore Reserve) pit designs. Indicated Resources are generally based on maximum 50m x 25m spaced drill pattern.

4.3.6. Mining Performance

Annual operational performance reports are available at OMH ASX Online.

4.4. Processing Activities

Processing of manganese ore is undertaken using standard heavy media separation techniques. Ore is beneficiated in a two-stage process:

(i) Ore is blended, crushed, screened and washed.

(ii) Ore feed is beneficiated in a heavy media separation (HMS) plant to produce lump manganese product via a drum separator and fines manganese product via a cyclone.

Material rejected by the drum circuit is subsequently re-crushed to less than 12mm and passed through a second cyclone to produce a second fines product.

The operating philosophy is to run the crushing circuit, the drum and cyclone plants, and the secondary processing plants 24 hours a day. An intermediate stockpile provides crushed feed for shutdowns on the crusher circuit. Conversely when the HMS plant is down the crusher can operate to feed the stockpile.

4.4.1. Treatment and Ore Processing Operations

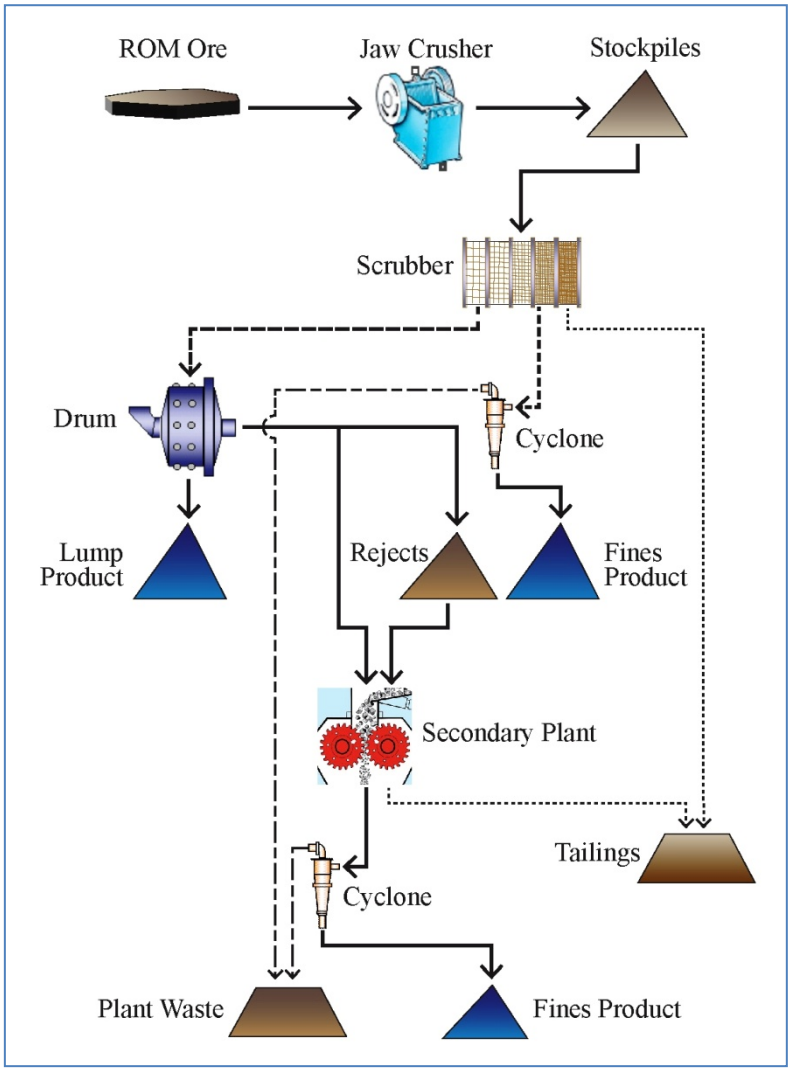


Figure 31: Process Plant flow diagram

4.4.2. Residue / Tailings Storage Facility

There are four Tailings Storage Facilities at the BCMM. The original TSF was decommissioned in 2012 due to reaching capacity. Subsequently three mining pits (Xhosa, Zulu then Gogo) have been converted to tailings storage facilities due to the growth of the mine. The original TSF and Xhosa are currently inactive, the Gogo TSF will supersede the Zulu TSF in 2020 and will be utilised for final tailings storage during future operations.

Authorisation was sought to commence deposition of tailings from the processing plant into the completed Gogo pit in April 2019. Pumping tailings to the Gogo pit allows the material in Xhosa and Zulu pits to consolidate. A minimum freeboard of 824mm will be maintained. At a tailings deposition rate of approximately 1,800,000 tonnes per annum and a density of 1.5 t/m^3, the Gogo pit would safely sustain tailings production for 6.4 years. Deposition of tailings into this pit is in accordance with our TSF Operations Manuals.

At completion of Gogo pit, tailings deposition will return to the subsequent Xhosa and Zulu pits.

The processing plant treats nominally 2,000,000 tonnes of ore per annum at approximately 35% ore recovery. The only chemical utilised in the process is ferrosilicon (1440 tonnes annually) which is used for its high density and is used in the Heavy Media Separation plant. The ferrosilicon is insoluble and is lost from the system due to adhering to the product, corrosion and recovery inefficiencies from the magnetic system. Water, used in the processing of the ore, is currently sourced from Zulu pit, dewatering of active mining areas, and where necessary water storages in inactive pits. The tailings material at Bootu Creek is classified as non-acid forming.

Monitoring of water levels and quality is conducted as per BCMM Water Management Plan. Physical monitoring is conducted as per the TSF operations Manual.

The processing facility has undergone upgrades to enable the retreatment of tails and process waste material. The concept for infrastructure upgrades to enable the retreatment of tails is described in Section 4.4.3. The sequence for processing tailings product is described below:

- Stage 1 - Process tails material, as generated from current processing operations, through new refinement process with final waste deposition into the Gogo TSF.
- Stage 2 - Extract and process tails material from a combination of Xhosa and original TSF.
- Stage 3 - Extract and process tails material from Zulu TSF. Waste will be directed into the Xhosa pit and Zulu once empty.
- Stage 4 – Crushing of all process waste (Heavy media floats) to minus 2mm and processed through the tailings treatment plant.

Tails and heavy media floats processing will be undertaken for approximately 8 years between 2020 and 2028. Rehabilitation strategy and timeline is outlined in the TSF Operations Manual. The ANCOLD guidelines will be utilised to direct this process of planning this rehabilitation strategy.

The tails material does not present any potential acid forming substances and does not contain any chemical substances from retreatment. Thus, the final rehabilitation strategy will be based around risk management of natural ore and landform stability with reduced manganese concentrations escaping to surface water and or groundwater.

4.4.3. Process / Mine Water Dams

The Bootu Creek Mine uses one process water dam. Open pit voids are utilised as water storage dams, receiving groundwater ingress and surface stormwater throughout a typical year. These dams are all clearly visible on the Disturbed area plans and the Water Management Plan.

4.4.4. Processing Performance

Annual operational performance against the LOM plan is reported in the EMR.

4.5. Tailings and Waste Processing

4.5.1. Background

The dense media processing plants (HMS and SPP) at Bootu Creek process only >1.0mm of crushed ROM ore (in real terms). All <1.0mm material bypasses any method of beneficiation as Tails.

Test work conducted of 2014 throughout on production tails indicated 30-40% of <1.0mm material in ROM and SPP feed. This represents a significant portion of the mined resource not being subjected to beneficiation. Therefore, saleable product in this fraction is being lost to revenue. It is proven that high grade material in Bootu Creek ore liberates with comminution, and therefore it can be expected that fine high grade particles created by crushing, are naturally deported and concentrated into the Tails stream. It was also identified that the heavy media floats would become an additional feed stock for the tailings treatment plant after further crushing to minus 2mm liberating the contain manganese.

An investigation was launched to understand and quantify the value contained in the continuous tails stream generated by daily processing, as well as that contained in the tails storage facilities. Similar investigations have in the past been conducted at Bootu, but the technologies to beneficiate fine ore have been either inefficient and/or capital intensive. Recent advances in simple non-capital intensive fines separation technology, utilising density as basis of efficient separation, prompted a revisit.

The investigation completed in 2015 demonstrated the following:

- Significant quantity of potentially saleable material in the Tails stream generated from the HMS and SPP plants – between 10-20% (taking inefficiency into account);
- Tails fraction highly amenable to beneficiation by density separation;
- Suitability of tested separation technology to achieve high efficiency and recovery, and provide simple and cost efficient solution; and
- Preliminary assessment of tails storage facilities indicates possible economic resource.

4.5.2. Design of Processing circuit

A process design for a processing facility was engineered in-house based on the following:

- Processing combined total HMS and SPP tails at a rate of up to 150t/h, plus additional 50t/h from the current tails storage facilities;
- Dual Reflux units required for above duty – plant designed to be modular – can be expanded if required
- Modify existing SPP crushing circuit to achieve a minus 2mm product; and
- Average production rate of 45-50t/h expected at 37% Mn grade.

4.5.3. Process Description

The feed for the classifier circuit will come from 2 sources, the tailings (<1.0mm) and a crushed heavy media floats (<2.0mm) through a reconfigured SPP crushing circuit. The combined streams are pumped through a set of Cyclones, to prepare feed at correct density to the Reflux Classifier. Cyclone underflow is separated into a coarse and fines fraction (cut 450microns) and each stream pumped into the designated classifier. Clean fluidisation water is pumped at a controlled rate into the classifier. The classifier is a static unit with no moving parts, except for the underflow discharge valve – controlling the material bed in the unit with the help of load cells and a PLC.

Slimes and low density ore discharges from the classifier via the overflow, and is pumped to the final Tailings storage facilities, combined with the feed Cyclone overflow (containing the bulk of <150micron slimes).

High density ore discharges from the Classifier underflow, at a controlled rate via a variable discharge valve. The product is pumped to a dewatering cyclone, where the under flow is discharge onto a stockpile. The dewatering cyclone overflow is recirculated to the plant, in closed circuit with the cyclone.

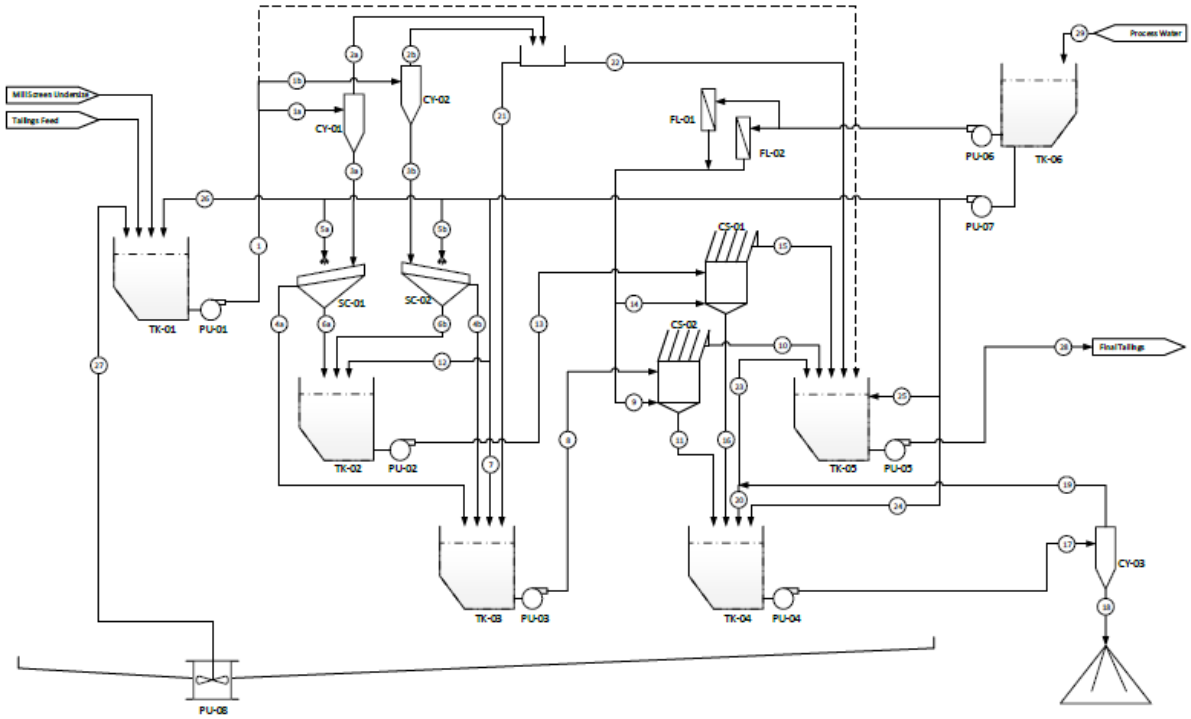


Figure 32: Tailings retreatment Process Plant Flow Diagram

4.5.3.1. Processing facility and product handling

Final approval to commence construction was granted from the OMH Board in early 2018.

The tailings treatment plant is designed for 2Mtpa feed rate made up of 2 feed source streams, crushed heavy media floats (<2.0mm) and tailings (<1.0mm) comprising a 50% split (see figure 34 above). The designed product production rate is 300,000tpa and in the early stage of operation the product will be blended into our existing fines product and handled as per our conventional materials handling processes. Once the circuit is optimised which is expected within 6 months of operation the introduction of an agglomeration process will occur taking the final classifier product combine with a binding agent (cement) to produce a pellet style product of around 6-8mm in diameter to enhance downstream materials handling and processing to mitigate environmental risks (i.e. dust). Below is the proposed layout of the agglomeration circuit.

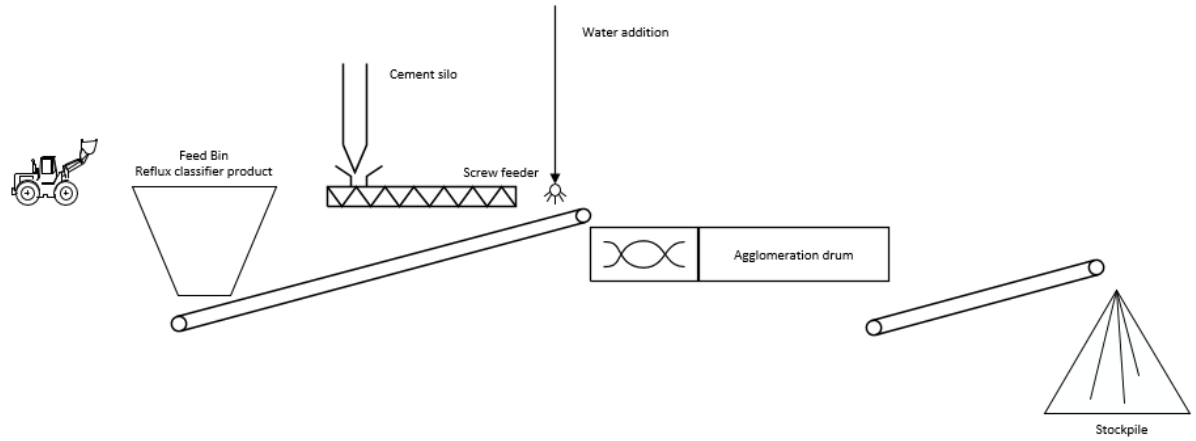


Figure 33: Tailings treatment process proposed Agglomeration Plant Flow Diagram

4.6. Exploration Activities

Exploration activities within the mineral lease are limited to resource delineation drilling and associated disturbance is likely to be consumed by mine development. All remaining exploration disturbance at end of mine life will be rehabilitated in accordance with advisory notes available on the DPIR website and considered best practice.

An Exploration MMP for Renner Springs was approved by the DPIR and drilling activities commenced in November 2019. Development of the Renner Springs deposit will be subject to a separate plan to be submitted to the DPIR for review and approval.

5. Environmental Management

5.1. Environmental Management Structure

OMM has an Environmental Management System (EMS) in place to manage environmental compliance requirements, commitments, and operational risks at the BCMM. Maintenance and implementation of the EMS is undertaken by the site Environmentalist. The Chief Operating Officer is ultimately responsible for the provision of resources to achieve the commitments and compliance requirements of the MMP.

All employees and contractors at the BCMM are responsible for complying with the MMP and environmental management strategies. Line management and supervisors are responsible for ensuring that staff and contractors, within their areas of responsibility, understand the EMS requirements and ensure works are conducted appropriately.

The Environmental Officer is primarily responsible for:

- Developing and implementing the EMS to ensure operational compliance with the MMP and all applicable legislation;
- Advising and developing management strategies for risk areas and or compliance matters;
- Training, auditing and inspecting operations to identify improvement opportunities;
- Undertaking all environmental monitoring in accordance with annual commitments;
- Collating, reviewing and reporting environmental data; and
- Collaboration and communication with stakeholders to achieve MMP objectives.

The primary objective of the EMS is to achieve high levels of environmental performance to prevent and minimise risk of environmental harm. The EMS provides a framework for managing environmental issues at the site and is structured to align with the Mining Management Act and includes:

- *Environmental Policy* - Establishes OMM's commitment to environmental management and sets objectives for employee and contractor conduct;
- *Approval Documentation* - Includes the company compliance requirements as outlined in the Mining Authorisation.
- *Management Plans* - Describes the approved management strategies (MMP, EMP, WMP, WSMP, ESCP, TSF Operations Manual).
- *Procedures & Instructions* - Details specific requirement to conduct activities in compliance with the various management plans.
- *Monitoring & Reporting* - Annual program for collating, reviewing and reporting on environmental performance.
- *Reviewing & Auditing* - program for assessing effectiveness of the EMS and continuous improvement.

The EMS is continuously reviewed during the life of mine to meet the needs of the Company and stakeholders.

Detail of key elements of the EMS and relevant documents appears in Table 11 below.

Table 10: Key elements of the Environmental Management System in use at the BCMM

	Element	Description	Documents
1	Environmental Policy	Establishes OMM's commitment to environmental management and sets objectives for employee and contractor conduct	EMP.
2	Legislative Obligations and Commitments	Statutory requirements set the standard for minimum regulatory compliance by OMM, employees and contractors. Company commitments set the minimum objectives for compliance.	Compliance Register.
3	Key Responsibilities	Key responsibilities and authorities are defined and documented within Management Plans, Procedures and Forms to facilitate effective implementation of the EMS.	MMP. EMP.
4	Education and Training	OMM will ensure appropriate training is provided for all personnel on site to meet its EMS requirements. All personnel are required to attend an induction prior to commencing work on site.	Induction. Training Needs Register.
5	Environmental Issues and Risks	Environmental risks associated with OMM's activities are identified, evaluated and managed. A Hazard Register will centralise risk assessment information.	MMP. EMP. WMP.
6	Operational Control	OMM will ensure that Company standards, management plans, procedures, work permits and forms are effectively implemented to achieve environmental objectives associated with all aspects of its operations. Monitoring systems and procedures will form the basis of measuring OMM's compliance with statutory requirements and performance with the EMS. OMM will establish an inspection programme to ensure performance of contractors is consistent with EMS requirements.	MMP. EMP. ESCP. WMP. TSF Operations Manual. WSMP. Environmental Procedures and Forms. Monitoring Matrix.
7	Audits and Review	Audits, inspections and reviews will allow for improvements to be integrated into the site's management plans and procedures. OMM senior management will review the EMS annually to ensure it remains effective.	AER EMR.
8	Communication	OMM will regularly consult with internal and external stakeholders.	MMP. AER. EMR.
9	Reporting	OMM will prepare internal and external reports on its activities.	AER. EMR.

5.2. Environmental Policy

The following presents the content of the BCMM Environmental Policy:

OM Manganese believes that protection of the environment is one of the key responsibilities of the company. We recognise that environmental management is an integral part of all activities, from exploration and mining to processing and exporting. Maintaining high levels of environmental performances at our operations will benefit all stakeholders, including shareholders, employees, traditional landowners and the broader community. To achieve and maintain high environmental standards, all employees at OM Manganese will specifically:

- *Comply with applicable environmental laws, regulations and standards;*
- *Implement systems to identify, control and monitor environmental risks arising from operations;*
- *Co-operate with authorities and stakeholders in the development of standards aimed at further improving the protection of the environment and the community;*
- *Implement methods and strategies to prevent pollution, minimise wastes and conserve natural resources;*
- *Ensure that all company employees and contractors are aware of their environmental responsibilities and conduct activities with a high level of competence;*
- *Promote cross-cultural awareness and protect all identified sites of cultural and heritage significance;*
- *Have timely and effective communications with traditional landowners and others who may be directly affected by the company's operations;*
- *Communicate the intentions of the policy with employees, suppliers and contractors, and;*
- *Seek continuous Improvement in the way OM Manganese looks after the environment.*

A signed copy of the company Environmental Policy is included in Appendix 1.

5.3. Environmental Commitments

OMM seek to achieve the following environmental commitments:

- Effectively manage hazardous materials to prevent and control any uncontrolled release to the environment.
- Contain tailings material generated by the processing operations within a suitably engineered facility to prevent egress to the environment.
- Regularly inspect water management infrastructure to ensure that mine affected water is contained and does not escape into the environment.
- Secure and manage topsoil stocks to promote viability and use effectively during rehabilitation works.
- Progressively rehabilitate disturbed areas as soon as practicable to minimise total disturbed area.
- Design and construct waste rock dumps to minimise erosion and landform instability, reduce visual impacts, and maximise rehabilitation success.
- Manage water resources to minimising deleterious effects to regional ground and surface water.
- Monitor environmental aspects to identify potential impacts and inform remediation and control measures.

5.3.1. Commitments contained in the MMP

OMM commits to the following during the 2020-2030 MMP period:

- Undertake further weed eradication works across the whole of site.
- Undertake works as far as practical to address issues identified in the ESCP.
- Progressively rehabilitate waste rock dumps, creek systems and disturbed areas[2];
- Continue to monitor surface and ground waters as described in the WMP.
- Assess potential impacts as a result of mine operations in the WMP.
- Continue to improve practices relating to hydrocarbon management to ensure operational compliance and spill prevention.
- Finalise an agreement regarding of post-closure assets with Traditional Owners.

5.3.2. Recommendations Resulting from Formal Environmental Assessment

A Public Environmental Report was compiled and lodged on 26 July 2004 following submission of a Notice of Intent on 20 November 2003. All recommendations arising from the review of that report have been incorporated into management plans in use at the BCMM. A summary of the recommended actions arising from the review of the PER and voluntary commitments made by OMM appears in Table 12 below.

Table 11: PER Assessment Report (No.44), July 2004 Recommendations and Voluntary Commitments

Recommendation / Issue	Comment	Document
Minister's Assessment Requirements and Recommendations		
Submission of a Water Management Plan to the DPIR is required detailing: • Impacts on downstream hydrology and ecology arising from the operation; • Site water quality and monitoring; • Management measures implemented to control water at the BCMM and prevent unplanned releases to the environment; • Erosion control measures to prevent sedimentation of natural water courses; • Undertake investigations of the regional aquifer and the effects of the operation; and, • Water extraction volumes.	Information initially provided to the Department of Infrastructure, Planning, and Environment and to the Department of Business, Industry, and Resource Development in 2004. Water Management Aspects are subject to annual review and information is submitted to the Department of Primary Industry and Resources annually.	Water Management Plan and Erosion and Sediment Control Plan
Preparation of a Tailings Storage Facility Operations Manual detailing: • Methods for pumping the tailings; • TSF infrastructure details; and, • Inspection schedules.	A TSF Operations manual was developed prior to commissioning of the facility and submitted to the Department of Primary Industry, Fisheries, and Mines in 2005. The TSF Operations Manual is subject to annual review for in-pit tails storages.	TSF Operations Manual.
Conduct full field surveys of the flora and fauna prior to commencing operations. Particular attention to the identification of any listed species or threatened species	Flora and Fauna surveys were completed in 2004 and 2008 by Low Ecological Services and the reports submitted to the Department.	MMP Section 2.1.3

[2] The mine site assets which have been identifed by the Traditional Owner's as suitable for future use, and therefore potentially do not require rehabilitation, are listed in Section 2.2.5. The Agreement with the Traditional Owners to transfer these assests is yet to be finalised. Until the agreement is finalised it is considered that all disturbed areas will require rehabilitation.

habitat is to be incorporated to field studies.		
A Weed Species Management Plan is to be developed and included in the MMP.	Weed Species Management Plan developed initially in 2005 following flora survey and submitted to the Department. The Weed Management Plan is subject to annual review and update of maps of weed locations.	Weed Species Management Plan.
A rehabilitation plan is to be developed which includes rehabilitation objectives and constraints, and a detailed methodology for the progressive rehabilitation of waste rock dumps, TSF, roads, infrastructure and pits. The plan should also include a rehabilitation outlook outlining the likely success of the plan and justify using examples of rehabilitation in similar terrain and climate.	Rehabilitation objectives and progress are detailed in the annual submission of the MMP. A Decommissioning and Closure Plan for the BCMM was developed in 2008 and is undergoing substantial review in consultation with traditional owners. This is now the Mine Closure Plan and includes specific details relating to the rehabilitation methodology.	MMP Section 5.6.3 Mine Closure Plan
Voluntary Commitments		
Progressively rehabilitate disturbed areas to minimise erosion potential and maximise revegetation success.	Rehabilitation earthworks are progressing on completed waste rock dumps.	MMP Section 5.0 and 4.1.5 MCP Section 2.5.2
Undertake annual vegetation surveys of revegetated areas to confirm successful rehabilitation of waste rock landforms.	Landscape Function Analysis and vegetation community assessments are undertaken on all rehabilitated areas.	MMP Section 5.6.3.1
Waste rock landforms will be constructed in such a manner as to minimise visual impact and maximise rehabilitation success.	Waste Rock dumps are constructed to replicate surrounding topography. Where dumps abut natural ridgelines they are constructed so as to blend in to the adjacent ridge height. Free standing dumps are constructed to attain a maximum height of 30 metres.	MMP Section 4.1.5
On completion of mining activities, infrastructure will be removed and all disturbed areas rehabilitated to allow the pre-mining land use to recommence. Infrastructure will not be decommissioned where agreement has been reached for post mining land users to take responsibility of infrastructure of value to them.	Consultation with traditional owners is ongoing to identify desired post closure outcomes, and any desired post mining use of infrastructure. The outcomes of these discussions will be incorporated into Mine Closure Planning.	Mine Closure Plan.
Install clean water diversions where practicable to minimise impacts to downstream environments.	Water diversions around the been installed where practicable.	Water Management Plan and Erosion and Sediment Control Plan.

All recommendations made during the review of the PER in 2004 have been incorporated into onsite practices and relevant management plans. OMM continue to review operational practices to ensure that voluntary commitments remain relevant and are achieved.

5.4. Environmental Training and Education

The environmental induction package is delivered to all visitors and personnel on site. A shortened version of the package is presented to site visitors. The complete package covers:

- OMM environmental policy;
- Relevant environmental legislation;
- Key environmental risks;
- Environmental incident reporting procedures;
- Air, Water, Land, Vegetation, and fauna management procedures;
- Significant fauna at the BCMM;
- Waste management and recycling;
- Hazardous materials management;
- Hydrocarbon spill response procedure;
- Aboriginal and Cultural Heritage management; and
- Sacred site protection and associated procedures.

The training register in use at the BCMM identifies personnel who have received induction training and other environmental training. In the event of substantial changes to procedures the information is circulated through various forms including prestart and toolbox meetings.

Environmental Emergency Response training is incorporated into Emergency Response Training as coordinated by the Health and Safety Representatives. Spill response refresher training is provided on a quarterly basis to ERT members. The general workforce receives spill training as part of the induction package.

5.5. Environmental Emergency Preparedness and Response

Personnel are trained to activate and implement the Bootu Creek Emergency Preparedness and Response Plan in reaction to onsite and offsite emergencies. Spill kits, and PPE specific to any environmental issue, as identified in the environmental risk assessment, are supplied and available for the emergency response team (ERT). Environmental issues arising from any incident are discussed in the clean-up section of emergency response manuals.

In the event of an emergency the procedure stipulates that all radio communication ceases until authority to resume is provided. The person raising the emergency is initially responsible for determining the type and quantity of assistance required. The receiver of the emergency call will act as the Communication Coordinator and arrange any external support services required.

External emergency response services which may be required include:

- Bushfires NT.
- Tennant Creek Emergency Services.
- Royal Flying Doctors Service.

The ERT training sessions are conducted frequently (minimum of monthly) and incorporate a test of the emergency sirens to commence training. Environmental incidents covered in training sessions include:

- Fire on the site.
- Chemical spill and ventilation.
- Hydrocarbon spill and clean up.

5.6. Implementation Monitoring and Review

5.6.1. Identification of Environmental Aspects and Impacts

Risk assessments of environmental aspects are conducted and recorded within the Environmental Aspects and Impacts Register. Environmental aspects and potential impacts resulting from operations at the BCMM are assessed across the whole of site; and information drawn from experienced personnel, available guidance notes and literature, and operational observations. Significant environmental aspects of operations at the BCMM are detailed in Table 13.

Table 12: Significant Environmental Aspects at the BCMM

Environmental Aspect	Risk Activities	Environmental Impact
Air/Emissions	• Operation of mobile plant and equipment; • Operation of fixed plant and generators; and • Ground disturbance and vegetation clearing.	• Exhaust emissions; • Generation of dust; • Generation of noxious vapours; • Point source particle emissions; • Emissions of greenhouse gases; and • Pollutants.
Surface and Ground Water	• Storage of hazardous materials • Servicing and refuelling of equipment; • Pit dewatering; • Dust suppression; • Water Diversion; • Pit water containment; and • Ore body oxidation impacts on pit water.	• Toxicity or stress to aquatic habitats; • Toxicity to livestock; • Contamination of surface water resource; • Contamination of groundwater resource; • Depletion of groundwater resource; • Alteration of surface water flow regimes; and • Landform erosion to stormwater.
Soil and Land	• Storage of hazardous materials; • Servicing and refuelling of equipment; • Ground disturbance and vegetation clearing; and • Waste rock stockpiling.	• Accidental spill or containment breach resulting in soil contamination; • Erosion; • Topsoil sterilisation; • Sedimentation; and • Exposed waste rock stockpiles.
Flora	• Ground disturbance and vegetation clearing; and • Operation of mobile plant and equipment.	• Weed introduction; • Alteration of habitat; • Alteration of water flow regimes; • Alteration of fire regimes; and • Vegetation die back.
Fauna	• Ground disturbance and vegetation clearing; • Operation of mobile plant and equipment; and • Tailings storage.	• Pest introduction; • Weed spread; • Alteration of habitat; • Alteration of water flow regimes; • Alteration of fire regimes; and • Fauna mortality.
Waste	• Catering operations; and • Machinery and plant servicing.	• Generation of food wastes; • Increase in rodent and feral animal populations; • Fauna mortality; • Generation of inert wastes; • Generation of waste hydrocarbons; and • Generation of waste tyres.
Heritage	• Mining Operations	• Damage to significant habitat; • Damage to sacred sites; • Damage to heritage areas; and • Restriction of access to significant sites.
Rehabilitation and Closure	• Mining Operations • Processing Operations • Infrastructure • Ground distrubance	• Surface contamination and unrectified distrurbance; • Exposed waste rock landforms; • Visual and aethetic impacts; and • Waste materials.

5.6.2. Risk Assessment

Environmental hazards and associated risks are identified during operations for new developments and activities at the BCMM. Appendix 2 includes the standard Risk Matrix in use at the BCMM. Table 14 presents the risk assessment of environmental hazards for the BCMM.

Table 13: Environmental risk assessment of operations at the BCMM

Potential Incident/ Unwanted Event	Environmental Impact	Initial Risk	Priority	Cause	Implemented Control	Resultant Risk	Priority
Open Pit							
Pit wall failure	Destabilisation and disturbance of immediate surrounds	M	17	Poor geotechnical understanding and pit development	Geotechnical investigations and engineered pit design	L	24
Overtopping / uncontrolled discharge	Aquatic habitat impacts from sediments, some toxicity from water quality	H	13	Insufficient storage capacity during extreme weather events	Water Balance Model and inventory monitoring Negative water balance	L	21
Loss of topsoil during pit development.	Insufficient topsoil available for rehabilitation.	H	13	Topsoil not stockpiled. Topsoil used for other applications. Topsoil covered by other material.	Stockpiling of topsoil for rehabilitation. Register of stockpile location, source, and duration of storage maintained.	L	21
Contamination of topsoil during pit development.	Topsoil rendered unavailable for rehabilitation or requires further treatment.	L	21	Spills and leaks. Weeds.	Stockpiles located to avoid disturbance and contamination. Weeds routinely assessed and eradicated.	L	24
Dewatering impacts on regional aquifer during pit development.	Decrease in groundwater level which may impact on vegetation in the area. Change in regional water quality.	M	17	Dewatering.	Monitoring of SWL's throughout mine life. Surface water diversions into pit voids may be considered during decommissionion process.	L	24
Impact on environment over time after pit closure.	Change in groundwater levels and quality (primarily salinity and eutrophication). Impact to stock. Attraction of feral animals to water source. Fauna trap.	H	14	Change in catchment features and groundwater recharge/discharge. Evaporative concentration. Pit filling up with water.	Bores in place to monitor any changes in groundwater levels and quality over time. Long term pit water quality modelling undertaken during life of mine. Possible stream diversions into pits.	L	22
Waste Dumps							

Potential Incident/ Unwanted Event	Environmental Impact	Initial Risk	Priority	Cause	Implemented Control	Resultant Risk	Priority
Saline drainage	Toxicity and stress to aquatic habitats	H	15	Poor waste rock characterisation subsequent and lack of suitable controls	Separation of ores from waste rock and isolation of this material from catchment	L	24
Changes in surface hydrology	Localised death in creeks or from ponding	M	18	Poor planning of waste dumping	Assessment of catchments and WRD locations	L	22
Placement and visual impact of waste landform on the surrounding landscape.	Aesthetics.	H	15	Inappropriate siting and design of waste dumps.	Limit of 30m high, 18^0 batter slopes. Revegetation of waste landform.	L	24
Erosion of battered faces on waste landform.	Build up of sediment in stormwater drains and surface water systems. Windblown dust. Lack of rehabilitation. Visual impact.	M	18	Insufficient revegetation of slopes to help stabilise batter. Surface water runoff. Wind erosion. General surface instability.	Progressive rehabilitation. Designed with concave surfaces, Inward sloping berm surfaces, rock armouring at water discharge points.	L	22
Processing Plant							
Loss of reagent to the environment	Smothering of vegetation. Inhalable particulate generation	L	23	Loss of ferro silicon from mixing tanks, piping, and transfer pumps.	Processing circuit design. Containment of tailings transfer pipes. Recovery of ferro silicon within circuit.	L	23
Loss of product	Localised smothering of habitat	L	21	Poor erosion and sediment controls	Install and maintain erosion and sediment controls. Isoloate ore dump catchment	L	23
Hydrocarbon spill	Contamination of soil, groundwater, and surface water.	L	21	Servicing and refuelling of mobile plant and equipment.	Service vehicle equipped with spill response materials. Refuelling of vehicles within bunded area. Storage of hydrocarbons on bunded pallet.	L	23

Potential Incident/ Unwanted Event	Environmental Impact	Initial Risk	Priority	Cause	Implemented Control	Resultant Risk	Priority
Tailings Storage Facility							
Structural damage to tailings wall.	Contamination of soil, groundwater and surface water.	H	16	Structural damage under extreme circumstances.	Implement remedial works if erosion occurs. TSF Design.	L	23
Overflowing of tailings dam.	Contamination of soil, groundwater and surface water. Loss of vegetation. Change in hydrology.	M	17	Extreme rainfall events. Cyclones. Human error.	Maintain freeboard as defined in the TSF Operations Manual. Earth bund around top of retaining wall to retain pipe failure.	L	23
Tailings seepage.	Contamination of soil, groundwater and surface water. Loss of vegetation. Change of hydrology. Change in groundwater levels and quality.	M	19	Inappropriate design of tailings dam.	Monitoring bores Toe drain and return sump to collect surplus water.	L	23
Air emissions from TSF.	Dust.	M	19	Dry surface.	Surface is constantly wet.	L	23
Explosives Management							
Emulsion spill	Nitrification of surface waters leading to flora/fauna mortality Infiltration of soil leading to groundwater contamination	H	16	Extreme rainfall events Containment structure failure	Emulsion is stored in self bunded, aluminium clad steel tank. Spill kits available to prevent escape of inadvertant spills while loading. Established drainage preventing water ingress to facility.	L	21
Booster solution spill	Nitrification of surface waters leading to flora/fauna mortality Infiltration of soil leading to groundwater contamination	H	16	Extreme rainfall events Containment structure failure	Emulsion is stored in self bunded, aluminium clad steel tank. Spill kits available to prevent escape of inadvertant spills while loading. Established drainage preventing water ingress to facility.	L	21

Potential Incident/ Unwanted Event	Environmental Impact	Initial Risk	Priority	Cause	Implemented Control	Resultant Risk	Priority
Discharge of Ammonium Nitrate	Nitrification of surface waters leading to flora/fauna mortality Infiltration of soil leading to groundwater contamination	H	16	Extreme rainfall events Containment structure failure	Ammonium Nitrate prill stored in secure sealed facility. Daily checks of storage area for security purposes and to assess for damage Shed constructed on elevated concrete pad to prevent water ingress	L	21
Power Station							
Leakage of hydrocarbons from storage areas/pipelines (including underground pipelines).	Contamination of soil, groundwater and surface water.	L	22	Ruptured tank. Damaged pipelines. Damaged flanges/valves. Failing of automatic shutdown valves on tanks.	Self bunded diesel fuel tanks. Regular maintenance of automatic shutdown valves.	L	22
Workshop Facilities							
Spillage of hydrocarbons during bulk transport to site.	Contamination of soil, groundwater and surface water.	H	16	Vehicle accident causing ruptured or damaged containers on vehicles.	Emergency response procedures activated. Contain and collect spilled / contaminated area.	L	23
Hydrocarbon contamination while onsite.	Loss of resources. Contamination of soil, groundwater and surface water. Loss of resources.	L	22	Ruptured or damaged containers. Spillage while transferring, using or transporting hydrocarbons onsite.	Implement controls as per HMP. Main storage facilities located greater than 1 kilometre from nearest water course. Contaminated surfaces are relocated to the bioremediation pad for further treatment.	L	23
Hazardous material spills.	Contamination of soil, groundwater and surface water.	L	22	Transfer from one container to another. Damaged containers. Damaged hoses (if applicable).	Materials storage and recycling facilities at all workshops. Earth bund for batteries at all workshop facilities.	L	23
Waste Management							

Potential Incident/ Unwanted Event	Environmental Impact	Initial Risk	Priority	Cause	Implemented Control	Resultant Risk	Priority
General waste management, including landfill site.	Windblown litter. Leachate. Dust. Odour. Attracts vermin.	L	22	Inappropriate siting, design and operation of landfill site.	Burial in active face of waste landform as soon as practicable.	L	23
Disposal of sewage wastes	Environmental health risk. Attracts vermin. Leachate. Odour.	M	17	Inappropriate siting, design and operation of septage disposal site.	Disposal sites selected and operated in accordance with measures stipulated in *Public Health Act* and Regulations and in the Code of Practice for onsite sewage and sullage treatment systems. Outlets are inspected weekly.	M	18
Aboriginal, Historical, and Heritage sites.							
Damage to identified Aboriginal Sacred Sites	Destruction of sacred site. Prevention of access to sacred site. Loss of visual amenity around sacred site	M	17	operational activities impinging on identified sacred site areas.	Authority Certificate obtained from the AAPA. Stipulations made in certification documents adhered to. Exclusion fencing erected. Site locations recorded on survey plans and maps.	L	22
Damage to previously unmarked heritage sites	Destruction of site of significance. Loss of historical record	L	22	Operational activities inadvertantly altering or destroying unmarked heritage areas/	Site wide survey for heritage areas prior to operations commencing. Personnel training in procedures to be followed upon discovery of heritage site.	L	23
Rehabilitation							
Ineffectual seeding.	Loss of vegetation. Slow growth rates.	M	18	Limit of topsoil or poor management. Lack of rain. Cyclone. Use of inappropriate species.	Research into appropriate species and times of the year when seeding is optimum. Re-seed if unsuccessful.	L	23

Potential Incident/ Unwanted Event	Environmental Impact	Initial Risk	Priority	Cause	Implemented Control	Resultant Risk	Priority
Impacts on soils and degree of erosion.	Sediment build up in surface water and other drainage systems so water will find alternative route causing erosion and flooding of areas.	M	18	Lack of stormwater diversion systems.	Routine maintenance of drainage and sump systems.	L	23
Impacts of feral animals on rehabilitation.	Native and feral animals grazing rehabilitation and trampling slopes.	M	18	Feral animals on property. Stock from nearby stations coming onto site.	Liaising with landowners to perform musters on mining lease. Reduce access to water surrounding rehabilitated areas. Construct fencing where possible.	L	23

The identification of hazards and associated risks promotes the development of individual management strategies applied at the BCMM. Environmental management strategies have been developed for the following core areas:

- Emergency Preparedness and Response.
- Environmental Training.
- Soil, Land and Vegetation Management.
- Fauna Management.
- Air Quality Management.
- Noise and Vibration Management.
- Groundwater and Surface Water Management.
- Waste and Hazardous Materials Management.
- Ethnographic and Archaeological Management.
- Socio-Economic Management.
- Aesthetic and Visual Management.
- Rehabilitation.
- Closure Management.

5.6.3. Environmental Management Plan

An overarching Environmental Management Plan (EMP) is in use at the BCMM and submitted with this LOM MMP to the DPIR. The document is split into two parts. The first part describes the administrative details of the EMP and includes:

- The OMM Environmental Policy.
- Environmental performance objectives.
- Establishment of EMP Sub-Plans for key environmental aspects.
- Environmental responsibilities necessary to implement the EMP.
- Consultation and reporting commitments.
- Auditing and review processes.
- Appropriate resources necessary to fulfil the requirements of the EMP.
- Contingency planning and incident management.

The second section details the individual environmental management strategies that the project will adopt to meet EMP objectives. For each core environmental management area this includes the following:

- Specific objectives and targets.
- Detailed mitigation strategies.
- Monitoring and measurement requirements.
- Reporting requirements.

Individual EMP sub-plans have been developed to manage high and medium environmental risks. These specific sub-plans provide the necessary level of detail and content required for implementation of the EMP objectives. The environmental management sub-plans include:

- Water Management Plan.
- Weed Species Management Plan.
- Mine Closure Plan.
- Erosion and Sediment Control Plan.
- TSF Operating Manual.
- Hydrocarbon Management Plan.

The Mine Closure Plan is currently under revision as the operations are extended to ensure that it accurately reflects the nature and extent of disturbance and includes measurable closure criteria; incorporates Traditional Owner expectations with respect to post closure land use; pit lake requirements; and effective mitigation of environmental impacts resulting from the operations. Identified potential issues and impacts associated with closure include:

- Failure to rehabilitate the mine site to the satisfaction of regulatory authorities and thereby not obtaining a certificate of closure.
- Failure to rehabilitate disturbed areas in accordance with generalised targets which are not reflective of Traditional Owner and other stakeholder views and rationales post-closure.
- Failure to correctly design, construct and or cater for clean water separation, water storage, and stormwater drainage which adequately minimises erosion and sedimentation issues.
- Incomplete or ineffective rehabilitation methodologies and outcomes leading to environmental legacy issues.
- Long term environmental damage as a result of mining and ancillary operations.

A summary tables containing the EMP objectives, management strategies and implementation measures for each environmental aspect are included below.

5.6.3.1. Summary of EMP Objectives and Management Strategies

The EMP and associated sub-plans detail the objectives and management strategies employed at the BCMM to identify and manage environmental risks and associated controls. A summary of these appear in Table 15.

Table 14: Summary of EMP objectives and mitigation strategies.

Aspect	EMP Objectives	EMP Management Strategies
Soil and Land	➢ Minimise land disturbance including disturbance to soil, vegetation and watercourses; ➢ Conserve soil to assist in the long-term rehabilitation of the site; ➢ Minimise wind and water erosion on disturbed and constructed surfaces; ➢ Prevent contamination of land surfaces as a result of mining activities; ➢ Maximise use of contained seeds and microbes in topsoil; ➢ Prevent or minimise introduction of soil borne diseases and weeds; and ➢ Minimise adverse impacts on adjacent pastoral activities.	➢ Ground Disturbance Permitting; ➢ Stockpiling natural resources (river rock, rubble, vegetation, topsoil); ➢ Progressive rehabilitation of waste rock dumps; ➢ Implementation and maintenance of drainage, sediment and erosion controls; ➢ Regular monitoring and treatment of existing weeds; ➢ Control of feral animal populations; ➢ Source local seed species in quantities suitable for revegetation; ➢ Continuous seeding to increase soil stability; and ➢ Procedures and training.
Vegetation	➢ Minimise the loss of habitat, species diversity and abundance; and ➢ Re-establish appropriate habitat through rehabilitation. ➢ As far as practicable, prevent the introduction and transport of weeds within the mining lease; ➢ Regularly identify, monitor and record weed distribution and abundance; and ➢ Manage and control populations of weeds in accordance with regulations.	➢ Ground Disturbance Permit; ➢ Vehicle access restrictions; ➢ Vehicle and machinery inspections; ➢ Vehicle wash-downs; ➢ Chemical control application; and ➢ Revegetation as part of rehabilitation works. ➢ Weed Species Target Surveys
Fauna	➢ Minimise the loss of species diversity and abundance through the loss of appropriate habitat; and ➢ Assess populations of feral animals and when necessary implement control programs.	➢ Ground Disturbance Permitting; ➢ Training and awareness; ➢ Survey and communication. ➢ Feral animal control programs.
Waste	➢ Waste generation is minimised, and recycling of materials is maximised to the greatest practical extent possible; and ➢ That wastes disposed on site are placed in appropriately designed and operated locations and are stable in the long term.	➢ Dedicated site landfill; ➢ Segregation and recycling; ➢ Rubbish collection.
Hazardous Waste	➢ Waste generation is minimised, and recycling of materials is maximised to the greatest practical extent possible; ➢ Safe transport, storage and use of all potentially hazardous materials; ➢ Potential for accidental releases is minimised; and ➢ Any accidental releases that do occur are mitigated as soon as practicable and reported appropriately.	➢ Procedures in accordance with Safety Data Sheets; ➢ Storage tanks and secondary containment areas designed and constructed in accordance with AS1940 Storage and Handling of Flammable and Combustible Liquids; ➢ Surface drainage is intercepted to prevent entry to broader drainage systems and creeks; ➢ The explosives magazine and ANFO storage shed constructed and operated in accordance with regulatory requirements; ➢ Hydrocarbon and chemical spill kits; ➢ Incineration of suitable items; and ➢ Transport and offsite disposal of waste oil.

Groundwater and Surface Water	➢ Ensuring that mining operations do not impact water quality, flow intensity, or volume; ➢ To prevent or minimise any deterioration of surface water quality through changes in pH, mineral salts, sediment load, dissolved metals, chemicals and hydrocarbons; and ➢ Minimise the impact to regional aquifers and to prevent the contamination of groundwater via chemical or hydrocarbon infiltration; and ➢ Minimise potential adverse effects of mine dewatering on natural drainage systems. ➢ Manage all volumes of mine affected waste whereby discharge to the environment is not permitted.	➢ Maintain natural drainage lines where possible; ➢ Divert clean water from becoming mine affected; ➢ Implementation of effective erosion and sediment controls; ➢ Hazardous materials management and spill prevention; and ➢ Extraction of sustainable ground water quantities for use. ➢ Water balance and pumping/distribution regime.
Air Quality	➢ Minimise employee, contractor, and visiting personnel exposure to airborne dust; and, ➢ Minimise the generation of airborne dust from operations; ➢ Minimise point source and fugitive emissions.	➢ Occupational Hygiene Exposure Monitoring; ➢ PPE and signage; and ➢ Dust suppression.
Noise and Vibration	➢ Minimise employee, contractor, and visiting personnel exposure to noise; and ➢ Undertake blasting at appropriate times to minimise noise and vibration.	➢ Occupational Hygiene Exposure Monitoring; ➢ PPE and signage; ➢ Installation of sound-proofing insulation and shock absorption; and ➢ Blasting sequencing.
Cultural Heritage	➢ Avoid damage to any identified site; and ➢ Facilitate a process whereby potential new areas of significance can be investigated and formally identified by the relevant authority.	➢ General Site induction specifying the importance of the identified Sacred Sites; ➢ Identified Sacred Sites are known “exclusion zones” and fenced in accordance with AAPA certificate conditions; and ➢ Ground disturbance permitting.
Socio-Economic	➢ Minimise negative socio-economic impacts and enhance positive ones.	➢ Membership of the Executive Committee of the regional Chamber of Commerce; ➢ Maintenance of working relationships; ➢ Participation in remote health training and forums; ➢ Engagement with local emergency services; ➢ Source goods and services through local businesses where practicable; and ➢ Implement a consultative approach to the determination of decommissioning and closure criteria.
Aesthetic and Visual	➢ Maintain an aesthetic and visual impact that conforms with the expectations of the community; ➢ Return disturbed landforms that reflect the natural topography.	➢ Restricted access to the mine site to authorised personnel and visitors only; and ➢ Engineer disturbed landscapes (waste rock landforms) to blend in with the natural topography.

Rehabilitation & Closure	➢ Ensure that areas disturbed are rehabilitated and revegetated as soon as possible to minimise erosion by water and wind; ➢ Progressively seed portions of the waste landforms; ➢ Assess the success of rehabilitation programmes on a regular basis and incorporate learnings; ➢ Conduct any necessary follow up work to enhance vegetation success; ➢ Use local provenance species for rehabilitation of disturbed areas; ➢ Complete all shaping, topsoil replacement, cross ripping and seeding in the same operating period as mine works progress; ➢ Re-contour and cobble all major creek diversions to approximate original locations where possible; ➢ Recover all waste Mn not associated with the final retained road network and process either through the waste / tail retreatment facility or deposit in the Zulu pit fill. This activity will commence at the completion of mining when the haulage network is no longer required. ➢ Complete all statutory closure obligations.	➢ Rehabilitation planning and design; ➢ Implementation and maintenance of drainage, sediment and erosion controls; ➢ Revegetation planning; ➢ Biennial Landform Function Analysis (LFA); ➢ Source and maintain a suitable seed mix and adapt as needed.

5.6.3.2. Implementation of EMP Management Strategies

The EMR presents an in-depth description of ongoing management strategies implemented at the BCMM. Strategies are reviewed annually against current status and forward planning for internal compliance and improvement.

5.6.3.3. Summary of EMP Monitoring Programs undertaken at the BCMM

A summary of the monitoring programs described in the EMP and sub-plans has been included in Table 16 below.

Table 15: Outline of EMP Monitoring Programs

Aspect	Monitoring Targets	Method	Frequency/Timeframe	Record
Soil and Land	Condition of drainage, erosion and sediment control structures.	Structural Inspections.	Annual Pre Wet-season (October-November) Annual Post Wet-season (May-June).	Water Management Infrastructure Inspection Sheet.
	Effectiveness of control structures (turbidity).	TSS/TDS/Turbidity monitoring in instream flows.	Wet-season flow events.	Water Quality Field Record (turbidity) and photo reference.
	Erosion.	Erosion Survey Mapping. (To be developed).	Annual Post Wet-Season.	Photo reference, GPS and record sheet.
	Topsoil inventory.	Topsoil Survey. (To be developed in 2020).	Annual	Register of coordinates and map.
Vegetation	Weed introduction	Vehicle andMachinery Weed Inspections.	As required.	Weed Inspection Record.
	Weed abundance and distribution	Weed survey and continuous montoring.	Ongoing Annual Survey of new areas/weeds (October-November).	Survey maps and records.

	Vegetation die back due to altered flows, sedimenation and water quality.	Riparian Vegetation Monitoring.	Annual Post Wet-Season (April-May)	Field Record Comments and Photo records.
Fauna	Fauna mortality.	Fauna Mortality Inventory.	As required.	Fauna Incident Register.
		Snake relocations as per Permit 60997 to Interfere with Widlife.	As required.	
Waste	Generation of general waste.	Work Area Inspections.	Monthly.	Work Area Inspection Record.
	Generation of hydrocarbon waste.	Waste oil generation and disposal tracking.	Monthly (tanks) Quarterly removals.	Tank dip records (Fuel Reconciliation Spreadsheet). Waste Oil Reciepts.
	Waste management.	Incinerator Usage (Hydrocarbons).	As required.	Incinerator Usage Register.
	Generation of waste tyres.	Waste tyre disposal tracking.	As required.	Waste Tyre Register/map.
Surface Water	Contamination of surface water resource.	Mine Water Storages.	Quarterly	Mine water storage database.
	Toxicity or stress to aquatic habitats and livestock.	Instream Monitoring.	Annually, Monthly and As required (frequency of flow events during the Wet-season.	Instream Surface Water Database.
Groundwater	Depletion of groundwater resources.	Standing Water Level (SWL) Monitoring for active TSF and ex-abstraction bores.	Monthly.	Groundwater SWL database.
	Depletion of groundwater resource.	Standing Water Level (SWL) Monitoring for inactive TSF bores.	Quarterly	Groudnwater SWL database.
	Contamination of groundwater resource.	Abstraction Bore Water Quality Monitoring (pump equipped only).	Quarterly	Abstraction Water Quality Database.
	Contamination of groundwater resource.	All TSF Bore Water Quality Monitoring.	Quarterly	TSF Water Quality Database.
Air and Noise	Generation of noise, airborne contaminants and inahalable dust.	Occupational Hygiene Exposure Monitoring (including Port Facility)	Biannually.	Occupational Hygiene Monitoring Database.
	Generation of dust.	Dust Deposition Monitoring (Port Facility only)	Monthly (Port Facility).	Sampling results register.
	Fuel consumption and exhaust emissions.	Fuel tracking	Ongoing.	Fuel tracking datasheets.

	Exhaust emissions and fugitive dust emissions.	NPI & NGER Reporting.	Annaully (September and October).	NGER Reports and NPI Reports.
Cultural Heritage	Damage or movement of sacred sites.	Prism and Extensometer Montoring.	Monthly.	Geotechnical Report.
Rehabilitation & Closure	Condition of rehabilitated areas.	Landscape Function Analysis.	Bienniall.	LFA Rehabilitation Report.

5.6.4. Environmental Management Systems Audit

OMM will undertake an internal environmental audit on an annual basis. This audit will review the MMP compliance with MMP and Environmental Plan commitments and general environmental management systems; to ensure all matters are being managed effectively. Findings from the internal audit will be incorporated into plans, procedures and work instructions to implement corrective actions as required.

5.6.5. Key Environmental Activities

Key environmental activities are reviewed annually and outlined in the Environmental Management Plan. Activities planned will seek to identify and investigate potential impacts as a result of mining operations and provide targets for improved outcomes.

6. Water Management Plan

The Water Management Plan (WMP) for the BCMM outlines the objectives and practices utilised in the management of surface and ground water at the Bootu Creek Site. This plan has been prepared in accordance with DPIR advisory note AA7-023 and presents an overview of the water management system in use at the BCMM. The complete WMP is submitted with this LOM MMP to the DPIR.

6.1. Current Conditions

6.1.1. Rainfall

The long term average annual rainfall recorded at the BCMM is some 528.17mm (2006 to 2020). In comparison the long term average annual rainfall recorded at Banka Banka Station (approx. 14km to the south-west of BCMM) is some 433.3mm[3], whilst Tennant Creek Airport (125km south of BCMM) reports an average of 497.1 mm[4].

Rainfall is highly variable in the region. The table below illustrates the variation in monthly totals between sites within 125km radius.

Rainfall at BCMM is highest during the months of November to March, with the greatest monthly rainfall total of 510mm recorded in January 2006. The driest rainfall months are April to August although rainfall is generally limited after March. All water courses in the region are ephemeral and only achieve sustained flow following high intensity rain events or periods over several days.

Table 16: Rainfall recorded at the BCMM between 2016 and 2020

	Average Rainfall (mm)			Long term Average Rainfall (mm)			Evaporation (mm)
Month	**BCMM 17/18**	**BCMM 18/19**	**BCMM 19/20**	**BCMM 2006-2020**	**Banka Banka 1996-2014**	**Tennant Creek Airport 1991-2020**	**Tennant Creek Airport**
May	0	0	2.5	9.99	12.3	8.1	266.6
June	0	0	0	5.42	3.3	4.3	216.0
July	2.5	0	0	5.81	3.0	4.1	232.5
August	0	0	0	0.95	2.0	2.5	288.3
September	0.13	0	0	4.91	6.7	4.8	359.6
October	3.0	24.0	0	4.6	19.3	17.2	406.1
November	84.5	21.13	22.63	34.98	20.5	46.9	405.0
December	16.88	1.5	34.50	65.42	53.5	83.2	399.9
January	198.25	30.1	122.25	200.45	109.7	128.2	381.3
February	91.13	38.5	110.5	103.75	114.6	132.9	313.6
March	29.38	37.75	104.63	69.04	72.8	45.7	347.2
April	17.5	6.0	1.88	22.93	15.8	15.0	324.0
TOTAL Av.	**440.6**	**161.5**	**398.42**	**528.17**	**433.3**	**497.1**	**3,940**

[3] Obtained from Bureau of Meteorology for Station No. 015067, Banka Banka (1996-2014)

[4] Obtained from Bureau of Meteorology for Station No. 015135, Tennant Creek Airport (1991-2020)

6.1.2. Evaporation

The average annual evaporation for the Tennant Creek region is approximately 3,940mm. The highest rate of evaporation occurs during late spring, with October recording the highest monthly evaporation of 406mm. Evaporation rates exceed rainfall rates in every month and reflect a negative surface water balance typical of the region.

6.1.3. Surface Water

The project area is located within the Wiso catchment on the southern boundary of the Ashburton Ranges. A ridgeline runs through the project area from the north-west corner diagonally through to the south-east corner. A number of ephemeral creeks occur in the project area including Bootu Creek (URS, 2004).

Six primary creeks are present on the site: North, South and Chugga West Creeks which transect the eastern limb and Tourag East and Tourag West transecting the western limb. All these creeks drain into Bootu Creek. All creeks in the region are ephemeral and typically only flow for limited periods during the wet season in response to high rainfall events (URS, 2010).

Flow rates (based on critical rainstorm) for each creek identified on site have been calculated for a range of recurrence intervals. These flow rates have been calculated using a variety of methods to attempt to determine reliable figures (URS, 2010). The flow calculations demonstrate that Bootu Creek and North Creek represent the dominate creek systems at the site. Wildlife and pastoral use (stock watering) are the only likely uses of surface water in the area surrounding BCMM.

Table 17: Flow rates of creeks at the Bootu Creek Manganese Mine

Creek	Flow Rate (m^3 /sec)			
	ARI 5 Years	ARI 10 Years	ARI 20 Years	ARI 50 Years
Bootu Creek	71.6	90.6	158.5	175.0
Tourag West Creek	17.8	23.1	27.0	35.1
Tourag East Creek	5.7	7.3	8.5	11.1
North Creek	49.4	64.9	91.8	107.8
South Creek	23.0	30.5	39.0	49.5
Chugga West Creek	12.3	16.3	20.7	26.5

An increase in turbidity has been noted as an impact on surface water quality arising from interaction with operational areas. A number of higher erosive soils occur at the site.

The following controls have been implemented to contain and control runoff:

- A sediment trap has been constructed west of the Tourag ROM which receives run off waters from the ROM, adjacent haul road, and the Masai work area. Runoff water is directed via a settling pond into an interception trench adjacent to Bootu Creek, from here water reports directly to Bootu Creek
- Runoff water from the processing, maintenance and administration areas reports to the seepage interception trench at the toe of the Tailings Storage Facility embankment. This interception trench incorporates sediment traps.

- A seepage interception trench and sediment retention sumps exist around the base of the TSF to contain runoff from the processing plant area and erosion from the rehabilitated TSF batters. The sumps are located at the north eastern, south eastern and south western corners of the TSF and have an approximate volume of 25m^3 each. These sumps have not overflowed since installation.
- Wherever possible, bunds exist along the base of rehabilitated WRDs to contain sediment arising from erosion of batters.
- A series of spoon drains have been established along the Tourag haul road. These drains and associated culverts intercept run off water from the numerous small drainage lines along the ridge. Capturing runoff water and directing flow underneath haul roads serves to reduce sediment loading from uncontrolled flows across disturbed road surfaces and minimises erosion. Rock-lined drains and check dams assist to further filter out suspended sediments.
- Creek lines have been reinstated and rehabilitated where appropriate (North Creek, Tourag East Creek).

6.1.4. Groundwater

Groundwater resources within the Tennant region are described as a fractured rock aquifer system, with very few bore yields over 5L/sec (URS, 2009). Yields may be enhanced locally in transmissive sedimentary units, faults and shear zones (URS, 2008).

Locally, the BCMM sources groundwater from manganese ore aquifers and sedimentary units (Bootu Creek Sandstone). The contact zone between sandstone and manganese (top and bottom of orebody) seems to form the predominant fracture zones considered to be the main aquifer, with the underlying Attack Creek Formation acting as a regional-scale aquitard (URS, 2009). Aquifers within the Bootu Formation are thought to be regionally extensive throughout the Bootu Creek syncline (URS, 2009).

Groundwater yields up to 15L/sec have been recorded in the short-term at BCMM, however long-term yields can be as low as 5L/sec or less (URS, 2009). Groundwater quality is fresh to brackish, between 580 to 2,810mg/L TDS (Total Dissolved Solids) (URS, 2007).

Two regional groundwater bores are located within proximity to the Bootu Creek mining lease (within 5km). These bores are Gap Bore and Looa Bore and are were primarily used for Pastoral purposes prior to mine development.

6.1.5. Contained Water Resources

A large volume of water is required to run the processing plant and other facilities associated with the Bootu Creek project (e.g. mining operations, accommodation facility etc). Water is sourced from several dewatering and production bores, as well as recycled water from in-pit TSF and formerly mined pit voids which act as storages. Recycled water typically accounts for approximately 35-40% of the projects' water requirements. Volume of water stored onsite is presented in the EMR and AER.

6.2. Information Knowledge Gaps

Knowledge and information gaps are identified and addressed throughout operations, these are outlined in the Water Management Plan and assessed annually in the Environmental Mining Report. Limitations need to be addressed to assist in the better understanding and management of water resources at the BCMM.

6.2.1. Water Account

The mine water inventory is actively managed to ensure enough water resources for operational use and to mitigate uncontrolled discharges from storages. Operational demand is reasonably stable however annual rainfall volumes can vary considerably requiring careful management of storage capacity during drier years. Use and storage is managed by monitoring storage levels, transferring water between storages and moderating groundwater extraction. The primary storages for mine water are the process water dam and pit voids where mining is not operational, therefore storage is subject to change to accommodate the mining schedule.

As mentioned above evaporative losses from the system is significant. To an extent, groundwater is subject to evaporative loss from pit areas mined to depths below the water table. OMM has adopted the closure strategy of retaining open pit voids however has elected to voluntarily backfill pits, with all future mined waste, as far as practical. This action seeks to reduce the overall disturbance footprint by reducing surface area and depth of the pit voids, which subsequently minimises evaporative loss. Pit areas retained as water storages will further reduce this effect by increasing volume and head pressure to balance hydraulic connectivity.

The Mine Water Balance schematic illustrates the BCMM inventory sources, transfer arrangement and capacity of the Mine Water infrastructure to manage the inventory without discharge. This model described in the Water Management Plan and reviewed annually in the and EMR.

6.3. Risk Management

6.3.1. Identify Hazards and Rank Risks

Surface water and groundwater management at BCMM is considered critical due to the potential environmental impacts that can arise from mismanagement. OMM has identified potential contaminants for surface water and groundwater management at the site and have implemented specific control measures to reduce the risk of releasing those contaminants to the environment. These measures have been described in within the tables included in this section.

6.3.1.1. Potential Contaminants to Surface and Ground Water

Potential contaminants to surface and groundwater water at BCMM have been identified as:

- Heavy metals such as manganese, iron, chromium, copper, arsenic, lead, uranium.
- Hydrocarbons.
- Chemicals (ANFO containing ammonium nitrate).
- Ferro-silica.
- Sediment.
- Sewage.

The likely source of each contaminant, proposed management measures and an assessment of the potential risk to the environment each contaminant poses based on implementation of the documented management measures are described in Table 21. The EMR contains quality reporting.

6.3.1.2. Potential Impacts

There are a wide range of potential environmental impacts from the contaminants of concern as identified in the WMP. Elevated concentrations of heavy metals can cause adverse health effects in fauna, both aquatic and terrestrial (when the water is used for drinking purposes by animals). In addition to the potential toxic effects, other parameters such as suspended solids and salts can increase the stress on aquatic organisms. Both toxic and stress effects can impact biodiversity and habitat structure over time.

Erosion does not just have a downstream impact (other than through sediment mobilisation) but can also lead to destabilisation and degradation of infrastructure and de-value future land use.

Lowering of localised groundwater levels, as a result of dewatering mine pits, and localised mounding in the immediate vicinity to the TSF are additional impacts that could result from operations.

The Water Management Plan outlines a detailed risk assessment of off-lease and post-closure risks to water quality related to site operations, mitigation controls and measures.

The Bootu Creek project is a relatively low environmental risk operation with the focus of environmental management on control of sediment movement to the downstream Bootu Creek. The mine operates on a zero-mine-water discharge basis, only benign ferrosilicon is used in processing, the ore is non-acid forming, there is minor neutral drainage associated with the ore body.

Some groundwater effects related to dewatering of the pits and groundwater use to supplement mining and workforce potable requirements. No terrestrial or aquatic species of significance have been identified during desktop and site assessments. Transport of sediments and some solutes to tributaries that report to Bootu Creek remain a focus for improvement in management outcomes. The site is situated in proximity to several tributaries of Bootu Creek which flows intermittently and for very limited periods of time within the semi-arid environment with some years experiencing no flow at all.

Progressive rehabilitation of landforms to stabilise source points and sediment controls are a core feature of the site environmental management activities with over 49% of WRD stabilisation works completed prior to 2020. Photographic monitoring or riparian vegetation suggests no detectable change to conditions attributable to mine operations (e.g. smothering or dieback) with rainfall and creek flow remaining the dominant influence on condition.

Table 18: Action and Strategy Summary

Contaminant	Impact	Hazard Source	Management Strategies	Risk
Heavy metals: Manganese Iron Chromium Arsenic Lead Uranium	Surface water and groundwater	Spillage from haulage of ore (dump trucks and road trains).	Implement environmental incident report procedure. Adopt spillage management procedures. Clean and remove as required.	Low
		Dust from ROM/haul roads, processing plant and from loading of rail carts.	Regular use of water cart on OM and haul roads. Automatic water sprinkler system through key areas of the processing plant (e.g. primary crusher bin).	Low
		Runoff from processing plant.	Divert clean water around processing plant, and direct and contain runoff from processing plant to sediment retention areas.	Low
		Erosion of landforms.	Implement effective erosion and sediment controls.	Low
		Release of pit water	No active release of pit waters off lease or to downstream environments.	Low
Hydrocarbons	Surface water and groundwater	Diesel fuel farm	OMM: Fuel farm consisting of five x 55,000L tanks all have spill trays and are self-bunded. Only one tank is fitted with a nozzle for refuelling operations. Spill trays and hoses require ongoing maintenance. Contractor fuel yard has two x 100,000L tanks that are self-bunded. Maintenance records to be developed for tanks and workshop.	Low
		Waste Oil Storage	Installed a hydrocarbon absorbent polyline around refill area during reporting period to trap any potential spills. Any worn areas are remediated with patches.	Low

			Waste oil stored in tank is removed offsite by a waste contractor for recycling.	
		Workshop	Workshop hydrocarbon spills are cleaned up with spill kits. Records to be maintained to demonstrate checks/corrective action.	Low
		Washdown bay	Washdown bay drainage directed to oil water separator. Oil is removed offsite by a waste contractor. Excess water reports to the process water pond.	Low
		Equipment compound, services area and breakdowns.	Implement environmental incident report procedure and contain and remove the spill.	Low
Chemicals	Surface and groundwater	Explosives (ANFO) - chemical residues from loss of material from explosives yard.	Explosives compound is located on the lower level of the GoGo WRD. Bunds exist around the edge of the dump to prevent sediment and/or chemical residues reporting to South Creek.	Low
		Ferro silica - from loss of material from the processing plant via surface water flows.	Surface water flows from the plant area are directed to sediment control sumps near the old TSF. Stormwater is not released from these sumps.	Low
Sediment	Surface water	Surface water flows from plant and operational areas during periods of intense rainfall.	Surface water flows from the plant area directed to sediment retention sumps near the TSF. Stormwater is not released from these sumps. Surface water flows from operational areas are assessed individually to determine appropriate measures for sediment control.	Low
Sewage	Surface water and groundwater	Nutrients and bacteria from STP at accommodation village and from plant/office ablution facilities.	Wastewater effluent is encapsulated in clay rich WRDs and covered with clay material after each deposit. This method prevents ponding and reduces mosquito breeding and animal attraction. Treated excess solids are disposed of using the same method. Subterranean leach drain systems provide enough management for quantities of wastewater produced.	Low
Mineral salts	Surface water	Mineral salts most likely from ore body oxidation and dissolution within pit-dam water bodies.	Pit water contained and not discharged unless under an approved Discharge Licence and managed accordingly.	Low

6.3.2. Actions and Strategies in response to identified risks

The operational phase of the BCMM means that many established control measures for the management of surface water runoff and groundwater are in place. However, a shift toward understanding and managing a post closure environment is required to ensure successful closure. Measures in place at the Bootu Creek Manganese Mine to mitigate for identified risks are described in the Water Management Plan and EMR.

6.3.2.1. Contingency Planning

Contingency planning has been conducted to anticipate and provide rational response to non-standard events. Scenarios include loss of personnel, equipment and machinery, economic capacity, spills and flooding of pits. BCMM has made allowances in its staff and assets to best allow for changes in resource requirements and rapid response to site conditions.

The worst scenario planned for is the destabilisation of landforms and slumping or potential mobilisation of large volumes of sediments from site. In such a situation BCMM has heavy machinery on hand to assist in bunding or trenching in attempts to divert flows contain the material.

6.4. Monitoring

The Bootu Creek Water Monitoring Program includes both statutory and operational monitoring of surface and ground waters surrounding the site.

6.4.1. Monitoring Program

The Bootu Creek Water Monitoring Program is designed to be responsive to creek flows and rainfall events and adaptive to assess point source contributions to improve water quality management. Reference sites (BCUS, NCUS, SCUS) upstream of potential mine site influence are established for each of the four creeks that receive stormwaters from the BCMM. Sites are established in a series of locations downstream of each creek to assess how water quality changes within the creek and in relation to stormwater inputs.

Three sites (BCDS, NCDS, SCDS) in the downstream reaches of Bootu, Northern, and Southern Creeks are assessed with the greatest frequency due to their position and accessibility and are representative of off-lease water quality. A final site downstream of Bootu creek and post confluence of the other three creeks and represents the most downstream site is to be sampled at least once annually where practical and safe. This site has access constraints and receives waters from several additional tributaries and hence use as a final reference point can be challenging.

Mine water quality is also monitored in all the storages on site to allow assessment of risks to water resource values as well as inform management for any contingencies that may arise. Standing Water Levels are monitored on a quarterly basis to inform mine water inventory management. The frequency and parameters for analysis at each site are presented in Table 20.

Groundwater is monitored for water quality at all TSF bores and abstraction bores (equipped with pumps). Standing water levels are also collected at abstraction bores that are not equipped with pumps and at both old and current TSF bores.

A map layout including all monitoring locations is presented in Appendix 4.

Table 19: Monitoring locations and analytical suite for the Bootu Creek Manganese Mine

Water Management - Monitoring Programs			
Frequency	**Type**	**Location***	**Analysis**
Surface Water			
Quarterly	Mine water storage	All mine water storages	Standing Water level
Annually: during wet season (Initiate when flow commences past BCSS)	Creeks	Instream intersection sites	Full suite pH, EC, TDS, TSS, Turbidity, ORP, T, DO SO_4, NO_3, Cl, Ca, Mg, Na, K, P (Total) Metals (Dissolved and Total) - Al, As, Ba, Co, Cr (unspeciated), Cu, Fe, Mn, Mo, Ni, Pb, U, Zn
Quarterly	Mine water storages	All mine water storages	pH, EC, TDS, TSS, Turbidity, ORP, T, DO SO_4, NO_3, P (Total), major anions, major cations Metals (Dissolved and Total) - Al, As, Ba, Co, Cr (un-speciated), Cu, Mn, Mo, Ni, Pb, U, Zn,
Monthly: wet season only (Initiate when flow commences at BCSS)	Creeks	All accessible instream sites	Limited suite pH, EC, TDS, TSS, Turbidity, ORP, T, DO SO_4, NO_3, P (Total) Metals (Dissolved and Total) - Al, As, Cr (un-speciated), Cu, Mn, Ni, Pb, U, Zn
Rainfall events	Creeks	Instream intersection sites	pH, EC, TDS, TSS, Turbidity, ORP, T, DO
Groundwater			
Quarterly	Abstraction bores	Equipped Abstraction Bores	pH, EC, TSD, TSS, Turbidity, ORP, T, DO Ca, Mg, Na, K, Chloride, Sulphate (SO_4), Nitrate, Total Phosphorous Metals (Dissolved and Total) - As, Cd, Cr, Cu, Ni, Pb, Zn, Al, Ba, B, Co, Fe, Mn, Mo, U
Quarterly	Monitoring and/or Production bore	All TSF Bores	pH, EC, TSD, TSS, Turbidity, ORP, T, DO Ca, Mg, Na, K, Chloride, Sulphate (SO_4), Nitrate, Total Phosphorous Metals (Dissolved and Total) - As, Cd, Cr, Cu, Ni, Pb, Zn, Al, Ba, B, Co, Fe, Mn, Mo, U
Quarterly	Monitoring and/or Production bore	All TSF Bores	Standing Water Level
Monthly	Monitoring and/or Production bore	Unequipped Abstraction & Active TSF bores	Standing Water Level
Fortnightly (additional post->2mm daily rainfall events)	Monitoring bore	All	Standing Water Level and Piezometer**
* Location coordinates are included within the Water Management Plan. **Undertaken by site Geotechnical Engineer/Geologist.			

6.4.2. Data review and interpretation

Monitoring of surface water and groundwater will continue as per the Water Management Plan and capture data covering full seasonal cycles.

Water quality data for surface water and groundwater regimes is assessed against the following standard guidelines:

- ANZG 2018 guideline limits for 95% protection of aquatic ecosystems (ANZG 95%)/Upland River Tropical Australia (URTA); and
- ANZG 2018 guideline limits for Livestock

It is noted that due to the highly variable flow regime that variability in the results is to be expected. For this reason, the mean values are more appropriate for comparison with the guidelines as opposed to individual results which may reflect the upper 95% confidence interval.

Quarterly submissions of the full monitoring database will be provided to DPIR on an ongoing basis.

The Water Management Plan and EMR details the downstream and point source data which has exceeded the guidelines. It is noted that for some parameters the background and control site data also exceed the guidelines and therefore naturally elevates the downstream values. In this instance, comparisons of the results against the ANZG 2018 guideline is less appropriate and site-specific comparisons should be made. Ongoing monitoring of the upstream and control site locations is required to develop suitable site-specific criteria.

6.5. Management

6.5.1. Remedial or Corrective management actions

OMM has not applied for a Waste Discharge Licence (WDL) to enable active discharges of mine affected water off the mining lease. As such, all water is contained within appropriate storages and recycled within the operation.

During the wet season, overland flows and stormwater runoff generally elevates turbidity values within the downstream environment. The turbidity of upstream catchment varies, however provides a modest contribution to the downstream results. Improvements to sediment and erosion controls will further minimise contribution from site operations. Controls identified in the Erosion and Sediment Control Plan will be implemented and monitored accordingly.

OMM applied for grant to take surface water licence from the Department of Environment and Natural Resources (DENR) as per changes imposed in the Water Act 1992, in force 2019. BCMM operations were found exempt from requiring a licence for collection of passive surface waters as a result. The primary use of surface storage water is for processing and dust suppression. For these purposes the water quality does not pose a risk to the environment or closure objectives. Further future water management actions are outlined in the Water Management Plan and Environmental Mining Report.

6.5.2. Actions Proposed

Water quality impacts at BCMM are primarily attributable to sediment mobilisation from WRD and stockpiles. As per the ESCP, BCMM implements controls to minimise these impacts. Newly re-instated water diversions (North and Tourag East) may require minor maintenance earthworks following one or multiple wet seasons. Otherwise, water diversion trenches and sediment traps are established and will be monitored for effectiveness throughout the wet season. Waste material generated by mine development will be returned to completed portions of the pit. Other than sediment mobilisation it is highly unlikely that any activities planned for the life of mine will impact on water quality negatively.

Decommissioning and closure planning are ongoing with input being sought from traditional owner groups. OM Manganese will work with traditional owners, consultants, and the Northern Land Council and Aboriginal Areas Protection Authority to develop closure criteria and potential parameters for post closure land development projects under consideration.

7. Incident Reporting

A site accident and incident reporting system has been established which includes environmental incidents. The reporting system is used by all OMM and contract personnel. The reporting system is supported by formal investigation procedures to ensure the root causes of incidents are determined and appropriate control measures are taken to prevent reoccurrence. A flow chart of sample incident types and risk assessments and follow up reporting requirements has been developed and circulated to all managers and supervisors to assist in the ready identification and timely reporting of incidents.

In accordance with s29 of the Mining Management Act, all environmental incidents are reportable and are required to be documented on the Notification of an Environmental Incident form and submitted to the DPIR as soon as practicable.

A Hazard reporting system is in place at the BCMM and controlled by the Health and Safety Team. All personnel may submit hazard reports for review each day during pre-start meetings. Hazard identification procedures incorporate an immediate response and hazard rectification undertakings.

Environmental Incidents will be reported annually in the Annual Environment Report and Environmental Mining Report.

8. Closure Planning

The purpose of the Mine Closure Plan (MCP) is to outline rehabilitation and closure management strategies which apply to the BCMM. Closure planning is necessary to mitigate environmental risks to a standard that meets stakeholder expectations, for relinquishment of the mining lease, at the end of the mine life.

The overall objective of the MCP is to promote mine closure planning during the early stages of the project, in a manner which is integrated with mine development planning and is consistent with the Guidelines for Preparing Mine Closure Plans (DMP 2011, 2015). As such the MCP provides a conceptual and evolving closure strategy for the project. The physical rehabilitation of the BCMM is the underlying strategy addressed throughout the MCP.

Closure planning consists of five basic stages:

- The decommissioning of infrastructures not required for future use.
- The remediation of soil or water contamination.
- Rehabilitation of disturbed surfaces.
- Post-closure maintenance and monitoring.
- Tenement relinquishment and bond retirement.

Meetings with traditional owner groups, the NLC and the AAPA are ongoing throughout operations of the mine to enable discussions relating to establishing closure criteria and identification of assets to be left intact by agreement. Discussions to date have been preliminary in nature with greater representation from traditional owner groups with cultural authority over the mining area required. This consultation process will continue in order to gain alignment in closure objectives and to accommodate changes in mine planning.

8.1. Life of Plan – Unplanned Closure

The actions necessary to achieve the end land use objective and to ensure closure and rehabilitation criteria are met have been grouped into general and specific measures. General measures are the default measures applied as required across the site to satisfactorily address the issues. Area specific measures are detailed for areas that have unique issues that may not be adequately managed using the default rehabilitation and closure measures.

8.1.1. General rehabilitation and closure measures

The following default measures will be applied and used to calculate the rehabilitation and closure costs.

8.1.1.1. Demolition

All plant and permanent structures will be dismantled and removed. Recoverable materials may be sold if a suitable market can be found at the time of decommissioning. A reasonable estimate of salvage values that could be offset against the closure cost has not yet been calculated. This will be calculated from an asset register and incorporated within subsequent versions of this document.

All surface pipelines, power cables/lines and security fences will be removed, and materials will be sold or otherwise disposed within waste rock stockpile. Sub surface pipelines will remain if they cannot be economically salvaged but will be appropriately drained and flushed.

Plastic, pond liners will be cut, folded and buried in situ for belowground ponds or removed to the disposal site for aboveground ponds. Where practical OMM will recycle products, equipment and parts during decommission of the facility in order to reduce the volume of waste being buried in situ.

8.1.1.2. Clean up and Remediation

The largest hazardous material (by volume) required on the site is diesel required for onsite power generation and mining equipment operations.

A register will be maintained for all hazardous materials on site. At closure, remaining chemicals and hydrocarbons will be returned to the supplier or sold to a third party. Waste chemicals, hydrocarbons and contaminated materials will be removed offsite for disposal at a licensed facility or remediated onsite prior to disposal on site.

It is expected that minor spillage of hydrocarbons (fuels and oils) will occur during operations and will be dealt with as per the BCMM Hydrocarbon Management Plan. Small scale hydrocarbon-contaminated soils remaining at closure will be remediated in-situ using bioremediation absorbents. Larger scale contaminated soil will receive an application of bioremediation absorbents and then be incinerated or alternatively transferred offsite to a suitable facility. Remaining rubbish will be removed and disposed within the inert onsite landfill.

8.1.1.3. Revegetation

Following demolition and site clean-up the remaining disturbed sites will be graded to re-establish existing drainage lines. In addition, any remaining unrehabilitated WRDs will be profiled.

Topsoil will be sourced from stockpiles and applied to disturbed surfaces up to 200mm thick. This will then be deep cross-ripped to a depth of one metre, and along the contour of WRDs, to reduce compaction and ensure cohesion between the topsoil and subsoil. Ripping will also provide niches where water, organic matter and seed can collect. Direct seeding with native grasses, shrubs and trees may be conducted to supplement the seed source within the topsoil.

Where required, stock exclusion fencing around the rehabilitation areas will be retained for several years to allow the vegetation within the rehabilitated area to become established and the landform stabilised. Monitoring of rehabilitated areas will continue until the performance results demonstrate that conditions have achieved the closure criteria. The DPIR will undertake ongoing assessments to evaluate progressively rehabilitated areas for completion of earthworks and long-term sustainability and if satisfied, will relinquish the security held for these areas. Fences will then be dismantled if required.

8.1.2. Area Specific rehabilitation and closure measures

For the purpose of the MCP, the mine has been divided into nine (9) management areas. The general rehabilitation and closure activities applicable to all areas are described in Section 8.1 of the MCP and the specific closure measures applicable to each of the management areas are listed below:

- Open cut pits and associated facilities.
- Processing plant and associated facilities.
- Waste rock stockpile area.
- Workshops and stores.
- Offices and administrative facilities.
- Contractor yards.
- Water management facilities.
- Solid waste facilities.

- Roads, powerlines, fences and drains.

8.1.3. Progressive Rehabilitation Actions

Rehabilitation of previously disturbed surfaces will occur in conjunction with mining operations, these including:

- Roads.
- Pits.
- Landforms/stockpiles; and
- Tails dams.

8.2. Background for Costing of Closure Activities

Pursuant to s40 of the *Mining Management Act,* OMM have completed a costing of closure activities based on current status of disturbance at the BCMM. Until the consultation process with Traditional Owners is completed, and determination of final land use objectives is approved by the Minister, the costing of closure activities is based on the underlying objective of returning disturbed areas of the BCMM to pre-mining conditions.

A security self-assessment tool available on the DPIR website has been utilised to generate closure costs. A copy of this tool will be submitted at the time of each annual MMP update illustrating how costs have been accounted. In some instances, a lower Unit of Measure (UOM) has been used when completing the security calculation with a supporting comment to justify these inputs.

A summary of the existing disturbance at the BCMM is presented in the Mine Closure Plan.

Rehabilitation earthworks and revegetation of shaped landforms is undertaken progressively at the BCMM. As of 2020, earthworks have been completed on approximately 204 hectares of waste rock landforms across the lease. Seed application has been completed on approximately 191 hectares of these landforms. Of these seeded areas, the GoGo waste rock landform and the Xhosa waste rock landform have demonstrated rigorous vegetation growth in four successive LFA monitoring events and contributed to a total of 101.68 hectares relinquished from the mine security in 2011. Outcomes from LFA reports is included in the Mine Closure Plan.

8.3. Security Estimate

A security for the Bootu Creek Manganese Mine will be reviewed on an annual basis to account for any change in potential lease liability. Any amendments to an approved MMP, periodic audit and inspections or mine closure will require a revised security calculation to be submitted to the regulatory authority with the Environmental Mining Report.

Abbreviations

- MMP Mining Management Plan
- EMP Environmental Management Plan
- WMP Water Management Plan
- WSMP Weed Species Management Plan
- ESCP Erosion and Sediment Control Plan
- HMP Hydrocarbon Management Plan
- LOMP Life of Mine Plan
- MCP Mine Closure Plan
- EMR Environmental Mining Report
- AER Annual Environment Report
- DME Dept of Mineral and Energy (NT)
- DPIR Dept of Primary Industries and Resources (NT)
- OMM OM Manganese Ltd
- BCMM Bootu Creek Manganese Mine
- NLC Northern Land Council
- AAPA Aboriginal Areas Protection Authority
- TO Traditional Owner
- TPWC Territory Parks and Wildlife Conservation
- EPBC Environmental Protection and Biodiversity Conservation
- NRETAS Dept of Natural Resources Environment the Arts and Sport
- DMP Dept of Mines and Petroleum (WA)
- TSF Tails Storage Facility
- WRD Waste Rock Dump
- NPI National Pollutant Inventory
- NGER National Greenhouse and Energy Reporting

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Appendices

Appendix 1 – OMM Environmental Policy

OM (MANGANESE) LTD

Environmental Policy

OM Manganese believes that protection of the environment is one of the key responsibilities of the company. We recognize that environmental management is an integral part of all activities, from exploration and mining to processing and exporting.

Maintaining high levels of environmental performances at our operations will benefit all stakeholders, including shareholders, employees, traditional land owners and the broader community.

To achieve and maintain high environmental standards, all employees at OM Manganese will specifically:

- Comply with applicable environmental laws, regulations and standards;
- Implement systems to identify, control and monitor environmental risks arising from operations;
- Co-operate with authorities and stakeholders in the development of standards aimed at further improving the protection of the environment and the community;
- Implement methods and strategies to prevent pollution, minimise wastes and conserve natural resources;
- Ensure that all company employees and contractors are aware of their environmental responsibilities and conduct activities with a high level of competence;
- Promote cross-cultural awareness and protect all identified sites of cultural and heritage significance;
- Have timely and effective communications with traditional land owners and others who may be directly affected by the company's operations;
- Communicate the intentions of the policy with employees, suppliers and contractors; and,
- Seek continuous improvement in the way that OM Manganese looks after the environment.

Fanie van Jaarsveld

Managing Director

December 2019

Appendix 2 – OMM Risk Assessment Matrix

RISK ASSESSMENT CALCULATOR				
Step 1: Determine Consequences (highest of the two)			Step 2: Determine Likelihood	
	People Consequences	**Plant, Property, Productivity, Environmental Consequences**	**Probability**	
5	Fatality – Single or multiple Permanently disabled	More than $500k damage and/or significant business restructuring or closure. Long term irreversible damage to the environment or Sacred Sites.	**5**	**Almost Certain**: Known to happen often, is expected to occur in most circumstances.
4	Extensive or long term illness, injury or disease (Major LTI)	$100 - $500k damage and/or impact to business, loss of reputation, incur significant fines. Long term impact to the environment requiring significant resources to remediate.	**4**	**Likely:** Could easily happen, will probably occur in most circumstances.
3	Requires ongoing medical treatment or support (Typical LTI or MTI requiring structured return to work)	$50 - $100k damage and/or production disruption. Loss of containment, spillage, or impact to environment within lease area that is reportable to authorities.	**3**	**Possible:** Could happen, has occurred elsewhere.
2	Results in treatment by a doctor or medical professional.	Could cause $5 - $50k damage and/or slight production disruption. Loss of containment, spillage or impact to environment which requires some internal resources to remediate.	**2**	**Unlikely:** Hasn't happened yet, but could.
1	First aid treatment or no treatment required. No long term effects and immediate return to duties.	Under $5k damage with little to no impact on production. No lasting damage to environment, easily remediated.	**1**	**Rare:** Conceivable in extreme circumstances.

Step 3: Calculate Risk						
Risk Ranking		**Consequence**				
		1	**2**	**3**	**4**	**5**
Likelihood	**5**	H16	H10	E8	E3	E1
	4	M20	H15	H11	E5	E2
	3	L21	M19	H14	E7	E4
	2	L23	L22	M17	H12	E6
	1	L25	L24	M18	H13	H9

RISK ASSESSMENT CLASSIFICATION AND ACTION REQUIREMENTS	
Risk Ranking	Description
Extreme Risk E1-E6	Unacceptable Risk – STOP or DO NOT START activity until controls are established to reduce the risk to an acceptable level. • Develop / establish permanent long term control measures and review for effectiveness. • Immediate priority (same day) corrective action is required. • A major risk that requires further risk reduction, irrespective of cost. • Further analysis required identifying the most appropriate risk reduction measures.
High Risk H9 – H16	Unacceptable Risk – STOP or DO NOT START activity until adequate safeguards are implemented. • Develop / establish permanent long term control measures and review for effectiveness.
Medium Risk M17 – M20	Acceptable Risk – Implement control measures and safeguards as identified • May proceed with agreed controls in place • Maintain continual situational awareness and monitor for change in residual risk.
Low Risk L21 – L25	Acceptable Risk • Implement controls as considered necessary • Continue to monitor for change in residual risk as required.

Waste Rock Characterisation and Management

There are no acid forming rocks within the BCMM mining environment.

Graeme Campbell & Associates, (2009), "Bootu Creek Project, "Geochemical Characterisation of Process-Tailings-Slurry Samples, Implications for Process-Tailings Management".

The waste rock settings of the hanging wall and footwall waste are common and similar to all pits on the west and east limb.

The new pit Yaka 4 is in the same geological setting as all the Yaka pits and the rest of the western limb.

The new pit Chugga North stage 3 and 4 is in the same geological setting as all the Chugga sequence and the rest of the eastern limb.

Storage, Transport and Handling of Dangerous Goods

OMM is licensed as a major hazard facility to possess and/store dangerous goods in accordance with the Dangerous Goods Act and Regulations as specified in table 44 below. OMM holds a Licence to Possess, Store and/or Sell Explosives (no. 30500) which expires on 01 April 2019.

OMM is not requried to apply for a licence to store aviation fuel at the Bootu Creek Airport. However, NT Work Safe requrie this to be added to the permit for Schedule 11 Hazardous Chemicals.

Management of the explosives magazine and Security Sensitive Ammonium Nitrate (SSAN) storage facility is undertaken on site by appropriately experienced and qualified contractors. An n inspection by NT Worksafe on 29 November 2011 noted that the management procedures and safety precautions in place within these facilities is in accordance with relevant Australian Standards and regulations.

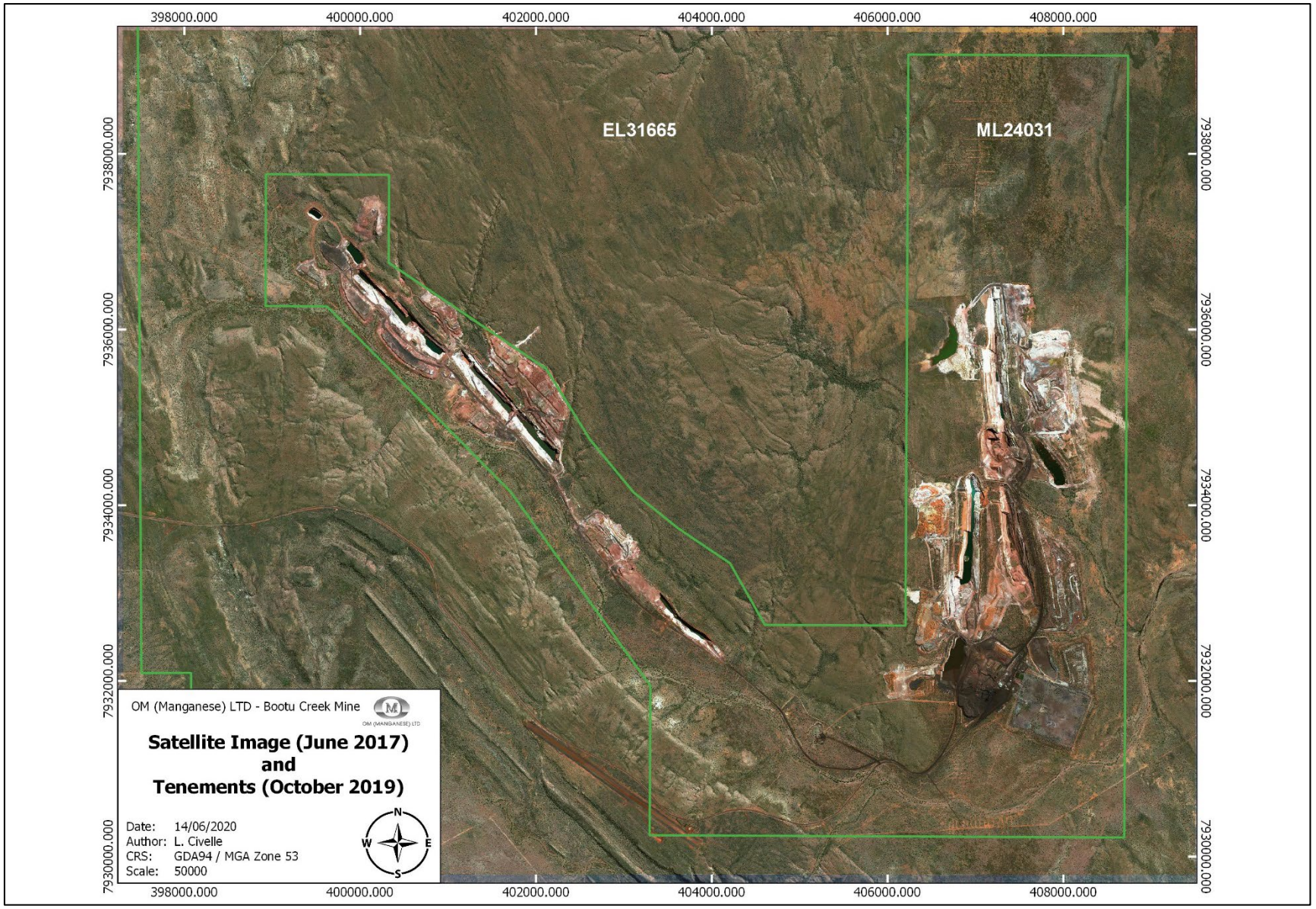
Hazardous materials and wastes are stored in appropriately labelled containers within bunded areas. Portable spill pallets are used for short-term storage of small quantities of hazardous materials. Regular inspections are undertaken to ensure rainwater is not allowed to accumulate within bunds during the wet season. An audit of the hydrocarbon management procedures and storage areas on site against Australian Standard 1940 – 2004 was conducted on 10 September 2011. The audit identified non-conformances detailed in the audit report subsequently submitted to the DoR on 16 September 2011.

Safety Data Sheets (SDS) for all dangerous and hazardous goods in use at the BCMM is available electronically via an internal database and on the site intranet, and in hard copy at the storage location. An annual review and update of the internal SDS Register is undertaken to ensure that the latest versions are available.

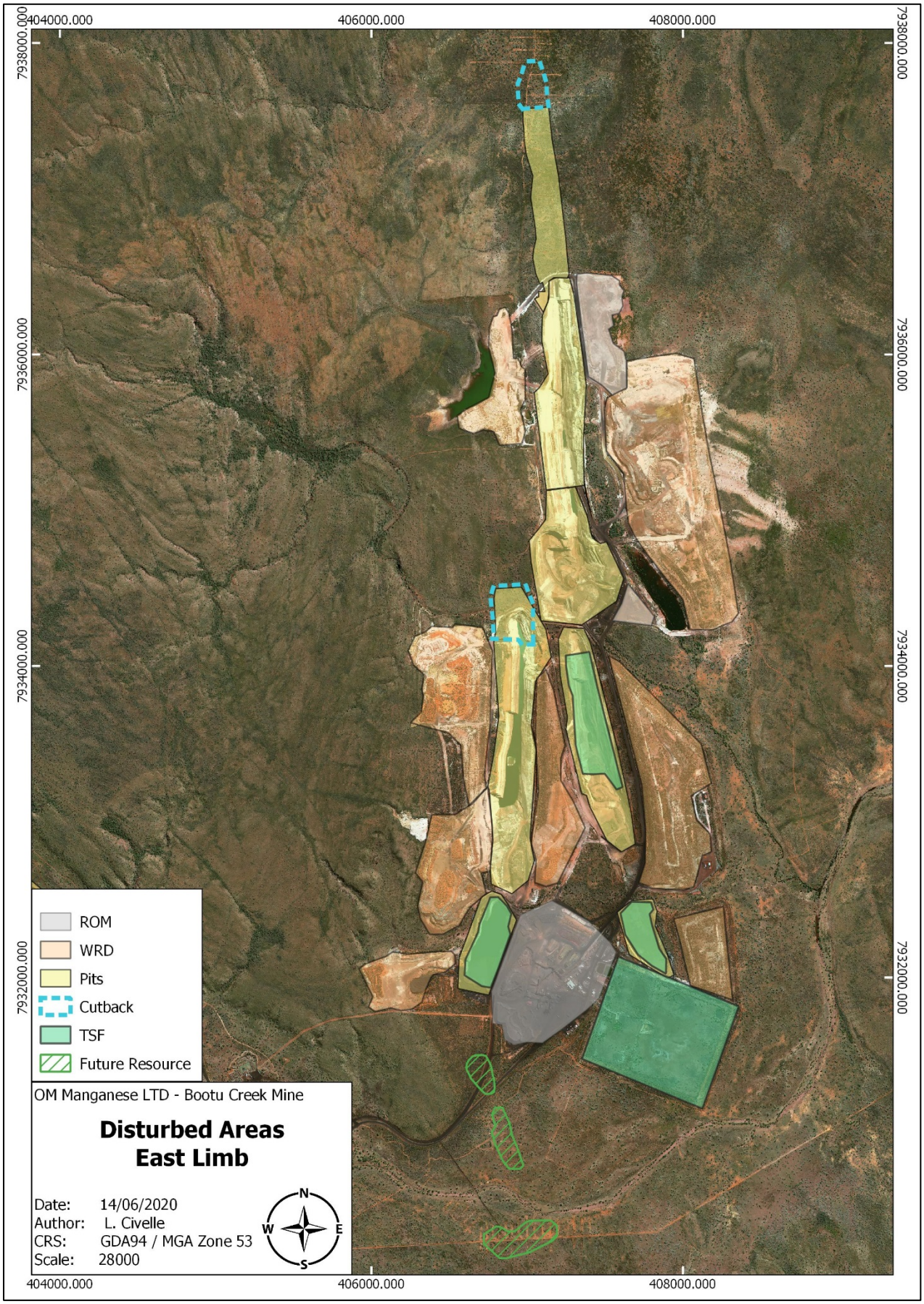
Table 20 Dangerous Goods and Storage Details as specified in Registration 30500 for the BCMM

Description	Quantity	Mode of Storage
Release Devices, Explosives	100.00 Kg	Magazine
ICI Fuse head electric ignitors	100.00 Kg	Magazine
All authorised explosives	5000.00 Kg	Magazine
Boosters, without detonators	1000.00 Kg	Magazine
Detonating cord	350.00 Kg	Magazine
Ammonium Nitrate/Fuel Oil mixture (ANFO)	100.00 Tonnes	Magazine
Ammonium Nitrate/Fuel Oil mixture (ANFO)	80.00 Tonnes	Tank
Detonators, non-electrical	40.00 Kg	Magazine

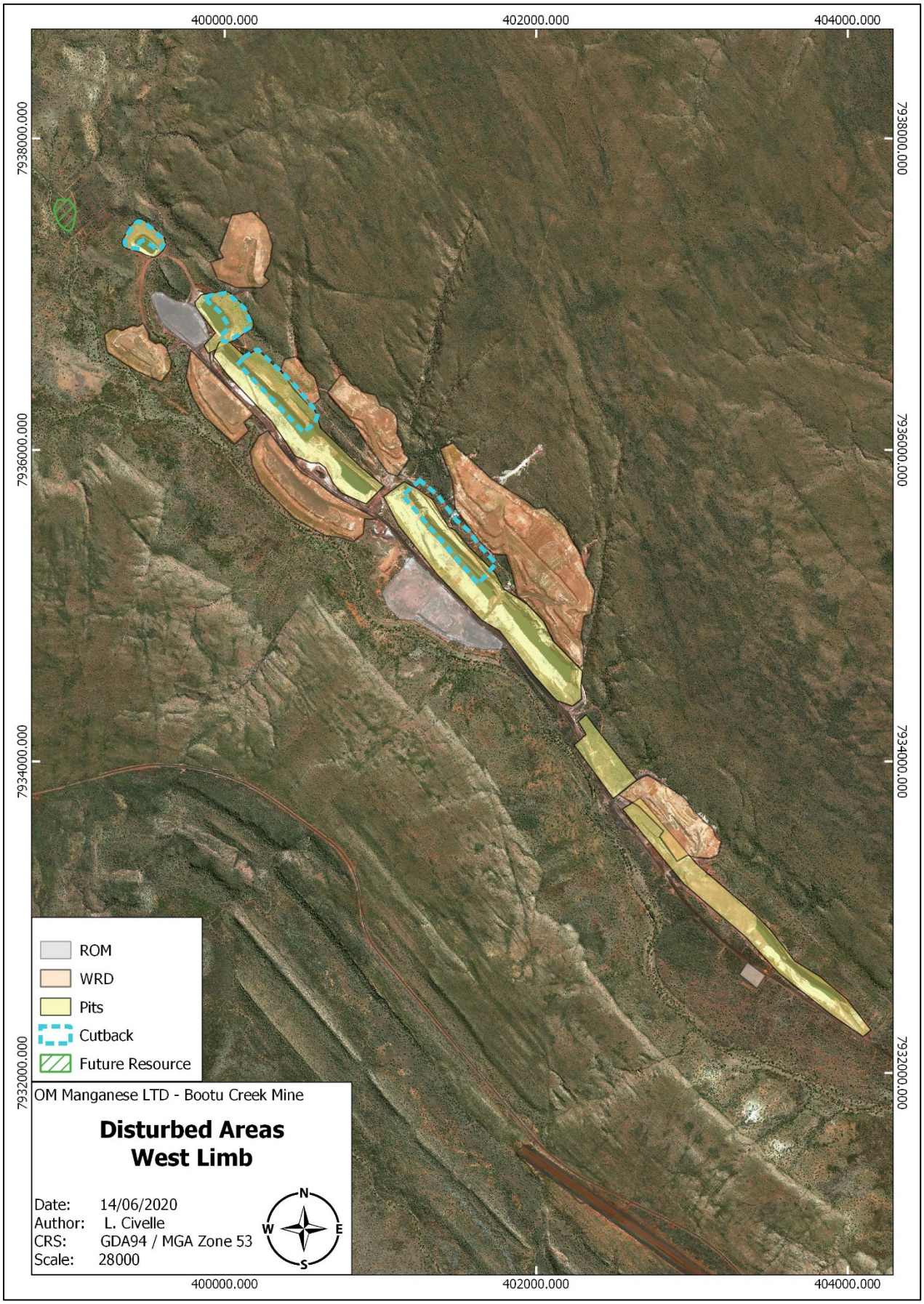
Appendix 3 – Site Layout (Aerial Image 2017)



Eastern Limb



Western Limb



Appendix 4 – BCMM Monitoring Location