SPRING HILL PROJECT

2021 Mining Management Plan
Authorisation Number: 1026-01

Prepared for:

TM Gold Pty Ltd
13 Rosser Street
Cottesloe, WA, 6011

SLR Ref: 680.10563-R01
Version No: v7.1
November 2021

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Unit 5, 21 Parap Road
Parap NT 0820 Australia
(PO Box 1300 Parap NT 0804)
T: +61 8 8998 0100
E: darwin@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with TM Gold Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Version	Details including responsible party and date
Version 1	M Costello – Authorised for client release 25 Nov 2016
Version 2	G Kenny – Finalised for issue to the Department, February 2017
Version 3	S Woodger – MMP Adjusted in response to RFI, 28 Aug 2017, Finalised for issue to the Department 30 Aug 2017
Version 4	SLR – MMP updated in response to RFI, finalised for issue to DPIR June 2019
Version 5	SLR – MMP updated in response to DITT comments (received 19/11/2020)
Version 6	SLR – MMP updated in response to DITT comments (received 2 July 2021)
Version 7	SLR – MMP updated in response to DITT meeting (29 September 2021)
Version 7.1	SLR – MMP Table 8 Updated in response to DITT request (1 November 2021)

The MMP must be endorsed by a senior representative of the company who has the appropriate level of delegation.

	Author	Reviewed by	Approved by
Date	21 October 2021	21 October 2021	21 October 2021
Name	SLR Consulting	Ashley Pattison TM Gold Pty Ltd	Ashley Pattison TM Gold Pty Ltd

I, Ashley Pattison, Executive Chairman declare that to the best of my knowledge the information contained in this mining management plan is true and correct and commit to undertake the works detailed in this plan in accordance with all the relevant Local, Northern Territory and Commonwealth Government legislation.

SIGNATURE:

DATE: 21 October 2021

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

ABBREVIATIONS

Abbreviation	Meaning
AAPA	Aboriginal Areas Protection Authority

Abbreviation	Meaning
AEP	Annual Exceedance Probability
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
bcm	Bank cubic metre
BOM	Bureau of Meteorology
CEC	Cation exchange capacity
CIL	Carbon in Leach
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEE	Commonwealth Department of Environment and Energy
DENR	Department of Environment and Natural Resources
DPIR	Department of Primary Industry and Resources
EL	Exploration Licence
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act*
EPRA	Emergency Preparedness and Response Plan
ESC	Erosion and Sediment Control
FERG	Fire, Emergency & Rescue Group
GAI	Geochemical abundance index
GPS	Global Positioning System
HSE	Health, Safety and Environment
IFD	Intensity Frequency-Duration
JORC	Joint Ore Reserves Committee
LES	Low Ecological Services
LOR	Limit of Reporting
ML	Mining Licence
MMP	Mine Management Plan
MNES	Matters of National Environmental Significance
NATA	National Association of Testing Authorities
NRC	Northern Resource Consultants
ORP	Oxidation-reduction potential
PAF	Potentially acid forming
PPE	Personal protective equipment
PPL	Perpetual pastoral lease
RMP	Risk management plan
ROM	Run-of-Mine
SDS	Safety data sheet

Abbreviation	Meaning
SPL	Species Protection Limit
TM Gold	TM Gold Pty Ltd
TPWC Act	*Territory Parks and Wildlife Conservation Act*
TSSC	*Threatened Species Scientific Committee*
WDR	Western Desert Resources
WRD	Waste rock dump

MMP Checklist

This checklist has been included with this Mining Management Plan (MMP) in accordance with the Department of Primary Industry and Resources (DPIR) *Mining Management Plan Structure Guide for Mining Operations.* The contents of the 'Requirements' column have been cross referenced to page numbers within this report, and appendices where applicable.

Y/N	Section	Requirements	DPIR comment
Y	Forward material	Has the plan been endorsed by a senior representative of the company?	
Introduction			
Y	1.1	Have operator details been included?	
Y	1.3	Are title details included?	
Y	1.4	Is there a project summary and description of improvements?	
Site Conditions			
Y	2.1	Have all the physical environment conditions for the site and surrounds been identified?	
Y	2.4.1, 2.4.2	Have the current land uses and users and stakeholders been identified?	
Y	2.4.2, 2.4.3	Have Community Affairs been described?	
Statutory and Non-statutory requirements			
Y	3.1	Has all legislation relevant to the operation and associated permits and approvals been identified?	
Y	3.2	Have all non-statutory obligations been identified and included?	
Y	3.3 Appendix E	Have Aboriginal and heritage sites been identified?	
Operational Activities			
Y	4	Have all operational activities relating to mining, processing, exploration and any related activities for the site been addressed in the MMP?	
Waste Rock Characterisation			
Y	Appendix L	Have results of waste rock characterisation been included and discussed?	
Y	Appendix L	Has a waste characterisation report been included?	
Y	7.1	Does the MMP include a waste rock management plan?	
Environmental Management			
Y	5.1	Has the environmental management structure and responsibilities been outlined?	
Y	Appendix N	Has the Environmental Policy been included?	
Y	5.4.1	Has a register of environmental commitments been included?	
Y	5.5 Appendix P	Has a summary of all recommendations from the Environmental Impact Assessment been included and addressed if the project has been formally assessed?	
Y	5.6	Has training and induction been addressed?	
Y	5.6.3	Is there an Environmental Emergency and Response plan?	
Y	6.1	Have all environmental aspects and potential impacts been identified?	

Y/N	Section	Requirements	DPIR comment
Y	6.2	Has a risk assessment been carried out?	
Y	7	Have Environmental Management Plans (EMPs) for identified risks been developed and included?	
EMPs			
Y	7	Do all EMPs include: Objectives and targets Management and mitigation strategies Monitoring and measurement Discussion and analysis of results Non-conformances and corrective actions	
Water Management			
Y	8.1	Has a comprehensive description of surface water conditions been included?	
Y	8.2	Has a comprehensive groundwater model been described?	
Y	8.3.1	Have information or knowledge gaps been identified and described for water management?	
Y	8.3.2	Are there comprehensive details (including scopes of work) on actions proposed to be taken to respond to any identified information or knowledge gaps?	
Y	6.2 Appendix J Appendix R	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	6.2 Appendix J Appendix R	Are all strategies and actions that will be undertaken to manage any risks identified included?	
Y	8.4	Has the water monitoring program been detailed?	
N/A		Has all monitoring data been included?	
N/A		Has an interpretation of data by a suitably qualified person been included?	
N/A		Has a discussion of trends over time been detailed?	
N/A		Have details of remedial / corrective strategies and scopes of work been included?	
N/A		Have proposed actions been detailed?	
Incident Reporting:			
N/A		Has a table of all incidents recorded on site been included and discussed?	
Closure Planning:			
Y	10.2	Has a Life of Mine Plan – Unplanned Closure plan been included?	
Y	10.1.1	Are all disturbances described?	
Y	10.2	Are remediation activities that would be required in the event of unplanned closure described?	
Y	10.1 Appendix H	Are activities required to achieve end land use objectives described?	
Y	Appendix U	Does the MMP include a detailed costing of closure activities for the life of plan?	
NA		Have all past disturbances and those proposed for the next reporting period been identified and included?	

Y/N	Section	Requirements	DPIR comment
Maps and Plans			
Y	Appendix A	Maps and plans have scale, scale bar, legend and north point?	
Y	Throughout	Datums used are MGA94 or GDA94 (expressed in decimal degrees) with elevations based on AHD?	

Amendments

Section	Amendment
Document control	Updated to current version number, date
Appendices	Appendix A provides the current figures for the MMP and these supersede related figures in other Appendices Appendices G, H, J, K, L, P and R updated to address DITT comments (2 July 2021) Appendices S and T updated with current forms Appendix G updated to address DITT comments (29 September 2021)
Section 3.1.1	Section addressing the *Water Act 1992* added
Section 4.1.5	Table 8 updated with mining schedule
Section 4.2	Language changed to meet the intent of the MMP
Section 4.2.2	Schedule added
Section 5.4.1	Commitments added to Table 10
Section 7.5.2	Section added stating size of bat habitat clearance
Section 7.7.1	Section updated to include pre-clearance survey of bat habitat
Section 8	Section updated
Section 8.3	Number of monitoring bores justified
Section 9.2	Reporting incidents to DITT added to dot points
Section 10	Closure and performance criteria incorporated into Table 4 of Appendix H. A schedule for completion of the closure plan incorporated into Appendix H and Section 10

1 Introduction

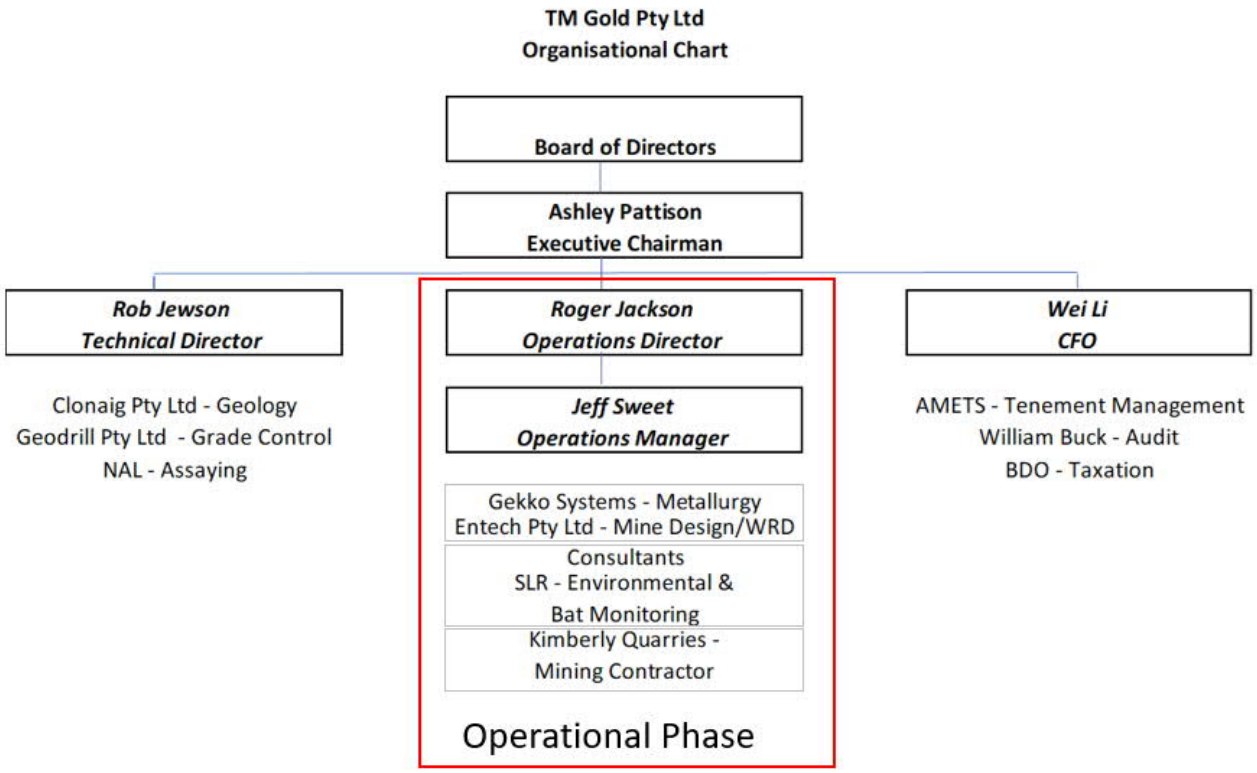
1.1 Operator Details

The Spring Hill Project is 100% owned by TM Gold Pty Ltd (TM Gold).

Table 1 Operator details for the Spring Hill Gold Project

Information	Detail
Operator name	TM Gold Pty Ltd
Key Contact	Robert Jewson, Technical Director
Address	13 Rosser Street, Cottesloe, WA, 6011
Phone	0422 727 475
Email	rob@pcgold.com.au

1.2 Organisational Structure and responsibility



1.3 Title Details

The Spring Hill Project overlies mining licence (ML) 23812, which is a 1,035 ha ML originally granted to Tenant Creek Gold (NT) Pty Ltd on 16 January 2004, contingent upon a boundary survey. The survey was completed in August 2005 and the lease was granted in March 2007. The ML was then acquired by Western Desert Resources (WDR) in July 2007. In mid-2011, WDR Gold entered a joint venture agreement with TM Gold. ML23812 is currently 100% owned by TM Gold and expires on 15 January 2025. ML23812 surrounds a number of small, pre-existing mining claims and is itself contained within the wider exploration lease (EL) 22957, which is also 100% owned by TM Gold.

ML23812 is located within the boundaries of perpetual pastoral lease (PPL) 815, the Mary River West lease.

In terms of native title, ML23812 is within the area of a registered Native Title Claim DC01/6 Mary River West.

1.4 Project Description

1.4.1 Site Location

The Spring Hill ML23812 is located approximately 200 km southeast of Darwin in the Northern Territory (NT). Access to the site is via the sealed Stuart Highway south from Darwin, and then a left turn onto the unsealed Springhill Road between Emerald Springs and Pine Creek. A map of the site location is provided in Appendix A of this report.

1.4.2 Proposed Infrastructure Layout

The proposed site infrastructure will include pits, a waste rock dump (WRD), a Run-of-Mine (ROM) pad, sediment dams, and workshops, demountable offices and ablution blocks along with onsite access and haul roads. There will be no onsite accommodation, with workers accommodated at nearby Pine Creek and Emerald Springs. A map of the proposed infrastructure layout is included in Appendix A of this report.

1.4.3 Project Summary

The tenements cover some historic gold workings, which have been the subject of exploration activities by various operators over at least the last 130 years.

Ross Mining acquired the project from Territory Resources in 1989 and formed an exploration joint venture with Billiton who carried out a major programme of work until it withdrew from the joint venture in March 1992. Ross Mining continued to explore the project area until 1994. In the mid-1990s, Ross Mining was acquired by Placer Dome and in 1995 the project area was relinquished. During 2003, the subsequent owner of the project, Tennant Creek Gold (NT) Pty Ltd, commissioned McDonald Speijers to undertake a first pass economic assessment of the mineralisation and to create a preliminary pit design for the Hong Kong, Main and East Zones on the southern part of the project area. The resulting resource estimate comprised 3.6 Mt @ 2.34 g/t Au for a total of 274,000 ounces of gold.

In 2007, WDR acquired the project from Tennant Creek Gold (NT) Pty Ltd. Project development work undertaken by WDR in the four years they managed the tenements included Bemex metallurgical scoping study, acquisition of 150m spaced SkyTEM airborne EM data and Quickbird VHR satellite imagery.

TM Gold intends to establish an open cut mine to extract oxide ore resources at Spring Hill and trucking ore offsite for processing at the Union Reefs Mill. The life of the mine for the project will be 16 months period, followed by closure and monitoring:

- Site preparation – 1 month
- Mining – 13 months
- Off-site processing – during mining and 2 – 3 months post-mining
- Rehabilitation and closure – 2 months
- Post-closure monitoring and post wet season remedial works - 10 years (as required for threatened bat management see Section 7.7.1), or longer if required to ensure closure is accomplished.

2 Site Conditions

2.1 Physical Environment

2.1.1 Climate

The Spring Hill Project lies in the tropical monsoon belt of the NT. The area experiences hot humid summers and cooler dry winters. The spread of rainfall gauges is sporadic. The closest rainfall station to the site with a dataset longer than 10 years is the Burrundie Railway station 8 km to the north, which measured rainfall in the region from 1889 to 1974. A full list of similar rainfall stations in close proximity to the site is provided in Table 2 below.

Table 2 List of nearby Bureau of Meteorology (BoM) rainfall stations and the number of years data held

BOM ID	Name	Start	End	Years of Data	Distance from Site
14007	Burrundie Railway Station	1889	1974	85	8 km north
14205	Emerald Springs	1981	2013	32	9 km west
14204	The Pines	1971	2016	45	22 km south west
14073	Hayes Creek	1957	2013	56	28 km west
14173	Ban Ban Springs	1968	Present	48	33 km north west

Data from these stations were assembled into a continuous climate dataset from 1900 until January 2017 and used to describe the climate of the region.

The site lies in the tropical monsoon belt of the Northern Territory and experiences an annual average rainfall of 1,018 mm per year (Figure 1). Approximately 70% of years on record have an annual rainfall between 800 and 1,600 mm with an even distribution of 15% of years having an annual rainfall volume above and below this amount, respectively.

The wet season extends from December through to March with 80% of the yearly rainfall typically falling within this period. Only 65% of rainfall occurs in the typical wet season months of December to February (Figure 2).

Rainfall in May to September is scarce with the majority of rainfall stations experiencing no rainfall on record for these months in most years.

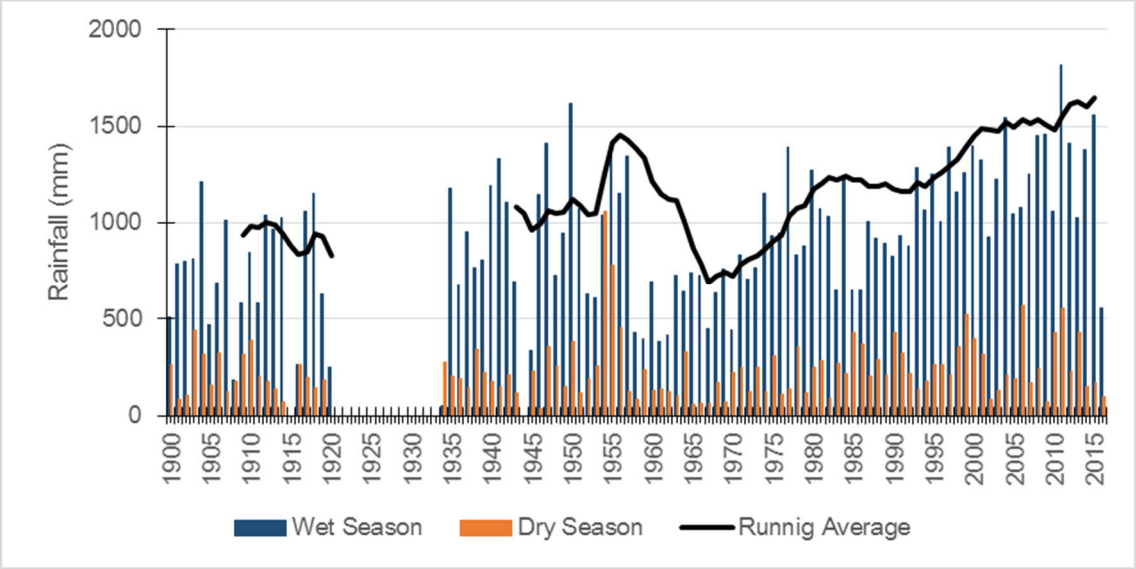


Figure 1 Historical Rainfall for the Region

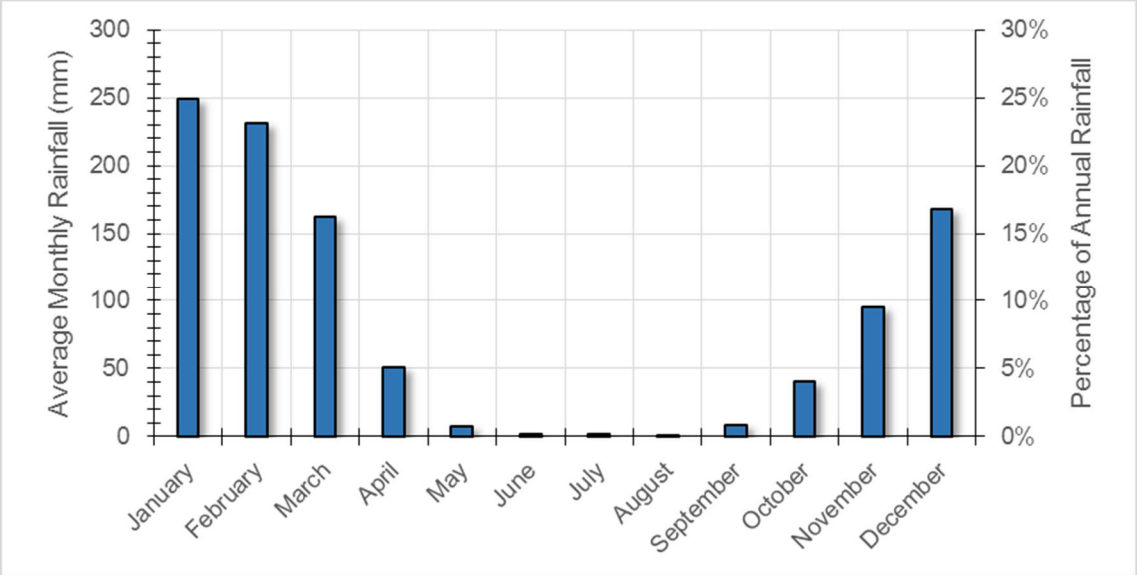


Figure 2 Average Monthly Rainfall

Intensity Frequency-Duration (IFD) data describe the calculated probability of the volume of rainfall measured over set time periods exceeding a specified value. The probability is provided as a percentage in the Annual Exceedance Probability (AEP). A storm with a 1% AEP has a 1% probability of being exceeded in any one year. BoM uses algorithms to calculate the IFD data for all locations in Australia based on a regular grid (approximately 2.5km) across Australia. The IFD data calculated for Spring Hill is provided below in Table 3.

Table 3 Rainfall Intensity Frequency-Duration Data Obtained from BoM for Spring Hill

Duration	EY	50%	20%	10%	5%	2%	1%
1 minute	2.9	3.1	3.9	4.3	4.7	5.3	5.6
2 minute	5.2	5.6	6.9	7.6	8.3	9.1	9.5
3 minute	7.3	7.9	9.7	10.8	11.8	12.9	13.7
4 minute	9.2	10.1	12.4	13.8	15.1	16.6	17.7
5 minute	11.1	12.1	14.9	16.7	18.2	20.1	21.4
10 minute	18.5	20.2	25.2	28.2	31	34.4	36.8
15 minute	24.2	26.4	32.9	36.8	40.5	44.9	48.1
30 minute	35.4	38.6	47.9	53.6	58.8	65	69.4
1 hour	47	51.2	63.5	71	77.9	86.2	91.8
2 hour	57.4	62.7	78.2	88	96.9	108	115.7
3 hour	62.7	68.7	86.4	97.8	108.5	121.9	131.7
6 hour	71.1	78.3	101	116.4	131.3	151	166.3
12 hour	80.4	89.5	119.2	140.5	162.1	192.1	216.7
24 hour	94.2	105.8	145.5	175.2	206.6	252.1	290.1
48 hour	116.6	131.9	184.6	225.1	268.6	332.6	385.8
72 hour	135.6	153.4	214.7	261.2	311	383.7	443.6
96 hour	152	171.7	238.5	288.3	340.7	416	478.2
120 hour	166.3	187.5	257.7	308.8	361.4	435.4	497.5
144 hour	178.8	201.1	273.1	324	375.2	445.4	506
168 hour	189.6	212.7	285.4	335	383.8	448.5	507

There have been two storms recorded that exceed the 1% AEP 24hr duration storm. These include:

- 393.7 mm that fell in April 1954.
- 294.9 mm that fell on 03 January 1914. This event also exceeded the 1% AEP 48 hr duration storm and the 1% 72 hr duration storm.

2.1.2 Recent Rainfall

There is a high variation in the annual averages of rainfall within the NT. The BoM's annual climate summary for the NT for the wet season of 2014–2015 noted that there was 'Average to above-average annual rainfall for the Northern Territory' (BoM, 2015) for the period. Successively, the 2015–2016 climate summary noted that there was below average rainfall (BoM, 2016), subsequently the 2016–2017 wet season was noted as having above average rainfall (BoM, 2017). Given that there is high variability from year to year and to characterise the nature of flows likely to have happened at the site, an assessment of the recent rainfall includes the wet seasons from October 2014 through to January 2017 so that a variation of the levels of rainfall are reflected.

Figure 3 details the daily and monthly cumulative rainfall from October 2014 to January 2017.

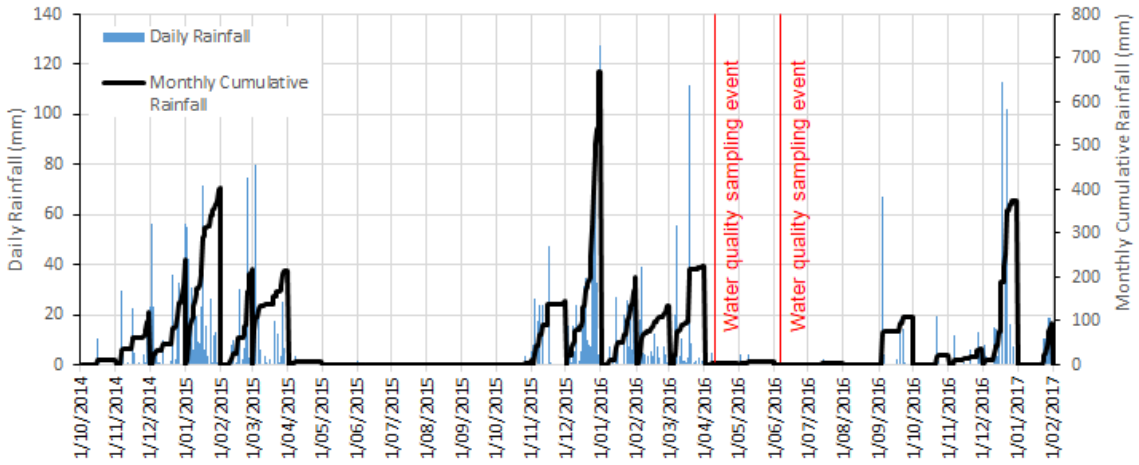


Figure 3 Recent Rainfall Trends at the Site, October 2014 to January 2017

2014– 2015 wet season rainfall

Rainfall for the 2014–2015 wet season began in late November within the region, where the monthly cumulative rainfall was approximately 120 mm. Rainfall from October to January was intermittent and there were only two days that exceeded all others for this period, which were at the beginning and end of December. A total of 56 mm was recorded on both days in December for the 24 hr period. The majority of rainfall within the region fell within January, where the cumulative monthly rainfall was approximately 403 mm. The highest rainfall was in March, where over a 72 hr period 115 mm was recorded.

Stream flow would have not been active within the region until late November to early December due to the late onset of the wet season. However, given the heavy to steady rains from January to February, stream flow would have been active during this time.

2015–2016 wet season rainfall

Rainfall over the 2015–2016 wet season is outlined above in Figure 3. The timing of two water quality sampling events is also marked above on Figure 3.

There was an early onset of the wet season with approximately 130 mm recorded in November. The majority of rainfall occurred in December with a total of 670 mm throughout the region (Figure 3). The majority of this rainfall occurred over a relatively wet period of 18 continuous days. The highest daily rainfall was 127.5 mm at the end of the storm season, which is between 50% and 20% AEP for the 24hr duration storm event. There were also two days that experienced daily rainfalls of between 80 and 90 mm. approximately 200 mm fell in January and March while approximately 130 mm fell in February (Figure 3).

Relatively gentle rain in November, followed by relatively intense rainfall in December before three months of relatively gentle rain would have ensured that stream flow and pools in small order streams would have been relatively persistent.

2016–2017 wet season rainfall

Rainfall over the 2016–2017 wet season is outlined in Figure 3 above.

Leading into the wet season, October and November recorded cumulative monthly rainfalls of approximately 21 mm and 37.9 mm, respectively. The heaviest rains of the season arrived in December of 2016 with approximately 375.8 mm cumulative monthly rainfall recorded within the local region for that month. The highest daily rainfall was also in December where approximately 113.2 mm was recorded for a 24 hr period. The area received approximately 92.7 mm for January, which was the end of the BoM data records.

2.1.3 Frequency of Extreme Events

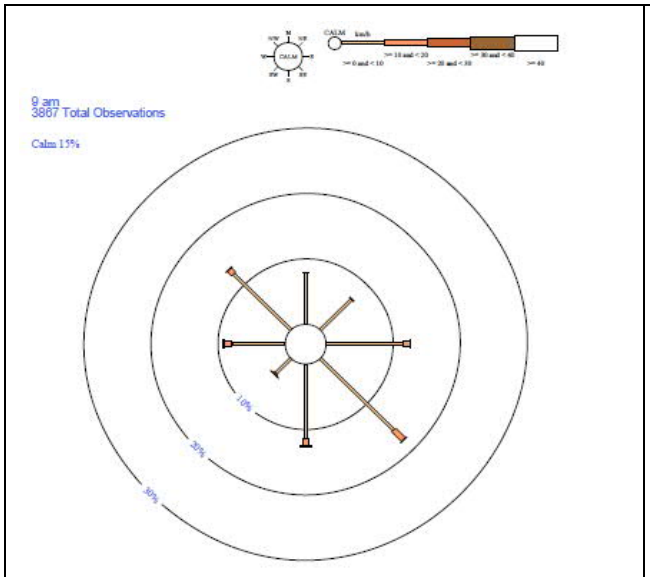
The fire regime in the vicinity of the Spring Hill ML is quite intensive, with fires on a near-annual basis in and around the ML. A map indicating the frequency of fire in the region is included in Appendix A. The mapped historic fire record indicates there have been fires at Spring Hill in 10 out of the last 10 years.

This unnatural fire regime has ongoing impacts on flora and fauna in the region, which is discussed further in the *Flora and Fauna Technical Report* (Appendix B). Intensive fire regimes also have impacts on surface water quality, and water quality may be directly affected as a result of changed water balance, replacement of the forest litter by an ash/charcoal layer, and enhanced wash off of materials into streams (Chafer, 2007). This is discussed further in the surface water section of this report.

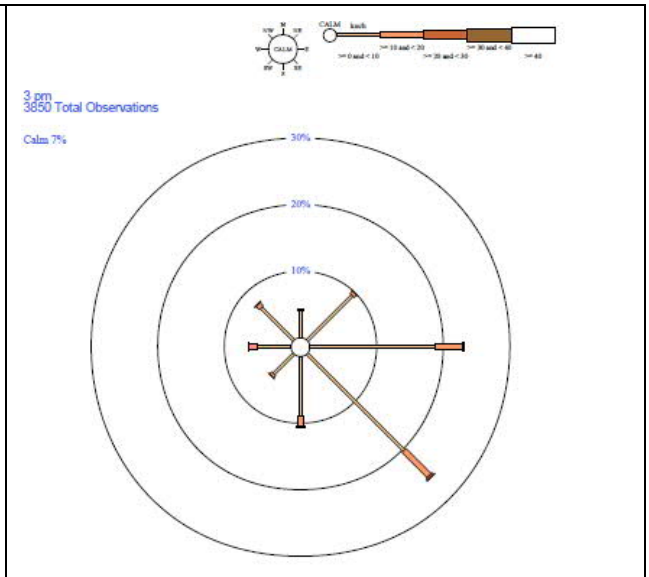
2.1.4 Wind Speed and Direction

Wind rose data was accessed from the nearest BoM station with comprehensive data available from the last 10 years, which is Pine Creek Council station number 014960. Data indicates the winds at Spring Hill predominantly blow from the southeast in both mornings and afternoons, with an easterly wind coming through in the afternoons almost as often as south easterly winds.

Figure 4 Wind roses from Pine Creek Council BoM Station #014960 (accessed October 2016)



9am wind observations



3pm wind observations

2.2 Land systems

2.2.1 Topsoil and Subsoil

The Spring Hill ML is in the Brocks Creek Ridge land system, which falls into the broader geomorphological unit referred to as Elevated Backbone Country or Eroding Upland Country. The site is included within Isbell's (1983) Pine Creek soil landscape province, in which the major soil features are described as predominantly sandy or loamy lithosols on slopes greater than 5%, with some associated earthy sand and red or yellow earths. Alluvial valleys and lower side slopes are predominantly lateritic podsolic yellow earths and solodic soils (Isbell, 1983). CSIRO land system maps (Christian *et al.*, 1953; Story *et al.*, 1969) describe the hills as having skeletal gravelly sandy loamy formed on metamorphics and associated alluvial flats as having light textured, acid soils. This land system is described as eroding upland country (Christian & Stewart, 1953). Steep terrain and short periods of torrential rainfall means the shallow soils of Spring Hill are prone to erosion from surface runoff in the wet season. A *Soils Technical Report* has been included with this MMP as Appendix C.

2.2.2 Topography

The general topography of the Brocks Creek Ridge land system is described as consisting of sharp, rocky north-south ridges and hills up to 182 m or more in height, with steep slopes (up to 40–60%) and generally sharp to gentle crests dissected by numerous creeks (Christian *et al.*, 1946; Story *et al.*, 1969). Erosion is active and there is little or no accumulation of soils on the steep slopes. The system is formed on steeply folded metamorphics of the Brocks Creek group, which includes rocks of the lower Proterozoic age and consists of sandstone, quartzite, greywacke, chert and siltstone (Christian *et al.*, 1946; Story *et al.*, 1969). Associated with the steep rocky ridges are low smoothly convex hills, small alluvial flats and channels incised through sandy or loamy alluvium (Christian *et al.*, 1946; Story *et al.*, 1969).

2.2.3 Geology

Spring Hill is located centrally within the Pine Creek Geosyncline, which comprises early Proterozoic sediments that were folded and metamorphosed to greenschist facies approximately 1800 million years ago. This sequence, which is dominated by mudstones, siltstones, greywackes, sandstones, tuffs and limestones, has been intruded by preorogenic dolerite sills man mainly postorogenic granites. Largely undeformed Middle Proterozoic to Mesozoic strata unconformably overlie the Early Proterozoic sequence. Detailed descriptions of the geology of the Pine Creek Geysyncline can be found in Needham *et al.* (1980) and Nicholson *et al.* (1994) (Sheldon *et al.*, 1994).

2.2.4 Vegetation

The Spring Hill Project area is located within the 'Brock's Creek Ridge Land System' described in the General Report on Survey of Katherine-Darwin Region (Christian & Stewart, 1953). This system is formed on metamorphics of the Brocks Creek Group in the Elevated Backbone Country. The major soils of this system are very gravelly sandy loam and skeletal soils formed on metamorphics of the Brocks Creek Group, with active erosion and little or no accumulation of soil on slopes (Christian & Stewart, 1953). Vegetation in this system is described by Christian and Stewart (1953) as *deciduous open forest* on the highest ridges, with lower ridges and slopes covered by mixed open forest without a prominent understory. Christian and Stewart (1953) note that Ironwood (*Erythrophleum chlorostachys*) is common on the slopes. These descriptions are consistent with the results of the baseline ecological studies conducted specifically within the Spring Hill Project area. The outcomes of these baseline surveys are discussed in the following sections.

2.3 Flora and Fauna

2.3.1 Overview

Flora and fauna baseline studies for the Spring Hill Project area were conducted in 1995 by Low Ecological Services (LES), with additional generic and targeted survey techniques employed in subsequent site visits. Northern Resource Consultants (NRC) conducted a systematic baseline survey in October 2016 to add to the existing body of baseline information and to provide data on current site conditions and to consolidate relevant findings from all baseline surveys conducted to date. NRC conducted additional targeted surveys during July 2017 to provide additional baseline data relevant to the proposed action. The *Flora and Fauna Technical Report* (Appendix B) also provides assessment of potential impacts to native flora and fauna based on the current legislative framework, which includes updates to the status of threatened species.

The *Flora and Fauna Technical Report* details the following aspects of the assessment, conducted in October 2016 and July 2017 for the proposed action at Spring Hill:

- Methodologies employed for assessing terrestrial flora and fauna within the study area.
- The presence and current status of species and communities within the local area.
- Potential ecological impacts of the project and recommendations for mitigating impacts, with a focus on species of conservation concern, such as those listed under Territory and Commonwealth legislation.

The study area for the current survey program was centred on an area of approximately 75ha encompassing the disturbance footprint for the currently proposed action and the habitat surrounding these areas. The proposed disturbance areas of the open cut pit, WRD, ROM pad and other infrastructure will occur in the central-eastern portion of the mining lease (see maps in Appendix A). The majority of survey effort for both the October 2016 and July 2017 current baseline study was concentrated in the proposed disturbance areas, which are located in an area of historic gold workings, which have been the subject of exploration activities by various operators over at least the last 130 years (Appendix A).

2.3.2 Land Units, Vegetation Communities and Flora Species

The land units relevant to the Spring Hill project area, identified in the previous baseline flora and fauna assessment (LES, 2013) include 'ridge crests and slopes', 'low undulating hills' and 'tall open woodland riparian'. A summary of the descriptions provided in LES (2013) is included in Table 4. The disturbance footprint for proposed action is primarily restricted to the ridge crests and slopes land unit. The floristic structure and composition within these land units is described in the following section.

Table 4 Summary of Relevant Land Units Identified in Previous Surveys (from LES, 2013)

Land unit	Description
Ridge crests and slopes	This land unit covers the entire mining area domains of the proposed action. It comprises rocky hills approximately 140 m high (260 m above sea level), with steep slopes of up to 60° and a narrow crest of approximately 30 m. Soils of this land unit are shallow and skeletal with sandy loams in depressions.

Land unit	Description
Low undulating hills	This land unit mainly encompasses areas to the south and west of the proposed action. It includes gentle rounded hills associated with alluvial washouts and channels which occasionally become inundated during the wet season. Hills have a local relief of less than 20 m (up to 120 m above sea level) and an incline less than 5°. Soils are sandy loams with silt stone sediment and quartz intrusions and are generally shallow except in depressions where clayey loams predominate.
Tall open woodland riparian	The relevant section of this land unit is located to the south of the proposed action on an existing access track. It is associated with low-lying creeks and drainage from hill slopes. Soils of this land unit are clayey loamy with loamy clays in larger depressions and coarse to fine sands in Creek beds.

The previous baseline survey by LES (2013) did not find any flora listed as threatened or near threatened under the *Territory Parks and Wildlife Conservation Act 2014* (TPWC Act) or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) within the survey area. Species recorded were generally widespread in the local area and typical of the Wet-Dry Tropics and the Pine Creek Region.

The floristic composition and structure of the vegetation communities within each of the identified land units, as described by LES (2013), is provided below.

Ridge crests and slopes were described by LES (2013) as low woodland dominated by mid to tall eucalypts over mid to tall grasses and scattered forbs. The upper canopy was dominated by *Eucalyptus bigalerita* (Northern Salmon Gum), *Eucalyptus tintinnans* (Salmon Gum) and *Corymbia dichromophloia* (Variable Barked Bloodwood), with subdominant species including *Corymbia papuana (*Ghost Gum), *Corymbia polycarpa* (Long Fruited Bloodwood), *Corymbia setosa* (Rough Leafed bloodwood), *Corymbia grandifolia* (Large Leaved Cabbage Gum) and *Xanthostemon paradoxus* (Bridal Tree).

The understorey consisted of locally dominant grass species: *Sehima nervosum* (Rats Tail Grass), *Cymbopogon obtectus* (Silky Heads), *Heteropogon contortus* (Black spear grass), *Sorghum plumosum* (Plume Sorghum) and *Themeda triandra* (Kangaroo Grass). Forb species included *Gomphrena* spp., *Thecanthes punicea*, and *Haemodorum coccineum* (Scarlet Bloodroot).

The low undulating hills unit was described as low woodland and was distinct from the ridge crest and slopes unit in that the canopy layer was generally sparser, with the understorey and canopy becoming dense in depression areas. The canopy layer was generally similar to that of ridge crests and slopes, but with dominant species being *Corymbia latifolia* (Rough Leafed Bloodwood), *Eucalyptus miniata* (Darwin Woollybutt) and *Eucalyptus tectifica* (Darwin Box). Ground cover species were similar to that of the ridge crest and slopes.

The riparian land unit was described as low open eucalypt forest of eucalypt trees (5–10 m high) vines, a dense shrub layer and dense ground cover of a mix of grasses and forbs. Species were generally consistent with the low undulating hills land unit but occurred in greater abundance in the riparian zone. There were also additional species adapted to the riparian conditions such as *Pandanus spiralis* (Screw Palm) and *Nauclea orientalis* (Leichhardt Tree).

The vegetation communities identified in each land unit during the October 2016 survey were found to be generally consistent with the descriptions provided in the original baseline survey report by LES (1996). A summary of the dominant vegetation within each mapped land unit is provided in Table 5.

The October 2016 survey focussed on describing vegetation communities present within the proposed disturbance area for the project and nearby surrounding areas. This survey revealed significant disturbance from historical mining and exploration activities in the proposed pit and WRD domains on the ridge crests unit. While there is significant disturbance within this unit, the overall dominant species composition and structure was consistent with the descriptions provided in LES (2013). Some additional species were identified in various parts of the study area, but none of these formed significant structural components to the communities described (further details on flora species is provided in Table 5).

Table 5 Dominant Vegetation for Each Land Unit (from LES, 1996 and NRC, 2016)

Land unit	Description
Ridge crests and slopes (low woodland)	Dominant: *Eucalyptus tintinnans, Corymbia dichromophloia, Erythrophleum chlorostachys.* Associated: *Gardenia megasperma, Terminalia ferdinandiana, Xanthostemon paradoxus, Vachellia pachyphloia, Corymbia setosa.* (Dominant groundcover species include *Sehima nervosum, Cymbopogon obtectus, Themeda triandra, Sorghum plumosum,* and *Heteropogon contortus*)
Low undulating hills (low woodland to open woodland)	Same as for ridge crests and slopes but also with *Corymbia latifolia, Eucalyptus miniata* and *Eucalyptus tectifica* often dominating the canopy layer.
Riparian (open woodland)	There are specifically surveyed in detail where the existing road occurs within this unit was dominated by *Erythrophleum chlorostachys*, *Corymbia confertiflora, Corymbia latifolia*, and *Lophostemon grandiflorus* with species such as *Pandanus spiralis*, *Xanthostemon paradoxus, Acacia holosericea, Flueggea virosa, and Brachychiton megaphyllus.*

None of the vegetation communities observed equate to a threatened ecological community listed under the EPBC Act.

It has been suggested a community of riparian monsoon forest approximately 0.5 ha in size is located in a gully on the western side of the project area. Monsoon forest patches are regarded as a significant habitat type under the NT Land Clearing Guidelines (Department of Environment and Natural Resources (DENR) 2019) due to their high species diversity. As monsoon forests are generally isolated, their removal is likely to result in localised species extinction and should be avoided wherever possible.

The vegetation community located in the western gully was specifically targeted for vegetation community assessments during the survey program in July 2017. The targeted survey included description of the species structure and composition of the vegetation at this location. The western slopes of the ridge throughout this area are characteristic of the ridge crests and slopes land unit described above, a mix of *Eucalyptus tintinnans, Corymbia dichromophloia* and *Erythrophleum chlorostachys* forming the canopy layer. The western gully itself is characterised by a steep rocky drainage line descending from the ridge crest, with steep sides joining with the surrounding ridge slopes. The full length of this gully was traversed, with vegetation community surveys conducted at regular intervals to describe the community present. The vegetation throughout the majority of this gully is consistent with the surrounding ridge crests and slopes land unit, with *Erythrophleum chlorostachys* being slightly more prevalent in the canopy layer within the gully. There is one steeper and rockier section of the gully that appears to be more sheltered from fire. This fire-sheltered rocky section covers an area of approximately 0.16 ha and is approximately 80 m long by 20 m wide.

Overall, the majority of vegetation in the western gully area is characteristic of the ridge crests and slopes land unit described previously. There is a small section that appears to be more sheltered from fire due to the steep terrain and rocky substrate, and this section supports a small number of flora species not recorded from the surrounding ridge crests and slopes land unit. However, the spatial extent of this community is very small (approximately 0.16 ha) and the species diversity is not significantly greater than the surrounding non-riparian communities. The biodiversity value of this small area is therefore assessed to be relatively low and it is unlikely to be providing any significant habitat values for any local flora and fauna species.

Further details regarding fieldwork conducted in July 2017 and the species composition at this location can be found within the *Flora and Fauna Technical Report* (Appendix B).

2.3.3 Habitat Description

The disturbance footprint of the proposed action is largely restricted to the ridge-top and adjacent slopes that support eucalypt woodland habitat on skeletal soils. The slopes are rocky with a generally sparse grassy groundcover and very sparse shrub layer. Areas on top of the ridge have been subject to substantial disturbance from exploration activities and historical mining. These areas are mostly cleared of vegetation and consequently have relatively low habitat value. The disturbance footprint of the proposed action is largely centred on these areas of existing disturbance on top of the ridge, with proposed pit locations occurring in areas of significant existing disturbance from exploration activities. Loss of habitat values associated with woodland communities on the ridge crests and slopes land unit will therefore be minor. This vegetation community and land unit association occurs over a broad area at the locality.

2.3.4 Fauna Species

Details of the desktop and field-based fauna studies conducted for the Spring Hill Project to date are provided in the *Flora and Fauna Technical Report*. The two main survey periods, involving systematic trapping programs and targeted surveys, were April 1995 and October 2016. These surveys revealed an array of fauna species within the project area and surrounding habitat. The more recent study, in October 2016, identified 42 bird species, 4 mammal species, 10 bat species, 13 reptile species and 5 amphibian species within the study area. The 2016 survey recorded a slightly higher diversity for most faunal groups, which may be due to survey timing or increased survey effort. Apart from the higher diversity, the species assemblage recorded during the recent study is mostly consistent with the previous study. A notable difference is that one individual juvenile Northern Quoll (*Dasyurus hallucatus*) was captured in the ridge crest land unit during the 1995 survey. The Northern Quoll is listed as endangered under the EPBC Act and critically endangered under the TPWC Act. This species has been subject to substantial declines across most of its former distribution and there are no recent records of this species at the locality. No further evidence of this species has been recorded within the project area, despite targeted survey effort and a second systematic program completed in 2016.

Species of conservation significance, such as the Northern Quoll, are discussed further in the following section.

2.3.5 Flora and Fauna Species of Interest including Threatened Species

Flora

No threatened or near threatened flora species were found within the study area, despite the use of targeted threatened flora survey methods. Four conservation significant flora species with potential relevance to the study area were identified in the desktop analyses and the likelihood of their occurrence within the study area was assessed using key criteria such as local records, and habitat suitability/quality. From this, three of the species were considered to have a low likelihood of occurring within the study area. It is considered unlikely any of these three threatened species would occur within the study area due to a lack of suitable habitat and/or a lack of local records.

Acacia praetermissa was identified during the desktop assessment as having moderate potential for occurrence within the project area. This species was specifically targeted over multiple survey programs incorporating various seasonal conditions. During the most recent survey (July 2017), specimens were located in the region (multiple sites near Emerald Springs) prior to the survey to confirm diagnostic characteristics and current reproductive stage at the time of the survey to facilitate detection. The species was flowering at the time of the July 2017 survey, which increases the detectability of this species. Three suitably qualified observers conducted random meander searches and the entire proposed disturbance footprint on the ridge crest was traversed. This species was not detected anywhere within the project area during any of the baseline ecological surveys to date, including during comprehensive targeted searches. Given the lack of evidence for this species occurring within the project area and the extent of existing disturbance from historical mine workings, it is unlikely the construction and operation of the proposed project will:

- lead to a long-term decrease in the size of the population of the species
- reduce the area of occupancy of the population
- fragment any population into multiple populations
- adversely affect habitat critical to the survival of the species
- disrupt the breeding cycle of an important population
- modify, destroy, remove or isolate; or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to the species becoming established in Koala habitat
- introduce disease that may cause the species to decline
- Interfere substantially with the recovery of the species.

Overall, in consideration of the EPBC Act Significant Impact Guideline criteria, found within the *Flora and Fauna Technical Report*, it is unlikely there will be any significant impacts to the vulnerable population of *Acacia praetermissa* as a result of the proposed action.

Fauna

Five species of conservation significance have been recorded within the study area during the ecological baseline surveys. As previously identified, one Northern Quoll individual was captured in the ridge crest land unit during the 1995 surveys. Multiple observations of Partridge Pigeons (*Geophaps smithii smithii*) were obtained during the 1995 and 2016 survey programs. This species is listed as vulnerable under the EPBC Act and the TPWC Act. Three threatened bat species were recorded from within the project area using a microbat call detection device. The Ghost Bat (*Macroderma gigas*; Vulnerable, EPBC Act), and the Northern Leaf-nosed Bat (*Hipposideros stenotis*; Vulnerable, TPWC Act) and Orange Leaf-nosed Bat (*Rhinonicteris aurantia*) – Near Threatened (TPWC Act) were recorded on multiple nights during the October 2016 survey. A targeted microbat survey was conducted in July 2017 and both the Northern Leaf-nosed Bat and the Ghost Bat were sighted and recorded via an echolocation recorded. Detailed results and proposed outcomes from this survey can be found within the *Targeted Microbat Survey Report* in Appendix D.

Northern Quoll

The Northern Quoll (*Dasyurus hallucatus*) is listed as endangered under the EPBC Act and critically endangered under the TPWC Act. There are many records of this species within the broader area. As previously identified, one individual was captured within the project area during the 1995 baseline survey (LES, 2013).

This species was formerly distributed across much of northern Australia, but its distribution has contracted significantly since European settlement to several disjunct populations (Oakwood, 1997). Poisoning from eating the introduced Cane Toad is a major mechanism for the decline of this species (Oakwood, 1997). Large scale monitoring in Kakadu National Park reported highly significant declines and local extinctions of Northern Quolls since the invasion of Cane Toads across the park (Woinarski *et al.*, 2010). These declines appear to have occurred throughout the Top End and there are no recent records from the broader Spring Hill or Pine Creek locality, despite multiple surveys and assessments for other mining projects in the area.

A report by Oakwood (2000) suggests the following factors are important for the persistence of Northern Quoll in parts of the Northern Territory:

- rocky areas
- tall open coastal eucalypt forests
- sandstone escarpment
- open forests and woodlands containing *Eucalyptus tetrodonta*, *E. miniata* and *E. tectifica*
- open woodland on low rocky hills containing *Corymbia setosa* and *C. bleeseri*
- riparian areas dominated by *Melaleuca virdiflora* and *Pandanus spiralis*

Based on these habitat attributes, the field assessments confirmed the study area contains habitat that is potentially suitable for the Northern Quoll. However, it is unlikely this species still persists in the area as there are no recent records from the broader locality.

Multiple survey techniques targeted detection of this species during the October 2016 survey period. Areas containing preferred habitat attributes, such as the rocky slopes and outcrops within the study area were targeted in particular using techniques such as cage trapping and motion-sensing infrared cameras. All traps were baited with material targeted at attracting Northern Quolls, including a mix of rolled oats and a variety of meats. Latrine searches in potentially suitable habitat areas were also conducted to supplement the trapping program.

No evidence of the Northern Quoll was detected during both the October 2016 and July 2017 field survey programs despite targeted effort using multiple techniques. Suitable habitat for the Northern Quoll occurs within the proposed disturbance footprint for the project; however, this habitat is not unique to the project area. Rocky outcrops and ridges are found throughout the local area. Given the lack of recent records in the area, and the lack of any evidence observed during the recent survey period, it is unlikely this species would be significantly impacted by the proposed action.

Partridge Pigeon

Partridge Pigeons were recorded at multiple locations within the lease area during the 1995 survey and were most common in the low undulating hills land unit (LES, 2013). During the October 2016 survey, a large flock of approximately 30 individuals was observed drinking at a dam located about 800m southwest of the project area in the low undulating hills land unit. Throughout the most recent targeted survey program in July 2017, no Partridge Pigeons were detected within the proposed disturbance footprint or any of the surrounding habitat in the ridge crests and slopes land unit.

During the targeted survey program in July 2017, three observers traversed the entire proposed disturbance footprint on the ridge crests and slopes. These targeted area searches were conducted for a minimum of three hours each day for three days. No sightings of Partridge Pigeons were recorded during the most recent systematic or targeted surveys.

During the October 2016 survey, diurnal bird surveys were conducted at two systematic sites within this land unit, for 30 minutes over a period of five days (total = two ecologists x 2.5h of systematic surveys per site). In addition to the systematic bird surveys, targeted surveys for Partridge Pigeons were conducted daily. Targeted surveys were undertaken by listening for calls and walking through vegetation to try and flush birds from cover. No sightings of Partridge Pigeons were recorded during the systematic or targeted surveys.

Habitat requirements for the Partridge Pigeon are not fully understood, but at local scales an important component of their habitat requirements appears to be the presence of a structurally diverse understory comprised of native grasses. At broader scales, they require a mosaic of habitat types including dense grassy areas and open sparse areas (Fraser *et al.,* 2003). This mosaic of habitats is an important component of their habitat requirements, since they prefer to nest in dense grassy areas with structurally complex ground cover but will move to open areas to feed. Foraging birds favour sites that have been burned, which allows them to pick up fallen seed from the ground (Whitehead *et al.*, 2003).

In terms of the habitat within the broader Spring Hill study area, the unit mapped as low undulating hills would be potential suitable for the Partridge Pigeon for foraging. This unit is woodland to open woodland with a sparse understorey of medium grasses. The steep rocky areas of the ridge crests and slopes land unit would generally not be attractive to the species as foraging habitat. The dense, grassy areas and structurally complex ground cover preferred for nesting are not a feature of the ground-truthed habitat at within the proposed disturbance footprint. It is therefore unlikely this species would be significantly impacted by the proposed action. The most likely interaction between project activities and local populations of this species is through traffic movement on the haul road in the lower terrain.

Detailed information and results from both the October 2016 and July 2017 surveys can be found in the *Flora and Fauna Technical Report* in Appendix B.

Ghost Bat

The Ghost Bat is listed as vulnerable under the EPBC Act and is not listed under the TPWC Act. It is the largest microchiropteran bat in Australia and is Australia's only carnivorous bat. Since European settlement, Ghost Bats have contracted further northwards, with much of their arid zone distribution disappearing in the past few decades (Churchill & Helman, 1990; Molnar *et al.,* 1984). The species current range is discontinuous, with geographically distinct colonies in parts of Queensland, the NT and Western Australia. Churchill (2009) identifies that this species is common in the Top End, whereas elsewhere they occur only in small or widely scattered colonies.

Ghost Bats occupy a variety of habitats in northern Australia, including tropical savanna woodlands. During the daytime, they roost in caves, rock crevices and old mines. Roost sites used permanently are generally deep natural caves or disused mines with a relatively stable temperature (Threatened Species Scientific Committee [TSSC], 2016, and references therein). In the Top End, they prefer caves with microclimates of 27–29°C and 80% relative humidity (Churchill, 2009).

The *Approved Conservation Advice* for the Ghost Bat, from TSSC (2016), identifies the following attributes of roost habitats from a variety of cited sources. Ghost Bats move between a number of caves seasonally or as dictated by weather conditions and require a range of cave sites. Most breeding sites appear to require multiple entranced caves. Ghost Bats disperse widely when not breeding but concentrate in a relatively few roost sites when breeding.

Additional targeted microbat surveys were conducted in July 2017 and October 2018. A significant colony of Ghost Bats was both sighted and recorded via an echolocation recorder. Detailed results and proposed outcomes from this survey can be found within the *Targeted Microbat Survey Report* in Appendix D. The EPBC Act approval received from the Department of Agriculture, Water and the Environment includes a number of conditions related to the management of Ghost Bats and is provided in Appendix Q.

Northern Leaf-nosed Bat

The Northern Leaf-nosed Bat is not listed under the EPBC Act but is listed as vulnerable under the TPWC Act. It has been recorded in locations associated with high sandstone escarpment areas in the Top End. It also occurs in the eastern and western Kimberly, and in Queensland around the southern Gulf of Carpentaria (DLRM, 2012). In the NT, they roost in sandstone caves, boulder piles, road culverts and disused mines. They roost alone or in well-separated pairs in the less humid twilight zone, with a roost temperature of 27°C and 46% humidity (Churchill, 2009). Most caves are shallow overhangs or splits in sandstone cliffs (Churchill, 2009).

The ecology and status of this species is problematic as records in the Northern Territory are infrequent, and therefore it is poorly known (DLRM, 2012). Threats to this species are not described and there is no management program for this species in the NT (DLRM, 2012). Management strategies to minimise impacts to this species within the project area will be included as part of the *Threatened Fauna Species Management Plan* (Section 7.7).

2.3.6 Invasive species

The report by LES (2013) identified *Hyptis suaveolens* (Hyptis), *Pennisetum polystachyion* (Mission Grass), *Melinis repens* (Red Natal Grass) and *Passiflora foetida* (Stinking Passion Flower) were present in previously disturbed areas. This was supported by the more recent survey data whereby Hyptis and Stinking Passion Flower were commonly recorded in areas of existing disturbance within the project area.

2.4 Socio-economic Environment

2.4.1 Current Land Use

The region around Pine Creek and the Spring Hill ML has historically been a major centre for mining in the Northern Territory, with minerals mined including uranium, iron ore, silver, lead, zinc and gold. In more recent years, mining in the area has decreased significantly.

While the Spring Hill lease is located within the Mary River West pastoral lease, the land across the ML is extremely steep and unsuited to grazing. There is no pastoral activity occurring in the vicinity of the proposed project. The land in the vicinity of the proposed disturbance is native vegetation, albeit heavily disturbed by the fire regime of the region.

2.4.2 Identified Stakeholders and Consultation

Pine Creek has a population of approximately 400 people. There is a strong sense of core community in the town, but locals recognise the impacts mining has on both growing and shrinking the population. The closure of Territory Iron's Frances Creek iron ore mine in January 2016 had a negative impact on local business and the town's economy. At its peak, the mine employed 300 staff, with numbers dwindling to 30 by the time of closure. There is a good deal of public interest in potential new projects in the area given the economic implications for the town.

Stakeholders for the Spring Hill gold project are included in this report in Table 6. Outside of the town of Pine Creek, other stakeholders include local pastoralists, fossickers and tourism operators for the region. Given the relatively small scale of the project and the short-term nature of this first phase of mining, TM Gold has not yet become involved in local community affairs. However, TM Gold are working closely with local contractors and providers for staff accommodation and plant and equipment for the Spring Hill Project.

2.4.3 Workforce Description and Demography

The workforce for the proposed project will comprise a mining contractor retained to manage construction of the project site, excavation of waste rock and ore, management and operation of the crusher and loading and transporting ore to the Union Reefs plant. TM Gold will have a General Manager present at the site to oversee compliance with this MMP and any conditions included in the Authority for the project. The approximate number of staff at site at any one time will be 10.

Site hours of operation will be 7am – 6pm, seven days a week from construction through to project closure. The workforce will be accommodated locally at Pine Creek or Emerald Springs as appropriate, but individual members of the workforce may commute from farther afield at start and end of shift.

Table 6 Stakeholders for the Spring Hill Project

Name	Association	Email or address	Phone
Infrastructure; Public Transport, vehicles and Licencing and Road safety; Land planning, building and development, mapping and aerial photography	Northern Territory Department of Infrastructure, Planning and Logistics	Northern Territory Department of Infrastructure, Planning and Logistics GPO Box 2520 Darwin, NT 0801	08 8999 5511
Biosecurity, Animal Welfare, Fossicking, Fisheries, Laboratories, Mining, Research Farms and Uranium	Northern Territory Department of Primary Industry and Resources	info.dpir@nt.gov.au	08 8999 2006 or 08 8999 5511
Bushfires, Environment, Flora and Fauna, Rangelands, Geospatial Services, Water Resources Division	Northern Territory Department of Environment and Natural Resources	Northern Territory Department of Environment and Natural Resources Level 1, Goyder Centre 25 Chung Wah Terrace Palmerston NT 0830	08 8999 5511
Indigenous representation in regards to: Legal, Anthropology, Regional Development, Caring for Country, Minerals and Energy.	Northern Land Council	Head Office: 45 Mitchell Street Darwin, NT 0801 Katherine: Lot 5 / 29 Katherine Terrace Katherine, NT 0851	08 8920 5100
Public Housing, Remote Public Housing, Local Government and Community Development, Homelands, Affordable Housing.	Department of Housing and Community Development	Cas Com Centre Building 5 13 Scaturchio Street Casuarina NT 0810	08 8999 8814
Pine Creek and Katherine Local Government	Victoria Daly Shire, Pine Creek Council	29 Crawford Street Katherine East, NT 0850	08 8972 0777
Darwin Mining Club, Northern Territory Branch of the Minerals Council of Australia	Minerals Council of Australia – Northern Territory Division	28/90 Frances Bay Drive, Stuart Park NT 0820	08 8981 4486

Name	Association	Email or address	Phone
Gunter Gschwenter	Mary River West Station	gg1@gschwenter.com	03 9659 8400
John Boote	Mary River West Station	jboote@gschwenter.com	08 8978 2438
United Service Station	United Pine Creek	TBC	08 8976 1217
Ray Waldridge	Pine Creek Laboratory	ray_nal@bigpond.com	08 8976 1236
Sue Valentine	Shire Services Manager – retired	TBC	08 8976 1391
Pine Creek Police	PC Police	19 Railway Terrace, Pine Creek, NT, 0847	08 8976 1255
Bunny Fountain	Pine Creek FERG (Fire, Emergency and Rescue Group)	TBC	0409 331 430
Dave and Sandy	Pine Creek Railway Resort	driftfieldengg@bigpond.com	08 8976 1001
Geoff and Janette Crowhurst	Katherine Mining Services Association	Geoff@CrowhurstEngineering.net.au	08 8971 0717
Graham McMahon	NT Prospectors and Detectorists Association including the Northern Territory Prospecting Club	TBC	08 8985 2907

3 Statutory and Non-Statutory Requirements

3.1 Statutory Requirements

This MMP has been developed as required under the NT *Mining Management Act 2018* and has been collated in accordance with section 40 of the Act to ensure that the required information is provided to DPIR for assessment. The *Mining Management Act* is the key piece of legislation for the Spring Hill Project; however, other environmental legislation which is also applicable and with which TM Gold will be required to comply includes:

- *Mining Management Act* 2002 (NT)
- *Mineral Titles Act* 2016 (NT)
- *Bushfires Management Act* 2016 (NT)
- *Environment Protection Act 2019* (NT)
- *Environment Protection and Biodiversity Conservation Act* 1999 (Commonwealth)
- *Waste Management and Pollution Control Act* 2016 (NT)
- *Environmental Offences and Penalties Act* 2011 (NT)
- *Heritage Act* 2016 (NT)
- *Aboriginal Sacred Sites Act* 2013 (Sacred Sites Act) (NT)
- *Weeds Management Act* 2013 (NT)
- *Water Act* 2016 (NT)
- *Soil Conservation and Land Utilisation Act* 2016 (NT)
- *Territory Parks and Wildlife Conservation Act* 2014 (NT)
- *Work Health and Safety (National Uniform Legislation) Act* 2016 (NT)
- *Dangerous Goods Act* 2012 (NT)
- *Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act* 2016 (NT)

3.1.1 *Water Act 1992*

The exemption from the *Water Act* for mining purposes has recently been removed. A Water Extraction Licence will be obtained prior to use of any surface or ground water, and all conditions (including the requirements for reporting of meter readings) will be incorporated in the Water Management Plan.

3.1.2 Transitional Matters relating to the *Environment Protection Act 2019*

The introduction of the *Environment Protection Act 2019* triggered changes to the *Mining Management Act 2001* including the addition of 'Part 13 - Transitional matters for *Environment Protection Act* 2019'. As the Spring Hill project was determined not to require assessment by the NT EPA, the transitional matters do not apply.

3.2 Non-statutory Obligations

In addition to statutory obligations, there are also a number of non-statutory obligations relating to the Spring Hill Project.

TM Gold will work to ensure common interests in the project are satisfied and ensure concerns raised or complaints received are responded to and resolved. A number of non-government organisations will have an interest in the project, and Spring Hill will work with these organisations where required to ensure the best outcome from the project for all parties. These organisations include:

- Northern Land Council.
- Northern Territory Division of the Minerals Council of Australia.
- Fire and Emergency Response Groups.

3.3 Sacred, Archaeological and Heritage Sites

3.3.1 Sacred Sites

The Aboriginal Areas Protection Authority (AAPA) is an independent statutory authority established under the Northern Territory *Aboriginal Sacred Sites Act 2013 (Sacred Sites Act)*. The AAPA is responsible for the protection of Aboriginal sacred sites on land and sea across the NT. The NT *Sacred Sites Act* 2013 protects sites that are 'sacred and otherwise of significance in the Aboriginal Tradition'.

In early 2016, cultural heritage consultants EarthSea Pty Ltd surveyed the Spring Hill site and issued a report dated June 2016, which is included in Appendix E. The survey report highlights that no sacred sites have been recorded or identified within ML23812.

In 2008, the AAPA issued an Authority Certificate (C2008/159) for exploration activities on ML23812. TM Gold engaged EarthSea Pty Ltd to update the certificate in October 2017. The updated AAPA Authority Certificate (C2017/120) was issued on the 19th of December 2017. The Certificate detailed that no recorded sacred sites were within ML23812. The Certificate can be found within Appendix E.

Traditional owners have been engaged with throughout the development of Spring Hill and will be for the duration of works and post closure.

3.3.2 Heritage and Archaeological Sites

European and Chinese mining heritage

Studies undertaken to date (Mitchell, 1994, 1995 and EarthSea, 2016) have identified a number of historic features of Chinese and potentially European origin associated with 19th Century mining activities recorded within the area of interest, ML23812. The registered heritage features of Spring Hill form part of the Pine Creek Gold Mining Heritage Trail, which allows unrestricted vehicle/tourist access into these sites and inadvertent access into the area of the proposed project.

Mining was undertaken by both European and Chinese enterprises, which has been previously documented in detail (Mitchell, 1995). The historical mining has resulted in a number of heritage sites being identified in the surveys undertaken to date within the project proximity. These sites are:

- SHJ – Spring Hill Battery.
- SH2 – Rock retaining wall.
- SH4 – Stone forge.
- SH5 – Hilltop workings.

The 2016 report completed by EarthSea identified the SH5 area is of low to moderate archaeological importance due to impacts from exploration activities over many years but recommends TM Gold look to fence off better examples of Chinese cultural heritage. Further details on the management strategies for identified areas are provided in the *Cultural Heritage Survey Report completed* by EarthSea (2016), which is also found in Appendix E.

Aboriginal heritage

The Spring Hill area of interest heritage survey identified one small archaeological site of Aboriginal origin (lithic scatter) and five isolated stone artefacts on highly disturbed ground. This area has been designated as site SH3 by Mitchell (1995) and EarthSea (2016) and is mapped in Appendix A of this MMP. The site has been classified as having a low level of archaeological significance.

4 Operational Activities

4.1 Mining Activities

4.1.1 The Target Commodity

TM Gold is proposing to mine the Spring Hill Project in various stages, subject to economics and *permitting requirements for each stage*. Stage 1 plans to mine the oxide resource only at Spring Hill. The oxide resource at Spring Hill is at times up to 90 m deep from surface with an average depth of 10–30 m. The resource will be mined in three pits as follows:

- Hong Kong 1 (Depth 90m, 2.56ha)
- Hong Kong 3 (Depth 10m, 0.280ha)
- Main Pit 2 (Depth 30m, 0.34ha)

Future stages will examine either further open pit mining or underground mining to extract known and potential resources below the Stage 1 proposed pits.

4.1.2 Resource Estimates

During 2017, the current owners, TM Gold released a 2012 Joint Ore Reserves Committee (JORC) mineral resource estimate for Spring Hill (April 2016), the total mineral resource contains 359,000 ounces of gold at a 0.7g/t Au cut-off grade.

The Pre-Feasibility Study only considers the processing of oxide ore types, which is estimated at 130,000 ounces of gold at a grade of 1.95 g/t Au above a cut-off grade of 0. 7g/t.

It is however noted that the current mine plan, excluding resources located within the bat exclusion zone, is for the mining of approximately 102,000 ounces.

The global mineral resource at Spring Hill is located in five areas, being:

- Eastern Lode
- Middle Lode
- Main Lode
- Hong Kong Lode
- Macau Lode.

TM Gold are proposing to yield ore from the Hong Kong Lode and the Main Lode via access to Hong Kong Pit 1, Hong Kong Pit 3 and Main Pit 2.

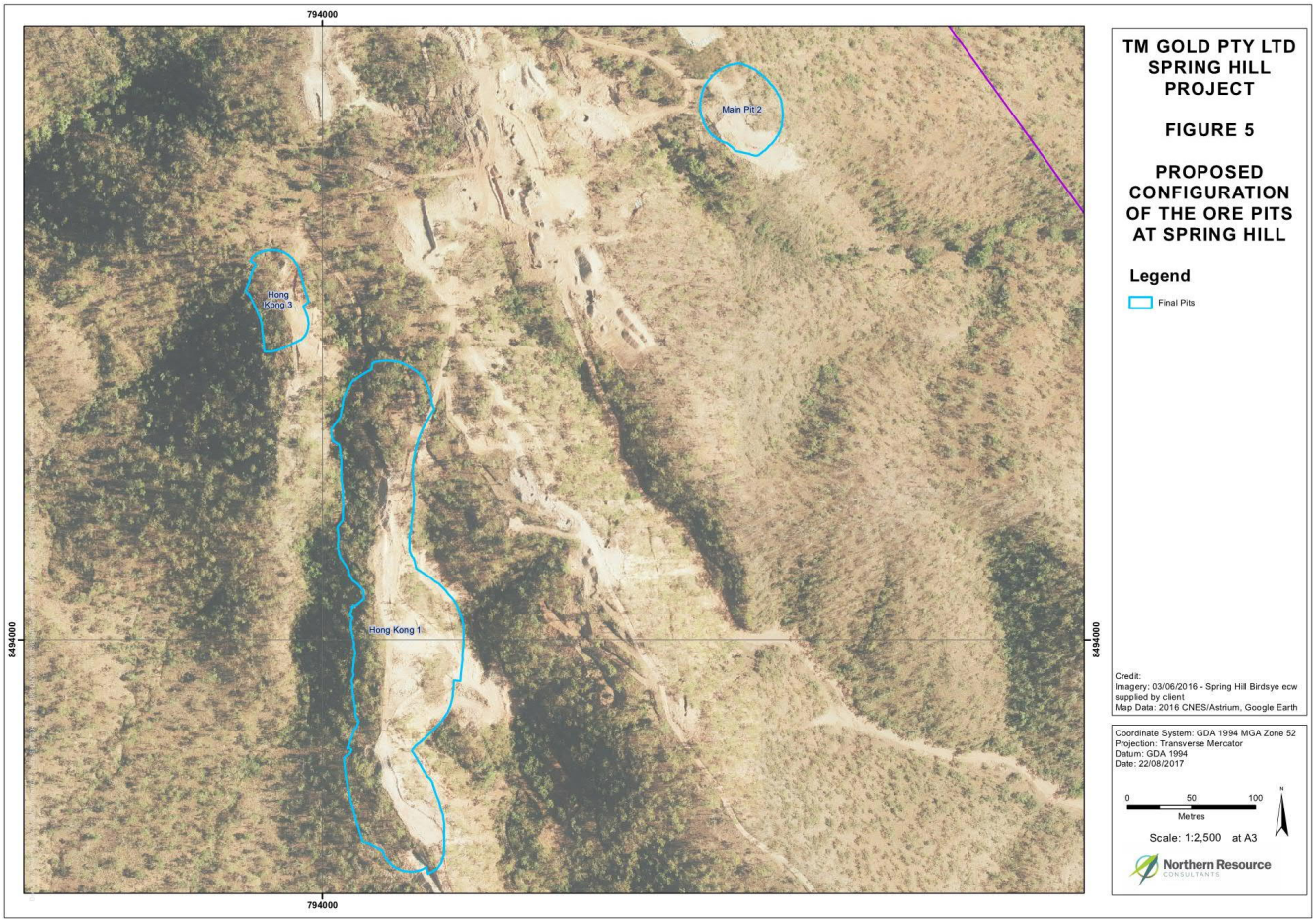


Figure 5 Proposed Configuration of the Ore Pits at Spring Hill (TM Gold, 2019)

4.1.3 Mining Methods

Mining at Spring Hill will be undertaken using a conventional open cut method of drilling, blasting and excavation using two hydraulic excavators and a fleet of six dump trucks.

TM Gold proposes to engage a contract mining company to undertake the mining activities. The mining schedule currently proposed involves eleven months for construction and excavation, with a further two or three months of processing, which will take place offsite at the Union Reefs Mill.

Controlled drilling and blasting will be required to enable excavation of the waste rock and access to the ore where it can no longer be mined economically via free dig operations. Initially there may be an amount of free dig material, but deeper material will require conventional drilling and blasting. Drilling and blasting of waste and ore would proceed on a continuous basis with blasts being fired every two to three days. TM Gold has undertaken a blasting study for the operation using an industry leading expert. The blast design provided by the expert has a low potential for transmission of vibration to the sensitive bat exclusion zone though the use of shallow drilling (<3.5m) and minimising the amount of emulsion needed to blast the rock.

4.1.4 Strip Ratio and Volumes – Waste and Ore

Cross sections of the proposed pits, Hong Kong 1, Hong Kong 3 and Main Pit 2, and the lithology encountered at various depths are shown below. The sections of each pit are detailed below in Figure 6 to Figure 11:

- Hong Kong 1 - Section A, B and C.
- Hong Kong 3 - Section D.
- Main Pit 2 - Section E.

The strip ratio and volumes of waste and ore are presented in Table 7. The life of mine strip ratio for the oxide open pit project is envisaged to be 3:31 waste to ore. The total waste volume to be moved is 1,363,287 bank cubic metres (bcm).

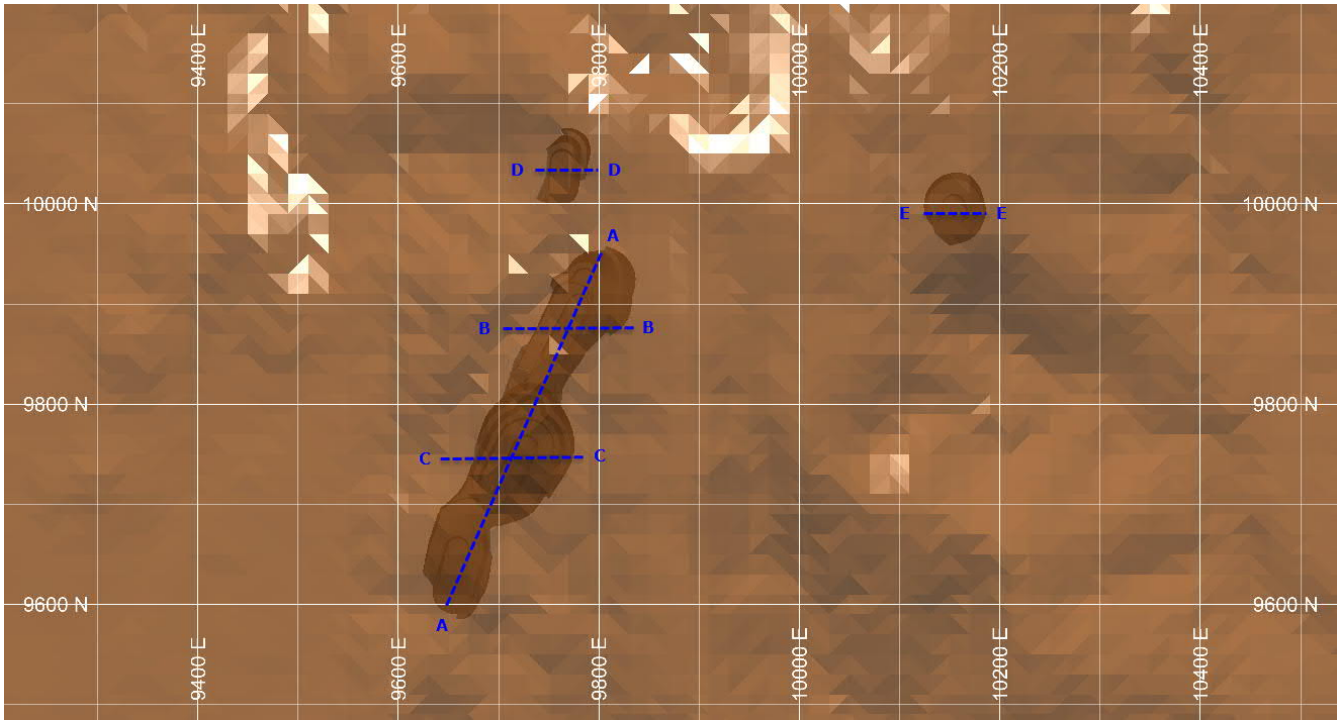


Figure 6 Cross Section Details of Proposed Pits, Location of Section

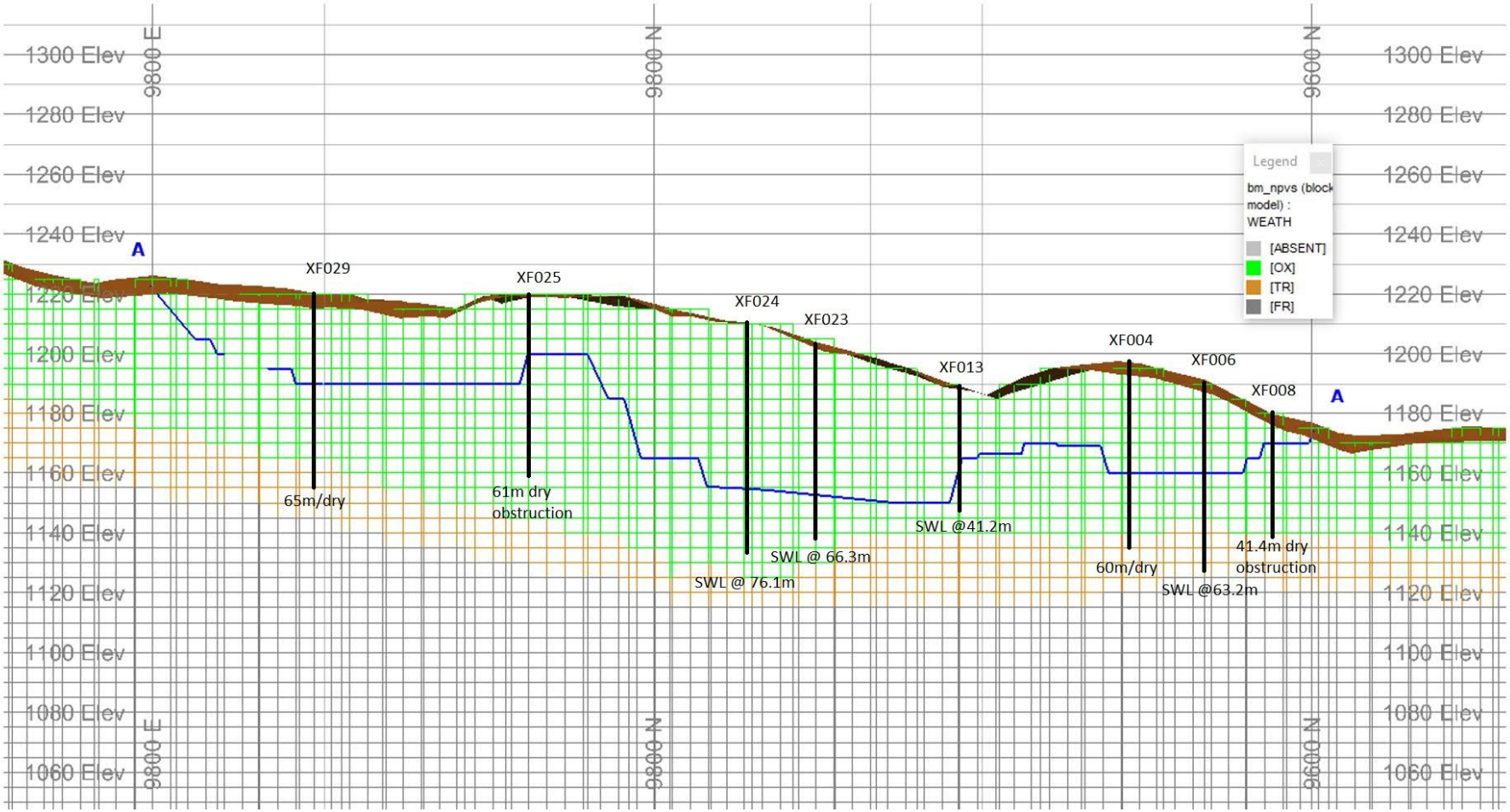


Figure 7 Cross Section A – Hong Kong Pit 1

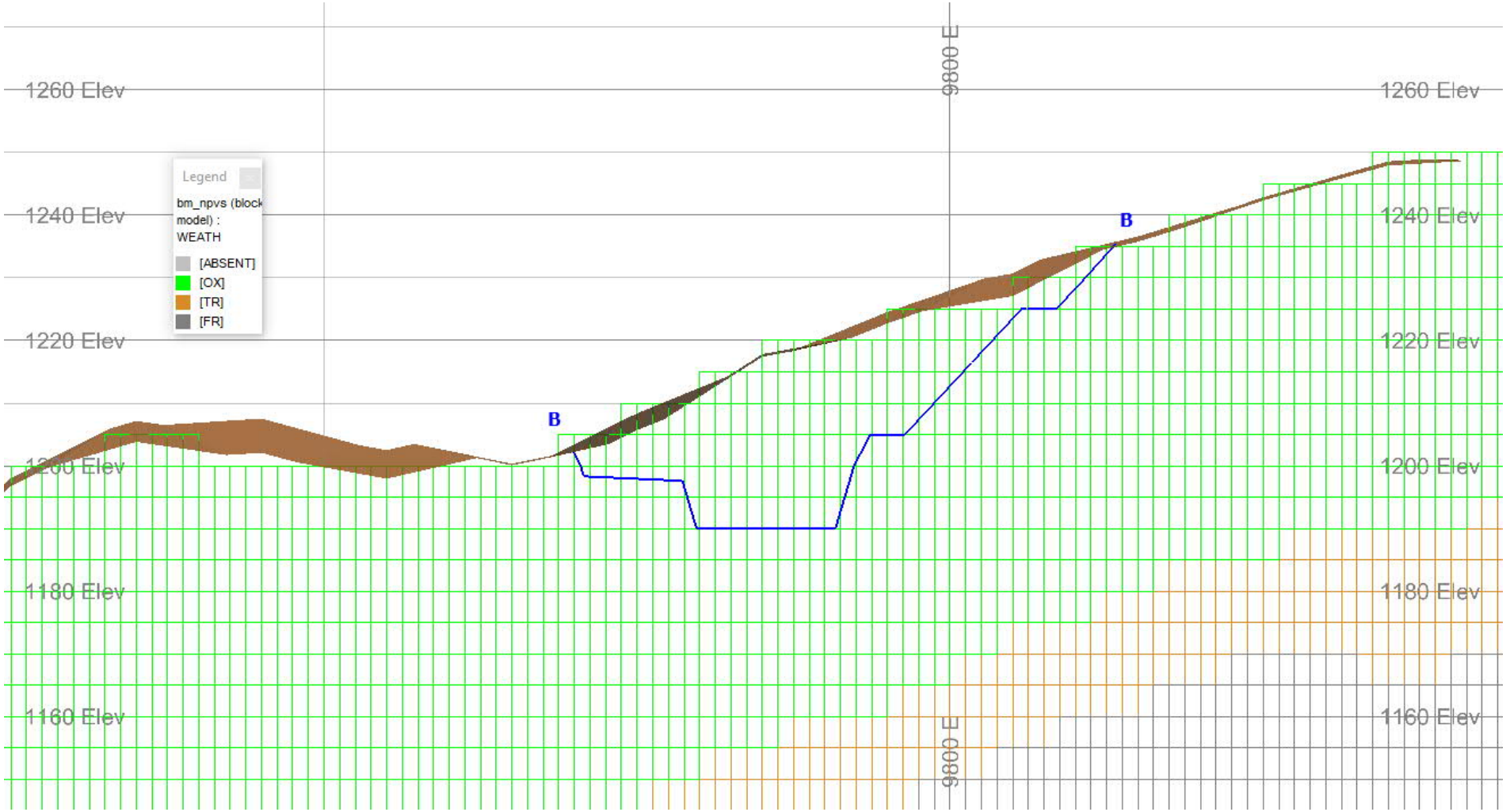


Figure 8 Cross Section B – Hong Kong Pit 1 - North

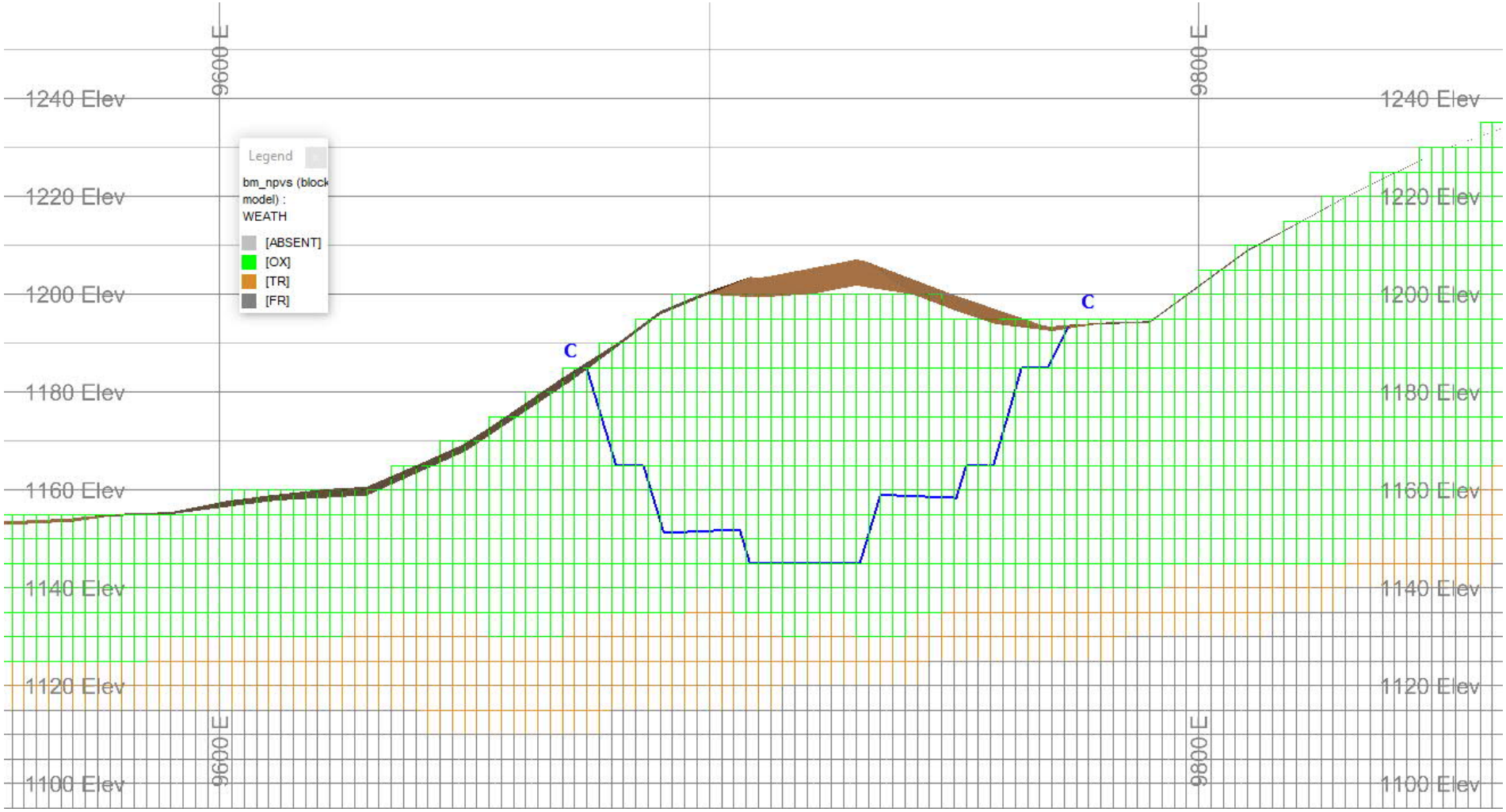


Figure 9 Cross Section C – Hong Kong Pit 1 - South

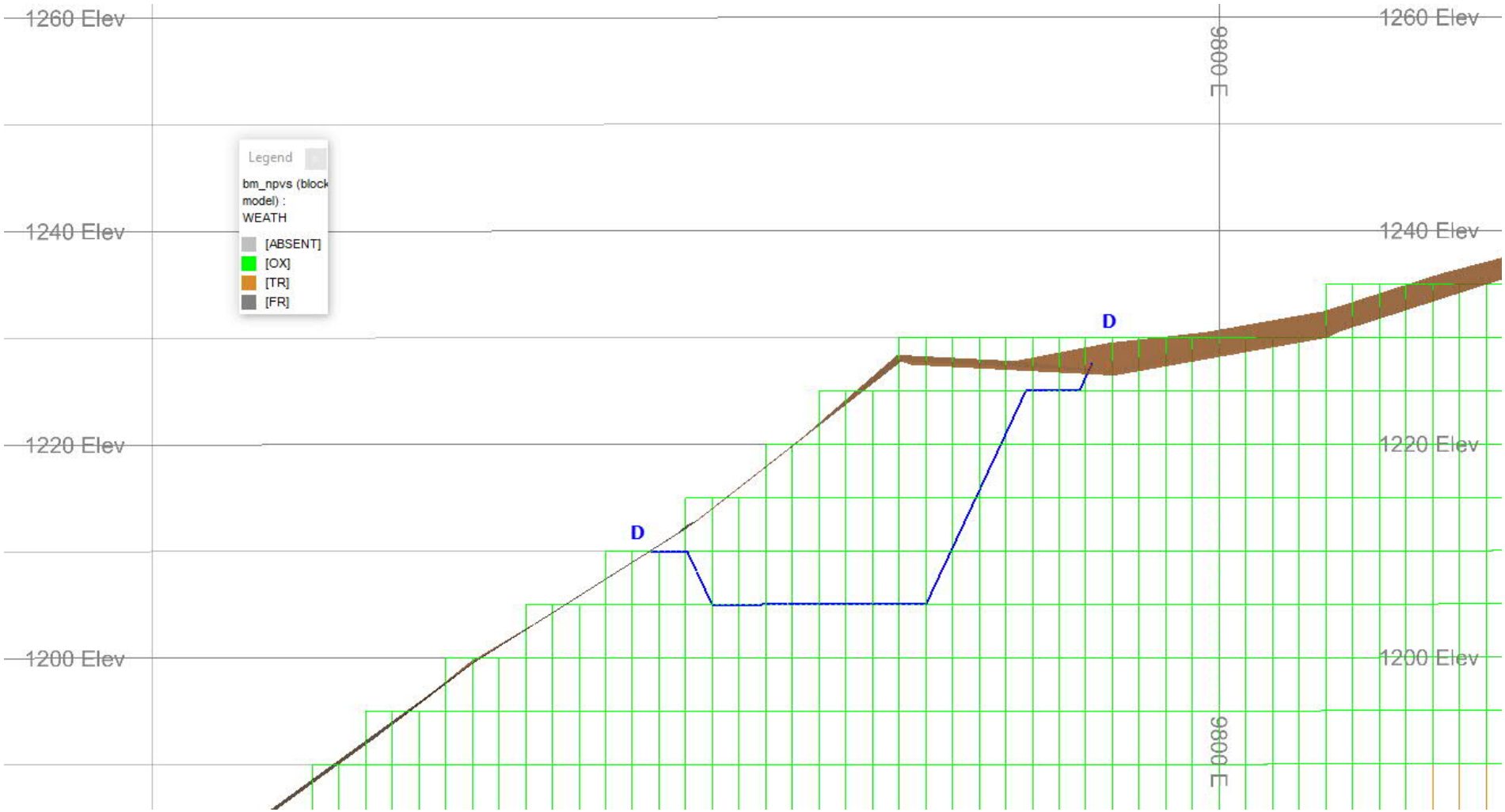


Figure 10 Cross Section D – Hong Kong Pit 3

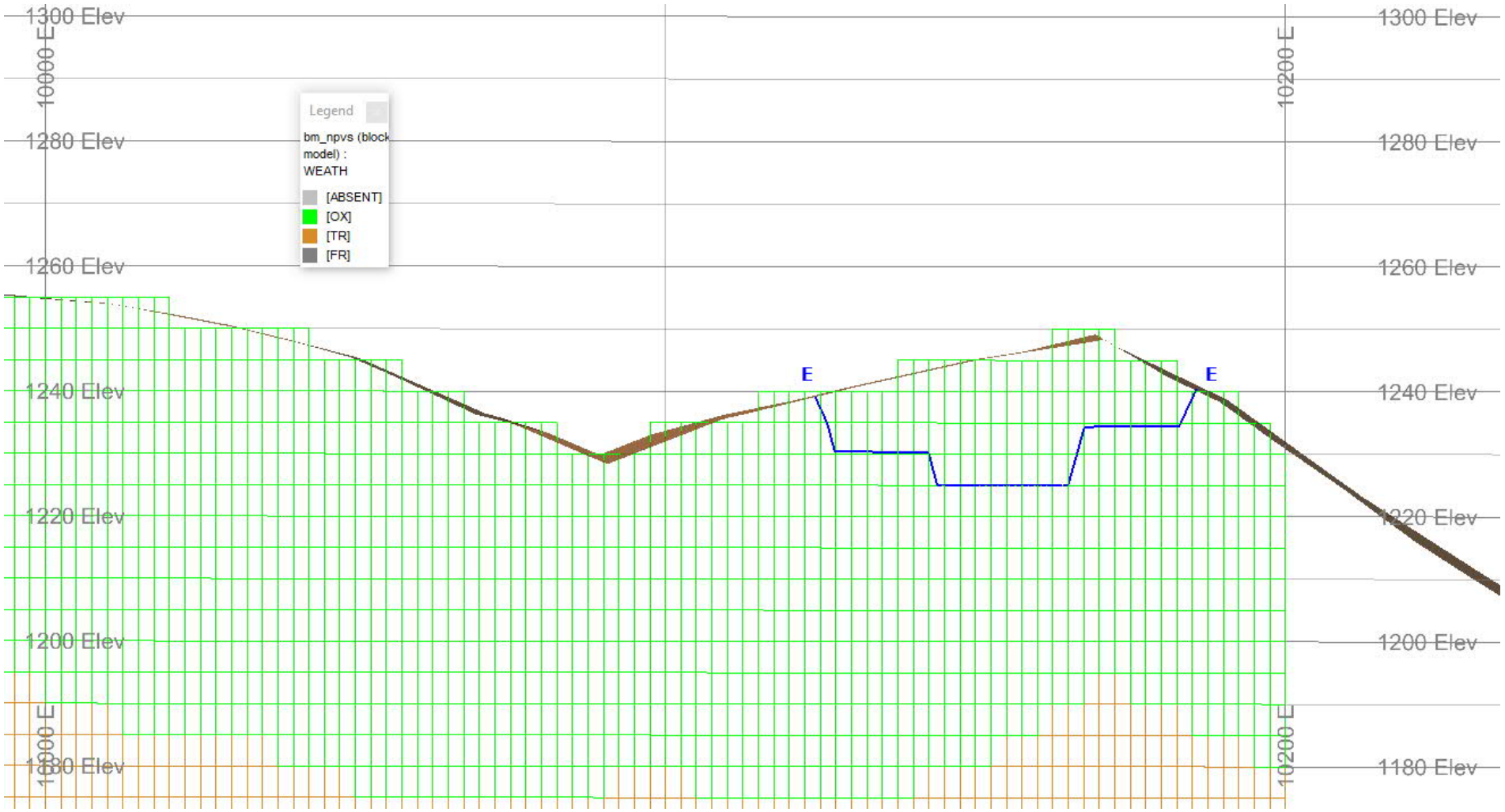


Figure 11 Cross Section E – Main Pit 2

Table 7 Planned Mining Schedule for the Spring Hill Gold Project (all measurements are in bcm)

Pit rock details			Strip ratio	Months													Totals
Pit Name	Ore/Waste	Rock Type		Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Total extracted
Hong Kong Pit 1	Ore	Oxide	(W:O) 3.3	-	29,071	36,082	26,934	30,344	32,112	30,227	36,186	38,997	36,256	38,301	39,367	17,007	390,884
	Ore	Transitional		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ore	Fresh		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Waste	Oxide		-	120,929	115,418	123,066	119,656	111,888	119,773	113,814	111,003	113,744	111,699	110,633	18,294	1,289,917
	Waste	Transitional		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Waste	Fresh		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hong Kong Pit 3	Ore	Oxide	(W:O) 2.4	13,124	-	-	-	-	-	-	-	-	-	-	-	-	13,124
	Ore	Transitional		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ore	Fresh		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Waste	Oxide		31,467	-	-	-	-	-	-	-	-	-	-	-	-	31,467
	Waste	Transitional		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Waste	Fresh		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Main Pit 2	Ore	Oxide	(W:O) 5.8	7,274	-	-	-	-	-	-	-	-	-	-	-	-	7,274
	Ore	Transitional		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ore	Fresh		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Waste	Oxide		41,903	-	-	-	-	-	-	-	-	-	-	-	-	41,903
	Waste	Transitional		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Waste	Fresh		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	Ore			20,398	29,071	36,082	26,934	30,344	32,112	30,227	36,186	38,997	36,256	38,301	39,367	17,007	411,282
	Waste			73,370	120,929	115,418	123,066	119,656	111,888	119,773	113,814	111,003	113,744	111,699	110,633	18,294	1,363,287

4.1.5 Stockpile Management

Ore material will be stockpiled on the ROM pad at the base of the WRD after excavation. At the ROM pad, material will be crushed using a portable track mounted jaw crusher. Ore will be loaded onto conventional double road trains and freighted off site. A haul road will be constructed, via the upgrade of existing extensive farm tracks, from the ROM pad to Spring Hill Road, where it will be transported to the Union Reefs' Carbon in Leach (CIL) processing plant for treatment. Tailings will be deposited into Union Reefs' existing tailings storage infrastructure.

Run off from the ROM pad will be controlled using a diversion bund and whoa boys at entrances, as shown on the site infrastructure map in Appendix A of this report; however, the exact specification of the drainage will need to be determined by a suitably qualified engineer prior to the commencement of operations.

Life of mine schedule

The life of mine schedule for the Spring Hill Project is quite straightforward, as the Project is short term and low impact. Mining activities will be operational and in line with the conservation requirements for threatened bat species.

Mining activities are scheduled to begin at Spring Hill in September 2019. The life of the mine will be 12 months with an additional 2-3 months of off-site processing, followed by closure and monitoring:

- Site preparation – 1 month
- Mining – 13 months
- Off-site processing – during mining and 2 – 3 months post-mining
- Rehabilitation and closure – 2 months
- Post-closure monitoring -10 years (as required for threatened bat management see Section 7.7.1).

Blasting on site will be conducted in line with the report *Prediction of Blast-Induced Ground Vibration and Air Overpressure* found in Appendix F, whereby vibration thresholds will be controlled to meet the requirements of the *Threatened Bat Monitoring Plan*, found within Appendix G.

The proposed mining schedule has been summarised and is included in Table 8. The schedule for movement of material is included in this report as Table 7.

Table 8 Proposed Schedule of Project Operations at the Spring Hill Project

Activity	Details	Timeframe
Site Preparation		
Vegetation removal	Any vegetation that needs to be cleared for the purposes of mining at the site, where practicable will be stockpiled for use in later rehabilitation. Clearing will be kept to the minimum required to conduct the mining project.	Month 1 May 2021
Removal and stockpiling of topsoil	Where topsoil is available, the top 200mm will be removed using scrapers or other efficient earth moving machinery and placed in low stockpiles for later re-use.	
Infrastructure construction	The required infrastructure including access tracks and roads, laydown yard, workshops, ablutions, ROM pad and explosives	

Activity	Details	Timeframe
	magazine will be constructed – buildings and structures will be demountable.	
Mining		
Material extraction	Removal and stockpiling of waste within the designated WRD during operations. Extraction will be carried out using two excavators and a fleet of trucks. Drilling and blasting will generally be required to fracture the ore and waste rock sufficiently to allow excavation. Ore will be loaded onto haulage trucks and taken to a ROM stockpile. The proposed disturbance footprints and depths of the three pits are as follows: Hong Kong Pit 1: Depth 90m, 2.70 ha Hong Kong Pit 3: Depth 10m, 0.27 ha Main Pit 2: Depth 30m, 0.34 ha The overall disturbance footprint for the project is ~17ha. Blasting on site will be conducted in line with the report *Prediction of Blast-Induced Ground Vibration and Air Overpressure* found in Appendix F, whereby vibration thresholds will be controlled to meet the requirements of the *Threatened Bat Monitoring Plan*, found within Appendix G.	Hong Kong Pit 3 Month 1 Main Pit Month 1 Hong Kong Pit 1 Month 2 to Month 13
Processing	Processing will continue into months 2 to 15 of the project, but this will take place offsite at the Union Reefs Mill.	Months 2–15 June 2021 – August 2022
Rehabilitation		
Site rehabilitation	Commence mine site rehabilitation. Rehabilitation of the following domains will occur on site: Domain 1: Associated infrastructure, including; demountable site office and ablutions, ROM pad, sediment basins and mobile crusher. Domain 2: WRD. Domain 3: Roads and access tracks with ESC infrastructure. Domain 4: Three open cut pits. Details regarding how the above domains will be rehabilitated is shown in the *Conceptual Mine Closure Plan* in Appendix H	Months 14–15 July to August 2022
Closure and decommissioning	All buildings associated with the mine will be demountable, requiring minimal concrete footings. At the end of mine life, all mobile infrastructure will be demobilised, and the offices and workshop areas rehabilitated.	Months 14–15 July to August 2022

Water requirements

The current water requirement for the Spring Hill operation is relatively minimal. There is no proposed processing of material on site and subsequently no operational water requirements other than for dust suppression and potable water for the site offices and ablution facilities.

The water balance modelling results (Appendix I) indicate that during the proposed operational period (dry season), water management requirements within the site are likely to be minimal; with no accumulation of water within the sediment dams or pits anticipated. Wet season rainfall may produce a temporal positive water balance, i.e. depending on rainfall intensities the pits may temporarily contain some water. However, any pit water is expected to dissipate towards the groundwater table. Overland flow towards the pits will be limited due to their positioning. Where necessary, bunding and diversion channels will reduce surface water inflow.

Since ore processing will be off-site, the only operational need for water will be dust suppression which is estimated to require approximately 170 m^3 per day. It is anticipated that this water can be sourced from the raw water tank and/or local bores. To reduce the amount of water required for dust suppression, a product in the form of a dust polymer or molasses will be utilised with water, which will in turn reduce evaporation and the amount of water required for dust suppression.

A detailed water balance for the project is provided in Appendix I.

Currently water extraction operations for mining activities in the Northern Territory are exempt from the requirement of a water extraction licence. TM Gold acknowledge that, in the future, mining operations will need a licence to extract water within a mining lease. If required in the future, TM Gold will apply for a water extraction licence once available from the NT Government.

Dewatering requirements

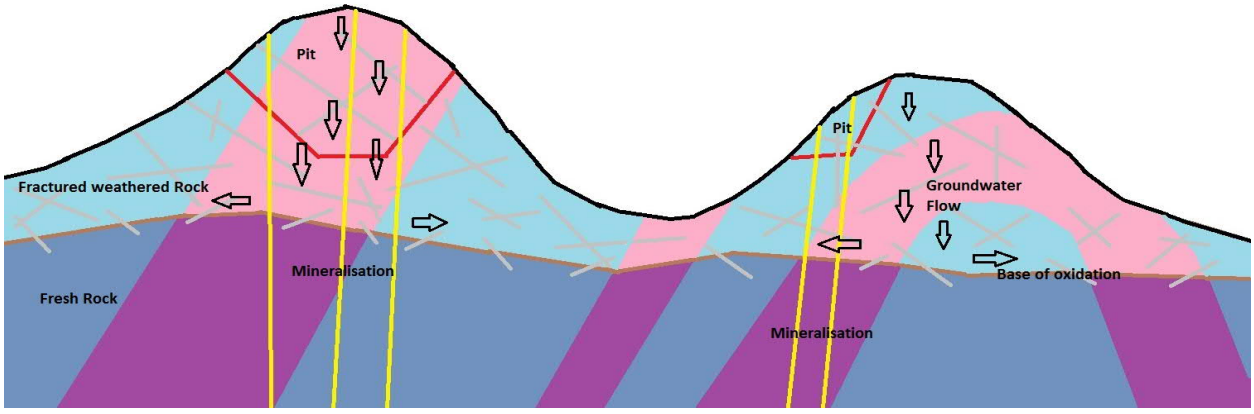
The depth of the water table has been noted to increase to the north of the Hong Kong Central prospect with depths of between 45 m and 75 m encountered to the south of easting 794049 and northing 8494089[1]. In this area, the base of complete oxidation varies between 27 and 60 m to the south easting 794052 and northing 8493907 to between 60 and 107 m north of easting 794052 and northing 8493907. A depth to water of 15 m was measured in a drill hole in a gully at easting 794139 and northing 8493818. Further north of easting 794049 and northing 8494089. Depths of >100 m were encountered. Two maps, one showing detailed site geology and one showing determined groundwater levels on site can be found within Appendix A.

Groundwater flow at Spring Hill is fracture controlled, which in higher topographic relief areas naturally results in dewatering of ridges and peaks. Based on the available information, the three proposed pits at Spring Hill will not intersect the local groundwater table, therefore the pits will generally not need dewatering. Wet season rainfall will result in temporary seepage from the immediate vicinity of the pits via the pit walls. However, the groundwater catchments for these pits consist of the tops and sides of ridges, hence, these catchments are very limited in size. Overall the seasonal percolation into the pits will be dwarfed by the seasonal influx of direct rainfall (see *Groundwater Technical Report* Appendix J).

Given the known water table in the northern part of Hong Kong 1 Pit exceed the maximum depth proposed, the potential for groundwater ingress through the northern pit walls is not expected during the oxide open pit mining phase (Figure 12). Contrary to this, as the base of the southern portion of the proposed Hong Kong 1 Pit will be below the previously encountered water table depths in this area, there is a possibility that groundwater will be intercepted during pit excavation. At the Hong Kong Pit's maximum depth of 94 m, seepage faces with a height of between 20 and 50 m may be encountered. However, since the exploration holes were measured dry there is no reason to believe that such perched aquifers exist beyond the nature of small temporarily filled fractures following rainfall events (see Section 8.2).

[1] All locations have been determined in GDA 94 MGA Zone 52.

Figure 12 Conceptual hydrogeological model showing host rock characteristics, pit positions and groundwater movement



Further details on management strategies are included in the *Groundwater Technical Report* included as Appendix J of this MMP.

4.2 Mine Design

4.2.1 Infrastructure Layout

The infrastructure for the mine will include three open cut pits, a single WRD based on a gully fill foundation, a ROM pad, a sediment basin downgradient of the ROM pad, erosion and sediment control infrastructure and bunding, demountable buildings for offices and workshops, ablution blocks, explosives magazine, site access and haul roads.

Fuel on site will be stored and dispensed by using a self-bunded tank and automated delivery system. Power will be supplied by a generator.

The proposed site infrastructure is presented in a map included in Appendix A of this report.

There will be no onsite accommodation, with workers accommodated at nearby Pine Creek and Emerald Springs. There will be no tailings dams, with tailings disposal utilising existing tailings infrastructure at Union Reefs Mill near Pine Creek.

4.2.2 Waste Rock Dump

A waste rock dump design suitable for long term stability, including slopes and cover design, has been prepared for the Spring Hill Project based on a site investigation to identify likely volume and quality of capping material under the potential WRD footprint (Appendix K).

Modelling indicates that a cover of 1 m will limit infiltration and that low to moderate permeability is achieved by a moderate level of compaction. The outcomes of the modelling will be adopted. Therefore, based on the final landform and a 1 m cover, the volume required to form the cover is 150,000 m^3.

The field investigation indicates that between 50% and 65% of this material is available from beneath the WRD footprint. TM Gold will source the remaining materials from stripping of the open pits and development of a borrow area just south of the WRD footprint, where similar materials are available. If materials are not available on site, then importation of clayey gravel/gravelly clay or similar performing material will be required. The cover material will be stripped and stored outside the WRD footprint prior to commencement of waste rock dumping.

It should be noted modelling has been based on assumed parameters, using available laboratory testing and published data. Once mining operations have commenced the following forward scope of work will be required to fully inform the final cover design:

- Typical particle size distribution and natural moisture content. This will inform the likely permeability of the WRD as a whole.
- Typical shear strength parameters. This will be required for operational development of the WRD.
- Actual portion of PAF material. This will then require careful scheduling to ensure it can be safely stockpiled and encapsulated during operation and closure.

The timing for the schedule of works outlined in the above scope will be as follows:

- Detailed particle size distribution, natural moisture content, shear strength and PAF/NAF parameters of the wasterock and cover materials will commence prior to the stripping of the cover sequence and will be ongoing until the conclusion of the mining phase. Bulk samples of the different strata types will be collected from drill cores and test pits.

4.2.3 Mining Reserves and Geology

The JORC (2012) mineral resource estimate for Spring Hill was delivered in April 2016. The total mineral resource contained 359,000 ounces of gold at a 0.7 g/t Au cut-off grade.

The Pre-Feasibility Study only considers the processing of oxide ore types which is estimated at 130,000 ounces of gold at a grade of 1.95 g/t Au above a cut-off grade of 0.7 g/t. It is however noted that the current mine plan, excluding resources located within the bat exclusion zone, is for the mining of approximately 102,000 ounces.

The geology of the mine site is described in detail in the *Waste Rock Characterisation Technical Report* included as Appendix L of this MMP.

4.3 Processing Activities

There are no processing activities proposed for the Spring Hill Project. The Project involves the mining of shallow oxide material, crushing on site and transporting ore material offsite to the Union Reefs' Mill for processing. Subsequently, there will be no water requirements for processing at site, no generation of tailings waste material and no requirement for storage of tailings.

The operation will not require a process or mine water dam, with the water infrastructure limited to a sediment capture basin located off the ROM pad.

4.4 Exploration Activities

Extensive exploration activities have been undertaken within the Spring Hill Project area. The site has been subject to land disturbance from exploration activities over a number of years, including the development of access tracks, exploration gridlines and drill pads. Disturbance due to exploration activities is focused around the locations of the proposed open cut pits and the WRD and will be rehabilitated as part of the rehabilitation process for those landforms.

4.5 Transportation Activities

The site is located on the corner of Spring Hill Road and Mount Wells Road, which is directly off the Stuart Highway, a major transportation route through the Northern Territory which extends from the border with South Australia to Darwin. The main traffic through the area as a result of mining activity would be the movements of employees to and from the site from Pine Creek, Katherine and Darwin and the movements of ore to the Union Reefs' Mill for processing, which is located 13 km southeast of the Spring Hill site. As detailed in section 3 above, there will be no processing activities proposed for the Spring Hill Project.

TM Gold will process its ore at the Union Reefs' Mill and that five type 1 road trains (two semi-trailers joined by convertor dolly) will be used to haul approximately 1,500 tonnes per day (SJ Traffic Consulting, 2017). The Spring Hill Road will be used, access roads to the site are detailed in Appendix A.

Traffic management risks and mitigation for the site have been described in detail within the Traffic Management Plan and Traffic Impact Statement (Appendix M). The Traffic Management Plan was created by ACE Traffic Control on 9 March 2017 and the Traffic Impact Statement was conducted by SI Traffic Consulting in April 2017 and was provided to examine the potential impacts on the intersection of Stuart Highway/Spring Hill Road (SJ Traffic Consulting, 2017). All transportation to and from site will be conducted in accordance with the *Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act* and associated Regulations.

Both the Traffic Impact Statement and the Traffic Management Plan conclude that the impact to the 'adjoining road networks is minimal, and no congestion is expected' (Ace Traffic Control, 2017) and 'the increase in traffic activity as a consequence of the development proposal is marginal and will not have any adverse impact upon the performance of the surrounding road network' (SJ Traffic Consulting, 2017). The Traffic Management Plan and the Traffic Impact Statement for the site is described in detail within Appendix M.

5 Environmental Management

5.1 Organisational Structure of Environmental Responsibility

The environmental management responsibilities at the Spring Hill Project will fall within the following organisational structure:

- An Environmental Management role will be recruited for, with responsibilities as outlined in Table 9. The Environmental Manager will be answerable to the Health, Safety and Environment (HSE) Officer.
- The HSE Officer will have environmental responsibilities as outlined in Table 9 and be answerable to the mine manager.

Specific areas of responsibility are described in Table 9.

Table 9 Environmental Management Responsibilities at Spring Hill

Personnel	Responsibility
Health, Safety and Environment (HSE) Officer	Compliance with Environmental Management Plans Achieving the commitments outlined in the MMP Ensuring the environmental outcomes in the MMP are achieved Responsible for adhering to the Health and Safety obligations on site as set out in *Work Health and Safety (National Uniform Legislation) Act* and associated regulations.
Environmental Manager	Environmental compliance tasks Monthly environmental reports Executing pre-closure planning tasks for environmental remediation in good time Implementation of Environmental Management Plans Environmental incident response

5.2 Workplace Health and safety

In addition to their environmental responsibility, the HSE Officer is responsible for compliance to the *Work Health and Safety (National Uniform Legislation) Act* and associated regulations. For the duration of operations including construction, the HSE Officer must ensure that the health and safety of all staff and visitors is not at risk.

Prior to the commencement of mining works at Spring Hill, the HSE Officer and the General Manager will provide the regulator, NT WorkSafe, a Risk Management Plan (RMP), set out as per the regulations. For the duration of mining at Spring Hill, the RMP will be subject to review and adjustment if any new health or safety risks are identified or if there is a change to the TM Gold control measures for managing risks to health and safety.

The HSE officer is also responsible for reporting of any workplace health and safety incidents immediately to NT WorkSafe.

5.3 Environment Policy

TM Gold is committed to continuous improvement in environmental performance throughout the life of the Spring Hill Project. This includes investigating and implementing innovative solutions to challenges presented by the site's topography. The aim of the Environment Policy is to protect and conserve the environment at the Spring Hill mine site by minimising the risk of negative environmental impacts. TM Gold will strive to enhance the existing environment wherever possible. A signed, dated copy of the TM Gold Environment Policy is included in Appendix N of this MMP.

5.4 Environmental Commitments

5.4.1 Commitments Contained in this MMP

The environmental commitments contained in this MMP are split into environmental domains detailed in Table 10.

5.4.2 Establishing Environmental Commitments

To identify environmental commitments appropriate to the Spring Hill Project, TM Gold conducted an environmental risk assessment for the activities inherent in the Project. That risk assessment process is included in Section 6.2. The commitments relate directly to the environmental risks assessed for the project. Where a risk is identified, management and mitigation strategies are detailed in various Environmental Management Plans in Section 7. The environmental commitments are a step further in the risk assessment process – a commitment to not allow the identified impact take place.

Table 10 Environmental Commitments of the Spring Hill Gold Project

Commitment reference	Environmental management issue	Commitment	Due date	Section in MMP	Performance criteria
SH_01	Vegetation clearing adversely impacts fauna (including threatened fauna) at the site.	Adverse impacts to fauna at Spring Hill caused by vegetation clearing will be minimised through the implementation of a Land Clearance Procedure formulated in accordance with the NT Government *Land Clearing Guidelines* (DENR 2019).	Ongoing implementation of the Land Clearing Procedure (Section 7.4)	7.4	All clearing undertaken with appropriate permits. All clearing supervised by a spotter/catcher. No fauna injuries/deaths recorded.
SH_02	Vehicle strikes kill or injure fauna (including threatened fauna) at the site.	TM Gold will implement speed limits on haul roads, site roads and access tracks and restrict traffic travelling off main site roads to avoid collision with fauna. Staff will be educated to avoid risk of collision and measures to be taken should an incident occur. Speed limit signs will be installed and road speed restrictions implemented. Speed limit signs in place.	Speed limits will be set when roads are constructed and maintained on an ongoing basis through the life of the project.	7.6	Site will maintain a record of speed limit infringements and penalties. No vehicle strikes recorded.
SH_03	Soil disturbance and traffic movement may result in the potential for increased occurrence of weeds on site.	TM Gold will implement the weed and pest management plan in accordance with the MMP, which includes ensuring vehicles and equipment are clean prior to accessing the site and ensuring that weed eradication programs are undertaken if required.	Ongoing during the life of the operations.	7.7	Weed and pest management plan implemented. Existing weed infestations controlled/eradicated. No new weed species recorded.

Commitment reference	Environmental management issue	Commitment	Due date	Section in MMP	Performance criteria
SH_04	Adverse effects on local/regional air quality as a result of airborne dust associated with the proposed project.	TM Gold will implement speed limits on haul roads, site roads and access tracks and run water carts during operations to reduce the intensity of vehicle-generated dust. Vehicles and machinery will be maintained as per the manufacturer's instructions and maintenance logs will be available for inspection if required.	Ongoing during the life of operations.	7.9	No environmental nuisance complaints received by TM Gold in relation to dust or airborne contaminants.
SH_05	Contaminated or sediment laden runoff from ROM pad or the WRD to the receiving environment. Potential to decrease water quality and impact on aquatic flora and fauna.	TM Gold will install erosion and sediment control infrastructure in accordance with the *Erosion and Sediment Control Plan*, which is included as Appendix O of this MMP. TM Gold will construct a sediment basin near the ROM pad to capture all potentially contaminated or sediment-laden stormwater from the ROM pad. TM Gold will construct a sediment basin at the western toe of the valley-fill WRD to ensure capture of sediment-laden stormwater from the outer batters of the WRD.	The ROM Sediment Basin and Erosion and Sediment Control (ESC) infrastructure must be implemented prior to the commencement of reprocessing operations.	7.2 Appendix O	ROM sediment basin and WRD sediment basin will be constructed promptly during the construction phase. Stormwater runoff from the ROM and office areas will be captured in the ROM sediment basin. Stormwater runoff from the outer batters of the WRD will be captured in the WRD sediment basin.

Commitment reference	Environmental management issue	Commitment	Due date	Section in MMP	Performance criteria
SH_06	Access to the site by tourists or members of the public following the established Pine Creek Gold Mining Heritage Trail.	All reasonable measures to restrict public or tourist access to the site will be implemented, including fencing, exclusion earthworks, and signposts at site and signage at local hostelries.	From the outset of construction up to project closure.	7.6	No unauthorised access.
SH_07	Disturbance to aboriginal or European/ Chinese sites of archaeological significance. (No registered or recorded sacred sites on the ML).	TM Gold will hold appropriate AAPA certificate(s) for the work area. Potential impacts to sites of archaeological significance will be subject to a cultural heritage survey before commencement.	Before commencement of operations and during operations.	3.2.1	No disturbance to significant archaeological/heritage sites.
SH_08	Impact to the receiving environment from hydrocarbon/chemical spills.	TM Gold will ensure that all hydrocarbons and chemicals are stored in appropriately bunded areas as per Australian and State Standards and Regulations and implement a spill response procedure to ensure immediate clean-up of spills on site.	Before commencement of operations and during operations.	71	All chemicals stored in an appropriately sized bund (110% of largest container) or self-bunded. No release of hydrocarbon or other chemicals.

Commitment reference	Environmental management issue	Commitment	Due date	Section in MMP	Performance criteria
SH_09	Impacts to local groundwater posed by construction of the pits.	TM Gold will ensure that impacts to groundwater are minimised long term for both the duration of operations and post mine closure until such a time as they relinquish the mining lease. Any inflow of groundwater to the Hong Kong pit will be pumped out to storage in one of the shallower, benign pits, or the sediment dams at site.	During construction and operations.	8.2	No impacts to groundwater quality.
SH_10	Impacts of mining on bats from frequency and intensity of blasting	A specific *Threatened Bat Monitoring Plan* (Appendix G) for Spring Hill has been developed and must be implemented. Refer to conditions of EPBC approval.	During construction, operations and closure.	7.7 and Appendix G	Performance criteria are listed in Appendix G

5.5 Recommendations Resulting from Formal Environmental Assessment

The Spring Hill project was referred to the Commonwealth Department of the Environment and Energy (DEE) on 15 February 2018, for assessment pursuant to the E*nvironment Protection and Biodiversity Conservation Act 199*9 (EPBC Act).

On 23 May 2018, a delegate for the Minister for the Environment and Energy determined that the proposal was a controlled action, due to the likelihood that the action would have a significant impact on listed threatened species and communities protected under the EPBC Act.

On 18 July 2018, it was determined that the proposed action should be assessed by preliminary documentation, details of which were provided on 15 August 2018. This preliminary documentation was requested so that the DEE could adequately assess the nature, scale and severity of likely impacts of the proposed action on matters of national environmental significance (MNES), and determine the adequacy of avoidance, mitigation and compensatory measures.

Appendix P contains the information developed to provide updated and additional information requested by DEE to satisfy the requirement specified in the letter 'Request for Additional Information - Preliminary Documentation: Spring Hill Gold Project, 200km SE of Darwin, NT (2018/8163)'.

Appendix Q contains the final approval received from the Department of Agriculture, Water and the Environment on 19 March 2021.

5.6 Environmental Training and Education

5.6.1 Site Inductions

All personnel, staff and contractors, working at Spring Hill will be required to participate in a site-specific induction before beginning their employment. Workplace health and safety, occupational hazards and safe workplace matters, social and community issues and cultural heritage matters associated with the project will be included in the induction.

Environmental awareness requirements will include weed hygiene, incident reporting requirements, details on identifying the Partridge Pigeon and reporting sightings, and the presence of threatened bat species including the Ghost Bat. Workers will be advised that access to the buffer zone and stopes will be prohibited to unauthorised personnel. A record of threatened species sightings within the project area will be maintained by the on-site environmental representative.

The General Manager will be responsible for commissioning ongoing training and meetings to review work practices. The Environmental Advisor will coordinate with the General Manager when matters arise that require an amendment to the site induction or further training for existing staff via a toolbox session.

Additional training that may be required on site will be weed identification for environmental staff and emergency response training for select members of staff.

5.6.2 Communicating the MMP to Employees and Contractors

The conditions of operation described in this MMP, the management strategy and details of the management plans will be communicated to staff and contractors in a number of ways.

The General Manager will be ultimately responsible for compliance with this MMP and the conditions of the Authority for the project. It will be the General Manager's responsibility to read and understand the management plans and environmental commitments within this MMP.

The management approach for each phase of the project will be communicated to staff and contractors through daily prestart meetings and, where necessary, using toolbox training. In a situation where a routine or targeted inspection reveals processes are not being conducted in a way to facilitate compliance with the MMP or conditions of the Authority, specific training will be delivered to the staff or contractors in question.

5.6.3 Environmental Emergency Preparedness and Response

TM Gold has developed an Emergency Preparedness and Response Plan (EPRP). An environmental incident is defined as any sudden or unexpected event that results in a negative environmental impact. All environmental incidents/emergencies such as major pollution incidents will be reported to the NT Environment Protection Authority (NT EPA) and the DPIR. TM Gold will contact both of these government departments in the event of an emergency incident. The site General Manager will be responsible for delegating tasks to respond to the incident and prevent/mitigate environmental harm. In general, the EPRP will endeavour to ensure:

- A safe environment for all employees, contractors, visitors and neighbours.
- That all activities are conducted in an environmentally responsible manner consistent with environmental regulations, guidelines and best practice.
- The identification and management of all significant environmental risks.
- That the response to emergencies is predicted primarily on the preservation of human life and the safety of emergency response personnel.
- The containment of emergencies and their effects within facility boundaries.
- Cooperation with external emergency response organisations.
- A safe return to normal operations.

6 Implementation, Monitoring and Review

6.1 Identification of Environmental Aspects and Impacts

The proposed Spring Hill Project is an open pit oxide project, excavating rock that has been characterised as largely benign, with no onsite processing. These activities have a relatively low environmental impact.

Specific risks posed by the proposed project activities are identified in Section 6.2. These risks and the associated controls have inspired the environmental commitments in Table 10.

6.2 Risk Assessment

6.2.1 Risk Assessment Matrix

The risk assessment matrix used for the Spring Hill Project is based on the sample provided in the *Template for the Preparation of a Mining Management Plan.* The key prompt to assessing a risk is the likelihood that a particular event or issue will take place. The definitions of the likelihood of an occurrence are included in Table 11.

Table 11 Definitions of Likelihood of an Incident Occurring at the Spring Hill Project

Measure of Likelihood	
Almost Certain	Expected to occur in most circumstances.
Likely	Will probably occur in most circumstances.
Possible	Might possibly occur at some time.
Unlikely	Could occur at some time.
Rare	May occur only in exceptional circumstances.

As the likelihood of each event is assessed, so is the potential consequence of the event taking place. The definition of the consequences used in this risk assessment is included in Table 12.

Table 12 Definitions of Consequence as it Applies to Risk Assessment for the Spring Hill Project

Measure of Consequence	
Catastrophic	Environmental disaster.
Major	Severe environmental damage.
Moderate	Contained environmental impact.
Minor	Some environmental impact.
Insignificant	Low environmental impact.

The likelihood and consequence of an event, combined, result in a risk rating for that event. A numerical rating is attributed to both the scale of likelihood and the scale of consequence of a potential event. A matrix that demonstrates the combined scores from those scales is presented in Table 13. Scoring risks allows them to be ranked in order of magnitude in terms of their need for mitigation. The need for action on a potential event ranked by its risk score is presented in Table 14

Table 13 Risk Assessment Matrix used for the Spring Hill Project

Risk Assessment Matrix	Severity of consequences				
Likelihood of occurrence	Catastrophic (5)	Major (4)	Moderate (3)	Minor (2)	Insignificant (1)
Almost certain (5)	10	9	8	7	6
Likely (4)	9	8	7	6	5
Possible (3)	8	7	6	5	4
Unlikely (2)	7	6	5	4	3

Risk Assessment Matrix	Severity of consequences				
Rare (1)	6	5	4	3	2

Table 14 Assessment of Risk Scores for the Spring Hill Risk Assessment

Risk Score	Risk Rating	Action Required
9 – 10	Extreme	Immediate.
7 – 8	High	Action plan required. Senior management attention.
5 – 6	Moderate	Specific monitoring or procedures required.
2 – 4	Low	Management through routine procedures.

6.2.2 Results of the Environmental Risk Assessment for Spring Hill

The risk assessment conducted for the Spring Hill Project breaks risk into potential sources of environmental harm and potential receptors of that environmental harm. Risks and impacts are identified, and mitigation strategies are also identified. Those mitigation strategies feed into the environmental commitments table included as Table 10. These commitments are TM Gold's pledge to not allow the environmental harm to happen and are reflective of the management and mitigation strategies at site.

Risk is broken into two project phases: construction and operation, and mine closure. The construction and operational risks are identified in Table 15 and the mine closure risks are identified in Table 19.

Table 15 Risk Assessment for the Spring Hill Project for the Construction and Operational Phases: L = likelihood, C = consequence, T = total risk rating

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Flora and Fauna									
Vegetation clearing resulting in injuries or mortality of fauna and flora. Threatened species include: - *Acacia praetermissa* - Partridge Pigeon - Microbats including Ghost Bats and Leaf-nosed Bats Refer to July 2017 *Flora and Fauna Technical Report* (Appendix B) for a full species list	5	2	7	Fauna spotter catchers will be utilised for clearing events for major infrastructure domains. All clearing will be conducted in accordance with the *Land Clearance Procedure*. Refer to the *Threatened Bat Monitoring Plan* (Appendix G) and *EPBC approval conditions*	3	2	5	At the end of clearing, those spotter catchers will prepare a report for TM Gold listing species impacted, with outcomes including relocation pre-clearing, capture and releases during clearing, injuries and fatalities. Refer to the *Threatened Bat Monitoring Plan* (Appendix G) and *EPBC approval conditions*	The *Land Clearance Procedure* must be finalised before land clearing commences pre-construction. Fauna spotter catchers must be utilised for all land clearing operations.
Native fauna death or injury due to vehicle interaction. Threatened species include: - *Acacia praetermissa* - Partridge Pigeon - Micro bats including Ghost Bats and Leaf-nosed Bats Refer to July 2017 *Flora and Fauna Technical Report* (Appendix B) for a full species list	3	2	5	Enforce speed limits on site access roads and the haul road. Ensure roadside vegetation is cut back and maintained to increase visibility. Require an incident report to be completed for all fauna interactions resulting in vehicle damage. Restrict driving to mine management roads unless otherwise authorised.	2	2	4	Continue to enforce speed limits. Track incident reports of vehicle interactions.	Ongoing through the life of the mine, including construction, operation and rehabilitation activities.

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Soil disturbance and traffic movement may result in the potential for increased occurrence of weeds on site. Possible introduction of new weed species and increased weed density and occurrence.	5	3	8	Implement weed management strategies. Ensure vehicles travelling from high risk areas are washed down before entering the site. Restrict traffic access to established roads and tracks only. Local wash down facilities to be used if available.	3	3	6	Routine weed and seed inspections of vehicles. Weed management strategies to be implemented on an ongoing basis. Local weed wash-down facilities to be used when required.	Strategies and plans to be in place before construction commences. Routine weed and seed inspections to be conducted weekly.
Threatened Flora and Fauna									
Acacia praetermissa									
Vegetation clearing resulting in mortality of *Acacia praetermissa*.	1	5	6	This species was not identified to occur on site despite survey effort exceeding guideline requirements. Refer to the *July 2017 Fauna Flora Technical Report* for survey effort. Fauna spotter catchers will be trained in the identification of this species to promote awareness during vegetation clearing. If this species is identified during vegetation clearing, works will cease and be revised to best manage impacts to this species. All clearing will be conducted in accordance with the *Land Clearance Procedure.*	1	5	6	At the end of clearing, those spotter catchers will prepare a report for TM Gold listing species impacted, with outcomes including relocation pre-clearing, capture and releases during clearing, injuries and fatalities.	The *Land Clearance Procedure* must be finalised before land clearing commences pre-construction. Fauna spotter catchers must be utilised for all land clearing operations.

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Death or injury due to vehicle interaction.	1	3	4	Enforce speed limits on site access roads and the haul road. Require an incident report to be completed for all interactions. Restrict driving to mine management roads unless otherwise authorised.	1	2	3	Continue to enforce speed limits. Track incident reports of vehicle interactions.	Ongoing through the life of the mine, including construction, operation and rehabilitation activities.
Partridge Pigeon (*Geophaps smithii smithii*)									
Vegetation clearing resulting in injuries or mortality.	2	4	6	Fauna spotter catchers will be trained in the identification of this species and utilised for clearing events for major infrastructure domains. All clearing will be conducted in accordance with the *Land Clearance Procedure*.	1	4	5	At the end of clearing, those spotter catchers will prepare a report for TM Gold listing species impacted, with outcomes including relocation pre-clearing, capture and releases during clearing, injuries and fatalities.	The *Land Clearance Procedure* must be finalised before land clearing commences pre-construction. Fauna spotter catchers must be utilised for all land clearing operations.
Death or injury due to vehicle interaction.	3	5	8	Enforce speed limits on site access roads and the haul road. Ensure roadside vegetation is cut back and maintained to increase visibility. Require an incident report to be completed for all interactions. Restrict driving to mine management roads unless otherwise authorised.	2	5	7	Continue to enforce speed limits. Track incident reports of vehicle interactions. Signpost and record areas where species has been observed. Site inductions or toolbox meetings to include information about the risk of injury or death to this species from vehicles. For further information refer to the *July 2017 Fauna Flora Technical Report*.	Ongoing through the life of the mine, including construction, operation and rehabilitation activities

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Northern Leaf-nosed Bat (*Hipposideros stenotis*)									
Vegetation clearing resulting in injuries or mortality.	1	3	4	Despite this species being cave dependent fauna spotter catchers will identify hollow bearing trees. Hollows are to be inspected for the presence of fauna, particularly microbat species. If microbats are detected and unable to be relocated, hollow bearing trees are to be monitored and felled after which time microbats have vacated the hollow.	1	2	3	There is no existing management program for this species in the Northern Territory. The Threatened Bat Monitoring Plan has been developed with reference to management of the species in similar habitats in Western Australia (Appendix G).	Ongoing through the life of the mine, including construction, operation and rehabilitation activities.
Death, disturbance or injury due to vehicle interaction.	1	4	5	Enforce speed limits on site access roads and the haul road. Ensure roadside vegetation is cut back and maintained to increase visibility. Require an incident report to be completed for all interactions. Restrict driving to mine management roads unless otherwise authorised. Restrict activity to daylight hours.	1	4	5		Ongoing

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Death or injury due to disturbance to occupied stopes.	4	4	8	Avoiding impacts to habitat by excluding operations in identified habitat. Adhere to an 85m buffer zone around stopes identified to be occupied by this species as advised in the *Threatened Bat Monitoring Plan* and EPBC approval conditions A specific *Threatened Bat Monitoring Plan* for Spring Hill has been developed and must be implemented. Refer to conditions of EPBC approval	1	4	5	Refer to the *Threatened Bat Monitoring Plan* (Appendix G) and EPBC approval conditions for specific management procedure	Ongoing through the life of the mine, including construction, operation and rehabilitation activities.
Ghost Bat (*Macroderma gigas*)									
Vegetation clearing resulting in injuries or mortality.	1	3	4	Despite this species being cave dependent fauna spotter catchers will identify hollow bearing trees. Hollows are to be inspected for the presence of fauna, particularly microbat species. If microbats are detected and unable to be relocated, hollow bearing trees are to be monitored and felled after which time microbats have vacated the hollow.	1	2	3	Refer to the *Threatened Bat Monitoring Plan* (Appendix G) and EPBC approval conditions for specific management procedure	Ongoing through the life of the mine, including construction, operation and rehabilitation activities.

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Death, disturbance or injury due to vehicle interaction.	1	4	5	Enforce speed limits on site access roads and the haul road. Restrict activity to daylight hours. Ensure roadside vegetation is cut back and maintained to increase visibility. Require an incident report to be completed for all interactions. Restrict driving to mine management roads unless otherwise authorised.	1	3	5		
Death or injury due to disturbance to occupied stopes.	4	4	8	Avoiding impacts to habitat by excluding operations in identified habitat. Adhere to an 85m buffer zone around stopes identified to be occupied by this species as advised in the *Threatened Bat Monitoring Plan* (Appendix G) and EPBC approval conditions Scheduling works outside of known breeding season. A specific *Threatened Bat Monitoring Plan* (Appendix G) for Spring Hill has been developed and must be implemented. Refer to conditions of EPBC approval.	2	4	4		

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Air Quality									
Adverse effects on local/regional air quality as a result of airborne dust associated with mining operations	3	2	5	Nearest sensitive receptor approximately 10km from the site. Speed limits to be enforced on haul roads and site roads and access tracks to reduce the intensity of vehicle-generated dust. To reduce the amount of dust on site, dust suppression on site will be through the use of a dust polymer control system or molasses. This will also result in a reduction in the use of water alone for dust suppression.	2	2	4	Management through routine procedures.	A dust polymer or molasses diluted in water will be used for dust suppression on water trucks. Water trucks for dust suppression should begin operating at the onset of construction work and continue during operations on a schedule.
Waste Rock									

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
The behaviour of waste rock at site is not consistent with the indications of the initial characterisation.	3	4	7	Progressive waste rock characterisation will be undertaken at site on an ongoing basis during the life of the operation.	2	4	6	Progressive waste rock characterisation will consist of both on-site and third party off-site testing. The on-site process orientated sampling program will have a 1 in 10000t sampling frequency above 15m and 1 in 5000t sampling frequency below 15m to account for an unlikely but potential increase in PAF material in the less weathered material towards the Hong Kong 1 Pit floor. The off-site testing to be conducted by a NATA accredited laboratory will involve sampling at a rate of 1 sample per 20,000t of each lithology. NATA accredited analysis will also be used for quality assurance of the higher frequency, on-site testing program. Potentially problematic rock will be marked, flagged and handled in such a way as to ensure encapsulation within the WRD. Details regarding the identification, classification and testing of waste rock is detailed within the *Waste Rock Characterisation Technical Report* (Appendix L) and within the *Conceptual Mine Closure Plan* (Appendix H).	Waste rock characterisation must begin with pit excavation and be conducted throughout the life of mine until excavation is complete.

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Surface Water									
Contaminated or sediment laden runoff from ROM pad to the receiving environment. Potential to decrease water quality and impact on aquatic flora and fauna.	4	4	8	Construction of a sediment basin near the ROM pad to capture all potentially contaminated or sediment-laden water from the ROM pad. Implementation of ESC infrastructure and maintenance in accordance with the Soil and *Erosion and Sediment Control Plan* included as Appendix O of this MMP.	1	3	4	Routine inspections of ESC infrastructure to identify any issues. Any issues to be notified to the General Manager and replacement/repairs to be undertaken as soon as possible. Water quality monitoring to be undertaken on at least a monthly basis and following any rainfall.	The ROM sediment basin and ESC infrastructure must be implemented prior to the commencement of excavation and crushing operations. Inspections to continue on a regular basis during operations.
Contaminated or sediment laden runoff from the outer batters of the WRD to the receiving environment. Potential to decrease water quality and impact on aquatic flora and fauna.	4	4	8	Construction of a sediment basin at the toe of the WRD to capture potentially contaminated or sediment-laden water from the outer batters of the WRD. Implementation of ESC infrastructure and maintenance in accordance with the Soil and *Erosion and Sediment Control Plan* included as Appendix O of this MMP.	2	4	6	Routine inspections of ESC infrastructure to identify any issues. Any issues to be notified to the General Manager and replacement/repairs to be undertaken as soon as possible. Water quality monitoring to be undertaken on at least a monthly basis and following any rainfall.	The WRD sediment basin and ESC infrastructure must be implemented prior to the commencement of excavation and crushing operations. Inspections to continue on a regular basis during operations.

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Site Access									
The cultural heritage features at the project site form part of the Pine Creek Gold Mining Heritage Trail, which allows unrestricted vehicle/tourist access into these sites and inadvertent access into the area of the proposed project. There is a risk of injury or death to members of the public accessing the site.	4	5	9	Access routes to the site will be clearly signposted. Signposts will forbid unauthorised access, require vehicles be escorted and provide a UHF channel for mine site communications. Where practical, secondary access routes to the site leading from established tourist areas will be obstructed by earthworks or fencing as well as signposted, to ensure no tourist vehicles can access the area (e.g. in proximity to the old gold battery). Signage will be provided to local hostelries advising of the change in access, and staff informed so they can communicate same to tourists. The bat exclusion area will be fenced at its perimeter, avoiding the use of barbed wire, and signs noting that unauthorised access is prohibited.	1	5	6	The exclusion infrastructure and signage should be inspected weekly during operations. Any damage to or removal of exclusion infrastructure and signage should be noted, immediately reported to the site general manager and rectified within 24 hours.	Onsite access route signage must be erected before the commencement of works. Obstruction of secondary access routes must take place before the commencement of works. Communication to local hostelries should be conducted in the week before commencement of works.

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Groundwater									
Impacts to local groundwater posed by construction of the pits, e.g. groundwater drawdown.	3	3	6	Inflow of water into the pits will be monitored during excavation. Currently the Hong Kong 1 pit is the only pit that may contain any water.	3	2	5	The Hong Kong 1 pit will be dewatered to either a shallower, benign pit or the sediment basins, and that water can be tested for water quality. Routine groundwater monitoring will be conducted monthly to monitor concentrations of analytes described in the groundwater monitoring program. It should be noted that the three proposed pits at Spring Hill will not intersect the local groundwater table, therefore the pits will not need dewatering. Wet season rainfall will result in temporary seepage from the immediate vicinity of the pits via the pit walls. However, the groundwater catchments for these pits consist of the tops and sides of ridges, hence, these catchments are very limited in size. Overall the seasonal groundwater seepage will be dwarfed by the seasonal influx of direct rainfall. Further details can be found within the *Groundwater Technical Report* in Appendix J of this MMP.	Groundwater monitoring will be conducted from the outset of construction at frequencies indicated in the groundwater monitoring program. Monitoring inflows to the pits will commence with excavation.

Potential impact Event	Risk Rating			Control Strategy	Residual Risk Rating			Monitoring and Management Procedure	Deadline for Implementation
	L	C	T		L	C	T		
Cultural Heritage									
Disturbance to aboriginal or European/ Chinese sites of archaeological significance. (No registered or recorded sacred sites on the ML).	3	3	6	Extensive archaeological survey work has been conducted within the Spring Hill area. The surveys have identified and clearly mapped sites of archaeological significance. Staff will be advised of the cultural significant areas through an induction process.	1	3	4	Management through routine procedures and implementation of recommendations contained in the *Cultural Heritage Survey Report* (EarthSea, 2016; Appendix E).	Strategies and plans to be in place before construction commences. Advice on artefacts of archaeological significance to be provided to staff at the project kick-off meeting for the construction phase.
Contaminant Management									
Impact to the receiving environment from hydrocarbon/ chemical spills.	4	2	6	All hydrocarbons to be stored in appropriately bunded areas as per Australian Standards. Fuel will be stored and dispensed using a self-bunded tank and automated delivery system. All minor chemical storages to be bunded in a bunded area or using temporary bunded containments. TM Gold will implement the Spill Response Procedure contained in this MMP to ensure immediate clean-up of all spills to prevent release to the receiving environment.	1	3	4	Management through routine procedures. Implementation of the Spill Response Procedure.	All strategies and management plans to be in place before construction commences. Routine procedures to be implemented on an ongoing basis.

7 Environmental Management Plans

7.1 Waste Rock Management

Waste rock management will comprise adaptive management to be conducted based on the outcomes of progressive characterisation as summarised below and detailed in Appendix L.

7.1.1 Legislation and regulations

The regulatory requirements governing waste management in the Northern Territory are contained within the following legislation:

- *Waste Management and Pollution Control Act 2016 (NT)*
- *Waste Management and Pollution Control (Administration) Regulations 2014 (NT)*
- *Water Act 2016 (NT)*
- *Mining Management Act 2018 (NT).*

Additional guidelines that are relevant include:

- ANCOLD Guidelines – Guidelines on tailings dams; planning, design, construction, operation and closure (ANCOLD, 2012)
- GARD Guide – Best practices and technology to address AMD issues (INAP, 2009)
- TEAM NT: Technologies for the Environmental Advancement of Mining in the Northern Territory
- Environmental Assessment Guidelines – Acid and Metalliferous Drainage. Northern Territory Environmental Protection Authority (NTEPA, 2013)

Waste rock at the Spring Hill project will be deposited in a single WRD to the north-west of the pits. NAF material will be used initially as valley fill to ensure a compacted NAF base for the dump. Progressive waste rock characterisation at site will be utilised to ensure PAF material is identified and encapsulated within the benign material that forms the substantially greater volume of waste rock at the Spring Hill site.

7.1.2 Progressive waste rock characterisation and classification program

The objective of progressive waste rock characterisation at the Spring Hill project is to reaffirm the mostly benign waste classification results of the initial 53 samples and identify PAF material early to ensure this is handled appropriately. This will be achieved mainly by field identification and classification based on laboratory analysis of waste rock samples. Important factors to be considered in the program for reliable characterisation of waste rocks are:

- Sampling frequency.
- Sampling techniques.
- Analytical test methods to be used.
- Quality assurance/quality control.

7.1.2.1 Sampling frequency guidelines

There are no specific guidelines on the number of samples to be collected during progressive waste rock characterisation. However, the *Technologies for the Environmental Advancement of Mining in the Northern Territory* (TEAM NT) Toolkit recommends the minimum number of samples to be tested as a 'first pass' per significant geological unit to be 100 based on a quote from Dr. Kevin Morin.

This guideline also quotes the USEPA guideline that recommends 1–50 samples per million tonnes of each potentially at-risk rock unit. It also recognises that the sampling frequency is related to the variability of individual units and the properties of each discrete geological unit.

The Guidelines – Assessment and Management of Acid Drainage Queensland Department of Environment and Resource Management (DERM, 1995), states that "Given the variation in mineral types and locations it is important to establish what an adequate sampling intensity is. The usual procedure is to collect a large number of samples and to undertake a simple screening process. The number of samples required and the sampling intensity will depend on a number of factors including:

- geological variability and complexity in rock types, information and experience from adjacent or geologically comparable mine sites,
- potential for significant environmental or health impacts,
- the size of the operation,
- relative costs,
- statistical requirements which ensure samples are representative,
- the volume of each class of waste rock type, and
- the level of confidence in predictive ability.

The minimum number of samples collected from each rock/overburden type during initial sampling should generally be as per Table .

Table 16 Sample guidelines

Mass of Each Separate Rock Type (tonnes)	Minimum Number of Samples
<10,000	3
<100,000	8
<1,000,000	26
<10,000,000	80

7.1.2.2 Sampling frequency for the Spring Hill project

Considering that the Spring Hill deposit is classified as orogenic lode-gold type deposit, mineralisation is not confined to any particular rock unit. Within the three proposed open pits, the strata intersected by the mineralised quartz veins consists of oxidised sedimentary units with very similar geochemical attributes. Hence, it is reasonable to consider the entire strata sequence as one unit.

Analysis of statistical variance between waste rock samples from the various lithological units and proposed pit locations suggests there are spatial variations between waste rock characteristics. For example, samples from the Main Pit 2 area have a higher NAG pH and NAPP compared to other locations, indicating higher neutralisation capacity available in this area. Additionally, regardless of sampling location Greywacke and Sandstone/Siltstone lithologies appear to have lesser neutralisation capacity when compared with the other lithologies (sandstone, siltstone and overburden). However, it is considered that these spatial and lithological variations do not necessitate differential sampling frequencies since the results indicate that the risk of acid production from these outliers is lower in general than the majority of samples across the project site. No single group of waste rock samples, whether based on spatial location or lithology, has been shown to be predominantly acid producing. Therefore, it is considered appropriate to use published guidelines on sampling frequency.

Based on the review of sampling guidelines, composite samples will be sent to the laboratory for analysis at a rate reflecting the approximate volume of waste rock for the project, that being 1,363,287bcm. At a bulk density for solid sandstone of approximately 2.3t/m^3 the total waste tonnage of the project will be 3.14 million tonnes.

Reflecting the Queensland sample guidelines, the TEAM NT Toolkit guideline and the USEPA guideline, and the overarching benign nature indicated by the results from the initial 80 samples for Spring Hill, TM Gold propose a sample rate of 1 sample per 20.000t of each separate rock type, or a total of approximately 157 samples over the life of project.

In addition to the off-site testing, higher frequency on-site testing is considered prudent. On-site classification would involve the physical description of the samples (block location, geology, rock type, visual sulfide occurrence), the crushing and pulverizing of samples and basic analytical testing following the AMIRA (2002) guideline as outlined in the management strategies section 2.3 Analytical test methods.

The previously proposed formal NATA accredited analysis of samples would become part of the quality assurance program, with the main process orientated sampling being conducted at a 1 in 10000t frequency above 15m and 1 in 5000t frequency below 15m. The proposed frequency accounts for an unlikely but potential increase in PAF material in the less weathered material towards the Hong Kong 1 Pit floor.

7.1.2.3 Sampling technique

- One composite waste rock sample should be collected per 20,000t or part thereof
- Drill-hole spoil or blast chips can be used for waste rock characterisation.
- Representative sampling should be ensured in the field by splitting the bulk samples and subsampling.
- Each sample bag should be properly labelled identifying the bench RL, geological unit and blast-hole number, if applicable. Location of sample within the pit should also be recorded.
- Each sample should be viewed by a qualified geologist for characteristics listed in Table 17.
- Samples should be sent for laboratory testing for determination of parameters listed in Table 17.

Table 17 Waste rock sample observation parameters and laboratory analysis

Geological Observation	Laboratory Testing
• Visual sulfide (primarily pyrite) and carbonate content with an estimate of accuracy • Mineralogy, grain size, mode of occurrence of sulfides and carbonates. • Extent of oxidation • Presence of gypsum, barite, graphite or siderite	• Paste $pH_{(1:2)}$ • Paste $EC_{(1:2)}$ • Acid Base Accounting (including total sulfur analysis) • NAG pH

7.1.2.4 Analytical test methods

All test methods used for progressive waste rock classification must adhere to AMIRA (2002) guidelines.

If the laboratory is not NATA accredited, then it must be ensured that all reagents used in the laboratory (e.g. hydrogen peroxide for NAG pH test) should be of laboratory reagents quality conforming to “Analar” standards.

Hydrogen peroxide containing stabilisers must not be used for laboratory analysis of NAG pH.

Initial pH of hydrogen peroxide solution for NAG pH analysis should not be less than 4.5. If the pH is less than 4.5, adjust the pH by using a NaOH solution made up by adding 1g of NaOH to 100mL of deionised water. Quality protocols should continue to include recordings of the strength and pH of the H_2O_2 for each sample batch (AMIRA, 2002) as well as for each sample.

Sufficient time must be allowed for sulfate oxidation to take place at room temperature. AMIRA (2002) recommends allowing time until effervescence or ‘boiling’ ceases or a maximum of overnight (12h). This time frame should be strictly adhered to.

The sample should be gently heated on a hot plate until effervescence stops or for a minimum of 2h (AMIRA 2002). After heating, deionised water should be added to bring the volume back up to 250mL.

If fuming or sudden heating/boiling of sample in conjunction with rise in pH is observed during NAG pH test, it is most likely an indication of catalytic decomposition of hydrogen peroxide. In such cases NAG pH testing is unreliable and the sample should be sent off for analysis at a NATA accredited laboratory. Alternatively, the sample can be assumed to be PAF as the primary cause of catalytic decomposition is high pyrite concentration.

To ensure the detection of catalytic breakdown of H_2O_2, it is recommended that temperature and pH be recorded continuously using loggers. This will also aid in quality assurance of the analytical procedure.

7.1.2.5 Quality assurance/quality control

At least one replicate sample should be included in the analysis for every batch sent to and analysed by the laboratory.

NATA accredited laboratories will provide their standard QA/QC documentation with the submission of sampling results.

If the laboratory used for statical geochemical analysis is not NATA accredited for the parameters being analysed, then internal quality control should include blanks and, where practical, spiked samples to assure the validity of the results. In addition, 1 in 10 samples should be sent for analysis at another laboratory with NATA accreditation for quality assurance and to check the reliability of non-NATA accredited laboratory.

7.1.3 Waste rock classification criteria

If total sulfur content is greater than 1.5%, the waste rock can be classified as PAF irrespective of its NAG pH. For waste rock material containing less than 1.5% total sulfur, NAG pH vs NAPP will be used for classification of waste rock material as outlined in Table 18.

Table 18 Geochemical classification criteria for the NAPP classification scheme (AMIRA, 2002)

Category	NAPP Value	NAG pH
Potentially Acid Forming (PAF)	Positive (+)	<4.5
Non-Acid Forming (NAF)	Negative	≥4.5
Uncertain (UC)	Positive	≥4.5
	Negative	≤4.5
Acid Consuming (AC)	Less than –100kg H_2SO_4/tonne	≥4.5

7.1.4 Non-conformance

A notification under section 14A of the Environmental Administrative Assessment Procedures would be required if progressive waste rock characterisation identifies potentially acid forming materials or contaminants that are significantly different in concentration and quantities to current understanding, necessitating revised waste management arrangements.

7.2 Spill Response Procedure

7.2.1 Objectives and Targets

The objective of this spill response procedure is to limit environmental harm occurring in the event of a spill of a hazardous material at the Spring Hill project. Storage and handling of hazardous materials are addressed in this report in the section titled Hazardous Material Management Plan in the Environmental Management Plans in Section 7.4. This procedure is designed purely to address the response in the event of a spill.

Fuel will be stored and dispensed using a self-bunded tank and automated delivery system. The fuel tank will have a capacity of 10,000L to facilitate refuelling of mobile plant and equipment, and fuelling the diesel generators for the workshop and crusher.

7.2.2 Targets

A spill response procedure similar to that outlined in Figure 13 will be followed. Actions will be taken to excavate the contaminated soils from within the spill footprint and transport off site as required.

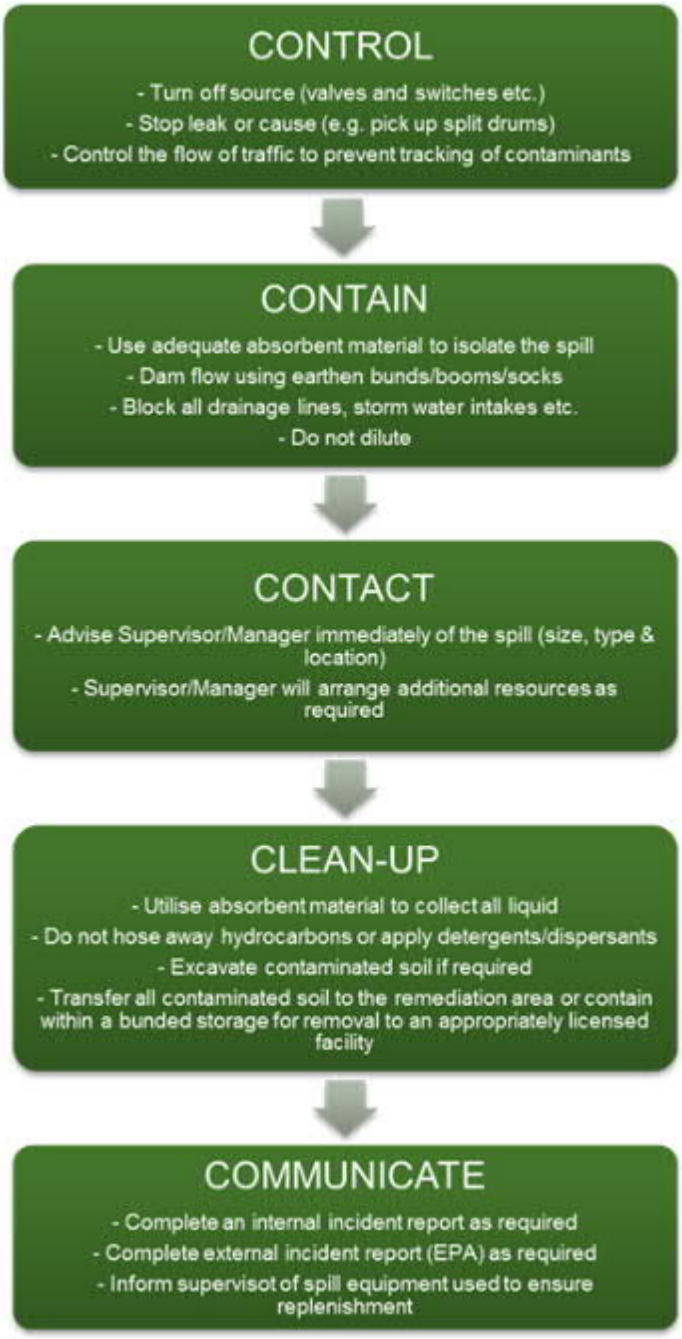


Figure 13 General Spill Response Procedure

7.2.3 Management and Mitigation Strategies

Spill response kits will be available and be easily accessible to staff during refuelling operations. TM Gold staff and any contractors involved in the works will be suitably trained in spill response procedures and familiar with the contents and use of the spill kits. The contents of spill kits will be checked and replaced as needed. In the event of a chemical spill or leak of any volume, staff will be required to advise management as soon as possible.

Using the spill response kits, a clean-up of the spill site will be undertaken by suitably qualified staff members. Disposal of any contaminated material or waste, if present, will be undertaken through an externally sourced and suitably qualified, licenced waste removal operator.

For major spills, generally defined to be the loss of more than 100L of a given chemical, the incident will be notified to the NT Government.

Storages on site will be designed and maintained in accordance with AS 1940-2004: Storage and handling of flammable and combustible liquids. All spills at site are to be reported to the site General Manager. An incident report must be completed for each spill. These incident reports will be maintained in a register by the General Manager and be available for inspection if required.

All waste management on site will be undertaken in accordance with the NT *Waste Management and Pollution Control Act*.

7.2.4 Monitoring and Measurement

Site inspections to be conducted during operations will include inspecting the following areas of the site:

- fuel storage
- any chemical storages
- waste stockpiles
- bunded areas
- ROM pad, for the identification of any incidental spills
- spill response kits to ensure adequate supplies
- areas subject to spill incident reports to ensure clean-up was effective.

These site inspections will be undertaken on a weekly basis by TM Gold with the ultimate responsibility lying with the General Manager.

7.2.5 Effectiveness

Site inspection reports and spill incident reports will be reviewed monthly for the following:

- Evidence that bunding and containment has been inspected and is functioning adequately.
- Evidence that spill clean-up procedures were followed promptly in the event of a spill.
- Evidence that spill clean-up procedures were adequate to deal with the spill event.

7.2.6 Non-conformance and Corrective Action

A non-conformance with the spill management procedure would include the following:

- Spill kits not used to clean up a spill.
- Spill kits not restocked after use.
- Spills not contained.
- Spills not responded to immediately.

- Spill clean-up equipment inadequate to respond to the spill in question.
- Spill containment infrastructure insufficient to contain a spill.

If the effectiveness review identifies an issue with how spill events are handled, the spill response procedure will be reviewed. Additional procedures and inspections may be put in place to address the deficit. Additional infrastructure may be required. Toolbox training will be prepared to address any changes and delivered to staff during prestart meetings to ensure all staff are appraised of changes in spill management processes.

7.3 Soil Management

7.3.1 Management of the Soil Resource at Spring Hill

There are minimal soils at Spring Hill Project because of its location at the top of a series of local hills. Therefore, any soils that have developed *in-situ* are a valuable resource that must be preserved to ensure successful rehabilitation of the operation.

The presence and depth of the soil profile at Spring Hill is dependent on the location within the landscape. All operations occur on the top of hill crests and subsequently soil development is minimal. Soil development is partially related to slope as areas with lower slope are expected to have a reduced volume of concentrated runoff, therefore retaining additional soil particles. Subsequently the ground cover across the greater area is generally highly weathered bedrock with soil developing between cracks. Areas of good soil development are extremely limited, and where present, have a high percentage of rockiness (Figure 14).

An *Erosion and Sediment Control Plan* has been prepared in conjunction to this report and can be found in Appendix O. Refer to this document for all Soil and Erosion management processes.

Figure 14 Representative Photograph Showing Bare Ground Cover of the Area

Soil exploration holes were installed over the area of disturbance to characterise the depth and quality of topsoil resource. The proposed ROM, stockpile, office and dam area lay on the crest of a local ridge line with a maximum slope of approximately 18% prior to development. A soil hole was installed in this area (Soil 04) and revealed 0.3 m of topsoil before auger refusal due to high rockiness. Soils encountered were a powdery clay loam and are generally considered good for stripping and stockpiling for use in any rehabilitation works requiring topsoil. A topsoil stripping depth of approximately 0.3 m is recommended for implementation across the ROM, office and stockpiling area. Material stripped should be stockpiled in long, rectangular stockpiles no more than 0.8 m in height to limit wind erosion, loss of seedbank and soil sterilisation. Further works to manage topsoil stripping (where applicable) at Spring Hill are outlined in Table 19.

Table 19 Spring Hill Topsoil and Subsoil Management Matrix

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
Maximum retention of soil resource for reuse in rehabilitation	Topsoil and subsoil to be stripped simultaneously Soil to be cleared from hilltops downwards to ensure maximum capture Soil to be cleared promptly after vegetation clearance Stripped soil to be stockpiled promptly and not left sitting in transport machinery Soil to be stockpiled in windrows of no more than 0.8 in height	Prompt stockpiling and seeding of topsoil will avoid the risk of loss of soil from cleared areas through erosion from weather events. Stockpiles must be shaped to indicated heights (1.5 m) and batter angles to preserve the resource. Destination locations for stripped soil stockpiles should be identified before stripping begins, with consideration given to other planned site disturbances to ensure the stockpiles will not be impacted by other site activities and will not need to be moved until use in rehabilitation.	Soil stockpiles should be identified and clearly delineated on a survey map. Soil stockpiles must conform to maximum height restrictions (1.5 m). Soil should be added to a stockpile the same day it has been stripped.	Volumetric calculations of stripped and stockpiled soils should reveal sufficient resource for rehabilitation. Groundtruthed soil stockpile locations will correspond to mapped locations.	Stockpiles identified as poorly located should be relocated only if absolutely necessary, as repeated handling of soil increases the risk of damage to the soil's structure. Loss of stockpiled soil through erosion should be promptly identified and corrective action taken to prevent such loss, e.g. installation of diversion bunding for stormwater runoff. Insufficient topsoil resource for rehabilitation will require supplementation through borrowing from other areas at site.
	Soil to be stripped efficiently with minimal compaction, wastage or contamination from vehicle movement.	Stripping should be undertaken by the excavator standing on the surface of the topsoil, digging the topsoil and subsoil to its maximum depth and loading into a transport vehicle positioned and travelling mostly on the basal layer under the subsoil.	Topsoil stripping should be supervised to ensure stripping and stockpiling is conducted appropriately. Appropriately qualified machine operators are to be employed for topsoil stripping and stockpiling.	Supervision of stripping will identify an efficient operation with few issues and no major problems. Soil will be stockpiled appropriately in the correct locations.	If a supervisor identifies stripping undertaken in a less than efficient manner, stripping should be halted and staff directed as to a more efficient process.

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
Quality of soil in the stockpiles to be preserved	Preserve the strength and integrity of the stripped soil.	Soil structure can be easily compromised during stripping activities. Soil should be stripped in a slightly moist condition if possible. If sustained heavy rainfall (e.g. greater than 10 mm in 24 hours) is received, stripping should be suspended until at least 24 hours after the cessation of rain, or until the ground has had a chance to dry.	Rainfall should be monitored during stripping operations, and stripping suspended if more than 10mm of rain falls in 24 hours.	Stripping will be suspended in the event of rainfall exceeding 10mm in 24 hours.	Stripping wet soil may lead to compaction and/or damage to the soil's structure. Soil stockpiled while wet must be inspected weekly for erosivity and vegetative regrowth. Poor performance may require the application of fertiliser / an appropriate seed mix to improve the quality of stockpiled soil.
	Stockpiles must be protected from fire.	Fire breaks should be cleared around stockpiles.	Fire breaks should be kept clear of obstructions and properly maintained during the life of the project.	There should be no fire impact to stockpiles.	If fire impacted, stockpiles should be inspected weekly for signs of recovery e.g. regeneration of vegetation. If fire impacts stockpiles, TM Gold should consider widening fire breaks for the remainder of mine life. If fire impacted stockpiles are not seen to be productive within three weeks of fire, they should be seeded with a suitable grass seed mix appropriate to the region.
	The seed bank integrity should be retained.	Stockpiles should be allowed to revegetate from within their own seed bank to help reduce erosion potential.	Stockpiles should show signs of vegetation regrowth within three weeks of stockpiling.	Stockpiles should be fully vegetated within a month of stockpiling.	If stockpiled soils are not seen to be productive within three weeks of stockpiling, they should be seeded with a suitable grass seed mix appropriate to the region.
	Preserve the soil structure and integrity.	Stockpiles should be appropriately located from the outset, so there is minimal handling of soil.	There should be a soil stockpile map prepared before stockpiling begins.	There will be no requirement to relocate stockpiles.	Stockpiles should not be moved unless absolutely necessary. If it is necessary to move a stockpile for reasons other than use in rehabilitation, the destination site should be carefully selected to ensure the risk of repeated movement is minimal.

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
	Stockpiles should remain weed free.	Stockpiles should be inspected for weed occurrence, and weeds treated *in situ.*	Stockpiles should be inspected before reuse for weeds.	No more than 10% of vegetation cover on a stockpile should be weed species.	Stockpiles discovered to have any new weed incursions, or greater than 10% weed infestation must be promptly treated with a suitable herbicide and treated again in a timeframe indicated by the herbicide manufacturer to ensure effective weed control.
	Stockpile fertility should be suitable for rehabilitation	Test samples from soil stockpiles at least three weeks before rehabilitation work commences.	Soil quality testing of stockpiles.	Samples of stockpiled soil should display the following characteristics before use in rehabilitation: pH between 5 and 9 CEC of at least 4 meq/100g Total organic carbon value of 1.2-1.7% at least, (or higher) Exchangeable sodium of <6%	Remedial measures should be considered where stockpiles do not meet the criteria outlined in the effectiveness section of this plan. These may include application of fertiliser or mixing with other material to achieve the minimum standards for effective rehabilitation.
Integrity of soil stockpiles to be preserved	Stockpiles should be shaped for maximum integrity.	Soil to be stockpiled in windrows of no more than 1.5m in height	Stockpiles will be constructed to the maximum height indicated.	Stockpiles will not be constructed higher than 1.5m.	Incorrectly sized stockpiles will need to be reshaped promptly.
	Stockpiles should be protected from runoff erosion.	Diversion bunding should be used to protect soil stockpiles from runoff erosion	Stockpiles should be inspected monthly to ensure protection bunding is appropriate.	Bunding should be sufficient to divert stormwater runoff around stockpiles.	If a lack of protection bunding is identified in inspections, bunding should be installed promptly.

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
	Stockpiles should not pose a risk to surface water.	Stockpiles should not be located near drainage channels, and if location near a channel (e.g. <20m) is inadvertent, an exclusion bund should be constructed between the stockpile and the drainage channel. Stockpiles should not be located on steep slopes.	Stockpiles will not be located near drainage channels, and if they are there will be exclusion bunding in place. Stockpiles will not be located on steep slopes.	Stockpiles will be a suitable distance from drainage channels and not located on steep slopes.	Stockpiles inspected and decreed to pose a risk of infiltration to drainage channels will be managed as follows: Exclusion bunding is preferable to rehandling of the stockpile Handling and relocation of the stockpile will take place if exclusion bunding is impractical or potentially ineffective.

7.4 Hazardous Material Management Plan

This management plan addresses the purchase, selection, storage, use, movement, decant and disposal of hazardous materials for the Spring Hill Project.

Hazardous materials that will be on site include explosives, flammable liquids and gases and chemicals that are corrosive or chemically reactive. TM Gold will comply with relevant statutory requirements in regard to the handling and management of hazardous materials on site. This will be in accordance with *Work Health and Safety (National Uniform Legislation) Act* and associated regulations, the *Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act* and associated Regulation and the *Dangerous Goods Act* and associated Regulations.

The only fuel to be stored at site will be in a 30,000 L self-bunded fuel tank to be used for fuelling of mobile plant and for the generator.

Explosives will be kept and utilised on site. TM Gold will adhere to all NT WorkSafe licencing requirements in regard to both explosive storage and discharge. Further works to manage explosives, fuel and other hazardous materials on site are detailed in Table 21.

Table 20 Spring Hill Hazardous Materials Matrix

Objective	Target	Applicable Legislation	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
Safe use, storage, and disposal of chemicals and hazardous goods.	Storage and handling of hazardous materials must be in accordance with regulations	*Work Health and Safety (National Uniform Legislation) Act, The Dangerous Goods Act, The Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act* and their associated regulations	Handling and storage of all hazardous substances must be in accordance with the Safety Data Sheet (SDS) for that substance.	All spills will be reported and investigated.	Spills will be minimal, reported immediately, investigated and promptly cleaned up. Explosives will be managed where exposure to potential risk is at a minimum.	Storage areas will be regularly inspected. An incident database will be maintained. The Environment Manager or General Manager will record and sign off on monthly inspections of hazardous waste storage areas. Spills will be reported and a spill incident database maintained.
			All mobile equipment and light vehicle servicing activities including wash down will be done on impermeable surfaces.	Vehicle servicing and wash down areas should be inspected weekly.		
			Decanting and labelling of hazardous materials will be carried out in accordance with the National Code of Practice for the Labelling of Workplace Substances NOHSC (1994)	All substances should be labelled appropriately. There should be no spills while decanting substances.		
			SDS must be kept in close proximity to their respective hazardous material.	MSDS will be easily accessible.		
			An appropriate storage area for hazardous material storage must be constructed at the outset of the operation and built to Australian Standards 1940-2004.	Hazardous material storages areas will be appropriately bunded or temporary bunding structures provided in areas where hazardous materials are to be temporarily stored.		

			Fuel storage areas must be properly bunded.	Bunding should be inspected regularly for integrity.		
			Small amounts of waste hydrocarbon materials should be collected and stored in properly labelled 205 L drums.	Hydrocarbon waste storage drums should be inspected to ensure they are properly labelled and stored themselves on a temporary bunding.		
			All oil waste must be taken off site for disposal at a properly licenced facility.	Waste disposal records must be kept.		
			Explosives are to be stored, transported and utilised in accordance with Australian Standard AS 2187. Personnel responsible for the management and use of blasting explosives will hold a NT Shotfirers Licence from NT WorkSafe as per the regulation Explosives will be kept in an Explosives Magazine, built to adhere to the standards and requirements under the legislation that will be managed by staff holding a NT Shotfirers licence.	All non-conformance to AS 2187 will be reported, investigated and rectified within a site register and within the site risk management plan as per sections 18 and 18 of the *Work Health and Safety (National Uniform Legislation) Act.* The holder of the NT Shotfirers licence will be responsible for maintaining the standards for explosives management and reporting any non-compliance to the Health, Safety and Environment Officer and the General Manager.		
			Personnel must be provided with the appropriate personal protective equipment	PPE must be available in proximity to hazardous materials.		

			(PPE) for handling and management of hazardous substances.			
	Spills must be dealt with promptly	*Work Health and Safety (National Uniform Legislation) Act, The Dangerous Goods Act, The Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act* and their associated regulations	The spill procedure must be followed at all times.	Spills must be reported and an incident report completed.	There will be a databased of spill incidents maintained.	The incident database will available for inspection and will be complete and up to date. If the database is not up to date, an investigation should be conducted into the existing spill procedure and further staff education provided.
			Spill kits and spill materials for larger spills should be provided in close proximity to the relevant storage areas.	Spill kits and spill materials should be inspected weekly to ensure they are fully stocked.	Spill kits should be readily available and properly stocked.	Incomplete spill kits should be reported and restocked immediately. Staff education may be given if spill kits are repeatedly used and not reported for restock.

7.5 Land Clearance Procedure

7.5.1 Strategies and Methodologies for Land Clearing

Efficient and strategic land clearance for the project is key to minimising environmental harm from the outset of the project, and critical to effective rehabilitation at the end of the project. The small disturbance footprint presents a further opportunity for this to be a low impact project that can be rehabilitated smoothly at project closure. The land clearing guidelines detailed in Table 21 have been developed in accordance with the NT *Land Clearing Guidelines* (DENR 2019).

7.5.2 EPBC Condition

In accordance with EPBC Approval Conditions, no more than 18.36 Ha of Ghost Bat habitat is to be cleared over the course of the project to minimise any potential impact to the Ghost Bat population on site.

Table 21 Spring Hill Land Clearance Procedure

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
All clearing must be permitted	Ensure permits to clear are lodged and approved in time for clearing works	The required authorisation for land clearing must be identified and approval sought in a timely fashion for clearing. No clearing must take place without appropriate permits.	Land clearance planning must include lead times for permitting.	Permitting will be in place for clearing.	Clearing performed without the necessary permits must be reported to the relevant government authority.
Conduct land clearance in an efficient manner that maximises retention of resources reusable in rehabilitation	Clear only areas that are required to be cleared and must not be outside the boundaries of the Project Area	Mark the areas to be cleared before clearing. Bat exclusion zone to be clearly marked before clearing. No clearing or vehicle movements are to occur within this area	GPS equipment should be used by surveyors to mark out areas to be cleared, and clearing should be supervised to ensure no 'out of bounds' clearing takes place.	Approved clearing sites should be well flagged to avoid confusion and unnecessary and illegal removal of native vegetation.	If the supervisor sees clearing taking place outside designated areas, all machinery movement should be halted and the clearing plan reviewed.
	Avoid unnecessary environmental damage through soil compaction	Access to the site should be managed to prevent introduction of weed species or unnecessary compaction of soils by vehicles.	Site access should be signposted clearly and unauthorised vehicles apprehended.	Soil compaction should be minimal.	Clearing methodologies should be reviewed with contractors / machine operators if compaction is deemed to be excessive. Unauthorised vehicles should be apprehended promptly and asked to leave the area.
	Minimise impacts to soil integrity and composition	Clear felling or chaining techniques should be used to facilitate clean pushovers of larger vegetation and reduce vehicle movements across the site. Timing should be closely managed to ensure large areas of soil are not left exposed without being promptly stripped for stockpiling.	Clearing will be conducted in accordance with this plan.	Clearing will be conducted efficiently; soil compaction will be minimised and vehicles movements across site restricted.	Clearing methodologies should be reviewed with contractors / machine operators if compaction is deemed to be excessive.

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
	Maximise retention of material for reuse in rehabilitation	Post-clearing debris should be cleaned up using a blade and stockpiled in windrows running along the contour to minimise loss of material through stormwater runoff.	Stockpiling will be conducted in accordance with this plan.	Stockpiles should be constructed in accordance with this plan.	Stockpiles that are inappropriately situated should be relocated.
	Post-clearing debris to be stockpiled to minimise bushfire risk	Debris should be stockpiled away from native vegetation and away from other infrastructure.	Stockpiling will be conducted in accordance with this plan.	Stockpiles should be constructed in accordance with this plan. Firebreaks should be maintained as described.	Stockpiles that are inappropriately situated should be relocated. Firebreaks should be maintained through the life of the operation.
Manage bushfire risk appropriately	Bushfire controls to be used	Fire breaks of at least 2m in width should be cleared around and stockpiled vegetation (if applicable).	Fire breaks will be installed in accordance with this plan.	Firebreaks should be maintained.	Firebreaks should be routinely inspected and maintenance work carried out if and when required.
	Steep slopes that do not form part of the disturbance footprint should not be cleared	Vegetation should be left intact on steep slopes that lie between infrastructure areas but do not form part of the disturbance footprint. Note the importance of maximising connectivity, the next objective in this table.	Vegetation will be left intact where practicable and vegetation condition reviewed at rehabilitation.	Steep slopes will not be cleared.	Where steep slopes have been cleared, ESC infrastructure must be implemented.
Minimise erosion risk	Minimise potential for erosion prior to clearing	Land clearing should not occur unless preceded by the installation of all necessary drainage and sediment control measures.	Adhere to Appendix O Erosion and Sediment Control Plan.	Prevention of erosion due to/ during clearing	The exception would be any land clearing necessary to allow installation of these control measures.

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
	Post-clearing debris to be stockpiled to minimise erosion risk	Post-clearing debris should be stockpiled in windrows running along the contour to minimise loss of material through stormwater runoff. Where this is not possible, diversion bunding should be used to divert stormwater away from smaller debris at high risk of washing away in a storm event.	Stockpiles should be inspected for form and placement.	Stockpiles should not erode in a rainfall event.	Improperly formed or positioned stockpiles should be reshaped and/or moved.
Minimise impacts to fauna	Maximise habitat connectivity through the use of native vegetation buffers	While vegetation should not be cleared from steep slopes that do not form part of the disturbance footprint for erosion control reasons, it is important to provide buffers between areas of retained vegetation and disturbance areas to maintain functional habitat linkages. If retained vegetation is left in small, isolated pockets, it will rapidly lose the most sensitive species and decrease in biodiversity value. The short –term nature of the project will mitigate much of this decrease, but buffers should be retained where possible.	Remaining vegetation should be inspected at rehabilitation for condition and noted in the baseline rehabilitation reporting.	Habitat connectivity will be maximised where possible.	Due to the short-term nature of the project, issues with connectivity will be rectified on rehabilitation.
	Direction of clearing must provide egress for fauna species	Clearing should be conducted directionally in a manner that allows fauna species the best opportunity to relocate to native habitat. Clearing must be undertaken progressively, downhill, over a number of days to allow fauna the opportunity to relocate away from the disturbance.	Clearing must be supervised to ensure the direction allows a means of egress.	Fauna will be able to escape the clearing where possible.	If the supervisor declares the clearing to be improperly conducted, the clearing will be stopped and processes reviewed before resumption of the activity.

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
	Fauna spotter catchers to be used	Fauna spotter catchers will be present for all vegetation clearing.	A fauna spotter catcher report will be available post clearance.	Fauna to be removed from cleared areas and relocated	If the fauna spotter catcher considers the clearing improperly conducted, the clearing will be stopped and processes reviewed before resumption of the activity.

7.6 Native Flora and Fauna Management Plan

7.6.1 Objective and Targets

The objective of the native flora and fauna management plan is to minimise the impact of the proposed mining activities on native flora and fauna at Spring Hill.

Targets for this management plan are for flora and fauna species diversity to be maintained in the locality and be rehabilitated to a state representative of pre-mining conditions.

7.6.2 Management and Mitigation Strategies

Excavated areas can pose a risk to native fauna through entrapment and exposure. Excavated areas should be checked regularly for trapped fauna, with inspection occurring at least twice daily. These areas should be checked early in the morning for fauna that has become trapped overnight and again in the late afternoon for fauna that has become trapped over the course of the day.

Safe egress points should be included to allow fauna to escape of their own accord. Any fauna that cannot escape of their own accord should be removed in a manner that is safe for both the animal and the person handling the animal. Dangerous fauna species such as snakes should only be handled by a suitably qualified and experienced person. The use of a fauna spotter-catcher during the vegetation-clearing and construction period is recommended to minimise the chances of injury to native fauna. The fauna spotter-catcher should hold all relevant permits for handling and relocating wildlife and should be present during clearing activities. The role of the spotter-catcher would be to advise on appropriate clearing methods to ensure animal escape paths are maintained and relocate fauna located within the disturbance area accordingly.

Vehicle strike represents a general threat to native fauna species. This threat is particularly relevant to the Partridge Pigeon and strategies for managing vehicle interactions with fauna are described below in the Threatened Species Management Plan in Section 7.7.

7.6.3 Monitoring and Measurement

Records of threatened wildlife are to be maintained and injuries or deaths to be reported.

Specific monitoring requirements as specified in the *Threatened Bat Monitoring Plan* (Appendix G) and EPBC approval conditions must be implemented.

7.6.4 Effectiveness

The Environmental Manager will keep a register of fauna interactions and sightings as appropriate. Exercises such as land clearance and topsoil stockpiling, which directly influence the success of this management plan, should be monitored to ensure they are carried out in accordance with their own, detailed management plans.

Rehabilitation monitoring will be conducted post mine closure and the success of rehabilitation measured during that monitoring feeds directly into the success of the targets in this plan.

7.6.5 Non-conformance and Corrective Action

Non-conformances with this plan would include:

- Fauna deaths from interaction with operational infrastructure and vehicle strikes.
- A decrease in vegetative condition over the life of the mine and an unsuccessful standard of rehabilitation post mining.
- A decrease in the fauna habitat condition post mining.
- Disturbance to cave dwelling bats as specified in the *Threatened Bat Monitoring Plan* (Appendix G).

Fauna deaths during the operation will be investigated and, if required, a toolbox session will be compiled on species identification, fauna awareness and adhering to speed limits, for delivery during the prestart meetings.

Specific corrective actions for impacts on bats are specified in the *Threatened Bat Monitoring Plan* (Appendix G).

A poor result in rehabilitation monitoring will prompt corrective actions that may include, but not be limited to, landscape contouring, re-topsoiling and planting and/or reseeding with species appropriate to the area.

7.7 Threatened Fauna Species Management Plan

7.7.1 Species-specific Management Plan for Bats

Three threatened bat species were recorded from within the project area using a microbat call detection device. The Ghost Bat (*Macroderma gigas*; Vulnerable, EPBC Act), Northern Leaf-nosed Bat (*Hipposideros stenotis*; Vulnerable, TPWC Act) and Orange leaf-nosed bat (*Rhinonicteris aurantia*) – Near Threatened (TPWC Act) were recorded on multiple nights during surveys. These threatened species, along with other cave dependent bat species, were found to be occupying stopes associated with historical mine workings within the proposed disturbance footprint of the open pit development areas.

The results of the targeted microbat survey show that the Spring Hill Project site supports significant roosting habitat for multiple cave-dependent microbat species. Up to five cave-dependent species were recorded in some of the habitats surveyed, including the Ghost Bat, the Northern Leaf-nosed Bat and the Orange Leaf-nosed Bat. Many of these species would occupy different zones within the stope habitat, and therefore some of the features assessed likely represent a complex habitat structure. Furthermore, some of these species require very specific cave roost microclimates. Overall, the diversity of bat species recorded, the apparent population sizes for at least some of these species and the number of stopes providing potential habitat, all suggest the Spring Hill Project area represents a significant site for microbat biodiversity. The significance of the site at the species level depends on the scale at which populations/habitats are assessed and the conservation-significance of the species.

The proponent will implement a species-specific management and monitoring plan for these conservation significant bat species occurring within the Spring Hill project area.

Objectives and targets

Broadly, the objectives and key performance criteria for the success of the mitigation measures for threatened bats are as follows:

- No significant damage to identified stopes that would prevent their ongoing use by bats.
- Persistence of target species in study area during operations.

- No significant decline of target species in study area during operations.

Management and mitigation strategies

The plan includes implementation of the following measures:

- Impacts to mine stopes will be avoided by designating a buffer zone around the stopes, at a minimum distance of 85 m from the nearest mine stope. This will be fenced with wildlife-friendly fencing, and unauthorised access to this area will be prohibited.
- Pit development will be sequenced to minimise vibration impacts.
- The *Threatened Bat Monitoring Plan* (Appendix G) for Spring Hill must be implemented.
- Through blast design, blast vibration will be limited to the established threshold, which is likely to be less than 10 mm/sec at old mining stopes.
- Dust, weed and pest animal control strategies to be implemented.

Monitoring and measurement

Monitoring will be undertaken in five phases, each of which has its own separate aims and objectives:

- Pre-clearance of bat habitat
    - A comprehensive survey of all potential roosting habitat within the project area to document all Ghost Bat habitat will be conducted 5 busines days prior to clearance of bat habitat. The survey will be conducted by a suitably qualified ecologist
    - All areas of roosting habitat and additional roosting habitat will be identified.
    - The 85m buffer around the bat habitat exclusion zone will be updated to include any major roosts identified in the pre-clearance survey.
- Pre-mining phase
    - Establish baseline levels and variation of noise, vibration and bat activity.
    - Determine utilisation of different stopes, including species composition and counts of Ghost Bats.
    - Determine reproductive status of threatened bat species.
- Early mining phase
    - Monitor vibration and over-pressure at pre-determined blast events.
    - Develop thresholds of vibration, over-pressure and bat responses.
    - Simultaneously monitor bat behaviour in response to blasts and adjust blast design and resulting vibration as necessary.
    - A maximum of two blasts per day for the first five days until threshold levels of vibration disturbance is reliably established.
- Operational phase
    - Confirm that the over-pressure and ground vibration levels, and bat behavioural responses do not exceed the criteria specified

  - Develop and implement appropriate and adequate responses that delivers a desired outcome
  - Monitoring effectiveness of management treatment.
- Post-mining phase
  - Monitor the composition, function and changes to bat populations over time after cessation of mining.
  - Record important autecological information relating to cave dwelling bats at Spring Hill, including population studies, breeding times, roosting and foraging behaviour.
  - Assess the importance of the Spring Hill threatened bat populations and its relationship with other populations.

During the operation of the mine, levels of ground vibration, over-pressure, noise levels and bat vocalisation will be monitored. At each event, each of these parameters will be entered into a log book and compared to predicted levels. Any exceedance of predicted levels or the established noise and vibration threshold, or any recorded level of bat disturbance will be noted and will require corrective action to ensure that the next subsequent disturbance event will be of lower intensity. The following procedure for disturbance by blasting must be followed:

- Blast charges must follow the recommendations of the blast design report (Boucher 2017 in Appendix F and within the Threatened Bat Monitoring Plan [Appendix G]).
- Predicted vibration levels must be recorded in the log book.
- The Environmental Manager must ensure that active monitoring of seismic activity, noise and bat activity is occurring in the nearest occupied stope to the location of the blast.
- The Environmental Manager must ensure that at least one hour of pre-disturbance monitoring has been recorded prior to blasting.
- The Environmental Manager must advise the blast engineer that the conditions of the required corrective actions for previous blasts have been met, and that they have authority to proceed with the blast.
- The precise time of the blast event is recorded in the log book.
- The ground vibration and over-pressure levels recorded at the sensitive receptors are noted in the log book, and any exceedances of the vibration and noise threshold immediately reported to the mine manager.
- Bat activity relative to the background level recorded in the preceding one hour is noted and interpreted in relation to the impact definitions described in Appendix G, and results entered into the log book.
- The Environmental Manager must advise the mine manager of the noise, vibration, and bat impact level achieved
- The Environmental Manager and the mine manager must acknowledge and sign each recorded sequence of observations relating to an individual blast event
- The Environmental Manager must ensure the corrective action is undertaken in accordance with the definitions provided in Appendix G, and immediately notify the administrators if mine activities result in a Very High or Critical level of impact to the cave dwelling bats

- If recorded ground vibration and over-pressure levels exceed predicted levels by more than 10%, The Environmental Manager must notify the Mine Manager and Blast Engineer, who must modify the blast design to ensure the subsequent blast will not result in an exceedance.
- The Mine Manager must ensure that no subsequent blasting occurs unless actions from the preceding blast have been resolved.

Non-conformance and corrective action

Non-conformance with any of these items must be reported to the Environmental Manager and corrective action undertaken. Any action that results in a very high or critical outcome will be immediately reported to the regulatory authorities and will result in operations being suspended until given the authority to proceed.

7.7.2 Species-specific Management Plan for Partridge Pigeons

The Partridge Pigeon (*Geophaps smithii smithii*) has been recorded in the habitat surrounding the proposed action. This species is listed as vulnerable under the EPBC Act and the TPWC Act. While this species has not been recorded in the disturbance area for the proposed project, the following management approaches are aimed at minimising potential impacts to this threatened fauna species.

Objectives and targets

The objective of this Threatened Fauna Species Management Plan is to minimise likelihood and scale of potential impacts to the Partridge Pigeon.

These species have not been detected within the proposed disturbance footprint during any of the field survey programs to date, so no targets relating to local population size are proposed. During the October 2016 survey, this species was only observed as a large flock drinking at a nearby dam. This dam is located approximately 800m southwest of the project area in the low undulating hills land unit. No Partridge Pigeons were detected within the proposed disturbance footprint or any of the surrounding habitat in the ridge crests and slopes land unit

The most likely interaction between project activities and this species is through traffic movement on the haul road in the lower terrain. General management approaches and strategies to minimise potential traffic interaction impacts to this species are proposed and detailed in the Recommendations section of the updated *Flora and Fauna Technical Report* in Appendix B. Adoption of these impact mitigation measures will reduce the risk of impacts to this species in the low undulating hills land unit, and as a result it is unlikely there would be a significant impact to the Partridge Pigeon as a result of this short-term project.

The management approaches below are aimed at minimising the likelihood of impacts to any individuals of these species that may occur within the project area over the duration of the project. However, given the presence of suitable habitat for this species in the surrounding area, the target for impact management approach is to avoid impacts to this species at the local scale.

Management and mitigation strategies

One of the key impact management and mitigation strategies for threatened fauna species will be an education strategy comprised of a site-based induction and awareness program. The induction program will include details on identifying the Partridge Pigeon and reporting sightings.

Interaction with vehicles is a readily manageable threat to this species from the proposed development. The following controls must be implemented to minimise the likelihood of death or injury to Partridge Pigeons (and other native fauna species) from vehicle strike:

- Site inductions or toolbox meetings will include information about sensitive aspects of the environment in which personnel are working, including the risk of injury or death to Partridge Pigeons from vehicles.
- Due to the ground dwelling nature of the species, all vehicles will remain on existing access tracks and roads wherever possible.
- Clearing works will be carried out in a sequential manner that allows fauna to escape to natural areas away from construction works.
- Speed limits will be implemented as appropriate for the condition of the roads and access tracks on site. Locations of Partridge Pigeon sightings should be recorded and a limit of 20km/hr is recommended within 200m of locations where Partridge Pigeons have been regularly observed.

Monitoring and measurement

Specific monitoring of Partridge Pigeon populations within the project area is not proposed; however, a database of any incidental sightings of this species within the project area should be maintained. As a minimum, the information recorded should include the number of individuals observed and a GPS coordinate for the location of the observation.

Effectiveness review

The following key components of the project management plans inform interpretation of its efficacy in avoiding and minimising impacts to threatened fauna species:

- An environmental awareness program and threatened species component to site inductions has been implemented.
- The appropriate species composition is established in rehabilitated areas.
- Speed limits are implemented in areas where threatened fauna species have been sighted.
- A record of threatened species sightings within the project area has been maintained,

Non-conformance and corrective action

Non-conformance with any of these items must be reported to the Environmental Manager and corrective action undertaken.

7.8 Pest and weed management

7.8.1 Objectives and Targets

The objective of this pest and weed management plan is to ensure there is no increase in the abundance or distribution of pest flora or fauna species because of the Spring Hill Project.

Management and Mitigation Strategies

Pest plants

Soil disturbance is a major contributor to weed establishment and invasion. A number of pest plant species were identified in the flora surveys.

Weed management will incorporate enforced weed hygiene measures, routine weed inspections, and the monitoring and management of revegetation sites to prevent sites becoming dominated by high biomass introduced grasses. A policy of early detection and eradication of all new weed species not currently occurring on site will be implemented.

The following recommendations are relevant to the construction phase as well as ongoing monitoring and management post-construction:

- Upon induction onto site, weed management processes, weed identification and responsibilities for weed control will be communicated to all visitors and new staff.
- All staff and visitors will need to sign a staff and vehicle roll when bringing a new vehicle to site or visiting site for the first time with a foreign vehicle. Staff need to be informed that signing the document is a requirement of working on site and bringing a new vehicle onto site. By signing the document, the signee is stating that their vehicle has been cleaned prior to entering the site and is weed free. Vehicles and machinery brought on site should be clean and free of weeds, dirt and other material that may contain weed seeds and cause exotic species to become established within the works areas.
- Provide weed wash down facilities on site which will be regularly inspected and treated as required.
- Prior to leaving site, vehicles will need to be inspected for seeds and evidence of weeds. If the presence of weeds is observed, the vehicle will need to be washed down at the designated weed facility. This area will be routinely sprayed and monitored for weeds for the duration of operations and at closure.
- Wherever possible, construction activities should work from areas with fewer weed species and smaller infestations towards areas where there is a greater abundance of weeds.
- Routine weed inspection and control will be undertaken in heavy traffic areas including roads and hardstand areas for the durations of operations.
- Implement a policy of early detection and eradication of all new weed species not currently occurring on site, particularly those listed as declared under the NT *Weeds Management Act*.
- Disturbance areas should be rehabilitated as soon as possible to minimise the establishment of weed species.
- Revegetation sites will be regularly inspected and managed to prevent the dominance of aggressive introduced grasses such as Mission Grass.
- Vegetation rehabilitation should incorporate a mix of local native species, including multiple species of grass, shrub and tree seeds of local provenance.

Pest animals

Given the proposed short duration of operations, it is not considered necessary that feral animal control programs be implemented, provided appropriate measures are taken to avoid encouraging or increasing pest animal populations in construction and operation areas. Onsite waste, particularly food waste, should be managed so as not to encourage scavenging wildlife to the area. Bins should be fitted with lids and these should remain closed between rubbish deposits.

Sightings of pest animals will be reported to the on-site Environmental Manager who will decide on the appropriate course of action depending on the circumstances.

Cane Toads, however, have the potential to cause a significant impact to threatened bats on site and efforts will be made to ensure no increase in Cane Toad abundance on site. Cane Toads will be managed at Spring Hill by limiting potential breeding sites, and through regular monitoring and management.

Monitoring and Measurement

The presence of pest species in and around the mine site should be reported to the Environmental Manager. Any instance of feral species seen living in and around areas such as the offices and workshops must be reported to the Environmental Manager and steps taken to control this infiltration.

Regular observation of disturbance sites and stockpiles for the presence of weed species must be undertaken (at least monthly). Where weed establishment is identified, appropriate control measures should be implemented as soon as possible to minimise the impacts of weeds on native habitat.

The following measures will be undertaken to avoid any increase in toad populations at the project site:

- Allow sediment ponds to dry out during the dry season;
- Undertake routine toad inspection and control;
- Remove sediment ponds during rehabilitation;

Non-conformance and Corrective Actions

Non-conformance with this management plan would be evidenced by an increase in weed and pest fauna species on the site as a result of activities around construction, operation and closure of the Spring Hill Project.

In the event of an increase in weed and fauna pest species, the proponent will engage in eradication programs as required to reduce the incidence of weed and fauna pest species on the site.

7.9 Waste (Domestic and Industrial) Management Plan

The Spring Hill project is a relatively short-term project with an intended low environmental impact. As such, the company will not maintain an on-site landfill. All domestic and industrial waste will be stored and labelled appropriately before removal from site by a licensed contractor (if classified as regulated waste). Further works to manage waste are detailed in Table 22.

Table 22 Waste (Domestic and Industrial) Management Matrix

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
Minimise environmental impacts associated with the generation and disposal of waste from mining activities	Generate less waste where possible.	Volumes of waste being generated should be recorded.	Waste storages should be inspected weekly.	Volumes of waste generated versus volumes of waste recycled.	Waste storages should be inspected weekly to ensure nothing that can be recycled is being disposed of.
	Recycle more waste where possible.	Volumes of waste being generated should be recorded.	Waste storages should be inspected weekly.	Volumes of waste generated versus volumes of waste recycled.	Waste storages should be inspected weekly to ensure nothing that can be recycled is being disposed of.
	Segregate domestic and industrial waste	Waste types must be labelled in storage, through use of colour coded bins or through use of labelling on containers.	Waste storages should be inspected weekly.	Waste will be segregated according to type.	If waste is found to be mixed inappropriately, a waste management toolbox session should be delivered at the next pre-start meeting.
Promote the efficient use of resources	Promote recycling	Promote recycling of material where possible on site. Investigate the availability of recycling contractors for site pick up of waste.	Volumes of waste should be recorded.	The site will recycle as much material as possible.	Where recycling facilities are available and are not used, a waste management toolbox session should be delivered at the next pre-start meeting.
Educate staff on correct waste disposal	Make sure all staff understand the different waste streams on site	Include waste disposal instructions in the site induction.	Inspect waste disposals to ensure waste is being properly segregated.	Waste will be segregated according to type.	Where waste is being disposed of inappropriately, a toolbox session should be delivered at the next pre-start meeting.

7.10 Dust, Noise and Vibration Management Plan

The nearest populated sensitive receptor to the Spring Hill operation is the Emerald Springs Roadhouse, approximately 10 km (in a straight line) from the site. Based on the activities proposed under this MMP and the offsite processing while considering the distance of the site from Emerald Springs it is highly unlikely the minimal residents of the Roadhouse would be negatively impacted by dust, noise and vibration from the operation.

The highest risk environmental sensitive receptor on site are Ghost Bats that occupy populated stopes. Mitigation of noise and vibration to these receptors is detailed within the *Threatened Bat Monitoring Plan* in Appendix G.

To reduce the risk of impact to environmental receptors, this dust, noise and vibration management plan aims to control dust generated by traffic related to the project, and also reduce noise and vibration caused by mining activities. Further works to manage dust, noise and vibration are detailed in Table 23.

Table 23 Dust, Noise and Vibration Management Matrix

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
Prevent dust from becoming a nuisance	Minimise dust from construction and mining activities	Use dust suppressing water carts with a mixture of polymer or molasses dust suppressant chemical on the site roads and the haul road to Union Reefs. The mobile crusher plant for crushing ore will be fitted with a dust suppression system	Dust generation will be monitored visually and dust suppression polymers or molasses with water carts will be used in dry periods.	Depositional dust should remain below nuisance dust limits, which on a visual inspection would be sufficient to create a visible layer of dust on a parked car or outdoor furniture in one day.	An excess of depositional dust will prompt an increase in the use of water for dust suppression. The use of a polymer or molasses dust suppressant chemical will reduce the amount of water required for dust suppressant.
Minimise noise and vibration from operational activities	Limit machinery noise	Install sound proofing and noise abatement controls on machinery where applicable.	Where noise abatement controls exist for a machine, they must be installed and used.	Machinery noise will be limited.	When machinery is inspected, lack of sound proofing should be noted and rectified.
		Ensure vehicles are maintained as per manufacturer's instructions	A vehicle maintenance register must be kept.	There will be a vehicle maintenance register that shows up to date maintenance actions.	Where vehicles are inspected and maintenance is found to be out of date, an incident report must be completed and the vehicle taken offline until it can be maintained.

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
	Limit blasting noise	Limit blasting to daylight hours only. Vibration controlled blasting will occur primarily in the Hong Kong 1 zone, which is separated from the bat exclusion zone by a steep valley with low potential for vibration. Pit development will be sequenced to minimise disturbance to the Ghost Bat roost habitat areas, so any disturbance associated with pit development will be coming from only a single direction. Blast design will be implemented to ensure vibration levels at old mine stopes does not exceed 10mm/sec or the disturbance threshold for Ghost Bats identified during early vibration monitoring phase. Blasting protocols specified in the *Threatened Bat Monitoring Plan* (Appendix G) will be implemented.	TM Gold will maintain a noise complaints register. Blasting protocols specified in the *Threatened Bat Monitoring Plan* (Appendix G) will be implemented to monitor blasting vibrations	There will be no complaints on the register.	Any complaints received should be acknowledged within 24 hours and a resolution targeted within 7 days of receiving the complaint.
	Limit noise impacts on staff	Ensure staff utilise hearing protection on site where appropriate.	Provide hearing protection for staff.	Staff will wear hearing protection where required.	Any staff complaint on noise exposure must be acknowledged within 24 hours and an investigation initiated within 48 hours of receiving the complaint.

Objective	Target	Management and Mitigation	Monitoring and Measurement	Effectiveness	Non-conformance and Corrective Action
		Install signs in areas where hearing protection is required.	Conduct spot checks to ensure staff are wearing appropriate hearing protection.	Staff will wear hearing protection where required.	Any staff complaint on noise exposure must be acknowledged within 24 hours and an investigation initiated within 48 hours of receiving the complaint.
Operate a complaints process to ensure stakeholder feedback is handled promptly and issues resolved satisfactorily	Deal with complaints promptly and resolve issues in a satisfactory fashion.	Maintain a complaint register and communicate that register to staff and the local stakeholders.	Review the register for complaints monthly.	Complaints received will be dealt with successfully.	If on review, complaints were found to not be acknowledged or resolved promptly, an investigation must be undertaken into the reason for this.

8 Water Management

8.1 Surface water

8.1.1 Surface Water at Spring Hill

A technical *Surface Water Quality Report* is attached to this MMP as Appendix R. The Spring Hill Project is located in the Mary River catchment. A small number of first order streams convey runoff from the eastern side of the Bonnie Ranges into the main channel of the McKinlay River 2 km east of the mining lease. Similar drainage lines convey runoff form the western side of the Bonnie Ranges towards the south and north of the project area, which snake their way into the main channel of the McKinlay River upstream and downstream. Ten major catchments were identified in the study area, six of which will possess mining infrastructure. The project is not located within a Water Control District or a Water Allocation Plan area.

8.1.2 Surface Water Quality at Spring Hill

Low-intensity fires that do not burn the crown of the forest lead to leaf fall shortly after the fire. The first post-fire rains leach organic material out of these fallen leaves and deliver relatively large concentrations of dissolved organic matter to the water storage. In addition, large amounts of leaf litter may be delivered. In the stream, much of this organic matter is readily degraded microbially, with the concomitant consumption of oxygen. The resultant anoxia leads to elevated manganese concentrations, formation of reduced sulfur compounds with associated taste and odour problems, and water discolouration (so called 'black water') (Chafer, 2007). The frequent fire regime at Spring Hill is likely to have some impact on stormwater runoff to receiving waterways downgradient of the mine site, and these factors must be taken into consideration when analysing surface water and sediment results in the proximity of the proposed project.

Sampling of surface waters prior to mining did not identify exceedances of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZ Guideline) (2018) 95% species protection level (SPL) for Aquatic Ecosystems or the Stock Water Guidelines during the study; however, total arsenic and total barium were noted to be elevated. Total arsenic was recorded above the limit of reporting (LOR) in 10 of 12 samples from the area with an average concentration of 0.0051 mg/L. Total barium was recorded above the LOR in all 12 samples with an average concentration of 0.030 mg/L.

Exceedances of arsenic should be anticipated throughout the region. Waste rock sampling for the proposed operation identified that the majority of waste rock samples, regardless of depth or lithology, were significantly enriched in arsenic (Appendix R). Waste rock analysis also indicates that arsenic is not soluble within the host rocks and therefore expected to be found at high concentrations in stream sediments of the local region.

8.2 Groundwater

Open adits at the Spring Hill mine site were inspected during a field visit in June 2016. These adits are up to 20 m deep in places. Since water tables are below the 20 m mark in the wet and dry season, within the area it is not expected that these adits will hold any water body during the wet season.

They do not hold water and, as such, due to the depth of regional groundwater table are not expected to intersect groundwater. The proposed pits range in depth from 10m at Hong Kong 3 to 90 m at Hong Kong 1.

According to Sheldon *et al.* (1994), the water table below the Main to East Lodes is very deep – almost always being deeper than 100 m. In some localised areas, it is deeper than 135 m. At this area, the base of complete oxidation occurs from 20 to 100 m depth, with the majority of cases between ~60 and 80 m depth.

In the absence of designated groundwater bores on site a number of exploration drill holes were measured for groundwater levels in July 2017. Groundwater levels were recalculated to vertical levels (Table 24).

The July groundwater levels where below the base of the Hong Kong Pit 1 and importantly within or just above of the level of complete oxidation.

Despite the great depths of the aquifers, groundwater levels at Spring Hill will still respond to seasonal rainfall. Hence, it is likely that the July measurements captured groundwater levels just below the post wet season groundwater level maximum. Pre-wet season groundwater levels measured in November will show lowered groundwater levels, closer to the maximum depth of oxidation.

Table 24 Groundwater levels recorded from Spring Hill exploration drill holes July 2017

Hole	Easting GDA	Northing GDA	Recorded Depth	SWL Vertical
XF004	794072.0	8493876	60m	Dry
XF006	794088.2	8493857	85m	63.17m
XF008	794054.5	8493824	100m	Obstructed at 41.50m
XF012	794044.0	8493918	30m	Obstructed at 3.0m
XF013	794066.1	8493930	67m	41.43m
XF023	794066.9	8493973	97m	66.27m
XF024	794079.5	8493994	100m	76.11m
XF025	794080.6	8494051	–	Obstructed at 61m
XF028	794080.5	8494136	50m	Dry
XF029	794054.0	8494122	65m	Dry
XF030	794124.5	8494160	50m	Dry

8.3 Identification of Information and Knowledge Gaps

8.3.1 Identification of Gaps

The key knowledge gap for the Spring Hill Project is related to groundwater and its potential presence at depth within the project disturbance area.

8.3.2 Filling Knowledge Gaps

TM Gold is committed to the installation of additional groundwater monitoring bores in closer proximity to the project to allow determination of potential mine-related impacts to the groundwater quality in the vicinity of the pits and the WRD (see Section 8.4.1). Pending groundwater drilling rig availability, it is anticipated that the three new bores will be installed prior to the 2019/2020 wet season. Full details of the additional groundwater bores including the monitoring schedule are included in the Appendix J of this MMP.

8.4 Water Monitoring Program

8.4.1 Groundwater Monitoring

Existing groundwater monitoring bores

Four pre-existing groundwater monitoring bores will be employed for this monitoring program (Table 25). The justification of these locations, depths, screen intervals and sizing of the bores are discussed in the *Groundwater Technical Report* (Appendix J).

Table 25 Location, Depth, Screen Intervals and Depth of Existing Spring Hill Monitoring Bores

Bore ID	Easting (M)*	Northing (M)*	Total depth (M)	Screen interval (M)
RN027282	794100	8493200	50	N/A
RN025631	792850	8494550	35	29–35
RN025630	794950	8493200	39	33–39
RN026347	793250	8493250	N/A	N/A
*Coordinates in GDA94 MGA Zone 52				

Additional monitoring bores required

There is a lack of groundwater information in the vicinity of the proposed pits and WRD as the existing registered bores on site are all located at a relatively long distance away from these disturbances. As a result, three additional monitoring bores have been proposed to fill in these data gaps and provide a better understanding of the groundwater flow system at Spring Hill. Due to the large topographic gradients that exist at Spring Hill, the locations of monitoring bores have been selected with site access as an important factor. This will ensure drilling equipment can be easily transported to the site. The potential locations of monitoring bores are listed in Table 26.

Table 26 Potential Locations of Spring Hill Monitoring Bores

Site ID	Easting (M)*	Northing (M)*	Ground Elevation (MAHD)	Comments
SHMB1	793620	8493752	161	Intercepting fault line to target potential preferential flow from proposed pits
SHMB2	793439	8494100	156	Intercepting fault line to target potential preferential flow and seepage from proposed WRD
SHMB3	794542	8494531	160	Down-gradient to the east of proposed pits
*Co-ordinates reference system is GDA94 Zone 52				

SHMB1

Occurrence of groundwater in the subsurface at Spring Hill is expected to follow highly fractured areas associated with faulting. SHMB1 is located between RN26347 and Hong Kong 1 Pit. It will target a northeast–southwest fault that has been previously mapped at over 1 km long, which runs through the proposed Hong Kong 3 Pit. Any seepage of water contained in pit voids (e.g. Hong Kong 3 Pit and Main Pit 1) can potentially migrate along this fault line. This monitoring bore will ensure that if groundwater is contaminated, it can be detected before reaching unimpacted groundwater downstream of the mine (i.e. the aquifer that RN26347 is screened in).

SHMB2

This monitoring bore will be targeting the flow of groundwater through a northeast–southwest trending fault.

SHMB3

SHMB3 will be located to the east and down-gradient of the Hong Kong 1 Pit, the Main 1 Pit and the Hong Kong 3 Pit. This monitoring bore is situated between two northeast–southwest trending fault lines.

Groundwater monitoring analytes

Results from waste rock characterisation (Appendix L) revealed that the country rock contained trace metals that could pose a risk if leached into groundwater. These trace metals had a geochemical abundance index (GAI) score of three or greater and include:

- Arsenic
- Cobalt
- Manganese

Trace metals that were calculated to have a GAI score of less than three, but should be additionally monitored, include:

- Copper.
- Chromium.

Additional trace metals found to be present in the pH 5 extract were boron, nickel and zinc, subsequently these metals will be included in the analytical suite.

Selenium has not been tested for at Spring Hill, nevertheless associated ore deposits in the region have reported high selenium concentrations. Therefore, selenium will be included into the analytical suite.

Physicochemical parameters are to be measured in the field, as well as in the laboratory. These parameters include pH, temperature, electrical conductivity (EC) and oxidation-reduction potential (ORP). It is recommended to include aluminium, iron, alkalinity, major cations (Na^+, Ca^{2+}, Mg^{2+}, K^+) and major anions (Cl^-, SO_4^{2-}, HCO_3^-, CO_3^-, F^-) in the analytical suite for interpretational purposes (Appendix J).

8.4.2 Surface Water Monitoring

Regular monitoring intervals are recommended for the Spring Hill Project to ensure that water quality objectives are being met.

Samples shall be analysed by a National Association of Testing Authorities (NATA) laboratory for parameters detailed in Table 27. Comparison of water quality results shall be made against the ANZ Guidelines (2018) 95% SPL for Aquatic Ecosystems for samples taken from natural waterways, and the ANZ Guidelines 2018 Stock Water Guidelines for samples taken from the three human-made water storages. Where an exceedance against trigger values is identified, an investigation shall be undertaken to understand the potential for environmental harm.

If the trigger values above are exceeded during operations in the downstream environment for natural waterways, then the downstream results will be compared to upstream results. If the downstream results exceed the upstream results an investigation will be triggered.

In human-made dams, any exceedance of an ANZ Guidelines 2018 livestock watering trigger value will prompt an investigation.

Sampling shall be undertaken at locations specified in Table 28 and Figure 15. Monitoring shall be undertaken at the following intervals:

- Monthly
- Following a rainfall event.

Table 27 The 95% SPL for slightly to moderately disturbed systems and livestock drinking water quality trigger values from ANZ Guidelines 2018

ANZ Guidelines 2018	Type	Parameter	Trigger Value
Aquatic Ecosystem – 95% SPL (slightly to moderately disturbed systems)	Physical	Electrical Conductivity	350µS/cm
		Dissolved oxygen	80% (lower limit)
		pH	6.5 – 8.0
		Turbidity	15NTU
	Metal / Metalloid	Arsenic	0.024mg/L*
		Cadmium	0.0002mg/L
		Zinc	0.008mg/L
		Boron	0.37mg/L
		Copper	0.0014mg/L
		Lead	0.0034mg/L
Livestock drinking water quality	Physical	Total Dissolved Solids	4000mg/L (cattle)
		NOx as N	400mg/L
		NO_2 as N	30mg/L
		Calcium	1000mg/L
		Sulphate	1000mg/L
	Metal / Metalloid	Arsenic	0.5mg/L*
		Cadmium	0.01mg/L
		Chromium	1.0mg/L
		Zinc	20mg/L
		Boron	5mg/L
		Copper	1mg/L (cattle)

ANZ Guidelines 2018	Type	Parameter	Trigger Value
		Lead	0.1mg/L

* will be assessed against established background values

Table 28 Location of Surface Water Monitoring Points

Name	Long Name	Catchment	Purpose	Easting	Northing
HSD_DAM	Homestead Dam	Eastern	Storage	795218	8494123
E-DS1	Eastern Drainages - Downstream 1	Eastern	Downstream	794580	8494512
MR-US	McKinlay River Upstream	McKinlay River	Upstream	798246	8491925
MR-DS	McKinlay River Downstream	McKinlay River	Downstream	794763	8495838
WH-1	Waterhole 1	Northern	Storage	793042	8494652
E-DS2	Eastern Drainages - Downstream 2	Northern	Downstream	795354	8494721
S-US	Southern Drainages Upstream	Southern	Upstream	794924	8491874
S-US2	Southern Drainage	Southern	Upstream	795824	8491961
ALV_DAM	Alluvial Dam	Southern	Storage	793401	8493286
S-DS	Southern Drainages - Downstream	Southern	Downstream	795515	8492405

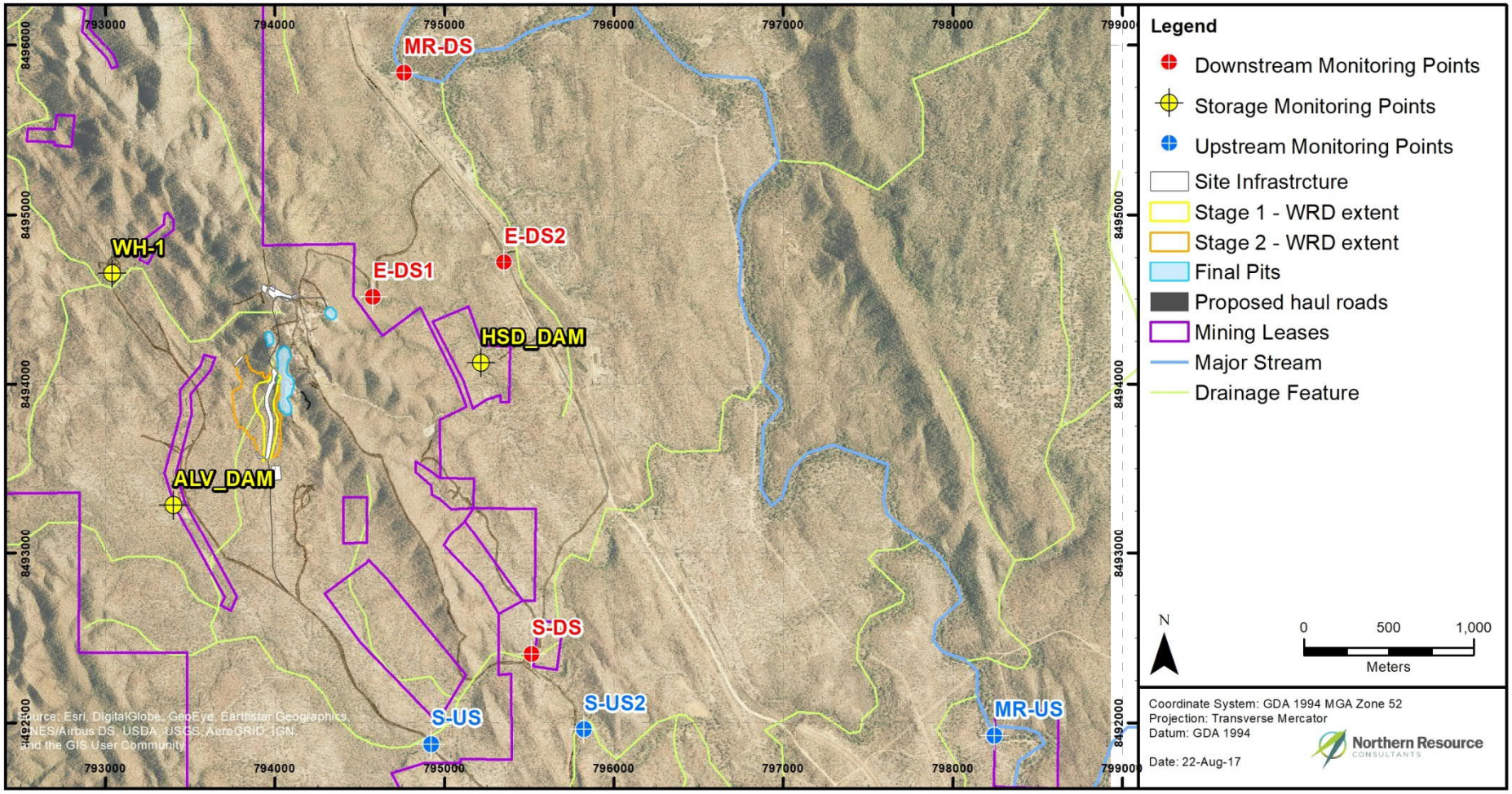


Figure 15 Location of Surface Water Monitoring Points

9 Incident Reporting

9.1 Incident reporting – Internal and External

Reporting to DPIR will be in accordance with Regulations 3 and 4 of the *Mining Management Act* and any individual reporting requirements may be contained in any authorisations issued under the *Mining Management Act*.

The procedure for reporting is:

- All incidents are to be reported to the General Manager as soon as the incident is identified.
- Examples of reportable incidents include spills (chemicals and fuel), burst or leaking pipelines and excessive dust generation.
- The General Manager will be responsible for onward reporting of qualifying incidents to the DPIR as soon as practicable, but within 24 hours of discovery of the incident.

Management of the incident will be in accordance with the steps described in the management plans, depending on the nature of the incident. An incident register will be maintained by the site General Manager and will be produced for inspection if required. The incident will be investigated to determine causes and identify procedures to prevent recurrence.

9.2 Process for Reporting Fauna Impacts

Monitoring and reporting impacts on threatened bat species will follow the protocol provided in the *Threatened Bat Monitoring Plan* (Appendix G).

The project may be subject to environmental audits by the Commonwealth Department of Environment and Energy or by the NT EPA to ensure compliance with approval conditions.

Any action that results in a very high or critical impact to threatened species (as defined in the *Threatened Bat Monitoring Plan* (Appendix G) will be immediately reported to the regulatory authorities and will result in operations being suspended until given the authority to proceed.

Any fauna that are injured or killed during construction should be promptly reported to the Environmental Manager as an environmental incident.

The procedure for reporting is:

- All fauna incidents are to be reported to the Environmental Manager and the General Manager as soon as the incident is identified.
- The General Manager will be responsible for the onward reporting of fauna impacts to the Commonwealth Department of Environment and Energy, the NT Environmental Protection Authority and the NT Department of Industry, Tourism and Trade under s29 of the MMA.

9.3 Process for Reporting Cultural Heritage Impacts

If culturally sensitive artefacts or objects are found during the construction works, the operator shall immediately stop works in the immediate vicinity of the artefact or object and advise the Mine Manager. The Environmental Manager shall establish an exclusion zone around the artefact or object until it has been inspected and/or removed by a person authorised by the Heritage Branch NT Government.

9.4 Process for Reporting to DPIR

Incidents that qualify for onward reporting to the department should be notified within 24 hours of discovery of the incident. In an event where an incident causes a breach of the conditions of the Authority for the project, reporting must be conducted in accordance with the details of that specific condition.

DPIR have produced a *pro forma* for the reporting of incidents under section 29 of the *Mining Management Act* (Appendix S). This *pro forma,* or a bespoke incident reporting form containing the same information, should be used to report any incident to the DPIR.

9.5 Incident Reporting – Health and Safety

If a workplace health and safety incident has also been identified as a '*notifiable incident*' as per Part 3 of *Work Health and Safety (National Uniform Legislation) Act*, the General Manager is responsible for ensuring that NT WorkSafe is notified immediately, as per Sections 35 to 39 of the Act. A '*notifiable incident*' as outlined within the Act constitutes the following:

- The death of a person
- A 'serious injury of illness', or
- A 'dangerous incident'
- The procedure for reporting is:
  - The HSE Officer on site is responsible to inform NT WorkSafe immediately via phone or email once they are aware of the incident. Written notification may also be requested within 48 hours of the incident.
  - The HSE Officer will then alert the General Manager of the incident.
  - The HSE Officer will need to ensure that the site of the incident will need to be preserved until a NT WorkSafe inspector arrives or directs otherwise.

On site procedures will ensure that all staff inform the HSE Officer of any incidents or health and safety risks on site. The HSE officer is responsible for maintaining a record of all potential health and safety risks and updating these within the Risk Management Plan.

TM Gold acknowledge that effective mitigation of health and safety risks can help to mitigate potential environmental risks for the life of mining operations at Spring Hill.

9.6 Process for Reporting to NT WorkSafe

Health and safety incidents are required to be reported to NT WorkSafe immediately after the incident, as such communication of the incident via phone or email will be utilised.

NT WorkSafe have produced a *pro forma* for the reporting for Health and Safety Incidents under Sections 35 to 39 under the *Work Health and Safety (National Uniform Legislation) Act.* A copy of this *pro forma* is included as Appendix T of this MMP. This *pro forma*, or a bespoke incident reporting form containing the same information, should be used to report any incident to NT WorkSafe.

10 Closure Planning

The Spring Hill Project is still in the approval stage, and some elements are well defined while other others are still being reviewed and refined. TM Gold have therefore prepared a Conceptual Mine Closure Plan (CMCP) which presents current information, and best practice guidelines that will be implemented during ongoing detailed closure planning. The Spring Hill CMCP is considered a live document that will undergo ongoing review, development and continuous improvement throughout the Spring Hill Project mine life with detail increasing as the mine moves towards closure. Table 29 shows the schedule for completion of the Mine Closure Plan. A copy of the CMCP is attached as Appendix H.

Table 29 Schedule for Mine Closure Plan

Stage	Preparation of Mine Closure Plan
Site preparation – 1 Month	Commence design of post closure landforms
Mining – 13 months	Update and finalise Mine Closure Plan
Off-site processing – during mining and 2-3 months post mining	Implement mine closure activities
Rehabilitation and closure – 2 months	Implement and complete mine closure activities with on-going monitoring
Post-closure monitoring and post wet season remedial works - ≥10 years (for bat management)	On-going monitoring and review/audit of data

10.1 Planned Closure Strategy

10.1.1 Expected Disturbance Areas

The Spring Hill project site layout involves the following major infrastructure components:

- ROM pad with mobile crusher and sediment basin (0.7ha)
- Administration offices (demountable, within ROM pad footprint)
- WRD (11.6ha)
- Access tracks/haul road (1.1ha).
- Hong Kong 1 Pit (2.7ha)
- Hong Kong 3 Pit (0.3ha)
- Main Pit 2 Pit (0.3ha)

10.1.2 Rehabilitation Domains

To assist in planning for rehabilitation the Spring Hill Project site has been segregated into the following mine domains:

- Domain 1: Ancillary infrastructure including site office and ablutions, ROM pad, sediment basins and mobile crusher.
- Domain 2: WRD.
- Domain 3: Roads and access tracks with ESC infrastructure.
- Domain 4: Three open cut pits.

Each of these domains will require rehabilitation works and associated costing for rehabilitation liability.

10.1.3 Completion Criteria

Completion criteria are important to ensure a clear definition of successful rehabilitation is established for each closure domain. The completion criteria and performance indicators in the CMCP have been developed to take into consideration the history and environmental setting of the region that influences rehabilitation performance. Performance indicators outline progress towards achievement of criteria. Completion criteria have been determined based on surrounding land use and post closure landform designs for the Spring Hill Project

Completion criteria developed for the Spring Hill Project are summarised in the CMCP (Appendix H) and describe the generic criteria which are applicable to all Spring Hill Project domains as well as presenting criteria relevant only to specific Domains. Further site specific closure criteria will also be developed as required for specific facilities. Refinement of completion criteria will continue as more information becomes available.

10.1.4 Preliminary Post-mining Land Use

While the Spring Hill lease is located within the Mary River West pastoral lease, the land across the ML is extremely steep and unsuited for grazing. There is no pastoral activity occurring in the vicinity of the proposed project. The land within and adjacent to the proposed disturbance is native vegetation, albeit heavily disturbed by the fire regime of the region.

At mine closure three open pits and the WRD as major landform features, essentially in perpetuity, post mining land use for other areas are described in Table 30.

Table 30 Post Mining Land Use

Domain	Description	Post Mining Land Use
Domain 1	Ancillary infrastructure	Natural ecosystem to be as similar as possible to the original ecosystem
Domain 2	Waste rock dump	Natural ecosystem to be as similar as possible to the original ecosystem
Domain 3	Roads and access tracks with ESC infrastructure	Reinstate the pre-mining land use
Domain 4	Three open cut pits	Residual void / water storage

10.1.5 Rehabilitation Implementation

TM Gold will engage appropriately qualified earthworks contractors to undertake the material movement and the bulk of rehabilitation and final earthworks at the site.

The works will be undertaken with the supervision of management and in accordance with the Spring Hill MMP. Given the short nature of the proposed project, the opportunity for progressive rehabilitation will be limited; however, TM Gold will be willing to implement rehabilitation activities on areas as they become available should they not be required for future operations.

The CMCP details all rehabilitation tasks required for each domain.

10.1.6 Closure and Rehabilitation Task Register

The proposed mining activities are expected to take eight months including construction works, after which processing will continue offsite for a further two months and rehabilitation can commence at Spring Hill.

The following schedule of rehabilitation and closure tasks presented in Table 31 is provided in the event that no additional activities are proposed or approved at the Spring Hill Project.

Table 31 TM Gold Closure and Rehabilitation Task Register for Spring Hill

Spring Hill – Closure and Rehabilitation Task Register	
Task	Expected Completion Date
Domain 1 – Associated Infrastructure	
Removal of infrastructure including buildings, fuel tanks, machinery, concrete pads etc.	Months 13-14
Removal of any localised contaminated soil offsite.	Months 13-14
Ripping, topsoiling and seeding of all areas of disturbed land within the associated infrastructure domain.	Months 13-14
Domain 2 – Waste Rock Dump	
Recontouring batters	Months 13-14
Contouring bench slopes and placement of rock lined drains	Months 13-14
Establishment of rock lined gullies for removal of water from the recontoured dump	Months 13-14
Seeding dump surfaces	Month 14
Domain 3 – Roads and Access Tracks With ESC Infrastructure	
Progressive removal of ESC infrastructure	Month 14
Ripping road surface	Month 14
Replacement of cleared material stockpiled in windrows	Month 14
Ripping replaced material and seeding	Month 14
Domain 4 – Open Cut Pits	
Geochemical and Geotechnical assessment of residual voids to ensure closure criteria are met	Month13
Repair of post closure diversion drains if required	Month 14

Spring Hill – Closure and Rehabilitation Task Register	
Construction of exclusion bund and fencing	Month 14

10.2 Life of Plan - Unplanned Closure

For the purposes of this plan, unplanned closure has been split into temporary care and maintenance (assumed to be for a period of up to 5 years where there is a foreseeable solution enabling future operations) and unexpected early closure (the sudden cessation of mining operation and permanent closure of the facility).

In the event of temporary closure, the functionality of the site for future mining operations must be maintained while making the site safe, limiting access for unauthorised persons and minimising environmental impacts. All pits and waste rock storages would be stabilised, infrastructure will be left in a safe and stable manner and ongoing monitoring and environmental management tasks would continue to occur.

In the event of permanent closure, where there is no foreseeable solution to successful future operations, a re-evaluation of closure works will be conducted to prioritise and identify essential tasks and the full site closure plan will be enacted. This CMCP would be revised to a Detailed Mine Closure Plan to include a detailed decommissioning plan relevant to the current stage of the project. As MMPs are submitted annually, they contain an up-to-date summary of the disturbed areas and the progressive rehabilitation status. As such, information in the current MMP at the time of closure would be used for planning associated with premature closure.

Key closure tasks to be undertaken in the event of unplanned closure are presented in the CMCP (Appendix H).

10.3 Post Closure Monitoring and Management

Overall, monitoring systems are expected to remain in service throughout the closure execution and post closure periods until commitment to continue post closure monitoring and management until closure criteria are met, to the satisfaction of the DPIR and the underlying land owner. Monitoring is also used to identify any corrective action required should monitoring results not meet obligations, or not be trending toward closure criteria.

At a minimum monitoring will continue for two years as specified in the *Threatened bat Monitoring Plan* (Appendix G), and will include

- Rehabilitation performance monitoring (ecosystem and erosion monitoring)
- Surface water monitoring
- Groundwater monitoring.

Details on the post closure monitoring requirements for each programme is provided within the CMCP (Appendix H).

11 Calculation of financial provision

Section 43A of the *Mining Management Act* specifies that the Minister will calculate the required amount of security to be provided to the Northern Territory Government. Once the security bond is set, the amount will be reviewed in conjunction with Government to ensure it remains consistent with the level of disturbance caused by the project at any specific time. The proposed bond details are included in Appendix U of this MMP.

12 References

ACE Traffic Control (2017) Work zone traffic management plan – Fawcett Cattle Company Pty Ltd to conduct Gold Ore Haulage Works for PC Gold Pty Ltd. Diane Eurell, 15th March 2017, Darwin, Northern Territory.

AMIRA. (2002). ARD Test Handbook – project P387A. Prediction & Kinetic Control of Acid Mine Drainage.

ANCOLD. (2012). Guidelines on Tilings Dams – Planning Design, Construction, Operation and Closure. Retrieved from http://www.ancold.org.au/?page_id=334.

Australian Bureau of Meteorology (BoM) (2017) Northern Territory in 2016: Hot, highly variable rainfall, Annual Climate Summary for the Northern Territory, Accessed the 7th of July 2017, < http://www.bom.gov.au/climate/current/annual/nt/archive/2016.summary.shtml>

Australian Bureau of Meteorology (BoM) (2016) Northern Territory in 2015: Warm days, many months of below average rainfall, Annual Climate Summary for the Northern Territory, Accessed the 7th of July 2017, http://www.bom.gov.au/climate/current/annual/nt/archive/2015.summary.shtml

Australian Bureau of Meteorology (BoM) (2015) Northern Territory in 2014: Year of extremes, but average overall, Annual Climate Summary for the Northern Territory, Accessed the 7th of July 2017, < http://www.bom.gov.au/climate/current/annual/nt/archive/2014.summary.shtml>

Boucher G. (2017) *Prediction of Blast-Induced Ground Vibration and Air Overpressure, Spring Hill*. Report to NRC.

Chafer, C.J. (2007). Wildfire, catchment health and water quality: a review of knowledge derived from research undertaken in Sydney's water supply catchments 2002–2007.

Christian, C.S. & Stewart, G.A. (1953). General report on survey of Katherine-Darwin region, 1946. C.S.I.R.O., 1953. Aust. Land Res. Ser. n° 1.Organisation (CSIRO) Australia.

Churchill S.K. (2009). *Australian bats* (Second Edition). Sydney: Allen & Unwin.

Churchill, S. K., & Helman P. M. (1990). Distribution of the ghost bat, *Macroderma gigas*, (Chiroptera: Megadermatidae) in central and south Australia. *Australian Mammalogy,* 13, 149–156. [Cited in TSSC, 2016]

Department of the Environment (DoE) (2013). Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999. Retrieved from: https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

Department of Environment and Natural Resources (DENR). (2019). *Land Clearing Guidelines*. Darwin, Northern Territory: Department of Natural Resources, Environment, the Arts and Sport.

Department of Land Resource Management (DLRM). (2012). Threatened Species of the Northern Territory – Northern Leaf-nosed Bat. Northern Territory Government [Complied by Milne, D.].

EarthSea (2016). PC Gold Pty Ltd: Cultural Heritage Survey, Spring Hill Project, ML23812 2016, Darwin, Northern Territory.

Fraser, F., Lawson, V., Morrison, S., Christopherson, P., McGreggor, S., & Rawlinson, M. (2003). Fire management experiment for the declining Partridge Pigeon, Kakadu National Park. *Ecological Management and Restoration, 4*, 93–101.

http://www.inap.com.au/GARDuide.htm. Published by the International Network for Acid Prevention.

Isbell, R.F. (1983). *Soils: an Australian viewpoint.* Melbourne: CSIRO.

Low Ecological Services (LES). (1996). Environmental Studies of Landscape, Flora and Fauna of the Proposed Spring Hill Project Area.

LES. (2013). Updated Environmental Assessment of Landscape, Flora and Fauna of Spring Hill Project Area. Report prepared for Thor Mining.

Mitchell, S. 1994. An Archaeological and Historical Survey of Selected Mining Sites in the Pine Creek District, Northern Territory. Unpublished report to the National Trust of Australia (NT Branch).

Mitchell, S. 1993. An archaeological investigation of heritage sites in the southern lease project area, Pine Creek. Unpublished report to the Shell Company of Australia.

Molnar R. E., Hall, L. S., & Mahoney J. H. (1984). New fossil localities for Macroderma Miller, 1906 (Chiroptera: Megadermatidae) in New South Wales and its past and present distribution in Australia. *Australian Mammalogy, 7*, 63–73. [Cited in TSSC, 2016].

Needham, R.S., Crick, I.H., & Stuart-Smith, P.G. (1980). Regional geology of the Pine Creek Geosyncline. In J. Ferguson & A. B. Goleby (Eds.), *Uranium in the Pine Creek Geosyncline*. International Atomic Agency, Vienna 1–22.

Nicholson, P.M., Ormsby, W.R., & Farrar, L. (1994). *A review of the structure and stratigraphy of the central Pine Creek Geosyncline.* Proceedings AusIMM Annual Conference 1994.

Northern Resource Consultants (NRC). (2016). Flora and Fauna Technical Report. Spring Hill Gold Project. Prepared for TM Gold Pty Ltd.

NRC (2017). Spring Hill Waste Rock Characterisation Technical Report.

Northern Territory Environmental Protection Authority (NTEPA). (2013). Environmental Assessment Guidelines: Acid and metalliferous drainage. Version 2.0.

Oakwood, M. (1997). The ecology of the northern quoll, *Dasyurus hallucatus*. PhD Thesis, Australian National University.

Oakwood, M. (2000). Reproduction and demography of the northern quoll, *Dasyurus hallucatus*, in the lowland savanna of northern Australia. *Australian Journal of Zoology, 48*, 519–539.

Sheldon, T., Scrimgeour, I., & Edwards, D. (1994). *Exploration report for Spring Hill 1994*, Unpublished report by Eupene Exploration Enterprises Pty Ltd for Ross Mining NL.

SJ Traffic Consulting (2017) *Spring Hill Gold Project, Traffic Impact Statement*. April 2017. Afshin Beigi, Darwin, Northern Territory.

Story, R., Williams, M.A.J., Hooper, A.D.L., O'Ferrall, R.E., & McAlpine, J.R. (1969). *Lands of the Adelaide-Alligator area, Northern Territory*. CSIRO Land Research Series 25. Melbourne: CSIRO.

Threatened Species Scientific Committee (TSSC). (2016). Approved Conservation Advice for *Macroderma gigas* (Ghost Bat). Canberra: Department of the Environment (now Department of Environment and Energy.

TM Gold (2017) *Figure 5: Proposed configuration of the ore pits at Spring Hill*, Produced by Entech Engineering, Perth. July 2017.

Tongway, D. J., & Hindley, N. I. (2004). Landscape function analysis: Procedures for monitoring and assessing landscapes with special reference to minesites and rangelands. Version 3.1. Canberra, ACT: CSIRO Sustainable ecosystems.

Whitehead, P.J., Bowman, D.M.J.S., Preece, N., Fraser, F., & Cooke, P. (2003). Customary use of fire by indigenous peoples in northern Australia: its contemporary role in savannah management. *International Journal of Wildlife Fire, 12*, 415–425.

Woinarski, J.C.Z., Armstrong, M., Brennan, K., Fisher, A., Griffiths, A.D., Hill, B., Milne, D.J., Palmer, C., Ward, S., Watson, M., Winderlich, S., & Young, S. (2010). Monitoring indicates rapid and severe decline of native small mammals in Kakadu National Park, northern Australia. *Wildlife Research, 37*, 116–126.

ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
5 Foelsche Street
Darwin NT 0800
Australia
T: +61 8 8998 0100
F: +61 2 9427 8200

GOLD COAST
Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Suite 2, 2 Domville Avenue
Hawthorn VIC 3122
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY
2 Lincoln Street
Lane Cove NSW 2066
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE
Level 1, 514 Sturt Street
Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

TOWNSVILLE SOUTH
12 Cannan Street
Townsville South QLD 4810
Australia
T: +61 7 4772 6500

AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: +64 27 441 7849

NELSON
6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628