MINING MANAGEMENT PLAN

Nobles Nob Gold Project

Operator:

Tennant Consolidated Mining Group Pty Ltd.

ABN 72 645 263 547 / ACN 645 263 547

Authorization Number:

1123-01

Amendment #1. September 2023

Copies to:

- Department of Industry, Tourism and Trade (Mines Division)
- Tennant Consolidated Mining Group Pty Ltd.

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I, Peter Main – Managing Director 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: 2nd October 2023

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APPROVED COMPANY ISO 14001 Environmental Management Systems QMS Certification Services
APPROVED COMPANY ISO 9001 Quality Management Systems QMS Certification Services

AMENDMENTS

Section	Amendment
4.2 – Proposed Mining of the Northern Tailings	Additional extraction and processing of a 5.5 ha footprint area of existing tailings, approximately 629,660 t of material.
4.3 – Proposed Mining of the Existing Nobles Nob Pit	Change (from a 'Goodbye Cut' at the base of the pit to 7 m below the current pit floor) to an expansion of the pit of 5.6 ha to 20 m below the current pit floor.
	Deposition of approximately 1,201,472 m^3 of waste rock produced from the expansion of the Nobles Nob pit, to be deposited on the existing Northern WRD.
5.1 – Ore Processing	Processing and tailings storage from 3 additional external deposits, Rising Sun, Weabers Find, and Black Snake.
5.5 – Tailings Treatment and Storage Facility	Change (from Geotubes) to dry stack tailings methodology using filter presses.
	Change in the size of the tailings area (from one 9 ha Geotubes platform) to 3 dry stack tailings platforms totalling 25.2 ha.
6.1 – Process/Mine Water Dams	Reduction in process water area due to improved tailings technology (from 2 ha area) to one 0.6 ha process water pond.
6.2 – Power Supply	Configuration of diesel generators changed (from 4 x 1250 kW generators) to 6 x 550 kVA generators.
6.3 – Water Supply 6.4 – Mine Dewatering	Expected water demands of the Project lowered (from 15 L/s) to 4.5 L/s due to improved tailings technology. Water supply plan changed to use water from dewatering of the Nobles Nob Pit first, and then the Juno mine site later, in sequence. Potable water supply changed (from piped town water supply) to initially trucked town water supply – and then installation of a potable water treatment plant.
6.5 – Wastewater Treatment System	Changed (from a septic system) to initially portable ablutions – and then installation of an advanced wastewater treatment system.

GLOSSARY AND ACRONYMS

AAPA	Aboriginal Areas Protection Authority
ABS	Australian Bureau of Statistics
AMD	Acid Metalliferous Drainage
ANCOLD	Australian National Committee on Large Dams
ANZG	Australian and New Zealand Guidelines
ASLP	The Australian Standard Leachate Procedure
ASRIS	Australian Soil Resource Information System
ATSI	Aboriginal and Torres Strait Islander
Au	Gold
BCA	Building Control Area
BOM	Australian Bureau of Meteorology
BPESC	Best Practice Erosion and Sediment Control
CLC	Central Land Council
CIL	Carbon-in-Leach
CN	Cyanide
CPESC	Certified Professional in Erosion Sediment Control
DEPWS	NT Government Department of Environment, Parks, and Water Security
DDH	Diamond Drill Hole
DITT	NT Government Department of Industry, Tourism and Trade
DMP	Dust Management Plan
DoH	Department of Health
EC	Electrical Conductivity
EMP	Environmental Management Plan
EMS	Environmental Management System
EP Act	*Environment Protection Act 2019*
EP Regulations	*Environment Protection Regulations 2020*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
ESCP	Erosion Sediment Control Plan
ESG	Environmental, Social and Governance
FTEs	Full Time Employees
GAI	Geochemical Abundance Index
GDEs	Groundwater Dependent Ecosystems
GHG	Greenhouse Gases
HDPE	High Density Polyethylene
MM Act	*Mining Management Act 2001*
MMP	Mining Management Plan

MNES	Matters of National Environmental Significance
MT Act	*Minerals Titles Act 2010*
NAPP	Net Acid Production Potential
NAF	*Non Acid Forming*
NAG	Net Acid Generation
NATA	National Association of Testing Authorities
NEPC Act	*National Environment Protection Council (Northern Territory) Act 1994*
NEPM-AAQ	*National Environment Protection (Ambient Air Quality) Measure 1998*
NGER	National Greenhouse and Energy Reporting
NGER Act	*National Greenhouse and Energy Reporting Act* 2007
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Agency
PERC	Open hold
PETA	Pre-Existing Tenements Agreement
Project	All project activities within the scope of proposed works the subject of this MMP
PWC	NT Power and Water Corporation
RC	Reverse Circulation drilling
RMP	Risk Management Plan
ROM	Run of Mine
SCLU Act	*Soil Conservation and Land Utilisation Act 1969*
SDS	Safety Data Sheet
SoBS	Sites of Botanical Significance
SoCS	Sites of Conservation significance
TCMG	Tennant Consolidated Mining Group
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbon
TPWC Act	*Territory Parks and Wildlife Conservation Act 1976*
TRH	Total Recoverable Hydrocarbons
TSS	Total Suspended Solids
Umwelt	Umwelt Environmental and Social Consultants
Water Act	*Water Act 1992*
WDL	Waste Discharge Licence
w/w	wet/weight
WM Act	*Weed Management Act 2001*
WMP	Weed Management Plan
WMPC Act	*Waste Management and Pollution Control Act 1998*
WRD	Waste Rock Dump
WQMP	Water Quality Management Plan

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1 INTRODUCTION

This Mining Management Plan (MMP) has been developed to meet the requirements of the *Mining Management Act 2001* (MM Act). A Mining Management Plan is required under Section 40 of the MM Act to detail the management of the mining operation, identify and document the key environmental risks associated with the operation, demonstrate consideration of and proposed mitigation for the risks, and meet the requirements of the MM Act. This document was first developed by EcOz Environmental on behalf of the Tennant Consolidated Mining Group (TCMG) in July 2022 (EcOz 2022). This amendment has been prepared by TCMG in September 2023.

This MMP is for the Nobles Nob Gold Project (the Project) that encompasses extractive mining and reprocessing of the old rock waste dumps and tailings storage. Proposed activities include extraction and processing of the existing Southern Waste Rock Dump (WRD) and existing Northern Tailings, and an expansion of the existing Nobles Nob pit. This will require the establishment of a new processing plant and a new tailings storage facility, waste rock deposition, and new water management infrastructure. The deposits proposed to be extracted within the scope of this MMP and the associated mine site infrastructure will be established within previously cleared and heavily disturbed areas. A hybrid power supply solution is also proposed, which includes a 4 ha solar field which would represent the only area of new clearing and disturbance on site. Further details of the proposed activities are provided in Sections 4 – 7 of this MMP.

It is proposed that following processing of the above deposits, the processing plant and tailings storage facility then be used to process ore from surrounding satellite sites. Processing of ore from the nearby Rising Sun, Weabers Find and Black Snake deposits, and storage of the resulting tailings is included within the scope of proposed activities for this MMP. The mining activities for these additional deposits will be covered within separate MMPs.

Exploration activities for the 2022 drill program were included in the first version of this MMP, however exploration activities for the 2023 drill program and all future drill programs are covered within a separate exploration only MMP for ease of assessment and disturbance tracking (Mining Authorisation 1163-01).

1.1 Operational Details

Operator Name:	Tennant Consolidated Mining Group Pty Ltd.
ABN/ACN:	72 645 263 547 / 645 263 547
Key Contact Person/s:	Peter Main
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1.1.1 Organisational Structure and Responsibility

Overall responsibility for environmental management and compliance at the Nobles Nob Site lies with the Managing Director (Peter Main), which includes implementing, resourcing and maintaining environmental management as documented in this MMP; and the maintenance of this MMP. The Project Manager and relevant onsite personnel are responsible for defining and communicating relevant environmental responsibilities and accountabilities to employees, consultants and contractors, during the stages of operations and closure.

The organisational structure for the Project is detailed in Figure 1-1 below.

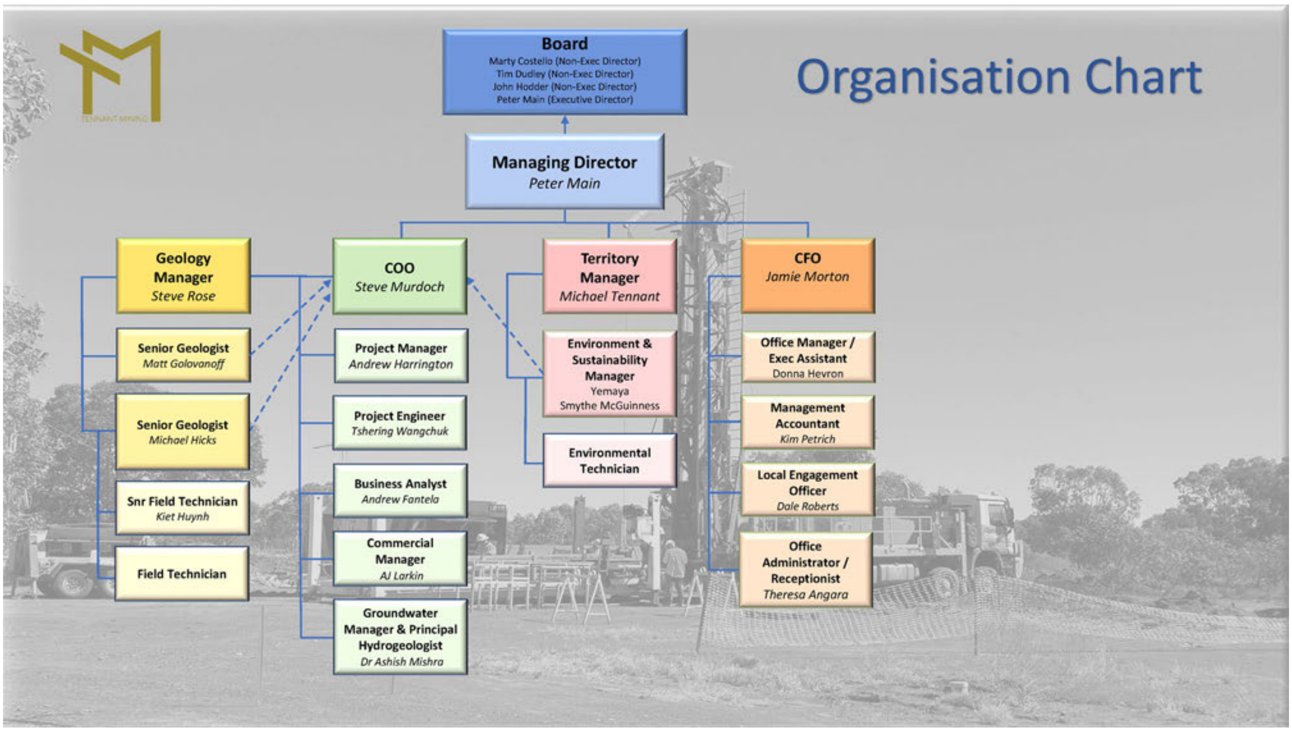

Figure 1-1 Organisational structure

1.2 Title Details

TCMG are the tenement holders for the Nobles Nob tenements. These are: MLC512, MLC513, MLC514, MLC515, MLC516, MLC517, MLC521, MLC525, MLC526, MLC531, MLC532, MLC533, MLC534, MLC537, MLC538, MLC539, MLC540, MLC541, MLC542, MLC543, MLC544, MLC545, MLC548, MLC549, MLC550, MLC556, MLC589, MLC590, MLC688, MLC689, MLC690, MLC691.

TCMG are the approved operator of the Juno tenements. These are: MCC284, MLC154, MLC155, MLC45, MLC46, MLC47, MLC578, MLC579, MLC652, MLC68. The nomination of operator form is attached in Appendix A. TCMG has an access agreement with Tennant Gold for use of the Juno tenements, for all required activities excluding active mining. A confirmation letter is also included in Appendix A.

All tenements relating to the Project are detailed in Table 1-1.

Table 1-1 Mining tenements related to the Project

Title number	Title holder	Grant date	Expiry date
MLC517	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC534	Tennant Consolidated Mining Group Pty Ltd	26/11/1956	31/12/2033
MLC690	Tennant Consolidated Mining Group Pty Ltd	31/12/1933	31/12/2026
MLC521	Tennant Consolidated Mining Group Pty Ltd	3/07/1953	31/12/2029
MLC525	Tennant Consolidated Mining Group Pty Ltd	23/12/1954	31/12/2030
MLC549	Tennant Consolidated Mining Group Pty Ltd	29/01/1959	31/12/2036
MLC545	Tennant Consolidated Mining Group Pty Ltd	19/02/1958	31/12/2035
MLC540	Tennant Consolidated Mining Group Pty Ltd	3/06/1957	31/12/2033
MLC548	Tennant Consolidated Mining Group Pty Ltd	29/01/1959	31/12/2036
MLC537	Tennant Consolidated Mining Group Pty Ltd	9/04/1957	31/12/2033
MLC515	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC516	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC589	Tennant Consolidated Mining Group Pty Ltd	6/05/1975	31/12/2030

Title number	Title holder	Grant date	Expiry date
MLC556	Tennant Consolidated Mining Group Pty Ltd	19/03/1962	31/12/2032
MLC689	Tennant Consolidated Mining Group Pty Ltd	31/12/1933	31/12/2026
MLC531	Tennant Consolidated Mining Group Pty Ltd	26/11/1956	31/12/2033
MLC541	Tennant Consolidated Mining Group Pty Ltd	3/06/1957	31/12/2033
MLC526	Tennant Consolidated Mining Group Pty Ltd	7/03/1955	31/12/2026
MLC538	Tennant Consolidated Mining Group Pty Ltd	9/04/1957	31/12/2033
MLC514	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC688	Tennant Consolidated Mining Group Pty Ltd	31/12/1933	31/12/2026
MLC542	Tennant Consolidated Mining Group Pty Ltd	19/02/1958	31/12/2035
MLC513	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC532	Tennant Consolidated Mining Group Pty Ltd	26/11/1956	31/12/2033
MLC691	Tennant Consolidated Mining Group Pty Ltd	31/12/1933	31/12/2026
MLC539	Tennant Consolidated Mining Group Pty Ltd	23/05/1957	31/12/2033
MLC590	Tennant Consolidated Mining Group Pty Ltd	6/05/1975	31/12/2030
MLC512	Tennant Consolidated Mining Group Pty Ltd	25/08/1950	31/12/2032
MLC550	Tennant Consolidated Mining Group Pty Ltd	29/01/1959	31/12/2036
MLC543	Tennant Consolidated Mining Group Pty Ltd	19/02/1958	31/12/2035
MLC544	Tennant Consolidated Mining Group Pty Ltd	19/02/1958	31/12/2035
MLC533	Tennant Consolidated Mining Group Pty Ltd	26/11/1956	31/12/2033
MLC68	Tennant Gold Pty Ltd	18/06/1968	31/12/2033
MLC154	Tennant Gold Pty Ltd	17/02/1973	31/12/2024
MLC46	Tennant Gold Pty Ltd	5/01/1965	31/12/2035
MLC47	Tennant Gold Pty Ltd	5/01/1965	31/12/2035
MLC578	Tennant Gold Pty Ltd	28/05/1968	31/12/2033
MLC652	Tennant Gold Pty Ltd	19/06/1987	31/12/2033
MLC45	Tennant Gold Pty Ltd	5/01/1965	31/12/2035
MLC579	Tennant Gold Pty Ltd	28/05/1968	31/12/2033
MLC155	Tennant Gold Pty Ltd	17/02/1973	31/12/2024
MCC284	Tennant Gold Pty Ltd	8/07/1989	7/07/2024

1.3 Project Description

1.3.1 Location

Project Name: Nobles Nob Gold Project

Mineral Titles: MLC512, MLC513, MLC514, MLC515, MLC516, MLC517, MLC521, MLC525, MLC526, MLC531, MLC532, MLC533, MLC534, MLC537, MLC538, MLC539, MLC540, MLC541, MLC542, MLC543, MLC544, MLC545, MLC548, MLC549, MLC550, MLC556, MLC589, MLC590, MLC688, MLC689, MLC690, MLC691.

As well as operation of Juno Mine Site (excluding active mining activities) on MCC284, MLC154, MLC155, MLC45, MLC46, MLC47, MLC578, MLC579, MLC652, MLC68.

Location: 13 kilometres south-east of Tennant Creek NT.

Site Access: The Project is accessible via Peko Road from Tennant Creek.

1.3.2 Project Summary and Improvements

The Project area encompasses a total of 355 ha, with 253 ha within Nobles Nob mining tenements and 102 ha within Juno tenements. Figure 1-2 shows the general location of the Project, Figure 1-3 shows an overview of the Nobles Nob Gold Project, and Figure 1-4 shows the Nobles Nob site layout. Both the Nobles Nob and Juno sites were historically mined as underground operations – and Nobles Nob as an open pit following collapse of the crown pillar. Further details of the mining history of these sites are outlined within Section 3.2.1 below. There is an extensive clearance and disturbance footprint across both sites, especially at Nobles Nob, where a Carbon-in-Leach (CIL) processing plant and a townsite were historically located. The open pit, tailings storage facilities, waste rock dumps and remnants of buildings and equipment remain on site at Nobles Nob. Mine legacy issues are evident including potential leaching of tailings across some areas of tailings, indicating less than adequate rehabilitation was undertaken in the past.

The Project activities proposed are extraction and processing of resources at Nobles Nob including the existing Southern WRD and existing Northern tailings from historical mining activities, and an expansion of the existing Nobles Nob pit. With establishment of an 840 ktpa CIL ore processing plant in the location of the historical plant south of the pit; a dry stack tailings treatment and storage facility with three staged platforms progressively stacked across areas of existing disturbance on site; a hybrid power generation facility including diesel storage, generators and a 4 ha solar field; use of existing site access tracks, and where required, upgrade of tracks for ore haulage; dewatering of the Nobles Nob pit, and at a later date dewatering of the Juno underground workings; and associated water management infrastructure. A summary of the proposed activities is outlined below, and further detail is given in Sections 4–7.

The extraction and processing activities proposed by TCMG to be undertaken within this Project include:

- extraction and processing of the existing Southern WRD from historical Nobles Nob mining operations. No waste rock will be produced.
- extraction and processing of the Northern Tailings from historical Nobles Nob mining operations. No waste rock will be produced.
- expansion of the existing Nobles Nob pit. Waste rock will be produced.
- Placement of waste rock from the Nobles Nob pit on to the existing northern waste rock dump (Northern WRD).
- Processing of ore and storage of tailings from the nearby Rising Sun, Weabers Find and Black Snake deposits (the mining of these deposits will be included in separate MMPs).

The associated infrastructure proposed to be established at the Project site includes:

- An 840 ktpa CIL ore processing plant.
- A dry stack tailings facility to store tailings from all of the above processing activities, including filter presses, 3 x staged platform areas, and associated drainage and sumps.
- A hybrid power generation facility consisting of up to 6 x diesel generators, a 2 MW battery, and a 4 MW solar array.
- Water management infrastructure including pumps to dewater the Nobles Nob pit, pipelines to transport water, a raw water storage tank, and a process water pond.
- A vehicle washdown bay.

Other activities proposed to be undertaken on site include:

- Dewatering of the Nobles Nob pit.
- Disposal of any excess water using the preferred method.
- Dewatering of the Juno underground workings when required.

- Extraction of water from Juno and piping to Nobles Nob at such time that additional process water is required, only expected when mining and dewatering of the Nobles Nob pit is complete.
- Use and upkeep of existing access tracks, including upgrading sections where required for ore haulage.

A risk-based approach has been taken to Project planning and design. All activities proposed will be undertaken within the disturbance footprint of previous mining operations and will not require clearing of any undisturbed areas – with the only exception being the establishment of the solar array, which is proposed within a 4 ha area of new disturbance. Wherever possible, the proposed activities have been placed within areas of like historical disturbance – e.g. the processing plant will be established on the site of the historical plant, waste rock will be placed on top of an existing waste rock dump, etc. The site plan has been designed in this way to avoid and mitigate environmental impacts and risks. By avoiding areas of new disturbance and avoiding the introduction of new disturbance types to areas wherever possible, this avoids new environmental impacts.

Following the environmental risk hierarchy, where environmental risks are not able to be avoided, site design and engineering controls have been planned to reduce risk as much as possible. For example, the use of dry stack tailings design significantly reduces the risks associated with tailings storage. Where residual risks remain, this will be mitigated through the implementation of environmental management controls on site – for example, implementation of erosion and sediment controls, water quality monitoring, weed management, and cultural heritage protection measures.

Numerous studies have been undertaken to understand the physical and socio-economic environment of the Project site (as outlined within Section 3 of this MMP) and the potential environmental aspects and impacts of the Proposed Project activities (as outlined within Sections 4–7 of this MMP). Based on this understanding, an environmental risk assessment of the Project was undertaken by qualified environmental professionals (as outlined in Sections 8–9 of this MMP). The environmental management system that will be implemented to mitigate any residual environmental risks are outlined in Sections 10–13 below, including commitments for ongoing monitoring, record keeping, reporting, review and improvement of the system. The over-arching environmental management plan for the Project is presented in Section 11, and some of the impact specific management plans that have been developed for the Project are included in the appendices. Continency planning for unexpected environmental incidences or closure is considered in Sections 12–13. The over-arching rehabilitation and planned closure commitments are outlined in Section 13. Further detailed rehabilitation and closure plans will be developed and added to this MMP as the Project progresses.

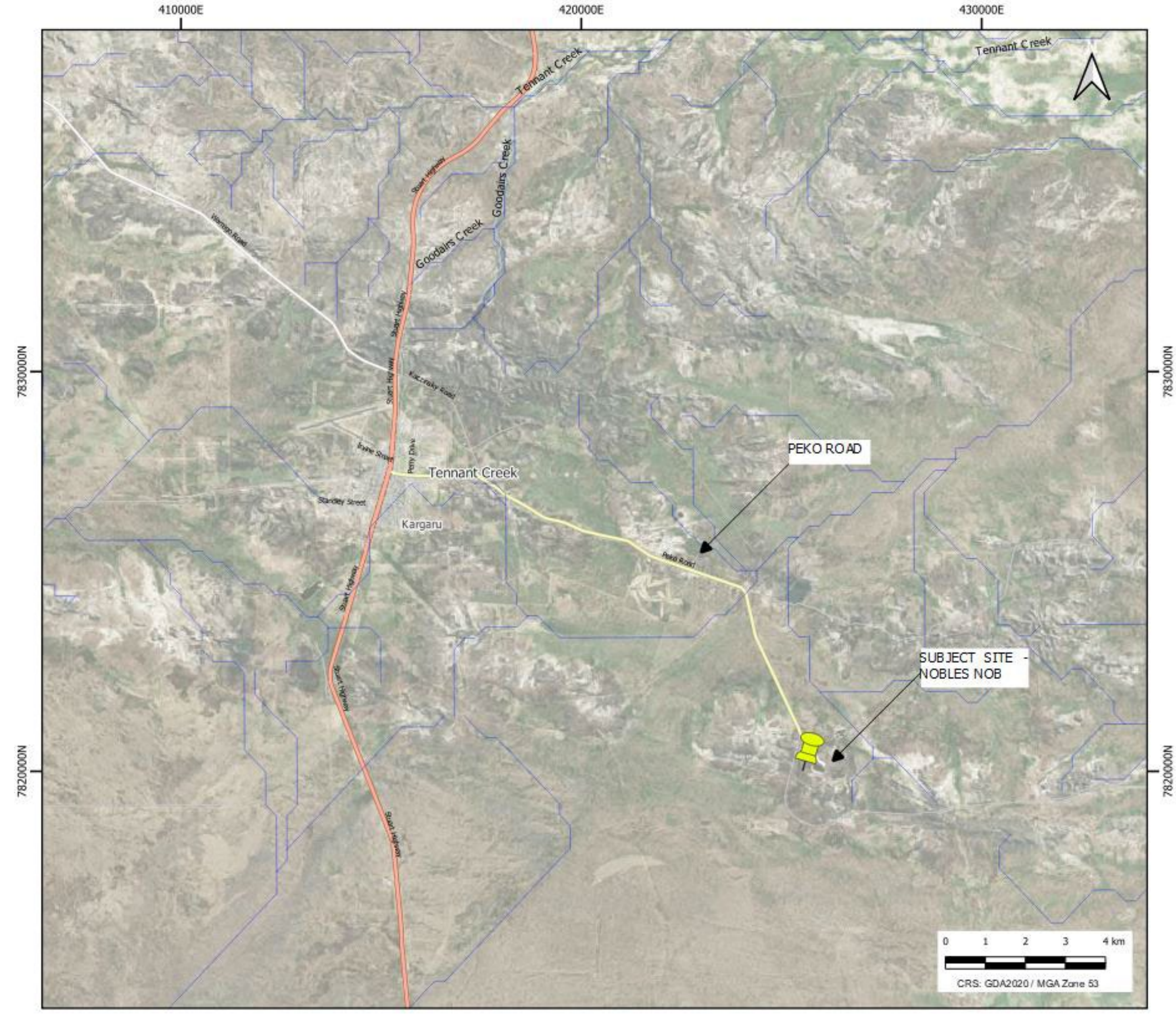

Figure 1-2 Project location

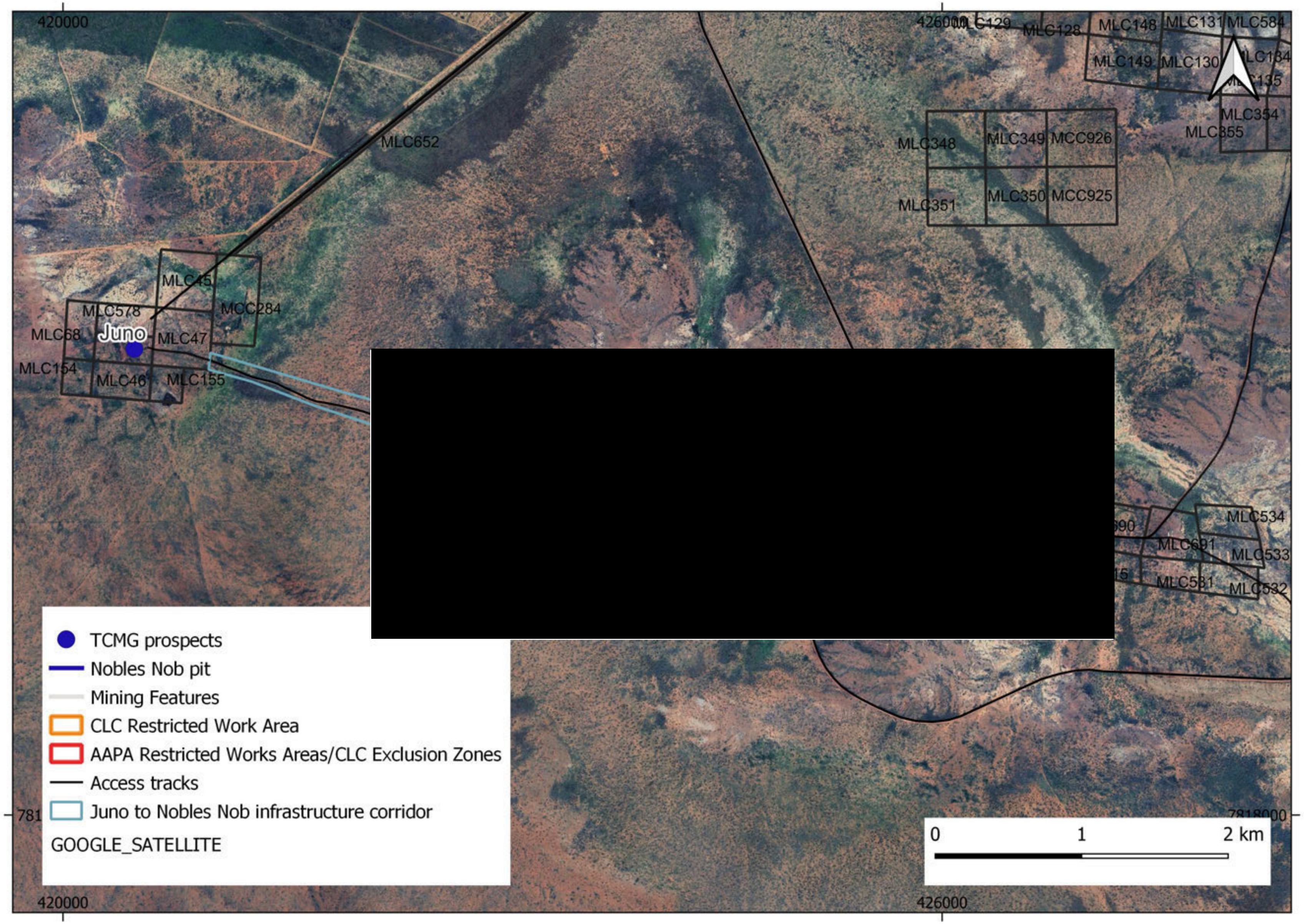

Figure 1-3 Nobles Nob Gold Project overview

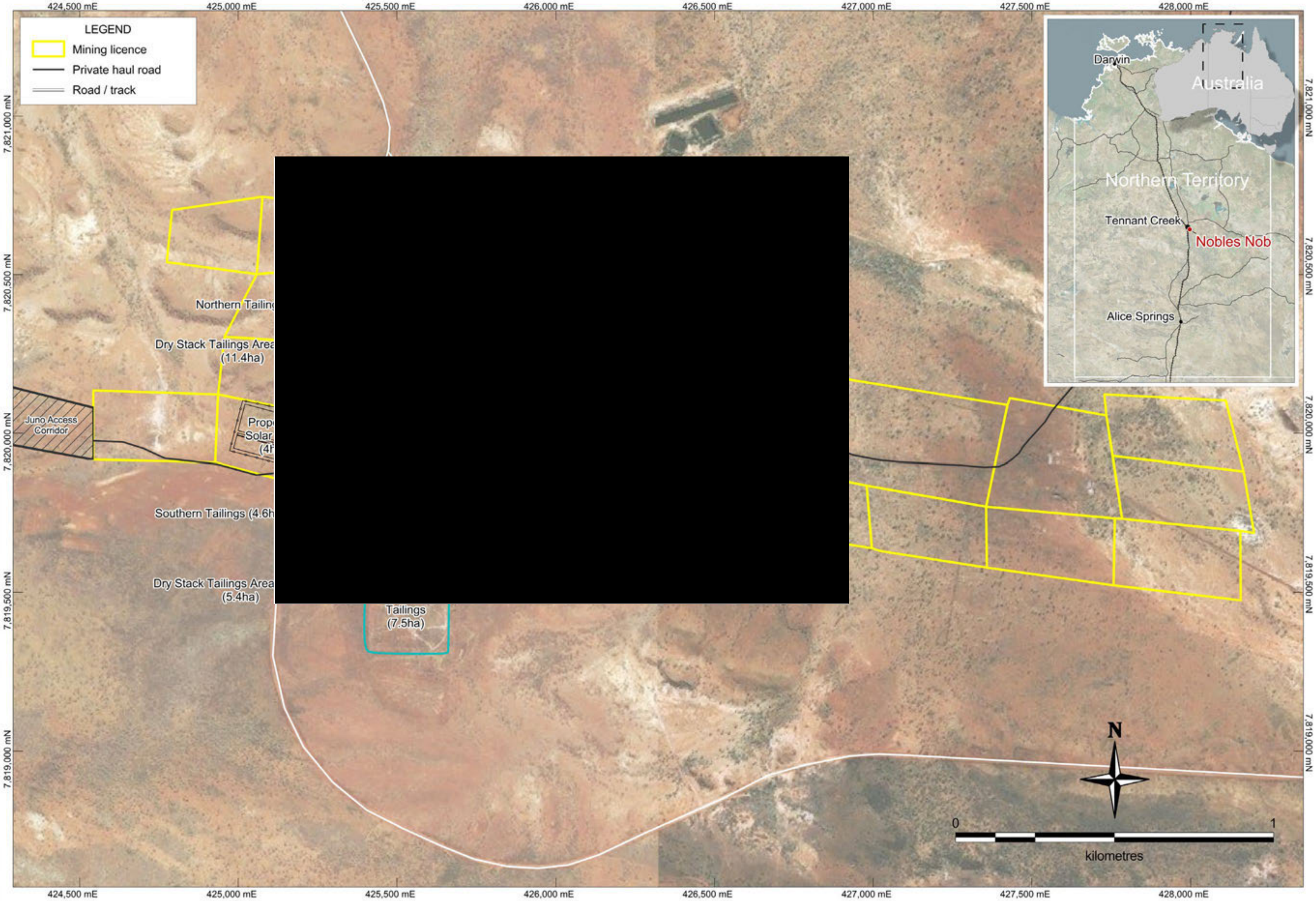

Figure 1-4 Nobles Nob Site Layout

2 STATUTORY AND NON-STATUTORY REQUIREMENTS

2.1 Statutory Requirements

Applicable legislation, permits and licences and their relevance to the Project area listed in Table 2-1. The associated policies and regulations apply.

Table 2-1 Relevance of legislation to the Project

Legislation	Regulation/ approval required	Project relevance
Mining Activities		
Environment Protection Act 2019 (EP Act)	No referral or approval required.	The Northern Territory Environment Protection Authority (NT EPA) is responsible for administering the EP Act, the key legislation used to perform the EIA of proposed actions in the NT. The primary purpose of the Environmental Impact Assessment process is to provide for appropriate examination of proposed projects that may cause significant environmental impact. TCMG has completed an extensive environmental assessment of its Project informed by numerous environmental, scientific and technical studies and advice from relevant qualified environmental, technical, scientific and subject matter experts, as outlined within this MMP and Appendices. Informed by the studies and risk assessment undertaken, the Project has been assessed in relation to the EP Act definitions of impact, the NT EPA's Factors and Objectives guidance, and using the NT EPA Pre-referral Screening Tool. This assessment was undertaken in a workshop together with EcOz Environmental in 2021, and again by TCMG in 2023 in relation to updated Project planning. The outcome of these assessments has concluded that the Project does not have the potential to have a significant impact on the receiving environment, and that any potential sources of impacts can be adequately mitigated, managed and reduced. Informed by these studies, assessments and advice of relevant suitably qualified experts, TCMG has therefore determined the Project does not meet any of the criteria or thresholds requiring referral to the NT EPA. See Section 9 of this MMP for further details.
Mineral Titles Act 2010 (MT Act)	Mineral Licence required.	The Department of Industry, Tourism and Trade (DITT) oversees the approval and regulation of mining activities in the NT. Under the MT Act, TCMG has been granted MCC284, MLC154-MLC155, MLC45-MLC47, MLC512-MLC517, MLC521, MLC525-MLC526, MLC531-MLC534, MLC537-MLC545, MLC548-MLC550, MLC556, MLC578-MLC579 MLC589-MLC590, MLC652, MLC68, MLC688-MLC691 that encompasses the proposed mine site. The Project also has an Access Authority to utilise neighbouring land for the use of water extraction and roads under Section 84. An application will be made to DITT prior to any mining activities taking place within the Project area.
Mining Management Act 2001 (MM Act)	Mining Authorisation and approval of MMP required.	The mining authorisation is the key regulatory instrument used by the NT Government for approval and compliance monitoring of mining operations in the NT. Mining Authorisation 1123-01 was granted to TCMG and approval of the Nobles Nob Gold Project MMP on 15 August 2022. All conditions and requirements under this authorisation have been undertaken for Project activities to date. Any amendments to the MMP will need to be submitted for approval and variation of the Mining Authorisation. This MMP will form the basis for the application for a variation of the existing mining authorisation.
Flora and Fauna		

Legislation	Regulation/ approval required	Project relevance
Planning Act 1999	No permit required.	Vegetation clearing on mining interests in the NT is controlled by application of the MM Act and MMPs. No land clearing permit is required.
Territory Parks and Wildlife Conservation Act 1976 (TPWC Act)	No permit required.	Pursuant to Section 56 of the NT TPWC Act, the taking or interfering with wildlife that is listed as threatened, requires approval at the Ministerial level. No threatened species' populations are expected to occur within the mining areas. No permit to take or interfere with wildlife that is threatened is required.
Environmental Protection and Biodiversity Conservation Act 1999 (*EPBC Act*)	No referral or approval required.	Commonwealth legislation. Provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – matters of national environmental significance (MNES). There are no MNES which will be impacted by the Project and the Project therefore does not require referral under the EPBC Act.
Weed Management Act 2001 (WM Act)	No approval required – appropriate weed control must be undertaken.	Occupiers of land (including mine sites) have an obligation to ensure listed weeds are not introduced or spread – and are appropriately controlled according to national, NT, and Barkly Region weed strategies. Noxious weeds are known to occur within the Project site. TCMG has developed a Weed Management Plan for Nobles Nob. Appropriate control measures are currently being undertaken by TCMG and will be implemented for the life of the Project. See Section 11.10 of this MMP for further details.
Land and Soils		
Soil Conservation and Land Utilisation Act 1969 (SCLU Act)	No approval required – appropriate erosion and sediment control must be undertaken.	The SCLU Act provides for the prevention of soil erosion, and for the conservation and reclamation of soil, and requires Erosion and Sediment Control Plans (ESCPs) to be devised for development projects. An ESCP has been developed by TCMG for the Project. The ESCP was certified by a Certified Professional in Erosion and Sediment Control (CPESC) and approved by DITT to meet the requirements of Mining Authorisation 1123-01. The ESCP will be updated to reflect this amendment to the MMP once approved and will be recertified by a CPESC and resubmitted to DITT for approval. See Section 11.1 and Appendix M of this MMP for further details.
Water Quality and Hydrological Processes		
Water Act 1992 (Water Act)	No licence required.	A waste discharge licence is required where waste comes into contact with water, e.g: discharge of waste water to water. Any discharge from operational areas to a watercourse would require a Waste Discharge Licence (WDL). The licencing system is managed by the NT EPA. In the initial stages of the Project, there will be no excess water for discharge. Water is to be recycled from tailings processing and reused through ore processing activities. No WDL is therefore required within the initial stages of the Project. During the proposed mining of the Nobles Nob pit, dewatering requirements may exceed Project water requirements, at which time management of excess water may be required. TCMG is assessing options to manage any excess water if and when it occurs. Options being considered include Managed Aquifer Recharge, Solar Pond Power Generation, Agricultural Use, and an Evaporation Pond. Depending on the option chosen, a WDL may be required. This and any other related approvals will be sought in due course prior to undertaking any licenced activity.
	A Water Extraction Licence is required.	A recent amendment to the Water Act now requires mining activities to hold a licence to take surface or groundwater; and a permit to construct or alter works that interfere with a waterway; where they are applicable. TCMG does not propose any works that will interfere with a waterway. TCMG does propose to take groundwater. TCMG has been granted a groundwater extraction licence under the Water Act (Licence No: L10012 granted 19 January 2023) to extract water from Juno to meet Project water requirements. TCMG has also sought advice on the requirements for dewatering activities; and has pre-emptively applied for a second groundwater extraction licence for the purposes of dewatering the Nobles Nob pit for mining activities. This second application was

Legislation	Regulation/ approval required	Project relevance
		accepted for processing on 8 May 2023 and is currently being assessed. The Notice of Intent was published 23 June 2023 for public comment.
Public and Environmental Health Act 2011	Notification is required prior to installation of a wastewater management system.	The Project site is outside of a Building Control Area (BCA). Installation of a wastewater management system outside of a BCA requires notification to the Department of Health (DoH), Environmental Health Division a minimum of 7 days prior to installation. Any wastewater management system installed will need to comply with the DoH definitions of a 'standard conventional septic system'. TCMG proposes to use a portable waste solution during construction activities and is currently assessing the requirements and preferred options for a wastewater treatment system. Prior to installation, TCMG will ensure that the above legislative requirements are met.
Social, Economic and Cultural Aspects		
Native Title Act 1993	A Central Land Council (CLC) Sacred Sites Clearance Certificate is required.	TCMG has been granted a Sacred Sites Clearance Certificate through the CLC which covers all works areas (C2022-077 granted 27 September 2022). All requirements and conditions of the certificate will be adhered to.
Northern Territory Aboriginal Sacred Sites Act 1989	An Aboriginal Areas Protection Authority (AAPA) Authority Certificate is required.	TCMG has been granted two AAPA Certificates which cover all works areas (C2022-064 granted 7 December 2022; and C2022-026 granted 23 June 2022). All requirements of the certificates will be adhered to.
Heritage Act 2011	No approval required.	There are no sites on the NT Heritage Register within the Project area.
Aboriginal Land Rights (Northern Territory) Act 1976	Land use Agreement voluntarily entered in to.	The Project site is located on freehold land owned by the Warumungu Land Trust. An existing land use agreement exists between the previous tenement owners Normandy Gold Pty Ltd (now Emmerson Resources Limited) and the Warumungu Land Trust and the Central Land Council. This agreement is known as the Pre-Existing Tenements Agreement (PETA) dated 9 December 1998 and includes some of the Project mining titles. TCMG has consulted and secured agreement of the Warumungu Land Trust and the Central Land Council for rights and obligations under the PETA for the Nobles Nob and Juno mining titles to be formally assigned to TCMG via a Deed of Assumption. The Deed was formally signed and executed by all parties in July 2023.
Other		
Work Health and Safety (National Uniform Legislation) Act 2011	A certified Risk Management Plan (RMP) is required.	Under the WHS Act, a person conducting a business or undertaking must ensure, so far as is reasonably practicable, that the health and safety of workers and others is not put at risk. In addition, the Work Health and Safety (National Uniform Legislation) Regulations 2011 specifies that a mine operator has the duty to submit a certified RMP to the Regulator (NT Worksafe) prior to allowing any mining or related activity to commence. An RMP is being prepared by TCMG and will be certified and submitted to NT Worksafe prior to undertaking works.
Dangerous Goods Act 1998	Authorisations for the transport, storage and use of explosives will be required for blasting.	The storage, use and transport of explosives requires an approval to be obtained from NT Worksafe. This will not be required in the initial stages of the Project but will be required for proposed drill and blast works for expansion of the Nobles Nob pit. These authorisations will be obtained prior to undertaking any such works.
Waste Management and Pollution Control Act 1998 (*WMPC Act*)	No approval or licence required.	The NT EPA grants environment protection approvals and licences for activities listed in Schedule 2 of the Waste Management and Pollution Control Act 1998. These activities are associated with the disposal of waste by burial; Listed Waste collecting, transporting, storing, re-cycling,

Legislation	Regulation/ approval required	Project relevance
		treating or disposing on a commercial or fee for service basis; and processing hydrocarbons so as to produce, store and/or despatch liquefied natural gas or methanol. None of the above activities are proposes within the scope of Project activities. All general and hazardous wastes will be removed from site by a licenced contractor. There is no onsite landfill proposed. No approval or licence is therefore required.
National Greenhouse and Energy Reporting Act 2007 (*NGER Act*)	Reporting not required.	Commonwealth legislation. Corporations must register and report if they emit greenhouse gases (GHG), produce energy, or consume energy at or above specified quantities in a given financial year. The Project will not trigger the current reporting thresholds. TCMG will keep records of GHG emissions from Project activities to inform Environment, Social and Governance (ESG) reporting. If at any time emissions are expected to exceed, or do exceed the thresholds for reporting, all required reporting and adherence to NGER Act requirements this will be undertaken.
National Environment Protection (Ambient Air Quality) Measure 1998 (NEPM-AAQ) *National Environment Protection Council (Northern Territory) Act 1994* (NEPC Act)	No approval required – appropriate dust control and air quality management must be undertaken.	The NEPM-AAQ is Commonwealth legislation with the stated desired environmental outcome of *ambient air quality that minimises the risk of adverse health impacts from exposure to air pollution*. Within this legislation, standards are set for air quality pollutants including particulates, and measurement protocols. The NEPC Act is a mirroring NT Act to the national NEPM-AAQ. TCMG has developed a Dust Management Plan (DMP) in accordance with the requirements of both of the above Acts, to control and monitor dust emissions on site and prevent adverse impacts to human health or receiving environments. The DMP has been approved by DITT to meet conditions of Mining Authorisation 1123-01. The DMP will be updated to reflect this amendment to the MMP once approved, and will be resubmitted to DITT for approval. See Section 11.3 and Appendix O of this MMP for further details.

2.2 Non-Statutory Obligations

Mine planning and design have considered the following standards, guidelines, and codes of practice relevant to avoiding or minimising environmental impacts.

Mining Best Practice Guidelines

- *A Guide to Leading Practice Sustainable Development in Mining* (Australian Centre for Sustainable Mining Practices, 2011)
- *A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Developments Sites, Contaminated Sites Remediation and Other Related Activities* (Government of Western Australia, Department of Environment and Conservation, 2011)
- *Free Prior and Informed Consent – An Indigenous Peoples' Right and a Good Practice for Local Communities – Manual for Practitioners* (Food and Agriculture Organization of the United Nations, 2016)
- *Conflict-Free Gold Standard* (World Gold Council 2012)
- *GRI Sector Standards Project for Mining – Exposure Draft* (GRI, 2023)
- *Responsible Gold Mining Principles* (World Gold Council 2019)
- *Towards Sustainable Mining - TSM 101: A Primer* (The Mining Association of Canada, 2019)

Waste Characterisation/Acid Mine Drainage

- *Global Acid Rock Drainage Guide* (International Network for Acid Prevention, 2014)
- *Materials Characterisation Baseline Data Requirements for Mining Proposals* (Department of Mines and Petroleum, 2016)

- *Environmental Assessment Guidelines on Acid and Metalliferous Drainage* (Northern Territory Government, NT EPA, 2013)
- *Preventing Acid and Metalliferous Drainage – Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, 2016)

Storm Water Management, Erosion and Sediment Control

- *Best Practice Erosion and Sediment Control* (International Erosion Control Association, 2008)
- *Northern Territory Land Suitability Guidelines* (Northern Territory Government, 2013)

Noise and Dust

- *A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Developments Sites, Contaminated Sites Remediation and Other Related Activities* (Government of Western Australia, Department of Environment and Conservation, 2011)
- *A Guide to the Sampling and Analysis of Air Emissions and Air Quality* (Victoria State Government, EPA Victoria, 2002)
- *Airborne Contaminants, Noise and Vibration – Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, 2009)
- *Methods for sampling and analysis of ambient air - Determination of particulate matter - Deposited matter - Gravimetric method (*Australian/New Zealand Standard, 3580.10.1:2003)
- *Dust Emissions Guideline – July 2021 for external consultation* (Government of Western Australia, Department of Water and Environmental Regulation, 2021)
- *Good Practice Guide for Assessing and Managing Dust* (New Zealand Ministry for the Environment, 2016)
- *Management of Dust from Development Sites – Guidance for Developing Dust Emission Control Plan* (Townsville City Council, 2019)

Tailings Management

- *Tailings Management – Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, 2016)
- *Guide to the Preparation of a Design Report for Tailings Storage Facilities (TSFs)* (Government of Western Australia, Department of Mines and Petroleum, 2015)
- *Global Industry Standard on Tailings Management* (International Council on Mining & Metals (ICMM), United Nations Environmental Programme (UNEP), Principles for Responsible Investment (PRI), 2020).

Water Management

- AS/NZS 1547:2012 Code of Practice for On-site Domestic Wastewater Management.
- *Australian Drinking Water Guidelines – National Water Quality management Strategy* (Australian Government, National Health and Medical Research Council, 2023)
- *Designing and Installing On-site Wastewater Systems – A WaterNSW Current Recommended Practice* (WaterNSW, 2019)
- *Guidance Notes for Wastewater Management (*Northern Territory Government, Department of Health, 2020)
- *Guidelines for Private Water Supplies* (Northern Territory Government, Department of Health, 2019)
- *Water Stewardship – Leading Practice Sustainable Development Program for the Mining Industry* (Department of Foreign Affairs and Trade, 2016)
- *Water Accounting Framework for the Australian Minerals Industry* (Minerals Council of Australia, 2014).
- *Code of Practice for Wastewater Management* (Northern Territory Government, Department of Health, 2020)
- *Methodology for the Sampling of Groundwater* (Northern Territory Government, Department of Primary Industry and Resources, 2016)
- *Methodology for the Sampling of Surface Water* (Northern Territory Government, Department of Mines and Energy, 2016)
- *Territory Water Plan* (Northern Territory government, Office of Water Security, 2023)

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Governments, 2018)

Storage and Handling of Hazardous Substances and Dangerous Goods

- National Standard for the Storage and Handling of Workplace Dangerous Goods
- Australian Code for the Transport of Dangerous Goods by Road & Rail (7.7-2020)
- Storage and Handling of Workplace Dangerous Goods National Code of Practice [NOHSC:2017(2001)]
- AS1940:2017 The Storage and Handling of Flammable and Combustible Liquids (Standards Australia, 2017)
- AS 1962:2006 Tanks for flammable combustible liquids
- AS 3780:2008 The storage and handling of corrosive substances
- AS/NZS 4452:1997 The storage and handling of toxic substances
- *Cyanide Management – Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, 2008)
- *Hazardous materials Management – Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, 2016)
- *Liquid Storage and Handling Guidelines June 2018* (Victoria State Government, EPA Victoria, 2018)

Mine Closure Planning

- *WA Guidelines for Preparing Mine Closure Plans* (Government of Western Australia, Department of Mines and Petroleum and WA EPA, 2015).
- *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, 2016)
- *Mine Closure – Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, 2016)

Weed Management

- *Australian Weeds Strategy 2017 – 2027* (Australian Government, Invasive Plants and Animals Committee, 2017)
- *Northern Territory Weed Management Handbook* (Northern Territory Government, Department of Environment, Parks and Water Security, 2021)
- *Tennant Creek Regional Weeds Strategy 2021 – 2026* (Northern Territory Government, Department of Environment, Parks and Water Security, 2021)

3 SITE CONDITIONS

3.1 Physical Environment

3.1.1 Climate

The Project area experiences a warm desert climate (BWh, according to the Köppen-Geiger Classification). The highest monthly mean temperature is 37.2 ºC recorded in December, whereas July records the lowest at 12.3 ºC. Median annual rainfall is 425.8 mm, concentrated between October and March as a result of low pressure systems associated with monsoonal troughs, cyclones and ex-cyclones (Figure 3-1) (BOM 2022).

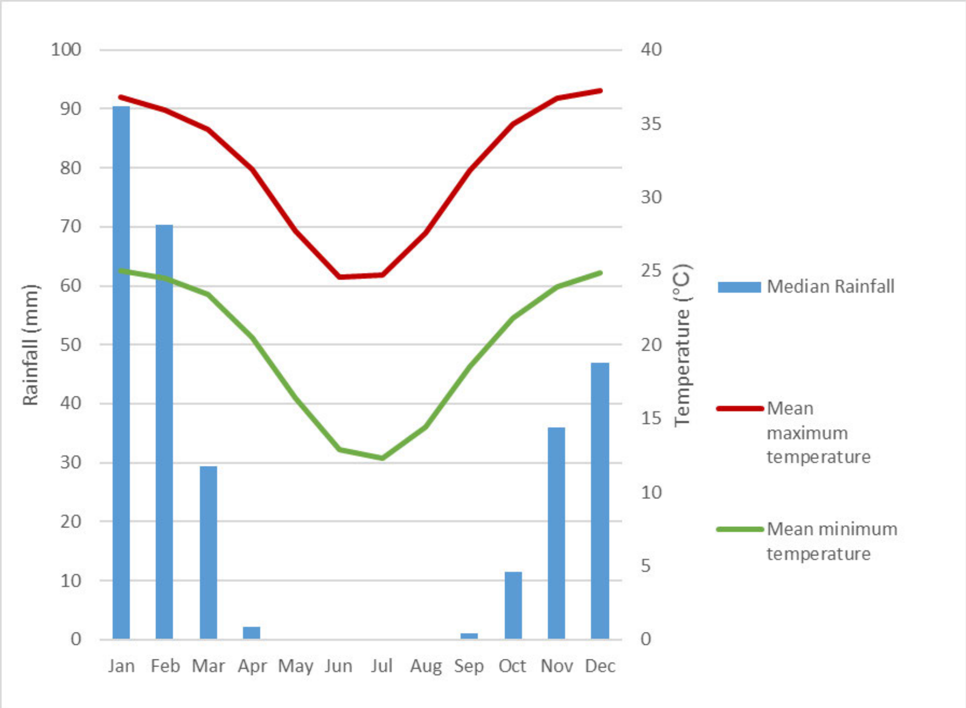

Figure 3-1 Average climate data for Tennant Creek Airport from 1969 to 2021 (BOM 2022)

3.1.2 Land System and Soils

The Project is situated within the Tennant Creek Land System, being dominated by sandstone plains and rises characteristic of the Ashburton Range subregion. It is part of the greater Davenport Murchison Ranges bioregion, characterised by plateaux, plains and rises on sandstone, claystone and limestone, and outcrops with shallow stony soils.

According to the Australian Soil Classification, the dominant soils at Nobles Nob are Kandosol, Rudosol and Tenosol, as shown in Figure 3-2 below.

- Kandosols are often referred to as red, yellow and brown earth. Kandosols are essential for agricultural and horticultural production. They occur throughout the Northern Territory and are widespread across the Top End, Sturt plateau, Tennant Creek and Central Australian regions.
- Rudosols are very shallow soils with minimal soil development. Rudosols include very shallow rocky and gravelly soils across rugged terrain and pure sand soils in deserts.
- Tenosols are weakly developed or sandy soils which are essential for horticulture. These soils show some degree of development (minor colour or soil texture increase in subsoil) down the profile.

The Digital Atlas of Australian Soils (ASRIS 1991) indicates that the soil types at Nobles Nob are primarily: AB31, BA13, and My80, as shown in Figure 3-3 below. The description of these soil types as per the Digital Atlas of Australian Soils are as follows:

- AB31 – these soils are associated with flat to gently undulating sand plains with some low broad sand rises and small alluvial flats. These soils usually comprise red earthy sands, with some clay pans.
- BA13 – These soils are usually found in areas with flat-topped, gently sloping areas and valleys on sandstones, siltstones, and shales. These soils are usually stony sands and loams.
- My80 – These soils are usually found in gently undulating plains and hills with rock outcrop. These soils are mainly neutral red earths, with a variable content and surface scatter of ironstone gravels. My80 soils are also often characterised with loamy soils, and some shallow gravelly and stony soils.

Soil from sumps that were dug for the 2022 TCMG drilling program were also examined across the site. The top layer of the soils was found to be brown to red in colour, dry, very fine loam with pebbles and larger rocks throughout. Below the top layer (i.e., approximately 0.5-1 m), the soil encountered was mostly clay with fine loam. The drilling records of the groundwater monitoring bores also recorded that the top layer comprised of approximately 3 metres of red laterite soils, followed by 3 metres of clay layer.

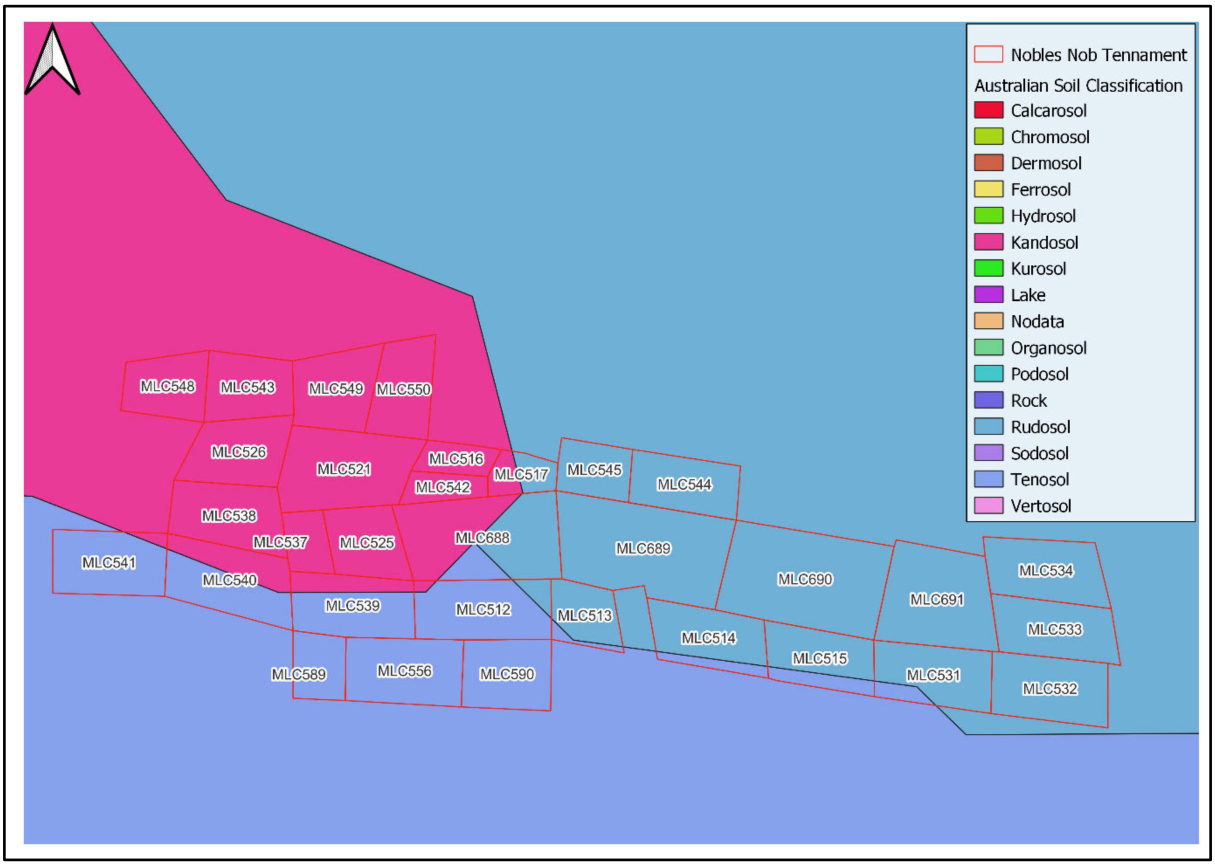

Figure 3-2 Soil Type from Australian Soil Classification at Nobles Nob

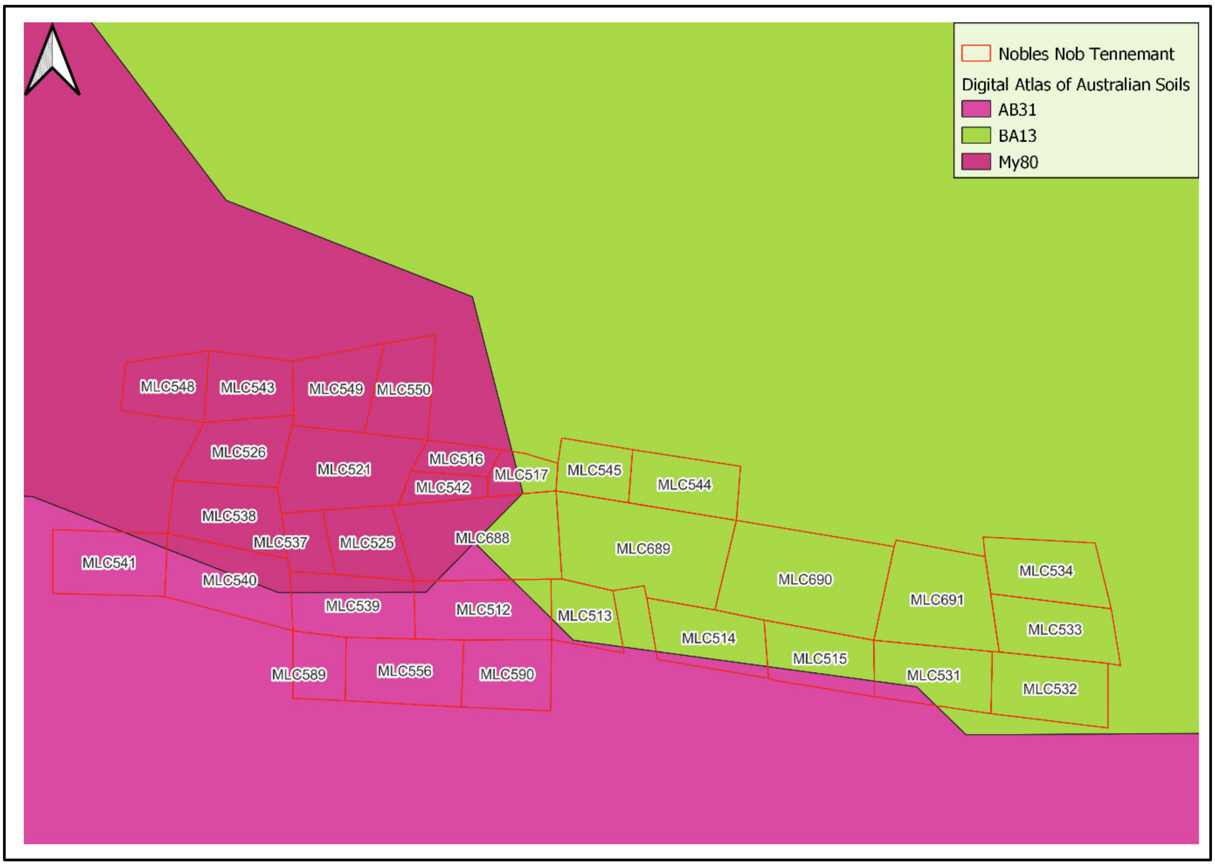

Figure 3-3 Soil Type from Digital Atlas of Australian Soils at Nobles Nob

3.1.3 Geology

The Project area is located within the Tennant Creek Geological Region, in the Warramunga Geological Province. This is within the Proterozoic Tennant Creek Inlier, which comprises a turbiditic flysch sedimentary sequence of volcaniclastic sediments, volcanic lavas, and volcanic rocks. In the Tennant Creek region, these rocks are typified by the Warramunga Group, which commonly strikes east-west with variable dip. These rocks have been intruded by various granites and deformed by the Tennant Event of 1850 Ma.

Gold-copper-bismuth mineralisation has been found to be hosted by fine grained haematitic mudstones and shaley siltstones. The mineralisation occurs within lenticular bodies rich in hematite. These are replacement bodies which cut across sedimentary structures and have been referred to as ‘ironstones’ by previous workers. Tennant Creek-type ironstone bodies grade upwards from chloritic alteration into stringer zones of chlorite-magnetite, coalescing higher into massive ore bearing magnetite +/- hematite, topped with talc-dolomite.

The hematite bodies are favourably situated in second order anticlinal folds, especially in domal positions or within faults or shear zones. The mineralisation is ‘poddy’ in nature and is typically located within steep dipping hinge zones of regionally minor folds with localised shearing and accompanying chlorite and silica with or without dolomite alteration. These dilation zones of rich gold mineralisation are also typified by strong magnetite alteration below the base of oxidation. Above the base of oxidation, the magnetite is chemically weathered to haematite.

The distribution of the metals is variable, with no direct correlation between bismuth, gold, and copper though some of the better-known deposits display zonation. For example, it is common to find an outer magnetite/dolomite altered copper zone, a mixed magnetite-silica bismuth zone and magnetite plus gold zone in the core. The mineralisation style at Tennant Creek is generally small tonnage but high-grade pods of iron rich mineralisation. Gold is also generally very fine grained in fresh deposits, but very coarse and nuggety in the oxidised deposits, such as Nobles Nob (Excalibur 2012).

3.1.4 Mining Reserves

Based on exploration of the Project area to date, mineral resource estimates have been made for a number of prospects both within, and within close proximity to the Project site. Resource estimates to date are outlined in Table 3-1 below.

Table 3-1 Statement of Mineral Resource Estimates

		JORC 2012 MRE (MII)		
		Total		
Prospect	**Classification**	**Tonnes**	**Grade (g/t)**	**Ounces**
Nobles CPS*	[redacted]			
Rising Sun				
Black Snake				
Shaft 12				

*Nobles CPS is referred to as the Southern WRD in this MMP

3.1.5 Flora and Fauna

EcOz Environmental undertook a desktop flora and fauna study of the Project site in 2021 (EcOz 2022). There are three Sites of Botanical Significance (SoBS) within a 50 km radius of the Project area. The Gosse River and Edinburgh Creek SoBS, included within the Davenport and Murchison Ranges Site of Conservation significance (SoCS), is located approximately 38 km to the south. The Short Range Waterholes SoBS is located 46 km to the north. The Little lake Surprise (Ngwrratiji) SoBS is located 35 km to the east-southeast. Given their distance from the Project area it is unlikely they will be affected by the proposed Project.

Flora

Previous surveys identified the vegetation to be predominantly eucalypt low open woodland and acacia-sparse shrubland over hummock grassland. Rises host a community of open woodland dominated by snappy gum (*Eucalyptus leucophloia* subsp. *euroa*) over gummy spinifex (*Triodia pungens*) grassland. Plains and drainage communities are composed by a mosaic of *Eucalyptus pruinosa* and *Corymbia aparrerinja* woodlands (Tennant Gold 2018). No vegetation communities or ecological communities of listed conservation significance have been recorded within 50 km of the Project area. A search of the NT Flora Atlas in February 2022 identified 22 records of 13 species of listed conservation significance within a 50 km radius of the Project area, three of which are considered Near Threatened under the *TPWC Act*: *Lythrum wilsonii*, *Trianthema glossostigmum*, and *Trianthema*. *oxycalyptra* var. *oxycalyptra*. These species are considered unlikely to occur within the Project area due to the disturbed and unsuitable habitat (Table 3-2), as assessed by EcOz (2022).

Table 3-2 Likelihood of occurrence of threatened flora within 50 km of the Project area

Species	**Status**		**Likelihood of occurrence**
	TPWC Act	**EPBC Act**	
Lythrum wilsonii	NT	-	Unlikely – disturbed and unsuitable habitat
Trianthema glossostigmum	NT	-	Unlikely– disturbed and unsuitable habitat
Trianthema. oxycalyptra var. oxycalyptra	NT	-	Unlikely– disturbed and unsuitable habitat

Lythrum wilsonii is an erect herb with lilac flowers found in seasonal swamps, under Eucalyptus vitrix, clay soil.

Trianthema glossostigmum is a groundcover with lilac flowers found on gravelly red soil to red sandplain associated with Triodia pungens-Acacia lysiphloia community.

Trianthema. oxycalyptra* var. *oxycalyptra is a purple flowered herb found on one small flat with red sandy soil between open rocky hills with granite boulders and triodia.

The vegetation within the 4 ha area proposed to be cleared for the solar field is representative of the surrounding vegetation type. Consisting of low open eucalypt woodland dominated by snappy gum (*Eucalyptus leucophloia* subsp. *euroa*). This area was inspected by TCMG in 2022, and no vegetation or ecological communities of conservation significance were identified.

Fauna

A search of the NT Fauna Atlas in February 2022 identified 1,070 records of 59 species of conservation significance within a 50 km radius of the Project area. Of these, 93 records corresponded to 15 threatened species under the *TPWC Act*. The EPBC Protected Matters Search added four threatened bird species to the list of species with the potential to occur within the Project area (see Table 3-3 below). Of these 19 species, five have a medium likelihood of occurrence and one a high likelihood of occurrence within the Project area.

Table 3-3ihood of occurrence of threatened fauna within 50 km of the Project area

Species	Status		Likelihood of occurrence
	TPWC Act	EPBC Act	
Gastropods			
Spencer's Tapered Snail *Bothriembryon spenceri*	VU	-	**LOW.** This land snail is found in leaf litter under fig trees and/or rocky areas, largely restricted to the Krichauff and Chewings Ranges west of Alice Springs. There is only one observation of his species 13 km northeast of the Project area.
Reptiles			
Great Desert Skink *Liopholis kintorei*	VU	VU	**LOW.** Great Desert Skink hasn't been observed for over 100 years within a 50 km radius of the Project area. NT populations are now restricted to the Tanami Desert, Uluru-Kata Tjuta National Park and Yulara.
Birds			
Curlew Sandpiper *Calidris ferruginea*	VU	CE	**LOW.** Curlew Sandpipers mostly occur around the coast. Inland they are found in smaller numbers near waterbodies. Considering there are no wetlands in its vicinity, they are unlikely to occur in the Project area.
Great Sandplover *Charadrius leschenaultii*	VU	VU	**LOW.** Great Sadplovers are mostly restricted to the Australian coast. Counting only with occasional observations inland.
Australian Painted-snipe *Rostratula australis*	-	EN	**LOW.** Australian Painted Snipe mostly occur in the eastern coast. Inland they are less common and inhabiting wetlands. Considering there are no wetlands in its vicinity, they are unlikely to occur in the Project area.
Red Goshawk *Erythrotriorchis radiatus*	VU	VU	**LOW.** There is only a limited extent of riparian habitat in the ML's, making the area only marginally-suitable. Important habitat for this species is primarily tall trees in riparian zones that are suitable for nesting within.
Grey Falcon *Falco hypoleucos*	VU	VU	**MEDIUM.** Grey Falcons are distributed sparsely over Australia's arid and semi-arid zones. It favours lightly timbered and untimbered lowland plains that are crossed by tree-lined watercourses.
Painted Honeyeater *Grantiella picta*	VU	VU	**MEDIUM.** Painted Honeyeater core range is inland south-eastern Australia, reaching eastern parts of Northern Territory over winter, where they are found predominantly in *Eucalyptus* and *Acacia* woodlands and forests. Their movement is connected to the presence of mistletoe and the role of that plant as a food source.
Night Parrot *Pezoporus occidentalis*	CE	EN	**LOW.** Night Parrot is a highly elusive nocturnal ground dwelling parrot found in the arid and semi-arid zones of Australia. It could

Species	Status		Likelihood of occurrence
	TPWC Act	EPBC Act	
			occur in the vicinity of the Project area although it have never been recorded within 50 km radius from it.
Princess Parrot *Polytelis alexandrae*	VU	VU	**LOW.** Princess Parrot is confined to arid regions of Australia. Although suitable habitat occurs in the vicinity of the Project area, this species has never been recorded within a 50 km radius.
Great Painted-snipe *Rostratula benghalensis*		EN	**NONE.** Great painted Snipe is a migratory species restricted to coastal areas in Australia, occasionally found inland in and around wetlands. It has never been observed within a 50 km radius of the Project area.
Mammals			
Pale Field-rat *Rattus tunneyi*	VU	-	**MEDIUM.** There is suitable habitat (especially closer to the creek), but few recent records for the region. However, the ML's does not represent important habitat for this species, and the poor vegetation quality within the disturbance area reduces the likelihood of this species occurring there.
Brush-tailed mulgara *Dasycercus blythi*	VU	VU	**MEDIUM.** The presence of hummock grassland (*Triodia pungens*) habitat could support this species. However, the occurrence of brush-tailed mulgara in the Project area appears highly unlikely due to absence of records in the 50 km radius search area for over a century.
Western quoll *Dasyurus geoffroii*	EX	VU	**LOW.** Western Quoll previously occurred throughout arid and semi arid Australia, but is now restricted to south-west Western Australia. It was last observed in the vicinity of the Project area over 50 years ago.
Golden bandicoot *Isoodon auratus*	EN	VU	**LOW.** It previously occurred throughout central Australia, but is now restricted to Barrow Island, the Kimberley, and Marchinbar Island.
Mala *Lagorchestes hirsutus*	EW	EN	**LOW.** Last observations of Malas in the vicinity of the Project area occurred over 50 years ago. This species used to be present across most of Australia. It has been recorded in hummock grassland on sandplains, spinifex on gravelly plains, tussock grassland and shrubland. It now only occurs on island in Shark Bay and feral-free areas near Alice Springs.
Greater Bilby *Macrotis lagotis*	VU	VU	**MEDIUM.** Greater bilbies occupy predominantly sandy landscapes that may also include rocky outcrops, laterite rises and low-lying drainage systems. These habitat characteristics are present in the vicinity of the Project area and may represent connectivity to the Great Bilby population of the Tanami.
Central Australian Rock-wallaby *Petrogale lateralis centralis*	NT	VU	**HIGH.** Central Australian Rock-wallaby habitat extends as far north as the Davenport and Murchison Ranges. Some suitable rock shelters within 50 km of the Project area contain recent signs (scats) attributable to this species. Therefore it is likely that this species occurs through the Project area.
Red-tailed Phascogale *Phascogale calura*	EX	VU	**NONE.** Declared Extinct in the NT. Last observations near the Project area occurred more than hundred years ago.

Weeds

The Project footprint lies within the area covered by the Tennant Creek Regional Weeds Strategy 2021-2026 (TCRWS) (DEPWS 2021). This strategy focuses on weeds that are most important to the region, categorising them as either:

- *Category 1 – Priority weeds* (present in the region, widely considered feasible to eradicate from the Region, typically evaluated as very high risk and have isolated and restricted distributions)
- *Category 2 – Priority weeds or strategic control – including the eradication of outliers* (species warranting strategic control across the landscape due to the high impact they have on land managers and on broader economic and environmental values)

- *Category 3 – Weeds of concern* (assessed by the weed risk management system as a medium to high risk, or have not been assessed, but have been identified by stakeholders as posing a threat to the values of the Region)
- *Category 4 – Hygiene and biosecurity* weeds (it is important for landholders to implement weed hygiene and other biosecurity measures to prevent the spread of weeds into clean areas, and to control these species where the opportunity arises)
- *Category 5 – Alert weeds* (have the potential to have a high level of impact to the region should it become established, the likelihood of the species naturalising and spreading in the region is perceived to be high).

All weeds listed within the TCRWS are listed in Table 3-4 below, together with their status as a Classified Species and/or whether a Statutory Weed Management Plan has been developed under the NT *Weeds Management Act 2001*; and their classification as a Weed of National Significance (WoNS) under the Australian Weeds Strategy. A blank cell indicates a 'No' or not declared.

Table 3-4 Declared weed species within the Tennant Creek region

Common name	Botanical name	Category in TCRWS	Statutory WMP	NT Declared Class	WoNS
Bellyache Bush	*Jatropha gossypiifolia*	1	Yes	A/B	Yes
Gamba Grass	*Andropogon gayanus*	1	Yes	A	Yes
Mesquite	*Prosopis spp.*	1	Yes	A	Yes
Prickly Acacia	*Vachellia nilotica*	1	Yes	A	Yes
Prickly Pears	*Opuntia spp.*	1		A	
Rope Cactus	*Cylindropuntia spp.*	1		A	
Rubber Vine	*Cryptostegia grandiflora*	1		A	
Athel Pine	*Tamarix aphylla*	2	Yes	A/B	Yes
Neem	*Azadirachta indica*	2	Yes	B	
Parkinsonia	*Parkinsonia aculeata*	2		B	Yes
Rubber Bush	*Calotropis procera*	2		B	
Mimosa Bush	*Vachellia farnesiana*	3			
Asbestos Grass	*Cenchrus basedowii*	3			
Buffel Grass	*Cenchrus ciliaris*	3			
Mossman River Grass	*Cenchrus echinatus*	3		B	
Noogoora Burr	*Xanthium strumarium*	3		B	
Caltrop	*Tribulus terrestris*	4		B	
Coffee Senna	*Senna occidentalis*	4		B	
Kapok	*Aerva javanica*	4			
Mexican Poppy	*Argemone ochroleuca*	4		B	
Mission Grass - annual	*Cenchrus pedicellatus*	4			
Sicklepod	*Senna obtusifolia*	4		B	
Giant Rats Tail Grass	*Sporobolus natensis and S.pyramidalis*	5			
Grader Grass	*Themeda quadrivalvis*	5		B	
Parthenium Weed	*Parthenium hysterophorus*	5		A	Yes
Siam Weed	*Chromolaena odorata*	5		A	

Declared weeds in the NT are classified as:

- Class A – to be eradicated;
- Class B – Growth and spread to be prevented; or
- Class C – Not to be intorudced to the Territory (all Class A and Class B weeds are also considered to be Class C weeds).

A search of the NR Maps database in February 2022 within a 50 km radius of the Project area showed records for twelve declared weeds, as shown in Table 3-5 below. A blank cell indicates a 'No' or not declared. Three of the recorded weeds are listed as Class A and should be eradicated from the Project area, including Bellyache Bush (*Jatropha gossypiifolia*), Parthenium Weed (*Parthenium hysterophorus*), and Athel Tree (*Tamarix aphylla*). The other recorded weed species listed are Class B and should also have their growth and spread controlled. One introduced weed species was recorded during a 2018 dry season survey conducted by EcoScience NT – the prickly shrub Parkinsonia (*Parkinsonia aculeata*). During the wet season survey, a total of nine introduced species were recorded, including three Class B declared species: Rubber Bush (*Calotropis procera*), *Parkinsonia aculeata* and Flannel weed (*Sida cordifolia*). Overall, despite the long history of disturbance due to a range of different factors, the Project area had a relatively low incidence of weeds.

Table 3-5 Declared weeds within 50km radius of Project area

Common name	Botanical name	Category in TCRWS	Statutory WMP	NT Declared Class	WoNS
Star Burr / Goats head	*Acanthospermum hispidum*			B	
Khaki weed	*Alternanthera pungens*			B	
Neem	*Azadirachta indica*	2	Yes	B	
Rubber Bush	*Calotropis procera*	2		B	
Mossman River Grass	*Cenchrus echinatus*	3		B	
Rope Cacti	*Cylindropuntia imbricata*	1		A	
Bellyache Bush	*Jatropha gossypiifolia*	1	Yes	A/B	Yes
Parkinsonia	*Parkinsonia aculeata*	2		B	Yes
Parthenium Weed	*Parthenium hysterophorus*	5		A	Yes
Coffee Senna	*Senna occidentalis*	4		B	
Spinyhead Sida	*Sida acuta*			B	
Athel Pine	*Tamarix aphylla*	2	Yes	A/B	Yes

TCMG has undertaken weed surveys in collaboration with the NT Weed Management Branch during 2022 and 2023, and has recorded the following declared weed species within the Project area:

- Athel Pine (*Tamarix aphylla*)
- Prickly Pears (*Ficus indica*)
- Rope Cactus (*Cylindropuntia fulgida*)
- Rubber Bush (*Calotropis procera*)

Previous efforts to eradicate Bellyache Bush and Parthenium Weed appear to have been successful, and removal of all Athel Pine on site is almost complete. TCMG has developed a Weed Management Plan in accordance with the advice of the NT Weed Management Branch and to meet statutory requirements. TCMG has been implementing annual weed control accordingly during 2022 and 2023.

Pests

A search of the NR Maps database in February 2022 within a 50 km radius of the Project area also showed records of nine introduced fauna species, as shown in Table 3-6 below. Of those listed below, Cattle have been observed on site by TCMG. A feral Donkey (*Equus asinus*) was also observed within proximity to the Project site by TCMG on one occasion (*pers. comm.* 2022).

Table 3-6 Recorded introduced fauna within 50km of Project area

Common name	Scientific name
Asian House Gecko	*Hemidactylus frenatus*
Barbary Dove	*Barbary Dove*
Cat	*Felis catus*
Cattle	*Bos taurus*
Fox	*Vulpes vulpes*
Horse	*Equus caballus*
House Mouse	*Mus musculus*
House Sparrow	*Passer domesticus*
Rock Dove	*Columba livia*

3.1.6 Hydrology

The following information has been summarised from the in-depth groundwater assessment studies undertaken by Umwelt Environmental and Social Consultants (Umwelt) at Nobles Nob in 2021 (Umwelt 2021b). For further detailed information see the full report in Appendix B.

TCMG installed 10 monitoring bores in May-June 2021 to monitor the quality of groundwater at Nobles Nob. Based on the analysis of aquifer yields, bore logs and lithology, the following hydrogeological units have been identified at Nobles Nob:

- Shallow weathered horizon
- Deep fractured sandstone/siltstone.

Groundwater can also occur associated with faults; however, no fault structures have been mapped within 2 km of Nobles Nob (Umwelt 2021b).

Shallow Weathered Horizon

The CSIRO regolith depth mapping indicates regolith depth up to 3 m around the pit (0-1 m close to the pit, and 2-3 m slightly away from the pit). This is consistent with the drilling logs of bore NNMW001, NNMW004 and NNMW005 that recorded 0-3 m of regolith. As per the CSIRO regolith depth mapping, higher regolith depth is mapped for the area where bore NNMW018 is located (approximately 10-20 m).

However, the drill logs of bore NNMW018 suggests approximately 3 m of laterite, followed by 3 m of clay, before reaching the siltstone at 6 m below ground. Observations on the extent of the weathering at 6 m below are not provided. Overall, the drill logs and regolith depth mapping suggest that the area's regolith depth is not very deep.

Previous studies (e.g., Rockwater, 1989; Verhoeven & Knott, 1980) have indicated that groundwater might occur in the shallow weathered horizon of the Warramunga Formation. However, the drilling records from the monitoring and registered bores generally suggest that no groundwater was encountered at shallow depths. Registered bores drilled at shallow depths (<32 m) also did not encounter any groundwater (Umwelt 2021b).

Deep Fractured Sandstone/Siltstone Aquifer

The groundwater monitoring bores and registered bores within 2.5 km of Nobles Nob suggest that the primary groundwater bearing unit on site is within the local scale fractured sandstone/siltstone of Warramunga Group (Umwelt 2021b).

Groundwater in this aquifer is generally first encountered between approximately 70 to 80 m below ground level. The bottom of the Nobles Nob open pit, which is approximately 80 m below the surface, has a permanent pool of water (Tennant Gold 2018), possibly indicating the water table in the region. The review suggests that the water level in all bores, except NNMW002 and NNMW011, was recorded higher than the depth at which groundwater was encountered, suggesting the confined nature of the aquifer (Umwelt 2021b).

3.1.7 Groundwater Flow and Direction

There is minimal information regarding groundwater flow directions in the fractured rock aquifers of the Warramunga Group. However, regionally it has been reported that groundwater flows from the southeast to the northwest, in line with surface topography (McPherson *et al.* 2021). The groundwater levels at Nobles Nob, retrieved from the monitoring data in October 2021, also suggest that the overall flow is from the east towards the west-northwest, mirroring the regional groundwater flow direction and overall surface topography (Umwelt 2021b). These observations are consistent with water monitoring data collected monthly since October 2021.

3.2 Socio-Economic Environment

The nearest town to the Project area is Tennant Creek, administered by the Barkly Regional Council and has approximately 3,000 inhabitants according to the 2021 Australian Census data (ABS 2023). A high proportion of the Tennant Creek population identify as Aboriginal or Torres Strait Islander (55.4%) compared to the national average (3.2%). Key demographics recorded for Tennant Creek as of the 2021 census date are shown in Table 3-7 below. The Project area is located approximately 13 km south-east of Tennant Creek, along Peko Road.

Table 3-7 Population statistics for Tennant Creek from the 2021 census (ABS 2023)

General population statistics					
People (total #)	Male (%)	Female (%)	ATSI (%)*	Median age	Participation in labour force (%)
3,080	50.9	49.1	55.4	33	51.3
Household statistics					
Weekly household income (median $)		People per household (average #)		Households where non-English language is used (%)	
1,677		2.7		36.7	

*Identified as Aboriginal and/or Torres Strait Islander

3.2.1 Historical Land Use

Historical Exploration

Previous exploration within the Nobles Nob and Juno tenements has been extensive. The magnetic anomaly that was formed by the Juno deposit was discovered by the Aerial, Geological and Geophysical Survey of Northern Australia in 1936. Drilling was first conducted in this area by the National Lead of America prior to 1960. In March 1960 Peko Mines N.L acquired the tenements from Merloo Gold Mines N.L and commenced the diamond drilling programme that ultimately discovered the Juno deposit in DDH02 in October 1964. Of interest holes 1, 3 and 4 were all barren, while the deviation of hole 2 from its planned target saw it hit significant values that would have been missed had it stayed on course. Exploration drilling activity increased following the discovery hole intersection (12.19m @ 170.11g/t Au, 30.63g/t Ag, 0.13% Cu, and 1.39% Bi, from 229.21m), with a considerable amount of surface and underground diamond drilling being completed over the years. 1977 saw the last production from the Juno mine. Ultimately the Juno gold mine produced 839,000 oz of Au from 0.45 Mt of ore. Excalibur Mining Corporation Limited investigated the remaining Juno resource. Cube consulting declared an inferred resource of 176,700 ounces from 842,000t at 6.5 g/t in 2010.

Excalibur Mining Corporation conducted extensive exploration in the 2000s leading to resources being declared over Nobles Nob and Rising Sun. A deal was entered into with Territory Resources Pty Ltd given the right to explore and option to buy the leases. After the initial 2018 drill program TRL encountered corporate difficulties and were unable to continue with the project.

Prior to TCMG's exploration of the site, there were 2,249 historical drill holes in the Nobles Nob deposit assay database. These drill holes include 774 diamond drill core (DDH), 702 reverse circulation (RC) holes, 100 aircore, 23 rotary air blast, nine open hole percussion, and seven underground diamond drill core. Most of the DDH and RC holes were inclined 60° to the north. Samples were collected at one-metre intervals as per standard drilling procedures.

Nobles Nob

Previous mining activity within these tenements has been extensive. The historically mined Nobles Nob deposit was a tabular body, 190 metres long, 40 metres wide and 80 metres in depth, which produced 1,218,038 oz gold (Au) (1.996 Mt at 17.3 g/t) (Porter Geo 2014). It outcropped but was barren of gold down to a depth of 16.5 metres. The Nobles Nob mine is hosted in non-magnetic haematite ironstone and it is only in the roots of this system that magnetite is present.

Gold was first discovered at Nobles Nob by William Charles Weaber and Malachy "Jack" Noble. In 1934, they commenced sinking a mine shaft into the ironstone that was outcropping at "Nobles Nob". After further shaft sinking the first parcel of ore was treated in early 1940. Mining continued at both Nobles Nob and Rising Sun until 1942. Australian Development NL purchased the mine from the Weaber family after WWII in 1947. At 135 ft below surface ore grades increased dramatically averaging 46.0 g/t Au and development of the mine continued into August 1967 when the crown pillar collapsed ceasing all mining.

In 1968 the collapsed underground operation was cleaned up and modified into an open pit with a new mill on site. Some of the material from the collapsed crown pillar was recovered, however most of the material was stockpiled in the existing mineralised Southern WRD to the south of the Nobles Nob pit. Production continued with the last gold bar being poured on site in September 1992.

Historical activities at the Nobles Nob site included establishment of a CIL process plant south of the pit, three separate tailings storage dams west and south of the pit, two separate waste rock dumps (southern and northern), a borrow ground west of the pit towards Juno, a water pipeline from Juno to Nobles Nob, and establishment of a town site with numerous buildings, shops, and facilities across the eastern and northern sections of the site. At that time, Lake Alice was used for recreation. Images showing the extent of some of these historical activities are shown in Figure 3-4 below.

Numerous other mines and shafts over the Nobles Nob tenements also produced gold. Table 3-8 below summarises past production.

Table 3-8 Historical gold production in the Nobles Nob area

Mine	Ore (t extracted)	Au (average g/t)	Au (oz produced)
Nobles Nob	2,140,000	17.0	1,169,775
Juno	450,000	56	838,236
Rising Sun	17,466	23.0	13,363
Two Blues	500	40.0	643
Kimberley Kids	305	50.0	490
Weabers Find	10	300.0	96

Total	1,184,367

In more recent years, mining activities at Nobles Nob have been restricted to intermittent exploration drilling programs, care and maintenance. TCMG carried out drilling in 2022 to confirm the viability of the proposed mining operations, with a total of 49 holes drilled for 5,364 m drilled into various prospects including Nobles Nob Deeps, Nobles North, Northern WRD, Nobles Nob West and Weabers Find, with depths ranging from 15 m to 309 m.

The open pit remains a significant feature of the local landscape and has been a local recreational and tourist attraction since the mine closed, although there have been safety concerns related to unauthorised access. There is also a history of grazing in this area, with stock from the neighbouring Tennant Creek Station accessing the wider tenement area.

Juno

Juno was an underground polymetallic mine that was operated from 1967 to 1977 and was processed along with ore from other sites at the neighbouring Peko Mine processing plant. Ore was contained in two major lodes which produced ~0.5 Mt of ore at a grade of ~52-60 g/t gold. With a total yield of 838,236 oz of gold; 2,293,422 kg of bismuth; 88,480 oz of silver; and 1,418 t of copper.

As with Nobles Nob, recent activities have included exploration, care and maintenance. In 2011, 5 RC holes were conducted at Nobles Nob. In 2012, 5 holes were drilled as well as a full scale structural geological mapping program and a ground-based gravity survey were undertaken. Work carried out during 2013 consisted of non-invasive ground-based activities using existing tracks. Walking gravity surveys and mapping were also carried out. TCMG carried out drilling in 2022 with a total of 11 holes drilled for 2,210 m into the Juno prospect with depths ranging from 180 m to 228 m. The main target was to test the upward extension of the orebody.

As with Nobles Nob, there is also a history of grazing in this area, with stock from the neighbouring Tennant Creek Station accessing the wider tenement area.

3.2.2 Current Land Use

The Project area sits on Warumungu Aboriginal Trust land. Currently the main entrance points to the Nobles Nob pit are fenced off to the public, and the site is being used for exploration activities, with exploration drilling most recently undertaken by TCMG in 2022. Since acquiring the tenement leases, TCMG has fenced and restricted access to the Nobles Nob pit for safety reasons.

There are two sacred sites within the Nobles Nob tenements important to the Traditional Owners of the area, [redacted] Open, safe access routes have been maintained to these sacred sites, which has been communicated to Traditional Owners, to allow free unrestricted access to these sites.

Due to the history of mining within the Project area, disturbance to vegetation is particularly evident. Although areas of reasonably healthy remnant vegetation remain or have regrown, the majority of the immediate Project area is moderately to severely disturbed. Leaching of historical tailings is evident in some areas. The current environmental condition of the area is therefore severely degraded and limits alternative available land uses. Cattle can be found grazing on site, presumably from the neighbouring Tennant Creek Station. The access ramp to the pit collapsed in 2001 and was repaired but collapsed again in 2022. It is therefore not currently safe to access the pit.

Other than exploration activities, care and maintenance are the only other activities currently being undertaken by TCMG on site. Including maintenance of fencing and signage, water quality monitoring, weed control measures, and environmental monitoring. TCMG is currently preparing to undertake mining activities. Site preparatory works and construction are planned to commence in 2024, in accordance with the current mining authorisation granted. No works outside of the current authorisation will begin prior to approval of this new amendment.

Figure 3-4 Historical disturbance and activities at Nobles Nob. A: Nobles Nob aerial view showing tailings and waste rock dumps 1991. B: Nobles Nob aerial view 1982. C: Nobles Nob processing c1950. D: Nobles Nob mill crushing section 1969. E: Nobles Nob crown pillar collapse 1967. F: Nobles Nob townsite 1964.

3.2.3 Identified Stakeholders and Consultation

TCMG engaged Ernst and Young to develop a comprehensive stakeholder engagement strategy in October 2021 and develop a Territory Benefit Policy and Plan. This was kicked off in January 2022 and is ongoing. A comprehensive stakeholder engagement program has been carried out in Tennant Creek, the Barkly Region, Darwin and the wider NT, throughout 2022 and 2023 and is ongoing.

Ernst and Young and TCMG identified six key stakeholder groups for the Project, which are listed in Figure 3-5 below. Strategies to engage with each of the key groups have been developed and targeted meetings, briefing sessions, development workshops, and initiatives have been carried out for each group. Further details of these engagements and initiatives are outlined within TCMG's Stakeholder Engagement and Communications Plan, and Territory Benefits Plan, both of which are 'living' documents that are updated regularly to remain current, and can be provided upon request.

Within its Territory Benefits Plan TCMG outlines the following key objectives to which it is committed:

1. **Community Benefits:** Deliver benefits to the community through collaboration, contribution, participation and an enduring positive legacy.
2. **Employment Benefits:** Employ as many Traditional Owners, Barkly Region Aboriginal and other residents, and Territorians as we can.
3. **Procurement Benefits:** Use as many Barkly Region Indigenous Business Enterprises and Barkly Region Enterprises in our supply chain as possible.
4. **Industry Benefits:** Collaborate with other major projects, local businesses andacross industry sectors to build a sustainable economyin the Barkly Region.

TCMG has developed a Buy Local Procurement Policy and Local Workforce Development Strategy which prioritise Tradtional Owners, and then local Aboriginal workers and enterprises, before other local workers and enterprises, and then wider Northern Territory, and finally interstate. TCMG has a Sponsorship Policy which is already being implemented in Tennant Creek, which includes support for:

- Community
- Aboriginal empowerment and engagement
- Arts and cultural
- Sport and recreation
- Education and training
- Business and industry
- Sustainability and environment

TCMG is committed to deliver as many benefits from the Project to the local community as possible. To date, engagement with each key group has been positive, with TCMG receiving positive feedback about its engagement approach and the potential benefits of the Project to the Barkly region.

TCMG's current workforce projections estimate a total of 169 full time employment positions (FTEs) will be required to be based in the Territory throughout the production phase of the project. The number of FTEs required will change incrementally during the construction (~109 FTEs) and commissioning (~45 FTEs) phases of the project, although many of those will be employed through TCMG's head contractor. The ongoing workforce (~169) during the production phase of the project will be directly engaged by TCMG as employees or contractors. At the end of the project, 88 FTEs are expected to be required during the closure phase. This workforce planning will continue to be updated as project planning progresses.

Category	Groups	
Aboriginal Community	1. Central Land Council 2. Traditional Owners 3. Prescribed Body Corporate 4. Aboriginal Community members 5. Aboriginal Leadership Group 6. Local Aboriginal Corporations	6a. Anyinginyi Aboriginal Corporation 6b. Julalikari Council Aboriginal Corporation 6c. Manungurra Aboriginal Corporation 6d. Papulu Apparr-kari Aboriginal Corporation 6e. Patta Aboriginal Corporation
Town of Tennant Creek	1. Local Businesses 2. Community Residents 3. Community and Social Service Providers	4. Childcare Providers 5. Charities and Not-For-Profits
Commercial	1. Local Contractors 2. Commercial Partners 2a. Emmerson Resources Ltd 2b. ICN NT 2c. Hidden Valley Ford 2d. Makita 2e. Territory Generation	3. Common Infrastructure Users 3a. Elmore 3b. Northern Iron 3c. Third Party Ore Suppliers 4. Other Major Projects 4a. Fortune Agribusiness 4b. Sun Cable
Education, Training and Employment	1. Charles Darwin University 2. Barkly Regional Schools 3. RTOs 4. RN Employment Services	5. Saltbush 6. Juno Centre 7. Barkly Work Camp 8. TCMG/Barkly Local Workforce Development Group
Government	1. Commonwealth Government 1a. Barkly Regional Deal 1b. Backbone Team 1c. Economic Growth and Support Working Group 1d. Regional Workforce Strategy Working Group 2. NT Government 2a. Ministers, Senators, MPs and MLAs 2b. Investment Territory Commissioner 2c. Major Project Commissioner 2d. Infrastructure Commissioner	2e. DIPL 2f. DITT 2g. DTF 2h. DCMC 2i. EPA 2j. DEPWS 2k. Buy Local Advocate 3. Chamber of Commerce NT 4. NT IBN 5. Aboriginal Areas Protection Authority 6. Minerals Council of Australia NT 7. Barkly Regional Council
Pastoralists	1. Tennant Creek Station 2. Phillip Creek Station	

Figure 3-5 Key stakeholder groups identified for the Project

3.2.4 Sacred Sites

The Project area is on Warumungu Aboriginal Land Trust land. The Aboriginal Areas Protection Authority (AAPA) has advised there are two recorded sacred sites within the Project area, [redacted] TCMG has been granted an AAPA Certificate under the *Northern Territory Aboriginal Sacred Sites Act 1989* for works on MLC514 and MLC549 granted 23 June 2022 (C2022-026); as well as a second Certificate which covers all remaining Juno and Nobles Nob tenements granted 7 December 2022 (C2022-064). These certificates cover the scope of works included in this MMP. These certificates designate Restricted Works Areas around the two recorded sacred sites, in which no work shall take place other than specified permitted work; no damage shall occur; and the use of existing tracks is permitted for transit only. See Appendix C for further details.

TCMG has also been granted a Sacred Sites Clearance Certificate through the Central Land Council (CLC). Being located on Aboriginal Land Trust land, this is required in addition to the AAPA Certificate under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Australian Government) and the Pre-Existing Tenements Agreement (PETA). This application was granted 27 September 2022 (C2022-077) and includes proposed exploration and mining activities within the Juno and Nobles Nob tenements. This certificate identifies the same two sacred sites as AAPA, and designates two Exclusion Zones around these sites, similar to those designated by AAPA; as well as an additional Restricted Work Area north of the Nobles Nob to Juno infrastructure corridor. Within the Exclusion Zones no access is permitted; and no angled drilling underneath these areas. Within the Restricted Work Area, limited works have been requested. See Appendix C for further details.

The combined Restricted Works Areas and Exclusion Zones designated by AAPA and the CLC are shown in Figure 3-6 below. No works are planned within these areas, other than the permitted use of existing access tracks and water monitoring sampling. TCMG has developed a Cultural Heritage Management Plan and will implement management controls including signage on site to ensure that no unauthorised access or damage will occur to known sacred sites as a result of Project activities. The Cultural Heritage Management Plan also outlines a response procedure to be followed in the case of unexpected heritage finds during Project works. All conditions outlined within the AAPA and CLC Certificates will be upheld. Site layout places infrastructure away from the location of sacred sites, and all planned works including exploration activities will be outside of the designated restricted areas.

The Project area occurs on Mineral Leases granted prior to Native Title allocation. An existing land use agreement exists between the previous tenement owners Normandy Gold Pty Ltd (now Emmerson Resources Limited) and the Warumungu Land Trust and the Central Land Council. [redacted] TCMG will continue to work in conjunction with AAPA and the CLC throughout the Project to ensure that all necessary approvals and precautions are taken to protect sacred sites. If any suspected artefacts are discovered during operations the appropriate authorities will be immediately notified.

[redacted]

Figure 3-6 Combined Restricted Works Areas and Exclusion Zones designated by AAPA and the CLC within the Project area

3.2.5 Heritage and Archaeological Sites

A search of the NT Heritage Register did not return any heritage or archaeological site within the Project area. The high level of historical disturbance activities indicates the likelihood of unrecorded heritage values and disturbance of such sites is extremely low.

4 MINING ACTIVITIES

4.1 Proposed Mining of the Southern WRD

The Southern WRD is located to the south of the Nobles Nob pit, on MLC512, MLC539, MLC556 and MLC590, as shown in Figure 1-4. This covers approximately 9.24 ha of land which was used for waste rock and mineralised waste disposal when the historical Nobles Nob pit was in operation and when the crown pillar collapsed. Mineralised portions of approximately 1,252,000 t of material over approximately 8.9 ha at the southern end of the Southern WRD is planned to be recovered and processed on site (generally the upper layer of material). Sections of the Southern WRD that are lower grade will not be processed (generally the lower layer of material) and will be progressively used as capping for rehabilitation instead, or left *in situ* if not required for use. Further detail of the staged processing approach is included in the attached operating plan for the processing of the Southern WRD (Appendix D). Further detail of the use of material for capping and its suitability for rehabilitation purposes is included in the attached letter at Appendix E.

Mining of the Southern WRD will be undertaken by conventional excavator / front end loader and truck method:

1. Clear and grub of regrowth of the mineable section of Southern WRD;
2. Mining of material in nominally 3-meter benches;
3. Ore processed on site;
4. Rehabilitate newly created faces in the Southern WRD; and
5. Unmined lower section of Southern WRD will be progressively used for capping of the tailings storage facility, or left *in situ* if not required.

Equipment:

- Front End Loader
- Excavator
- Off Highway Haul Trucks.

4.2 Proposed Mining of the Northern Tailings

Historical gold mine tailings are stored in a tailings storage facility termed the Northern Tailings area which covers approximately 11.1 ha of land with a total inventory of 1,290,999 t. Located adjacently west of the Nobles Nob pit, on MLC521, MLC525, MLC537, MLC538, MLC539 and MLC540, as shown in Figure 1-4. It is proposed to extract and reprocess approximately half of these tailings, a total of approximately 629,660 t, on the eastern side of the tailings over a total area of approximately 5.5 ha. Before undertaking this reprocessing, a thorough assessment of the existing historical tailings storage facility and tailings will be undertaken. This will include the geochemical characterisation of the tailings.

Extraction will be undertaken by utilising high pressure water jets to create a slurry, which will be transported via a pipeline to the processing plant for processing, where gold contained within the tailings will be extracted using the CIL process described in Section 5.2 of this MMP. This method reduces the need for traditional excavation and hauling, resulting in a smaller environmental footprint and lowered risk of dust emissions.

Mining of the Northern Tailings will include:

1. Clear and grub of regrowth of the mineable section of the Northern Tailings;
2. Mining of material and transport to pipeline;
3. Creation of a slurry and transportation via pipeline to process plant;
4. Ore processed on site; and
5. Establishment of a TSF on this area.

Equipment:

- Front End Loader
- Excavator

- Water jets and pumps.

4.3 Proposed Mining of the Existing Nobles Nob Pit

The existing Nobles Nob pit is located on MLC688, and in to MLC525, with a footprint of approximately 6.4 ha. It is proposed to expand the existing Nobles Nob pit by re-establishing open cut mining to access the remaining Nobles Nob gold deposit. The proposed pit expansion is to the north and east, to a total footprint of approximately 12 ha, as shown in Figure 1-4. This would represent an additional footprint of 5.6 ha and extend the pit in to MLC512, MLC516, MLC521, and MLC542. With a proposed pit depth of approximately 266 mAHD, which is an extension of approximately 20 m below the existing pit floor at 286 mAHD. A total of approximately 1,829,898 m^3 of material is proposed to be extracted, at a stripping ratio of 2.91, with a total ore volume of approximately 628,426 m^3.

The pit expansion will require dewatering of the pit and will require lowering the groundwater levels approximately 20 m below the existing pit floor. The impacts of the pit dewatering were considered in the Nobles Nob Open Pit dewatering assessment, which is included in Appendix F. The assessment concluded that the proposed dewatering of Nobles Nob pit is expected to have no adverse impacts on the groundwater system at Nobles Nob, except for changes in groundwater level. Any such impacts will be constrained within a 2.763 km radius. As such, the proposed pit dewatering is unlikely to deplete the aquifer or impact the water supply of Tennant Creek township.

The volume of waste rock expected to be produced from the pit expansion is approximately 1,201,472 m^3. It is proposed to store this waste rock in the Northern WRD. The Northern WRD is an existing waste rock dump located northwest of the Nobles Nob pit, which was used to store waste rock from historical operations at Nobles Nob. The waste rock will be stored within the footprint of the existing Northern WRD – adding a height of approximately 10-25 m across this area, which will be contoured to blend in with the surrounding topography.

[redacted], as designated by AAPA/CLC. All activities will be undertaken outside of this zone. Markers will be placed to delineate the boundaries of this zone, and all personnel are to remain outside of this area. Processing activities will be managed to avoid indirect impacts to the Sacred Site, including dust controls, and erosion and sediment controls.

Mining of the Nobles Nob pit will include:

1. Dewatering the Nobles Nob pit for access;
2. Re-establishment of safe access via existing pit ramp;
3. Drill and blast;
4. Excavation of waste rock and ore;
5. Processing of ore on site;
6. Deposition of waste rock to the Northern WRD; and
7. Any works required to leave the pit in a safe state for possible future mining activities.

Equipment:

- Excavator
- Off Highway Haul Trucks.

drainage from these samples is less likely.

4.4 Mining Performance Against Previous MMP

This is the first amendment of this MMP. In the time since receiving approval of the first MMP, exploration activities have been undertaken. Details of the exploration activities undertaken to date are outlined in Section 7.2 of this document. No Mining activities have been undertaken to date. Environmental management activities have also been undertaken, including weed control, groundwater monitoring, dust depositional monitoring, and general environmental monitoring.

5 PROCESSING ACTIVITIES

5.1 Ore Processing

It is proposed for an existing gold processing plant to be transported to, and re-established and commissioned onsite. Once relocated, the process equipment is subject to a detailed plant condition and refurbishment report. The plant will be placed within the area previously used as a processing plant during historical mining operations. Required site infrastructure will be placed within the historical disturbance footprint, with the only exception being the solar field. This includes ore treatment plant, power generation plant, fuel storage, wastewater treatment system, tailings treatment and storage facility, process water pond, and site buildings and office.

Once the processing plant is operational, it is proposed to initially process the material from the Southern WRD, followed by the Northern Tailings and Nobles Nob pit, as outlined in Section 4 above. Processing of these ores may be co-mingled depending on feed optimisation. Following this, it is then planned to process ore from surrounding satellite sites in the Tennant Creek area. The mining activities associated with each of these sites will be covered in separate MMP applications. The processing of the ore from these sites is planned to be included within the scope of this Nobles Nob Gold Project over time. Processing of ore from the three initial satellite sites to be mined, Black Snake, Rising Sun and Weabers Find, is included within this application to vary the current MMP. Further details are outlined in Sections 5.3 and 5.4 below. Further amendment applications will be made to include the processing of additional satellite site ore at the Nobles Nob gold plant over time. In each case, characterisation of the ore to be processed, and an assessment of potential impacts to the Nobles Nob site will be made prior to these applications being made.

All of the prospects within the Nobles Nob Project site are within the Warramunga Geological Province, with similarities in ore type and geological characteristics - indicating a high likelihood of similarity in mineralisation and waste rock characteristics. By leveraging the proximity of these satellite deposits, the mining operation can optimise its resource utilisation and operational efficiency. The similar ore types imply that the processing plant can utilise existing infrastructure, equipment, and processing techniques that will be in place. This streamlines the processing operations and reduces the need for significant modifications or additional investments, and opens up the viability of mining previously stranded deposits within the Tennant Creek Gold Field.

5.2 CIL Treatment Process

Ore processing will use a conventional Carbon-in-Leach (CIL) process, utilising Cyanide (CN) in solution to dissolve contained gold. Ore processing consists of a series of physical and chemical separation processes to separate out the gold, as outlined below. With the final product of gold doré bars for export.

Ore crushing is a three-stage process involving a primary jaw crusher, secondary crushing, and tertiary cone crushers to reduce the Run of Mine (ROM) ore feed material to a P80 (80% of material passing) sizing of 10 mm. This 10 mm ore is then fed into a ball mill together with water. The ball mill produces a smaller P80 material sizing of 106 microns in slurry. This slurry is then fed into a gravity separation circuit together with Quicklime. Quicklime is added to the mill feed for mixing and to maintain pH levels in the subsequent leach tanks that are sufficiently alkaline to hold CN in solution.

The gravity separation circuit consists of hydrocyclones which physically separate the heavy (gold) and coarse fractions of material, thus removing ‘free gold’ from the slurry feed. The heavier gold-bearing fraction is directed to a centrifugal concentrator; whereas the lighter and finer fractions report directly to the leach tanks.

The centrifugal concentrator further physically separates the gold-bearing fraction. This gold-bearing concentrate is then directed to an Acacia reactor; and the balance of the material is directed to the leach tanks.

The Acacia reactor uses an intense cyanidation process in conjunction with sodium hydroxide, to dissolve contained gold. This pregnant solution is directed to a dedicated electro-winning circuit, which forms a gold solid on steel wool electrodes. This solid is then smelted to form gold doré bars.

The bulk of the ore feed is contained in the ‘lighter and finer’ fractions which are split at the gravity circuit. This, together with the balance of material from the centrifugal concentrator, report to the leach circuit. The leach circuit consists of a standard CIL circuit, involving 8 tanks (each 8.3 m diameter and 8.5m height) which are mechanically agitated.

Liquid cyanide is dosed into the first tank, and the first two tanks (the leach tanks) have compressed air injected at the base providing oxygenation, to enhance gold leaching. The remaining 6 tanks (the adsorption tanks) have granular (+2 mm) activated carbon added, which captures the gold in solution. The quantum and collective volume of the tanks provides the necessary ‘residence time’ required for gold leaching, and for gold to carbon attachment to take place. Slurry is moved progressively from tank to tank via launders from one to the next. Slurry from the last tank is pumped through a screen separating the ‘loaded carbon’ from the leached material. The loaded carbon is sent to an Elution circuit; and the remaining leached material is sent to tailings. See Section 5.5 below for further details of tailings treatment and storage. Water recovered from the tailings filtration will be returned to the processing circuit. It is expected that ~88% of water will be recovered from the wet tailings for reuse.

Loaded carbon from the leach tanks reports to the Elution circuit, where it is washed. Wash water is returned to the leach tank circuit. Cleaned loaded carbon is then acid washed to remove impurities and transferred to a pressure elution circuit where gold is stripped from the carbon under pressure and heat, using sodium hydroxide. The stripped pregnant gold-bearing solution is directed to an electro-winning cell to form a gold solid on steel wool electrodes as previously described, and then smelted into gold doré bars. The stripped solutions are reused in closed circuit and introduced to the front of the leach tank circuit. The stripped carbon is “regenerated” using heat, at circa 750 degrees centigrade in a regeneration kiln, refreshing and reactivating its surfaces for adsorption performance and reuse.

The chemical processing reagents used are:

- Quicklime in bulk dry powder form for mill feed addition;
- Sodium Cyanide in solid form for mixing and leach tank addition;
- Sodium cyanide in solution for intense leach reactor use;
- Sodium Hydroxide in 1,000 litre pods; and
- Hydrochloric acid in 1,000 litre pods.

5.3 Processing of Ore from Black Snake

It is proposed to process and treat ore from the nearby Black Snake deposit at the Nobles Nob gold processing plant. A total of 36,327 t of ore is expected from Black Snake. The TSF design has included the volumes required to store the Black Snake tailings.

5.4 Processing of Ore from Rising Sun and Weabers Find

It is proposed to process and treat ore from the nearby Rising Sun and Weabers Find deposits at the Nobles Nob gold processing plant. A total of 32,690 m^3 of ore is expected from Rising Sun; and 8,181 m^3 of ore is expected from Weabers Find. The TSF design has included the volumes required to store the Rising Sun and Weabers Find tailings.

5.5 Tailings Treatment and Storage Facility

It is proposed to use dry stack tailings technology to treat and store the tailings from the proposed operations. This will involve staged preparation of dry stack tailings laydown areas of approximately 25.2 ha in total, which will be progressively placed within the existing disturbance footprint.

A staged approach is proposed for the establishment of the dry stack TSF within the Project area. It is proposed to stack the tailings within three staged areas:

1. Dry stack Tailings Area – Stage 1 (5.4 ha)
2. Dry stack Tailings Area – Stage 2 (8.4 ha)
3. Dry stack Tailings Area – Stage 3 (11.4 ha).

The first stage will be stacked on the existing historical Southern Tailings area, adjacent southwest of the processing plant. The existing Southern Tailings area has been sampled and determined to be uneconomic to be processed. This area will therefore be sterilised and the space effectively utilised as a TSF. The proposed footprint of this stage of the Tailings area is 5.4 ha.

The second stage will be stacked on the existing Southern WRD area. This area will first be excavated and the waste rock processed, as outlined within 4.1 of this MMP. Once complete, this area will then be prepared for use as a dry stack TSF, and used once the second stage is filled. The proposed footprint of this stage of the Tailings area is 8.4 ha.

The third stage will be stacked on the existing historical Northern Tailings area. This area will first be excavated and the existing tailings reprocessed, as outlined within Section 4.2 of this MMP. Once complete, this area will then be prepared for use as a dry stack TSF, and used once the first stage is filled. The proposed footprint of this stage of the Tailings area is 11.4 ha.

The proposed dry stack areas will have a total footprint of 25.2 ha. The proposed dry stacking area will have the capacity to store the produced dry tailings from all of the ores proposed to be processed within this MMP, including the Southern WRD, Northern Tailings, Nobles Nob pit expansion, Rising Sun, Weabers Find, and Black Snake – with spare capacity to cater for additional tailings from ore that may be brought from other satellite sites and processed on site at a later time.

5.5.1 Dry Stack Tailings Methodology

Dry stacking of tailings is a tailings management technique that involves dewatering the tailings to a moisture content suitable for stacking into a dry and stable form. This process significantly reduces the environmental impact and risks associated with traditional tailings storage methods. The key steps in the process that will be used for dry stacking tailings at Nobles Nob are outlined below.

1. **Receival** – Ore is processed for gold extraction as outlined in Section 5.2 above. The resulting tailings slurry exits the leach tank circuit and into the thickening treatment facility. At this stage, the tailings contain a mixture of water and fine particles and are approximately 40 % wet/weight (w/w).
2. **Thickening** – In the first stage of the dry stacking process, the tailings slurry will be treated with thickeners, which will thicken the tailings slurry up to 60% (w/w). Thickeners enable the separation of water from the solid particles, reducing the water content of the slurry.
3. **Dewatering** – Following thickening, the partially dewatered tailings slurry will undergo further dewatering processes to achieve the desired moisture content for dry stacking. Filter presses will be used as the dewatering method. Mechanical dewatering in a filter press will reduce the moisture content in the tailings to less than 20%.
4. **Discharging and Spreading** – Once the filter press sufficiently dewaters the tailings slurry, it will be discharged onto a specially prepared stacking area. The dewatered tailings will then be spread and distributed evenly across the stacking area. A wheeled loader or a dozer will be used to spread the dry tailings and provide sufficient compaction for the trafficability of the conveyor and stacker as needed. Additional compaction will be conducted in specified areas to limit the possibility of dynamic (earthquake) liquefaction of the tailings, which may cause instability of the stack. The stacking will be undertaken in accordance with Australian National Committee on Large Dams (ANCOLD) guidelines, to maintain the factor of safety of 1.5.
5. **Layering and Compaction** – To ensure stability and optimise space utilisation, the dewatered dry tailings will be layered and compacted. Each layer will be typically compacted using wheeled loaders or dozers and heavy machinery to increase the density and reduce the air voids within the stack. Compaction helps to create a stable and self-supporting structure. The aim will be to achieve

high compaction percentage for dry stacks for the Project, typically up to 90-95% of the maximum achievable density. The compaction percentage refers to the ratio of the final compacted density to the maximum achievable density of the tailings material. It is usually expressed as a percentage. Achieving this high compaction percentage will help in reducing the presence of voids within the stack, making it impermeable to water infiltration.

6. **Terracing and Contouring**: As the dry stack grows, a terrace or contour will be created by cutting into the slope of the stack at predetermined intervals. These terraces provide additional stability, allowing for better water runoff management and erosion control. Surface water, including rainfall, will be effectively managed to prevent erosion and maintain the stability of the stack. Diversion channels, drainage ditches, and erosion control measures will be implemented to guide and control water flow.
7. **Final Cover** Once the dry stack reaches its designed height, a final cover will be applied to minimise potential environmental impacts. This cover layer will provide further protection against erosion, dust generation, and infiltration, and will consider aspects such as soil types, climatic conditions, and long-term stability. The final cover design will also consider the post-closure land use objectives and will be in compliance with the relevant legislation and adhere to best practices to achieve successful and sustainable mine site rehabilitation.

6 OTHER PROJECT INFRASTRUCTURE

6.1 Process/Mine Water Dams

Process water will be sourced initially from the Nobles Nob pit during dewatering activities, and then from the adjacent Juno mine site, as further outlined in Section 6.3.1 below.

Dewatering of the Nobles nob pit will be undertaken using pumps within the pit. A raw water storage tank will be established south of the Nobles Nob pit, and a process water pond of approximately 0.6 ha will be constructed between the processing plant and the Nobles Nob pit, as shown in Figure 1-4. The process water pond will be dug out to approximately 1 m below ground level, with the excavated material compacted and used to make embankments around the pond. Water extracted from the pit will be transported to the raw water storage tank using High Density Polyethylene (HDPE) pipes. The process water pond will initially be filled with water from the raw water storage tank using a HDPE pipeline. In addition to that, the reclaimed process water from the processing circuit and filter press will also be transported to and stored in process water pond for reuse.

At such time that water is no longer sourced from the Nobles Nob pit, water will be transported from the Juno mine site to Nobles Nob via a HDPE pipeline. The water infrastructure at Nobles Nob as described above will then be used. Construction of a pipeline will be undertaken at such time that it is planned to begin dewatering at Juno. The pipeline corridor is located on Warumungu Aboriginal Land Trust freehold land, which has previously been approved and cleared and land access has previously been granted for this purpose. Use of this area was included in the CLC Sacred Sites Clearance Certificate granted to TCMG.

6.2 Power Supply

The expected power demands of the Project are estimated to be 3.0 MW on an annual average load basis. It is planned to supply this demand by generation on site with a total installed operational capacity of 4 MW, which will easily meet demand. With a hybrid solar and diesel power station which consists of: Diesel + Battery + Solar (hi penetration). Including 6 x 550 kVA peak rated diesel generators coupled with a 2 MW / 0.5 hr battery, and a ~4 MW solar array. A staged approach is planned to test and add solar, with the goal being to run day operations on solar power, when feasible. The solar array will be placed within a 4 ha area to the west of the processing plant (on MLC540), as indicated in the site layout shown in Figure 1-4.

Diesel fuel tanks will be stored on site to supply the diesel generators and their day tanks, with up to 4 x 110 kL tanks planned. This will cover two week's supply of fuel, and longer when solar is being used. These tanks will be placed in an appropriately designed and bunded fuel facility, and/or self-bunded containerised tanks will be used.

6.3 Water Supply

6.3.1 Process Water Supply

The expected water demands of the Project are estimated to be 3.5 L/s during the initial construction phase and ramping up to 4.5 L/s for the operational phase. The peak expected water demands of 4.5 L/s equates to approximately 142 ML per annum. This includes the water demands for processing operations, dust suppression and other site water demands. Water quality has been monitored at Nobles Nob and Juno since October 2021, and is deemed appropriate for these uses.

The expected water demands of the Project are lower than those previously calculated, due to changing the tailings storage technology to dry stack tailings, which has an overall lower water demand, and allows improved water reuse and efficiency.

It is proposed to access water supply from two key points. Initially from dewatering the Nobles Nob pit using an in-pit sump, and then from dewatering of the Juno underground workings, at such time as it is planned to mine at Juno. This makes use of water that needs to be removed in order to allow access for mining – and minimises the need for disposal of excess water.

The original plan had been to extract water from Juno and transport it to Nobles Nob from the start of the Project. As Project planning progressed, however, additional studies were undertaken into the dewatering that would be required to access and mine the Nobles Nob pit. It then became apparent that dewatering of the Nobles Nob pit would provide sufficient water to meet all Project requirements. As would dewatering of the Juno underground workings. Rather than disposing of this water and extracting additional water from Juno, Project planning was altered to avoid this.

Dewatering of the Nobles nob pit will be undertaken using pumps within the pit. A raw water storage tank will be established south of the Nobles Nob pit, and a process water dam of approximately 0.6 ha will be constructed between the processing plant and the Nobles Nob pit, as shown in Figure 1-4. Water extracted from the pit will be transported to the raw water storage tank using HDPE pipes. The process water pond will initially be filled with water from the raw water storage tank using a HDPE pipeline. In addition to that, the reclaimed process water from the processing circuit and filter press will also be transported to and stored in the process water pond for reuse.

At such time that water is sourced from Juno, this will be accessed from within the Juno mine shaft. Water will be pumped into a pipeline, which will transport the water over to the process water pond at Nobles Nob, with a total pipeline length of approximately 5 km. Construction of a pipeline will be undertaken as part of the activities proposed within this MMP. The pipeline corridor is located on Warumungu Aboriginal Land Trust freehold land, which has previously been approved and cleared and land access has previously been granted for this purpose. Use of this area was included in the CLC Sacred Sites Clearance Certificate granted to TCMG. TCMG has been granted a groundwater extraction licence under the Water Act 1992 (Licence No: L10012 granted 19 January 2023) for water supply from Juno. This is included in Appendix I.

TCMG has sought advice from the NT Department of Environment, Parks and Water Security (DEPWS) on the regulatory requirements for dewatering activities and has been advised that it is presently a ‘grey area’ under the current water regulatory scheme. TCMG has chosen to pre-emptively apply for groundwater extraction licences for the proposed dewatering activities. TCMG has been granted a groundwater extraction licence (Licence No: L10012 granted 19 January 2023) to extract water from Juno. A second groundwater extraction licence application has been made to extract water from Nobles Nob. This second application was accepted for processing on 8 May 2023 and is currently being assessed. The Notice of Intent was published 23 June 2023 for public comment.

6.3.2 Potable Water Supply

To meet potable water requirements, TCMG proposes to initially source water from the Tenant Creek town water supply. Water will be purchased from the NT Power and Water Corporation (PWC) and transported to the site with water trucks. This is planned for the initial phase of the Project, until dewatering of the pit has commenced, and sufficient on-site infrastructure has been established. A potable water treatment plant is then proposed to be installed on site.

As part of its commitment to sustainable resource management, TCMG is assessing the requirements and options for installation of a potable water treatment plant. Once it is deemed feasible to do so, TCMG proposes to install a treatment plant within the main Project footprint.

The proposed treatment plant will use a Membrane Bioreactor Reverse Osmosis system to purify the raw water, ensuring its compliance with potable water standards. TCMG acknowledges the importance of adhering to all legislative requirements concerning water treatment and will undertake the necessary steps to ensure full compliance. TCMG will prioritise the implementation of industry-leading practices and technologies to guarantee the production of high-quality potable water for its operations, including adherence with the Australian Government *Australian Drinking Water Guidelines* 2023 and the Northern Territory *Guidelines for Private Water Supplies* 2019.

6.4 Mine Dewatering

The Nobles Nob pit will need to be dewatered to allow access for mining. A pit dewatering study was undertaken using a complex analytical model (See Appendix F). The results of the assessment indicate that an extraction rate of 5.2 L/s will be required to dewater the pit to the existing pit floor and 16.41 L/s to maintain dewatering to the maximum proposed excavation to 20 m below the current pit floor depth. These are the maximum modelled rates expected – and may be lower than this depending on actual rates of aquifer recharge.

If these maximum rates occur, dewatering rates will be above the water requirements of the Project and disposal of excess water will be required. TCMG is currently assessing various options to beneficially use any excess water if and when it occurs. Options being considered include Managed Aquifer Recharge, Solar Pond Power Generation, Agricultural Use, and an Evaporation Pond. The preferred options will be considered for feasibility and preference in consultation with the relevant stakeholders. All relevant regulatory approvals for the preferred option(s) will be sought following this, and prior to undertaking any such disposal. This is not expected to be required in the initial stages of the Project, until mining of the Nobles Nob pit commences, at which time more extensive dewatering of the pit will be required.

6.5 Wastewater Treatment System

Initially, it is proposed to meet wastewater treatment and disposal requirements using portable ablutions equipped with in-built septic tanks. These septic tanks will be regularly serviced and cleared by a local waste disposal company to ensure proper maintenance and disposal of the collected wastewater. All collected wastewater will be disposed of offsite. TCMG is committed to preventing any release of untreated wastewater into the environment, thereby mitigating any potential negative impacts on surrounding ecosystems. This is expected to appropriately service site requirements while in construction and the initial phases of the Project.

After such time, it is proposed to install a dedicated wastewater treatment system. TCMG is assessing the requirements and available technology options. The objective is to implement a sustainable mining approach by treating wastewater, and recycling and reusing treated wastewater on site where possible. By implementing an advanced wastewater treatment system, TCMG aims to minimise water consumption and contribute to the conservation of water resources. TCMG will ensure that the selected system complies with all relevant regulatory requirements and is designed and constructed in accordance with the relevant guideless and codes of practice, including the AS/NZS 1547:2012 *Code of Practice for On-site Domestic Wastewater Management*, and the Northern Territory *Code of Practice for Wastewater Management* 2020.

7 EXPLORATION ACTIVITIES

7.1 Drilling Approved for 2022

Exploration activities were undertaken by TCMG in 2022 to assess the viability of expanding the Nobles Nob pit; the potential to reprocess existing historical tailings located on site including the Northern TSF; as well as the nearby Rising Sun and any other viable deposits on site. This drilling has led to the assessment that it is viable to mine the Nobles Nob pit and Northern Tailings, as included within this MMP amendment – as well as other deposits such as Rising Sun and Weabers Find, which will be included in separate MMPs and mining applications.

Drilling activities were included within this MMP for the 2022 drilling. All further drilling activities going forward will be considered separately within an exploration only MMP for ease of assessment and rehabilitation tracking.

Within the 2022 drill season, TCMG were approved to drill 11 holes (each within a 20m x 20m drill pad area) at the Juno mine site as shown below in Table 7-1 and Figure 7-1. The total area of drill pads that was approved to be cleared was 0.4 ha, with some overlapping between drill pads, as shown below in Figure 7-2. This was the total approved area of disturbance from drilling activities. No costeons, bulk sample pits, line/track clearing, water bores, or camp areas were required.

Table 7-1 Approved drilling at Juno in 2022

Hole ID	Easting	Northing	RL	Max depth	Hole type
phase_1001	420,340	7,821,284	349	197	RC
phase_1002	420,350	7,821,288	350	192	RC
phase_1003	420,330	7,821,298	350	209	RC
phase_2001	420,370	7,821,317	350	196	RC
phase_2002	420,380	7,821,308	349	193	RC
phase_3001	420,430	7,821,297	349	193	RC
phase_3002	420,430	7,821,267	349	163	RC
phase_3003	420,420	7,821,271	349	180	RC
phase_3004	420,440	7,821,320	348	204	RC
phase_4001	420,470	7,821,317	347	198	RC
phase_4002	420,480	7,821,357	347	221	RC

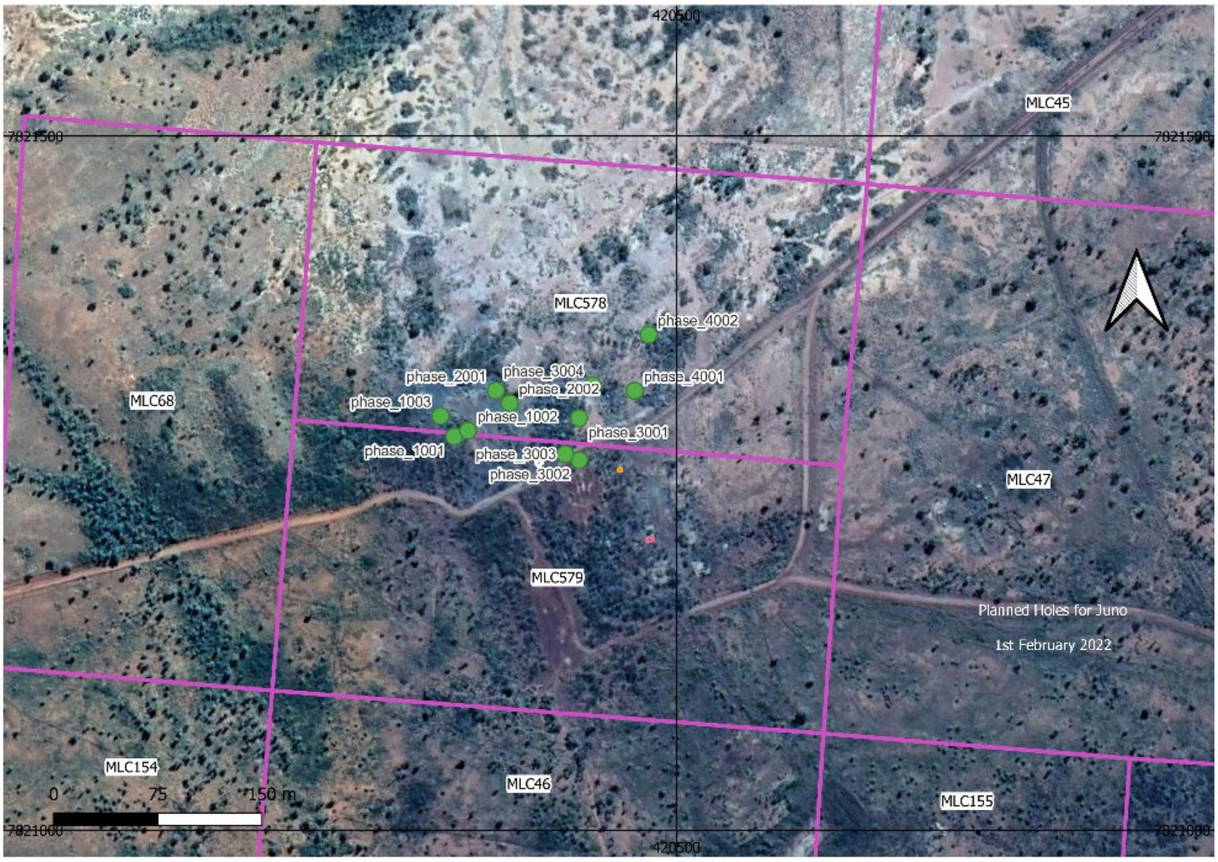

Figure 7-1 Location of approved drill holes at Juno in 2022

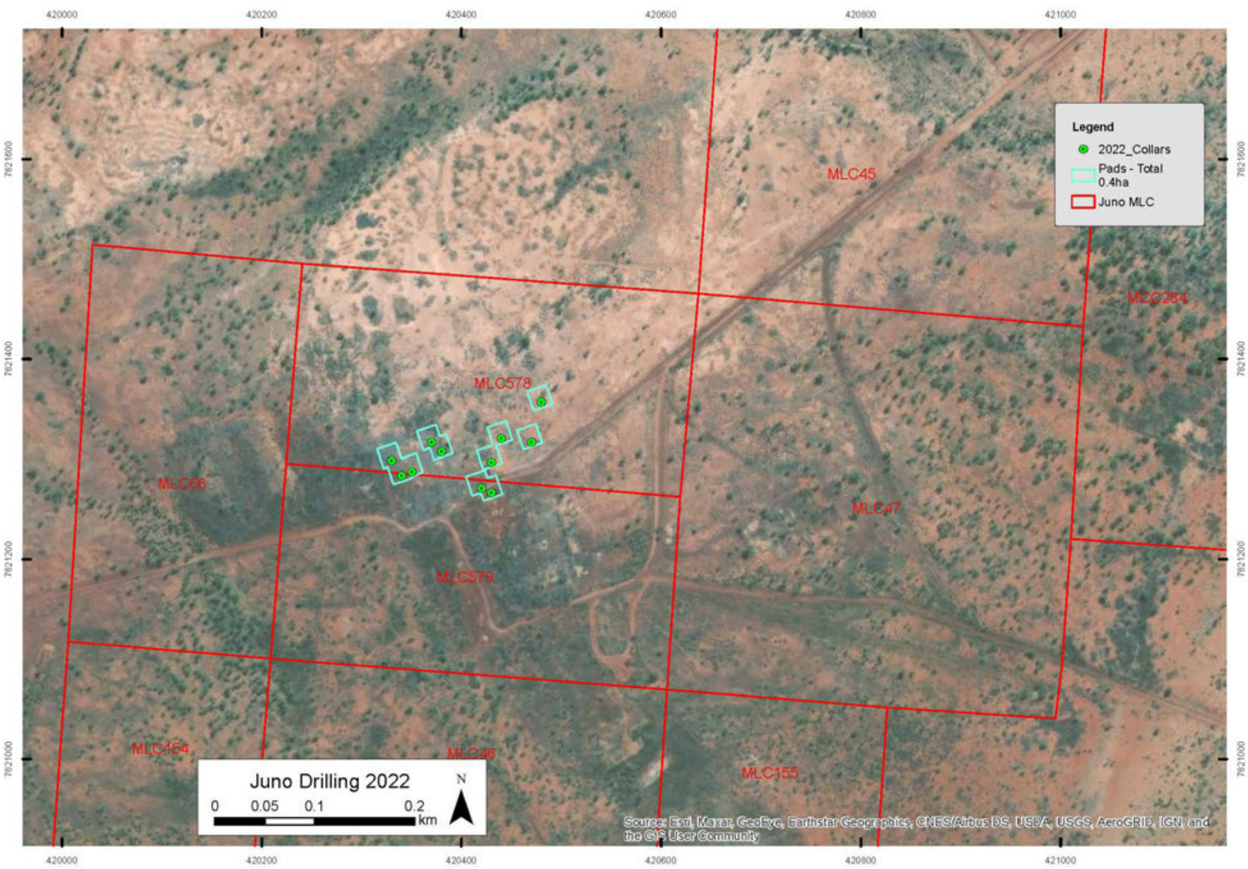

Figure 7-2 Location of approved drill pads at Juno in 2022

TCMG was approved to drill 54 holes (each within a 20m x 20m drill pad area) at Nobles Nob mine site. Information on the approved drill holes is provided in Table 7-2 and location in Figure 7-3, with closer detail of each drill area shown in Figure 7-5 (Nobles Nob West), Figure 7-6 (around Nobles Nob pit) and Figure 7-7 (Weabers find, east of the pit). The total area of drill pads approved to be cleared was 1.6 ha, with some overlapping between drill pads, as shown below in Figure 7-4. This was the total area of disturbance approved for drilling activities. No costeons, bulk sample pits, line/track clearing, water bores, or camp areas were required.

Table 7-2 Approved drilling at Nobles Nob in 2022

Hole ID	Easting	Northing	RL	Max depth	Hole type
46	424,610	7,820,032	213	162	RC
45	424,621	7,820,009	213	163	RC
44	424,629	7,820,025	207	170	RC
43	424,634	7,819,993	203	175	RC
35	425,830	7,820,112	209	167	RC
34	425,820	7,820,099	197	171	RC
24	425,840	7,820,066	199	173	RC
18	425,799	7,820,086	205	174	RC
29	425,709	7,820,168	199	184	RC
23	425,870	7,820,054	185	186	RC
31	425,700	7,820,154	191	192	RC
22	425,880	7,820,048	181	193	RC
32	425,720	7,820,150	188	195	RC
26	425,830	7,820,091	176	200	RC
20	425,860	7,820,079	152	230	DDH
30	425,650	7,820,169	147	245	DDH
21	425,860	7,820,055	88	285	DDH
36	425,890	7,820,065	140	290	DDH
16	425,749	7,820,125	96	299	DDH
27	425,789	7,820,138	84	313	DDH
19	425,849	7,820,126	61	335	DDH
17	425,799	7,820,104	37	339	DDH
28	425,769	7,820,168	58	343	DDH
25	425,840	7,820,122	43	366	DDH
33	425,780	7,820,139	29	378	DDH
38	425,960	7,820,142	299	91	RC
37	425,950	7,820,133	294	103	RC
39	425,970	7,820,108	260	137	RC
15	426,012	7,820,027	264	144	RC

Hole ID	Easting	Northing	RL	Max depth	Hole type
40	426,040	7,820,054	112	288	DDH
41	426,050	7,820,052	109	292	DDH
42	426,060	7,820,049	104	297	DDH
11	425,879	7,820,274	336	41	RC
14	425,894	7,820,246	335	43	RC
10	425,874	7,820,247	333	46	RC
12	425,884	7,820,278	330	47	RC
13	425,889	7,820,246	331	49	RC
4	425,870	7,820,263	330	51	RC
5	425,870	7,820,237	375	55	RC
9	425,859	7,820,259	319	59	RC
7	425,864	7,820,257	316	62	RC
8	425,854	7,820,259	316	62	RC
56	426,830	7,819,942	309	49	RC
54	426,860	7,819,936	307	50	RC
52	426,840	7,819,935	306	52	RC
48	426,820	7,819,942	303	56	RC
47	426,820	7,819,936	303	56	RC
57	426,810	7,819,940	302	57	RC
49	426,820	7,819,932	299	61	RC
50	426,800	7,819,938	298	62	RC
51	426,800	7,819,932	297	63	RC
55	426,860	7,819,930	291	69	RC
58	426,810	7,819,936	289	72	RC
53	426,840	7,819,927	281	81	RC

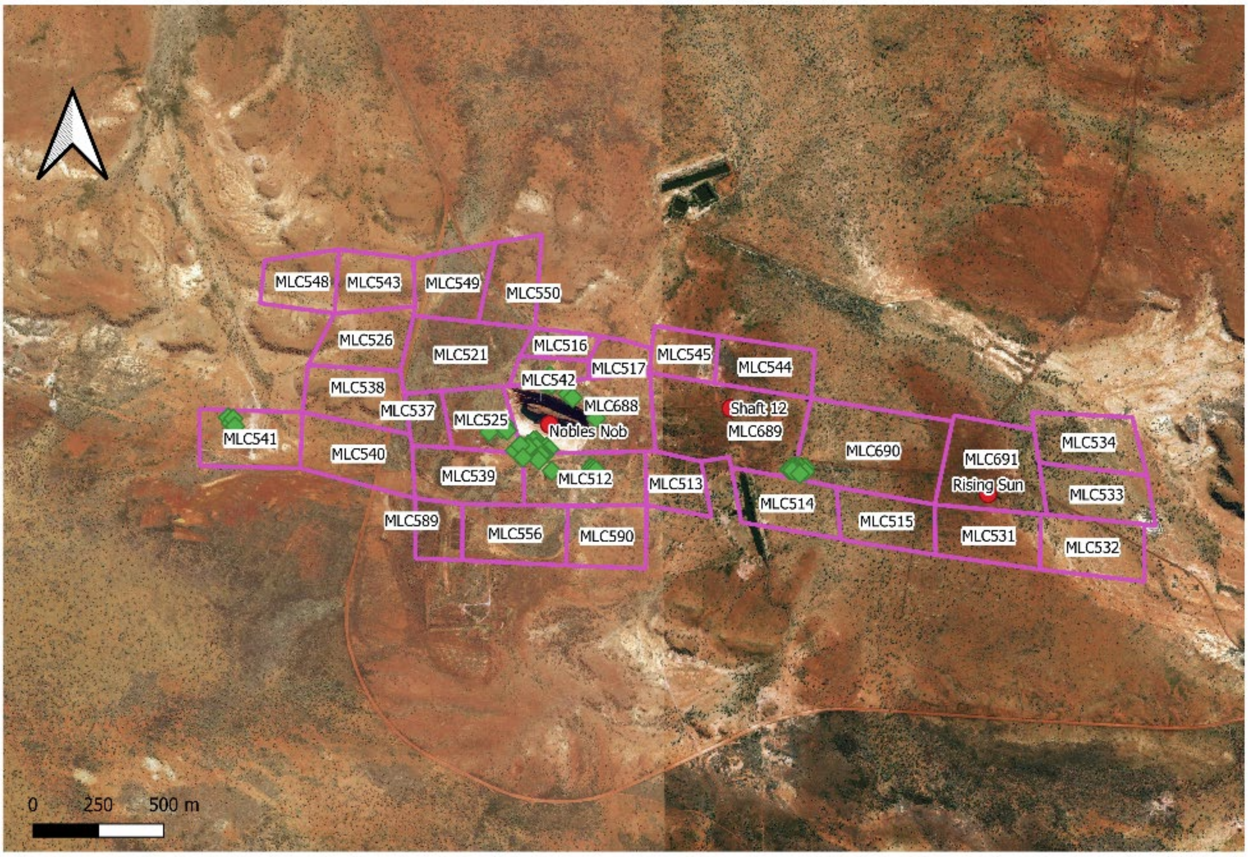

Figure 7-3 Location of approved drill holes at Nobles Nob in 2022

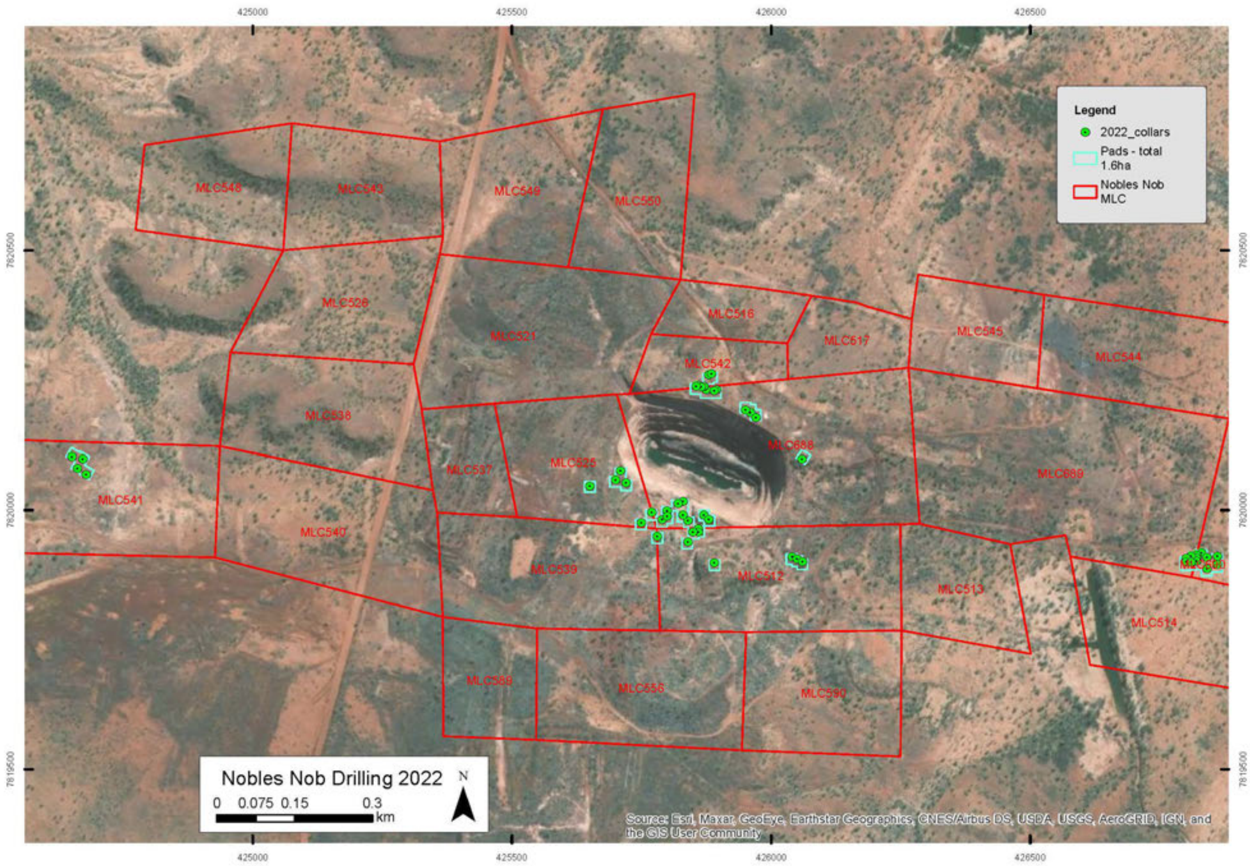

Figure 7-4 Location of approved drill pads at Nobles Nob in 2022

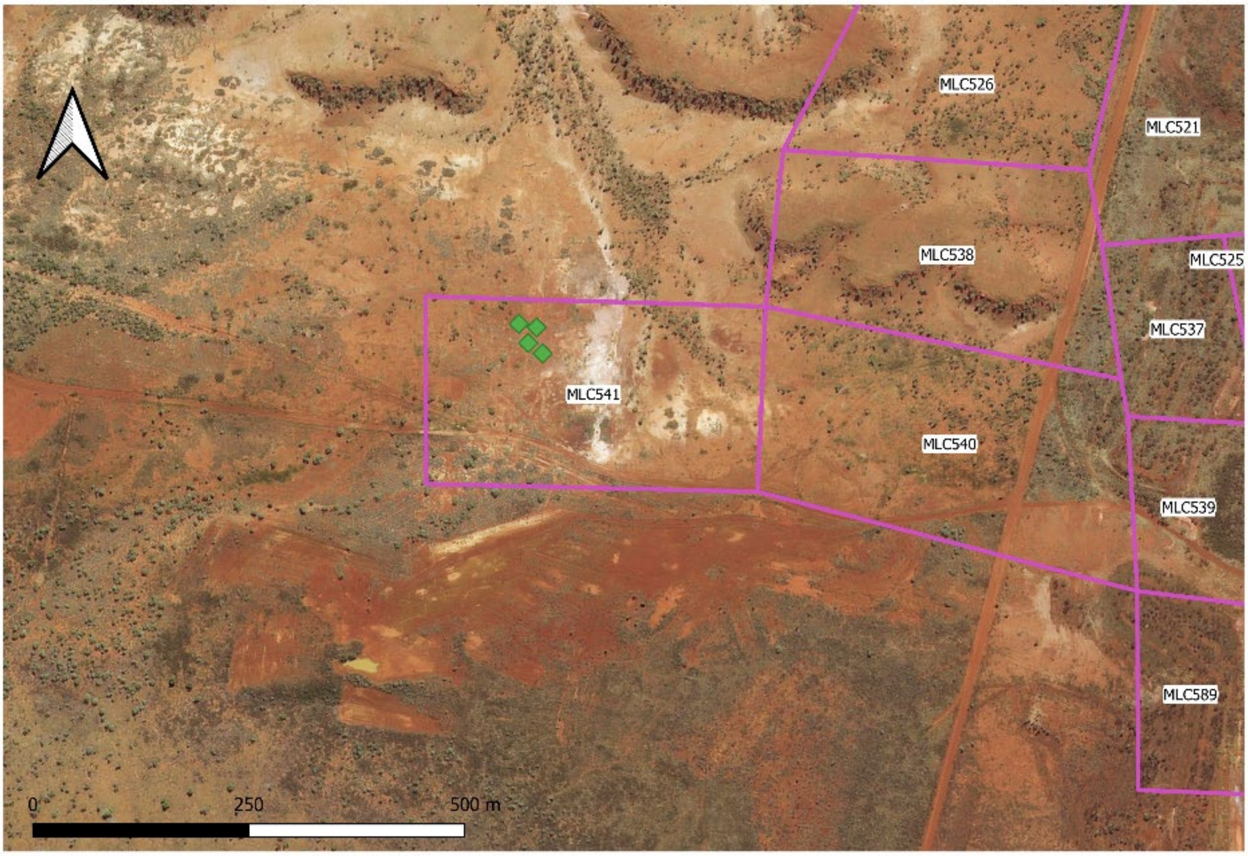

Figure 7-5 Location of approved drill holes at Nobles Nob West in 2022

Figure 7-6 Location of approved drill holes at Nobles Nob pit in 2022

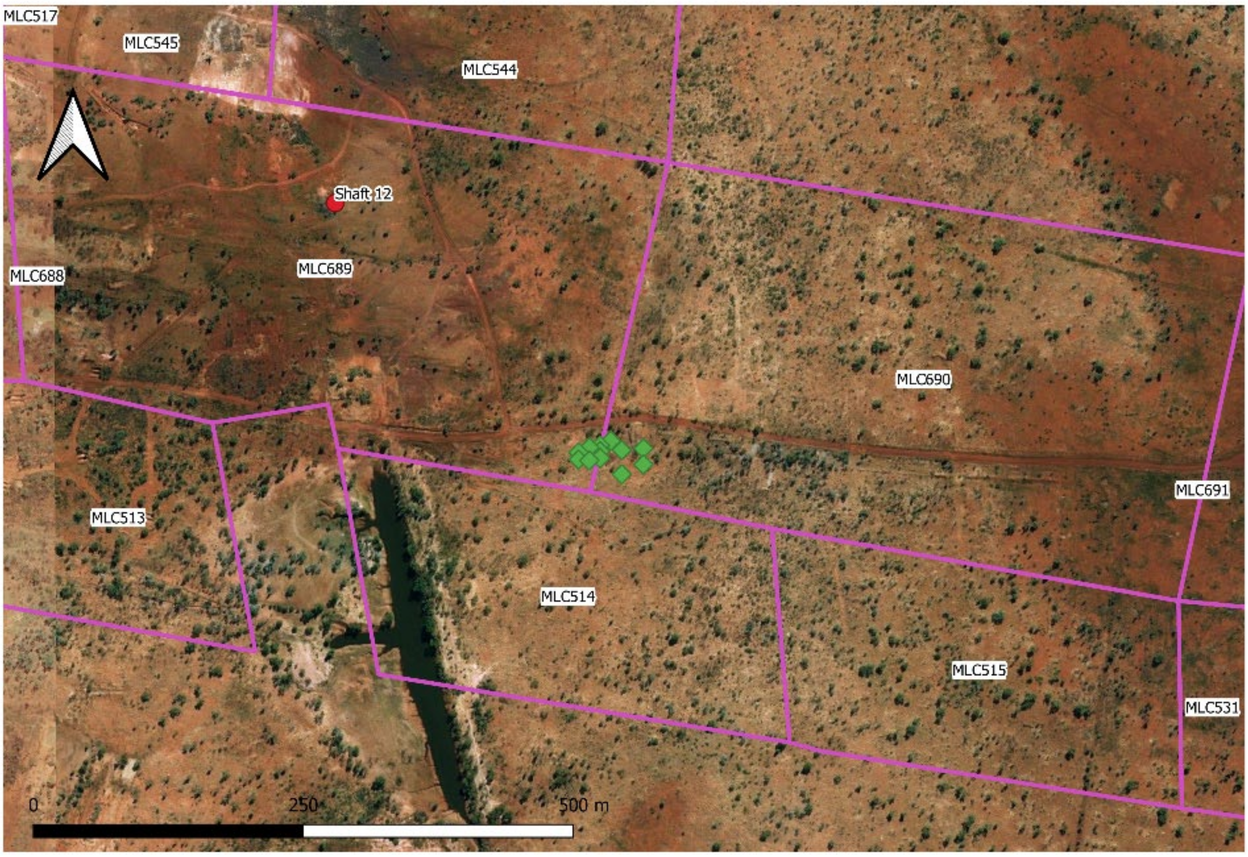

Figure 7-7 Location of approved drill holes at Weabers Find in 2022

7.2 Drilling Undertaken in 2022

Of the 11 approved RC drill holes at the Juno mine site, all 11 drill holes were completed, with a total drill depth of 2,210 m. Survey details of the actual location of these drill collars are included in Table 7-3 below. All drill holes were located on MLC578 and MLC579 targeting the Juno prospect.

Table 7-3 Drilling completed at Juno in 2022

Hole ID	Easting	Northing	RL	Depth	Hole type	Prospect
TJRC001	420473.37	7821347.65	346.84	224	RC	Juno
TJRC002	420465.8	7821310.89	347.52	189	RC	Juno
TJRC003	420434.08	7821312.4	347.88	210	RC	Juno
TJRC004	420424.73	7821289.24	348.98	188	RC	Juno
TJRC005	420425.9	7821261.15	348.87	180	RC	Juno
TJRC006	420415.49	7821264.86	349.17	180	RC	Juno
TJRC007	420374.58	7821300.09	349.43	204	RC	Juno
TJRC008	420363.02	7821308.79	349.54	192	RC	Juno
TJRC009	420343.6	7821281.35	349.45	205	RC	Juno
TJRC010	420333.8	7821274.92	349.41	210	RC	Juno
TJRC011	420321.51	7821288	349.75	228	RC	Juno

Of the 54 approved drill holes at the Nobles Nob mine site, 49 drill holes were completed. This included 8 DDH holes and 41 RC holes, with a total drill depth of 5,364 m. Survey details of the actual location of these drill collars are included in Table 7-4 below. Drill holes were located on the Nobles Nob tenements, targeting Nobles Deeps, Nobles North, Nobles West and Weabers Find prospects.

Table 7-4 Drilling completed at Nobles Nob in 2022

Hole ID	Easting	Northing	RL	Depth	Hole type	Prospect
TNDDH001	425808.99	7819979.34	356.1	315.8	DDH	Nobles Deeps
TNDDH002	425767.44	7820010.06	357.1	372.7	DDH	Nobles Deeps
TNDDH003	425728.6	7820002.68	356.55	378.6	DDH	Nobles Deeps
TNDDH004	425771.6	7819974.89	356.59	309.5	DDH	Nobles Deeps
TNDDH005	426062.06	7819946.38	362.61	258.6	DDH	Nobles Deeps
TNDDH006	426062.15	7819945.92	362.61	246.7	DDH	Nobles Deeps
TNDDH007	426062.09	7819944.05	361.56	270.7	DDH	Nobles Deeps
TNDDH008	425662.76	7820025.14	356.46	258.7	DDH	Nobles Deeps
TNNRC001	426059.31	7820099.81	379.13	186	RC	Nobles North
TNNRC002	425969.83	7820175.65	378.6	133	RC	Nobles North
TNNRC003	425965.51	7820195.8	376.59	121	RC	Nobles North
TNNRC004	425950.02	7820181.27	378.02	133	RC	Nobles North
TNNRC005	425894.71	7820223.91	376.94	73	RC	Nobles North
TNNRC006	425882.79	7820224.58	376.87	78	RC	Nobles North
TNNRC007	425883.22	7820261.99	374.36	79	RC	Nobles North
TNNRC008	425874.37	7820260.64	374.25	73	RC	Nobles North
TNNRC009	425876.76	7820231.52	376.25	85	RC	Nobles North
TNNRC010	425876.73	7820230.79	376.29	79	RC	Nobles North
TNNRC011	425873.06	7820224.58	376.3	79	RC	Nobles North
TNNRC012	425861.55	7820239	374.31	78	RC	Nobles North
TNNRC013	425860.21	7820240.96	374.2	78	RC	Nobles North
TNNRC014	425854.94	7820240.05	374.18	73	RC	Nobles North
TNNRC015	425873.08	7820223.87	376.29	61	RC	Nobles North
TNWDRC01	425513.16	7820350.58	367	15	RC	Northern WRD
TNWDRC02	425473.73	7820387.66	369.83	15	RC	Northern WRD
TNWDRC03	425473.98	7820425	370.79	15	RC	Northern WRD
TNWDRC04	425491.34	7820467.05	370.95	15	RC	Northern WRD
TNWDRC05	425517.65	7820500.23	371.17	15	RC	Northern WRD
TNWDRC06	425552.58	7820521.5	370.43	15	RC	Northern WRD
TNWDRC07	425592.17	7820509.28	368.83	15	RC	Northern WRD
TNWDRC08	425529.4	7820407.95	368.83	15	RC	Northern WRD

Hole ID	Easting	Northing	RL	Depth	Hole type	Prospect
TNWDRC09	425583.87	7820456.63	367.11	15	RC	Northern WRD
TNWDRC10	425590.88	7820550.93	369.47	15	RC	Northern WRD
TNWRC01	424665.78	7820059.73	354.76	168	RC	Nobles Nob West
TNWRC02	424660.38	7820088.44	355.14	169	RC	Nobles Nob West
TNWRC03	424654.2	7820075.4	355.06	145	RC	Nobles Nob West
TNWRC04	424640.4	7820094.36	354.97	169	RC	Nobles Nob West
TWFRC01	426820.09	7819908.32	351.36	55	RC	Weabers Find
TWFRC02	426820.1	7819913.52	351.41	61	RC	Weabers Find
TWFRC03	426820.14	7819902.06	351.5	61	RC	Weabers Find
TWFRC04	426800.14	7819907.49	351.61	61	RC	Weabers Find
TWFRC05	426800.1	7819900.96	351.67	66	RC	Weabers Find
TWFRC06	426840.17	7819909.4	351.36	55	RC	Weabers Find
TWFRC07	426840.26	7819886.56	351.4	79	RC	Weabers Find
TWFRC08	426860.2	7819910.85	351.13	49	RC	Weabers Find
TWFRC09	426860.1	7819895.7	351.2	73	RC	Weabers Find
TWFRC10	426838.29	7819920.08	351.38	49	RC	Weabers Find
TWFRC11	426810.14	7819911.81	351.49	61	RC	Weabers Find
TWFRC12	426810.11	7819900.35	351.65	73	RC	Weabers Find

7.3 Proposed Drilling in 2023 and Ongoing

Exploration activities for the 2023 drill program and all future drill programs will now be covered within a separate exploration only MMP for ease of assessment and disturbance tracking. An MMP for exploration activities at Nobles Nob was approved for the 2023 drilling season, with Mining Authorisation granted on 18 July 2023 (Authorisation 1163-01).

8 ENVIRONMENTAL RISK ASSESSMENT

8.1 Identification of Environmental Aspects and Impacts

Environmental aspects are the elements of TCMG and/or its contractor's activities within the Project area that interact or can interact with the environment (e.g. excavations, processing, hauling, fuel storage, vehicle and machinery movements, etc.).

Environmental impacts are any change to the environment, whether adverse or beneficial, wholly or partially resulting from TCMG and/or its contractor's activities.

TCMG has identified and assessed Project activities which may cause an impact (either positive or negative) to the environment. This includes aspects from mining, operations, processing and tailings storage. When identifying aspects, consideration has been given to potential emergency situations, normal and abnormal operating and environmental conditions.

Based on TCMG's understanding of the physical environmental and socio-economic site conditions informed by scientific and technical studies and assessments undertaken by suitably qualified scientific and technical persons and subject matter experts, and the potential environmental aspects and impacts of the Project, a Conceptual Site Model has been developed, as shown in Section 8.2 below. Building on this, a detailed risk assessment was undertaken, as summarised in Section 8.3 and detailed in Appendix J. Further consideration of some of the key environmental aspects and impacts of interest is provided in Section 8.4.

8.2 Conceptual Site Model

The Nobles Nob Conceptual Site Model has been developed to describe the potential environmental risks from the proposed Project disturbance activities and potential pathways and receptors of impact (Table 8-1). The potentially impacted receptors from the potential contaminants and impacts of concern are surface water, groundwater, vegetation, fauna, soils, air, and sacred sites. The overarching environmental objectives relating to these receptors are listed below.

Terrestrial ecosystems: *Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.*

Terrestrial environmental quality: *Protect the quality and integrity of land and soils so that environmental values are supported and maintained.*

Hydrological processes: *Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.*

Inland water environmental quality: *Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.*

Air Quality: *Protect air quality and minimise emissions and their impact so that environmental values are maintained.*

Culture and heritage: *Protect culture and heritage.*

Environmental management to achieve these objectives are discussed in Sections 10 – 13. These objectives are aligned with the Northern Territory Environment Protection Authority (NT EPA) environmental factors and objectives, which are further discussed in Section 9.

Table 8-1 Nobles Nob Conceptual site model

Disturbance	Potential contaminants and impacts of concern	Source	Pathway	Receptor
Mining of Southern WRD, Northern Tailings, and Nobles Nob Pit	• Turbidity (TSS) • Hydrocarbons (TRH/TPH) • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) • Electrical Conductivity (EC) • Dust produced during operations, haulage and transport • Ground disturbance • Clearing vegetation – reduced vegetation cover and habitat availability	• Excavation of Southern WRD and Northern Tailings material • Mining of Nobles Nob Pit • Mining fleet / pumps – hydrocarbon and dust sources	• Water – seepage and runoff • Pumps • Air emissions	• Surface water • Vegetation • Groundwater (although unlikely to be a receptor due to the depth of the groundwater table) • Air
Dry stack tailings storage facility	• Possible cyanide • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) • Electrical Conductivity (EC) • Impacts to sacred sites	• Runoff from the dry stack tailings	• Water – seepage and runoff	• Surface water • Groundwater (although unlikely to be a receptor due to the depth of the groundwater table) • Sacred sites
Disturbance areas post mining at Southern WRD, Northern Tailings, Nobles Nob Pit.	• Turbidity (TSS) • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu), zinc (Zn) and selenium (Se) • Electrical Conductivity (EC) • Dust	• Southern WRD and Northern Tailings areas • Nobles Nob pit	• Water – seepage and runoff	• Surface water • Groundwater (although unlikely to be a receptor due to the depth of the groundwater table) • Air
Run-of-mine (ROM) and Ore storage	• Turbidity (TSS) • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg),	• ROM and Ore stockpiles	• Water – seepage and runoff	• Surface water • Groundwater (although unlikely to be a receptor due to the depth of

Disturbance	Potential contaminants and impacts of concern	Source	Pathway	Receptor
	aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) • Electrical Conductivity (EC)			the groundwater table)
Process water pond	• Possible cyanide • Electrical Conductivity (EC) • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) • Hydrocarbons (TRH/TPH) • Turbidity (TSS).	• Process water • Dewatering of the Pit • Runoff from the TSF • Mining fleet / pumps – hydrocarbon sources	• Water – failure of equipment, seepage and runoff	• Surface water • Soils • Vegetation • Groundwater (although unlikely to be a receptor due to the depth of the groundwater table)
Solar field	• Ground disturbance • Clearing vegetation – reduced vegetation cover and habitat availability	• Construction and operation of solar field	• Water – seepage and runoff	• Vegetation • Soils • Fauna
Waste rock	• Turbidity (TSS) • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu), zinc (Zn) and selenium (Se) • Electrical Conductivity (EC)	• Waste rock material from Nobles Nob pit	• Water – seepage and runoff	• Surface water • Groundwater (although unlikely to be a receptor due to the depth of the groundwater table)
Processing ore from satellite sites	• Turbidity (TSS) • Hydrocarbons (TRH/TPH) • Elevated metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) • Electrical Conductivity (EC) • Dust produced during transport	• External ores • Haulage trucks – hydrocarbon and dust sources • Inputs to TSF	• Water – seepage and runoff • Transport	• Surface water • Vegetation • Groundwater (although unlikely to be a receptor due to the depth of the groundwater table) • Air

Disturbance	Potential contaminants and impacts of concern	Source	Pathway	Receptor
Upgrade and use of access tracks on site	• Turbidity (TSS) • Hydrocarbons (TRH/TPH) • Erosion • Dust • Impacts to sacred sites	• Ground disturbance • Vehicle travel	• Water – seepage and runoff • Transport	• Surface water • Vegetation • Groundwater (although unlikely to be a receptor due to the depth of the groundwater table) • Air • Sacred sites

8.3 Risk Assessment

A risk assessment of the potential and actual impacts for each of the identified environmental aspects is presented in Appendix J using the risk matrix and key presented in Table 8-2, and the likelihood and consequence categories in Table 8-3 and Table 8-4. The risk assessment has been informed by environment and technical studies and assessments undertaken by suitably qualified scientific, technical, and subject matter experts. The risk assessment aligns with the NT EPA factors and objectives, which form the environmental objectives of the Project. Comparison of the initial risk rating against the residual risk rating gives an indication of the expected effectiveness of the proposed mitigation measures.

As outlined in Appendix J, in all cases the residual risk following implementation of mitigation measures is categorised as Low risk – with the exception of five potential impacts, which were categorised as Moderate risk, as listed below:

- Soil erosion due to increased runoff from cleared areas
- Reduction of vegetation type and habitat availability for fauna due to clearing for the solar field
- Spread of contaminated soil during disturbance activities
- Reduced habitat quality due to introduction and spread of weeds
- Changes of vegetation community due to changes in fire frequency

According to the risk matrix key, these risks are all categorised as tolerable or acceptable. None of the residual risks represent high or significant risk.

Table 8-2 Risk matrix and key

		Consequence				
		1	2	3	4	5
Likelihood	A	1	3	6	10	15
	B	2	5	9	14	19
	C	4	8	13	18	22
	D	7	12	17	21	24
	E	11	16	20	23	25

Red	Extreme risk	Intolerable
Orange	High risk	Intolerable or tolerable
Yellow	Moderate risk	Tolerable or acceptable
Green	Low risk	Acceptable

Table 8-3 Likelihood categories

Qualitative measures of likelihood categories		
A	Rare	Highly unlikely, will only occur in exceptional circumstances. Has never occurred in association with a development in the region.
B	Unlikely	Could occur at some time but unlikely. Has only occasionally occurred in association with a development in the region.
C	Moderate	Might occur at some time. Has previously occurred in similar developments.
D	Likely	Known to occur or will probably occur. Has occurred several times in association with recent developments.
E	Almost certain	Common or repeating occurrence. Is expected to occur several times over the duration of a development in the region.

Table 8-4 Consequence categories

Consequence categories		
1	Insignificant	No measurable impact on the environment or social values
2	Minor	Some, minor, temporary environmental and/or social impact
3	Moderate	Contained temporary, or permanent minor, localised environmental damage or social impact
4	Major	Severe environmental and/or social impacts
5	Catastrophic	Environmental disaster

8.4 Assessment of Key Environmental Aspects and Impacts

TCMG has developed a thorough understanding of the environmental and socio-economic conditions of the Project site (as outlined in Section 3 of this MMP) from the range of environmental, scientific and technical studies and assessments undertaken by suitably qualified persons. Based on the Conceptual Site Model and environmental risk assessment undertaken as outlined in Sections 8.1 – 8.3 above, and the aspects and potential impacts of stakeholder interest, key environmental aspects and impacts of the Project have been identified.

The Project risk assessment indicates that the residual environmental risks are all categorised as acceptable or tolerable. More detailed communication of key environmental aspects of the Project have however been outlined below (Sections 8.4.1 – 8.4.4), given that these are aspects and impacts of import to key Project stakeholders.

These key environmental aspects and impacts include:

- Waste rock and ore storage – potential for acid metalliferous drainage
- Tailings storage – potential for contaminated drainage
- Clearance of vegetation – potential impact to biodiversity
- Interaction with Lake Alice – [redacted]

8.4.1 Waste Rock and Ore Storage

The potential for acid metalliferous drainage (AMD) was one of the key environmental risks considered and assessed by TCMG. Potential pathways of AMD from Project activities include from storage of ore (from the ROM pad), storage of waste rock, and storage of tailings. Of the proposed mining activities, processing of the

Southern WRD and Northern Tailings will not produce any additional waste rock. Expansion of the Nobles Nob pit will produce waste rock, which will be stored on the existing Northern WRD located northwest of the pit. A ROM storage pad will be located adjacent to the processing plant. Tailings storage is further considered in Section 8.4.2 below.

A waste rock characterisation study was undertaken by Umwelt in 2021 (Umwelt 2021a), as shown in Appendix K. With the potential impacts resulting from ROM storage and tailings considered in a parallel Groundwater Impact Assessment by Umwelt (Umwelt 2021b), as shown in Appendix B (based on Project planning at the time, which included Geotubes tailings storage method); and the potential impacts resulting from expansion of the Nobles Nob pit, waste rock dumps, dry stack tailings, and processing of ore from the Northern Tailings and other satellite sites considered in a subsequent Groundwater Impact Assessment conducted by TCMG in 2023 (TCMG 2023b), as shown in Appendix L (based on current Project planning).

Umwelt was engaged by TCMG to characterise waste rock samples from the historical Southern WRD of the Nobles Nob Project in the Northern Territory, Australia (Umwelt 2021a). TCMG collected a total of 25 composite samples from drill holes drilled on the Southern WRD and one within the historical ROM pad. Composite samples were collected by combining drill chips from various depth intervals. These samples were sent to a NATA accredited laboratory for analysis.

Given that the Southern WRD and historical ROM pad are composed of waste rock from historical mining of the Nobles Nob pit, the samples included in the analyses are considered indicative of the likely characteristics of the ore that will be stored on the ROM pad during mining of the Southern WRD. As well as indicative of the likely characteristics of the ore that will be stored on the ROM pad during mining of the Nobles Nob pit expansion, and the waste rock that will be excavated and stored in the Northern WRD from the Nobles Nob pit. Material from the historical collapse of the crown pillar was stored in the Southern WRD, containing material from a wide cross-section of the Nobles Nob pit. The Southern WRD therefore contains material representative of the wider Nobles Nob pit. While some natural weathering would have occurred to rock stored at the surface of the Southern WRD in the time since excavation, the samples used for analysis by Umwelt were composite samples from different depth intervals – and therefore likely to represent the geochemical characteristics of waste rock from the Nobles Nob pit.

The sample results assessed by Umwelt (2021a) were assessed for the potential of acidic, metalliferous, or saline drainage from these samples. A summary of the findings is presented below:

- ***Potential for Acidic Drainage***

  The results suggest that the aged pH of the samples ranged from a 5.9 to 8.6 pH unit, with the mean aged pH being 7, whereas the median aged pH being 6.9. Only one sample out of the total 26 samples recorded aged pH <6 pH units. The classification of the samples suggests that all 25 samples from the Southern WRD and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely.

- ***Potential for Metalliferous Drainage***

  The geochemical abundance index (GAI) assessment of the 25 samples collected from the Southern WRD and one sample from the ROM pad at Nobles Nob suggest that the samples are significantly enriched (GAI $\geq$ 3) with the following metals:

  - Molybdenum (Mo) – 5 out of 26 samples recorded GAI value equal to or greater than 3.
  - Mercury (Hg) – only the sample from the ROM pad recorded GAI value equal to 3.

  The Australian Standard Leachate Procedure (ASLP) tests for all 26 samples from the Southern WRD at Nobles Nob were assessed and the 80th percentile value was compared with the Australia and New Zealand Guidelines (ANZG) (2018) DGV for 90% species protection. The results indicate that leachate from the samples recorded 80th percentile concentration of aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) higher than the ANZG (2018) DGVs for 90% species protection. Out of these elements, none were found to be in significant abundance (i.e., GAI >=3) in the samples in GAI assessment.

The combined assessment of GAI and ASLP results suggests a potential of metalliferous drainage from a few samples enriched in aluminium, zinc, and mercury (the possibility of mercury enriched drainage was only seen from one sample). It is recommended that drainage from these samples be restrained, and the receiving environment should be monitored for these analytes.

- ***Potential for Saline Drainage***

  Electrical conductivity (EC) has been used as a proxy for salinity in this assessment. All 26 samples underwent aged EC (1:2) and ASLP EC measurement. The average aged EC recorded by the samples is 313.8 µS/cm, whereas the average ASLP EC is 55.1 µS/cm. Most samples (~73%) recorded aged EC between 150 and 450 µS/cm, whereas 100% samples recorded ASLP EC below 150 µS/cm. None of the samples recorded aged EC or ASLP EC higher than 900 µS/cm, indicating that the potential of saline drainage from these samples is less likely.

As outlined above, the potential for acidic or saline drainage was assessed to be unlikely. There was some metal enrichment seen in the waste rock samples, and some metals were recorded in the ASLP tests. Given the potential of acidic drainage is low from the waste rock sampled, it is therefore considered unlikely that drainage from waste rock or ore during rainfall events would mobilise these metals contained in the rock. Further, infiltration of any runoff from waste rock or ROM pad storage into groundwater is unlikely, given the low rainfall and low permeability of soils at the Project site.

Taking a precautionary approach, TCMG will implement Umwelt's recommendations and mitigate any risk of AMD occurring, although considered unlikely. Controls will be used to capture any surface water runoff around any potential contaminant sources, including around the waste rock deposition, tailings storage, and ROM pad areas. An Erosion and Sediment Control Plan (ESCP) has been prepared for the Nobles Nob site, which has been certified by a Certified Professional in ESCP from EcOz (the current version is included in Appendix M). This plan will be updated and recertified with the updates in Project planning contained in this MMP amendment, prior to works being undertaken. Progressive ESCP plans for construction and operation will be developed with contractors specific to the site works and environmental conditions at the time.

TCMG will also continue to monitor water quality across the Project site to ensure that the measures are working effectively, and water quality is not impacted by Project activities. Monitoring will be done in accordance with the Nobles Nob Water Quality Management Plan (WQMP), the current version is included in Appendix N. This WQMP will be updated to reflect changes in Project planning consistent with this MMP amendment and remain current prior to any works being undertaken.

Given the low risk of metalliferous drainage, and site controls that will be used to mitigate this risk, TCMG considers that the residual risk resulting from AMD at Nobles Nob is low and will be adequately monitored and managed on an ongoing basis.

Ore storage and tailings from external ore sources

Another potential source of AMD that has been assessed is the storage of ore on the ROM pad from satellite ore deposits. As well as storage of these tailings within the dry stack tailings areas. Assessments of the potential for AMD from these sources have been undertaken by TCMG for Black Snake, Rising Sun and Weabers Find, as outlined below. For any other additional satellite sites proposed to be mined in future, TCMG will undertake additional AMD studies and assessments of ore for those sites prior to submitting MMPs.

Black Snake

The Black Snake deposit is similar in ore type and geological characteristics to the Nobles Nob Project area. Both the Nobles Nob and Black Snake Project areas are within the Warramunga Geological Province, which indicates there is a high likelihood of similarity in mineralisation characteristics and ore quality.

TCMG undertook a waste rock and ore characterisation study for Black Snake, which is included in Appendix G (TCMG 2023c). The study found that the potential for any acidic or metalliferous drainage from Black Snake waste rock and ore is unlikely. TCMG undertook a review of the laboratory results of the previous waste rock and ore samples which were collected and analysed in 2017 by Emmerson as part of a previous MMP application. The laboratory results were assessed for the potential of acidic and/or metalliferous drainage from those samples.

The results state that the water extracted using a sample:water ratio of 1:5 recorded a pH ranging from 6.3 to 7.3, with the mean pH being 6.75. None of the samples recorded pH (1:5) <6 pH units or positive Net Acid Production Potential (NAPP), and the classification of the samples using the Net Acid Generation (NAG) pH and NAPP indicates that all samples are Non-Acid Forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is unlikely.

The metal concentrations of samples were assessed, with Geochemical Abundance Index (GAI) used to estimate the enrichment of metals in the samples relative to average crustal concentrations. As a general guide, a GAI value of 3 or above is considered a significant concentration and might indicate the potential of metalliferous drainage from that sample. Of the samples, one recorded a GAI of 4 for one of the metals tested, Molybdenum. The GAI was below 3 for all other samples and for all other metals tested. Molybdenum enriched drainage occurs in extremely acidic or alkaline drainage. As suggested by the pH (1:5) and NAG test, the drainage from these samples is likely to be near neutral and not highly acidic or alkaline. As such, chances of Molybdenum enriched drainage from these samples is considered unlikely.

Given that the potential for any acidic or metalliferous drainage from Black Snake samples is unlikely, and the ore characteristics are likely to be similar to those of the Nobles Nob Project area – processing of this ore and deposition of tailings within the Nobles Nob TSF is not expected to pose an increased environmental risk at the Project site.

Weabers Find and Rising Sun

The Rising Sun and Weabers Find deposits are located within the Nobles Nob mining tenements, both within 1.5 km of the Nobles Nob pit. All within the Warramunga Geological Province, which indicates there is a high likelihood of similarity in mineralisation characteristics and ore quality. TCMG undertook a waste rock characterisation study for Rising Sun, which is included in Appendix H. Given the close proximity of Rising Sun to Weabers Find (approximately 530 m apart) the findings of this study are taken to be representative of the material that is likely to be extracted from both deposits.

The study found that the potential for acidic or metalliferous drainage is unlikely, however saline drainage is likely. TCMG sampled pulps from the exploration drill holes around the proposed Rising Sun pit to characterise the waste rocks, and assess the potential of acidic, metalliferous, and/or saline drainage from these samples. The samples were sent to the National Association of Testing Authorities (NATA) accredited laboratory SGS (Perth) for analysis.

The results state that a sample:water ratio of 1:2 recorded a pH ranging from 6.5 to 8.5, with a median pH of 6.7. The samples recorded NAPP ranging from -5.727 kg H2SO4/t to 0.234 kg H2SO4/t. None of the samples recorded pH (1:2) <6.5 pH units. Furthermore, all samples recorded negative or low NAPP values (i.e., <1 kg H2SO4/t), and the classification of the samples using the NAG pH and NAPP indicates that most samples are NAF, thereby suggesting that the potential for any acidic drainage from these samples is highly unlikely.

The GAI assessment of the samples suggests that all samples recorded GAI value of greater than 3 for selenium. However, most samples also recorded selenium concentrations below the limit of reporting, indicating a low risk of selenium-enriched drainage. Furthermore, selenium-enriched drainage occurs in acidic conditions, which is not the case for these samples, as suggested by the pH (1:2) and NAG test. As such, chances of selenium-enriched drainage from these samples are unlikely. The ASLP test results of the Rising Sun samples indicated concentration of selenium in all ASLP leachate samples was below the detection limit, further confirming that selenium-enriched drainage is not likely. The ASLP test results also stated that leachate from the samples recorded a concentration of barium, manganese, and molybdenum above the detection limit. Drainage enriched with these elements only occurs in acidic conditions. As acidic drainage is not likely to occur from these samples, metalliferous drainage enriched in barium, manganese or molybdenum from these samples is also unlikely.

The aged EC (1:2) recorded by the samples ranged from 460 µS/cm to 1900 µS/cm, with more than half of the samples (~60%) recording EC greater than 900 µS/cm. This indicates that the potential of saline drainage from these samples is likely. Given the natural salinity of the groundwater within the Project area, with a range of

4,537 µS/cm - 14,980 µS/cm recorded within groundwater samples from October 2021, and an average of 10,455 µS/cm across the site (see Appendix B), the potential for saline drainage is not considered to pose a high environmental risk.

Given that the potential for any acidic or metalliferous drainage is unlikely, the natural salinity of groundwater, and that the ore characteristics are likely to be similar to those of the Nobles Nob Project area – the processing of ore from Rising Sun and Weabers Find and deposition of tailings within the Nobles Nob TSF is not expected to pose an increased environmental risk at the Project site. Any residual risk of saline drainage to surface water resources from surface water runoff during rainfall events will be mitigated using surface water drainage controls to capture any runoff.

8.4.2 Dry Stack Tailings Storage

TCMG considered various tailings treatment and storage options for the Project, including traditional tailings dams, Geotubes, and dry stack tailings. TCMG has preferenced dewatered tailings options such as Geotubes and dry stack tailings methods over traditional tailings dams, in order to avoid the potential environmental impacts related to tailings dams such as dam failure and seepage related issues. Geotubes had been planned for use within initial Project planning, however subsequent research into the dry stack tailings management technique has identified this as the preferred option to reduce environmental risk and optimise tailings storage space. It is also operationally more efficient, and the technology has been tried and tested in other projects and demonstrated to be effective, stable, and safe.

The advantages of dry stack tailings over tailings dams and Geotubes include:

- **Reduced Environmental Impact** – Dry stacking of tailings can significantly reduce the environmental impact of mining operations. Since the tailings are stacked in a dry and stable form, the potential for water contamination or leaching of contaminants is negligible.
- **Reduced Footprint** – Dry stacking of tailings can also significantly reduce the land footprint required for tailings storage. The stacking process creates a compact and stable tailings stack that requires less land area compared to traditional impoundments or Geotubes.
- **Improved Stability and Safety** – Dry stacking of tailings results in a stable and non-porous stack of tailings that eliminates the risk of dam failures and associated environmental disasters. Unlike impoundments, dry stacked tailings do not rely on water retention to maintain structural stability. This feature reduces the risk of liquefaction, a common issue with saturated tailings. Additionally, dry stacking eliminates the need for tailings dams, which can be potential sources of instability and safety hazards.
- **Reduced Water Consumption** – Dry stacking of tailings involves dewatering the tailings slurry to a moisture content that enables stacking into a dry and stable state. This water can then be reused for processing. This method significantly reduces water consumption for processing, compared to traditional storage methods that rely on the retention of large volumes of water. It is estimated that 88% of process water can be reclaimed for use.
- **Reduced Cyanide Consumption** – Reuse of process water containing cyanide lowers the overall cyanide consumption, as less will need to be added to recirculated water. Similarly, the low water content of tailings means that the cyanide levels within tailings are expected to be low.
- **Rapid Rehabilitation** – Due to layering and compaction of dry stack tailings which rapidly forms stable non-porous landforms, this allows for more rapid and progressive rehabilitation of dry stack tailings landforms. Once a stacking area is filled, capping and rehabilitation can be undertaken without the need to wait for extended periods to achieve stabilisation as is often the case with tailings dams.

Given the environmental benefits of the proposed use of the dry stack tailings management technique, this effectively avoids a large amount of the potential Project environmental risk associated with tailings storage. Given the rapid formation of a compacted non-porous landform, infiltration and contaminated drainage from the dry stack areas is unlikely to occur during rainfall events. Further, the assessment undertaken indicates that AMD or related seepage issues from dry stack tailings is unlikely to occur. As outlined for the management of AMD above, TCMG will take a precautionary approach and mitigate any risk of contaminated drainage occurring from tailings storage, although considered unlikely. Controls will be used to capture any surface water runoff around each tailings storage area. An Erosion and Sediment Control Plan (ESCP) has been prepared for the Nobles Nob site, which has been certified by a Certified Professional in ESCP from EcOz (the current version is included in Appendix M). This plan will be updated and recertified with updates in Project planning including the dry stack tailings areas and updated water management infrastructure now proposed, prior to works being undertaken. Progressive ESCP plans for construction and operation will be developed with contractors specific to the site works and environmental conditions at the time.

TCMG will also continue to monitor water quality across the Project site to ensure that the measures are working effectively, and water quality is not impacted by Project activities. Monitoring will be done in accordance with the Nobles Nob Water Quality Management Plan (WQMP), the current version is included in Appendix N. This WQMP will be updated to reflect changes in Project planning and remain current prior to any works being undertaken.

Given the low risk of contaminated drainage from dry stack tailings, and site controls that will be used to mitigate this risk, TCMG considers that the residual risk resulting from tailings storage at Nobles Nob is low and will be adequately monitored and managed on an ongoing basis.

8.4.3 Clearance of Vegetation for Solar Field

The vegetation within the 4 ha area proposed to be cleared for the solar field is the only area of new disturbance on site, and therefore the only area of new vegetation clearance. This area was inspected by TCMG in 2022 and was found to be an alluvial plain consisting of low open eucalypt woodland dominated by snappy gum (*Eucalyptus leucophloia* subsp. *euroa*) and ghost gum (*Corymbia aparrerinja*), which is representative of the surrounding vegetation type. EcOz Environmental undertook a desktop flora and fauna study and review of previous environmental studies for the Project area in their preparation of this MMP in 2022.

EcOz Environmental conducted a search of the NT Flora Atlas in 2022 which identified 22 records of 13 species of listed conservation significance within a 50 km radius of the project area. According to EcOz Environmental, these species are all considered unlikely to occur within the Project area due to the disturbed and unsuitable habitat. No vegetation communities or ecological communities of listed conservation significance were recorded within a 50 km radius of the Project area. Three Sites of Botanical Significance were recorded within a 50 km radius of the Project area, the closest being 35 km to the east-southeast. According to EcOz Environmental, given their distance from the Project area it is unlikely that they will be affected by the proposed development (EcOz 2022).

EcOz Environmental conducted a search of the NT Fauna Atlas in February 2022 which identified 1,070 records of 59 species of conservation significance within a 50 km radius of the Project area. Of these, 93 records corresponded to 15 threatened species under the TPWC Act. The EPBC Protected Matters Search added four threatened bird species to the list of species with the potential to occur within the Project area. Of these 19 species, five have a medium likelihood of occurrence and one a high likelihood of occurrence within the Project area. The one species with a high likelihood of occurrence is the Central Australian Rock-wallaby (*Petrogale lateralis centralis*). According to EcOZ Environmental, the Central Australian Rock-wallaby habitat extends as far north as the Davenport and Murchison Ranges. Some suitable rock shelters within 50 km of the Project area contain recent signs (scats) attributable to this species. Therefore it is likely that this species occurs through the Project area (EcOz 2022). Areas of suitable rock shelter habitat are not, however, found within the 4 ha solar field area, which is a low open flat alluvial plain, and does not contain any rock shelters. The Central Australian Rock-wallaby is therefore not likely to occur within the area of vegetation clearance.

Given that the 4 ha area proposed to be cleared is representative of the widespread surrounding vegetation community, and unlikely to contain flora or fauna of conservation significance, clearance of this area does not pose a risk to unique environmental values. This area will be rehabilitated at such time that the solar field is decommissioned and removed, and it is expected that it can be rehabilitated to a similar environmental condition with similar habitat values, vegetation cover, and biodiversity compared to that prior to clearing, and compared to surrounding vegetation.

8.4.4 Interaction with Lake Alice

TCMG is committed to protecting the cultural heritage and sacred sites of Traditional Owners across the Project site. As outlined within Section 3.2.4 and Appendix C, TCMG has received a CLC Sacred Sites Clearance Certificate and an AAPA Authority Certificate for the Project site. The CLC and AAPA each separately consulted with and took instructions from Traditional Owners in relation to these sacred site clearance processes. These certificates evidence the consent and support of Traditional Owners for TCMG's Project and proposed activities at its Nobles and Juno Project sites.

Each certificate includes identification of sacred sites with exclusion zones, restricted works areas and conditions which TCMG has used to inform its Project planning, placing of site infrastructure, and TCMG's cultural heritage protection and management planning, protocols, and processes. TCMG has consulted with Traditional Owners and received Traditional Owners instructions during liaison committee meetings on their preferred access routes to allow Traditional Owners free unrestricted access to their sacred sites – as well as their preferred signage and marking to restrict access of TCMG Project personnel from sacred sites restricted work areas and exclusion zones.

Lake Alice is [redacted] located approximately 500 m southwest of the Nobles Nob pit. Lake Alice is a shallow perched lake, which was historically dug out and used by the Nobles Nob townsite for recreation and as a water source. [redacted]

TCMG has assessed the potential impacts to Lake Alice resulting from Project activities including impact pathways of groundwater drawdown from dewatering; groundwater contamination; contaminated surface water runoff; and dust emissions. Studies were undertaken by a qualified technical expert within TCMG to assess the potential impacts of the Nobles Nob Project on groundwater, including any potential impacts to Lake Alice (TCMG 2023b). Findings of these studies indicate that Lake Alice is a perched lake with no interaction with groundwater. The proposed pit dewatering is therefore not expected to impact the lake, as further outlined below.

Water within Lake Alice is separated from the main groundwater source by an impermeable clay layer. Perched lakes often, despite being perennial, have a water surface level at a considerably higher elevation than those of other bodies of water, including aquifers, in the immediate vicinity. This is the case with Lake Alice, where the Lake Alice water level is considerably higher than surrounding groundwater levels, indicating the perched nature of the lake.

Water quality results from samples taken from Lake Alice also indicate the lake is fed by rainwater and is not hydraulically connected to groundwater at Nobles Nob. The electrical conductivity (EC), often used as a proxy measure of salinity, recorded in groundwater at Nobles Nob ranges from 4,400 μS/cm to 15,000 μS/cm, whereas it was recorded to be only 42 to 99 μS/cm at Lake Alice. Similarly, total dissolved solids (TDS) in groundwater at Nobles Nob ranged from 2,700 to 11,000 mg/L, whereas it ranged from 30 to 120 mg/L at Lake Alice. Compared to the groundwater bores, the water in Lake Alice also records a different composition of major ions. The water type of all groundwater bores is sodium chloride (Na-Cl) type, which reflects low recharge and the influence of evaporative processes. In contrast, the water type in Lake Alice is (Na-Ca-HCO3) type. The dominant cation in Lake Alice is sodium, followed by calcium, and the dominant anion is bicarbonate (HCO3).

The overall water type and ionic composition of water from Lake Alice, plotted in the Piper diagram in Figure 8-1, is very different from the composition of groundwater at Nobles Nob. This suggests that there is no connection or interaction between Lake Alice and the groundwater table.

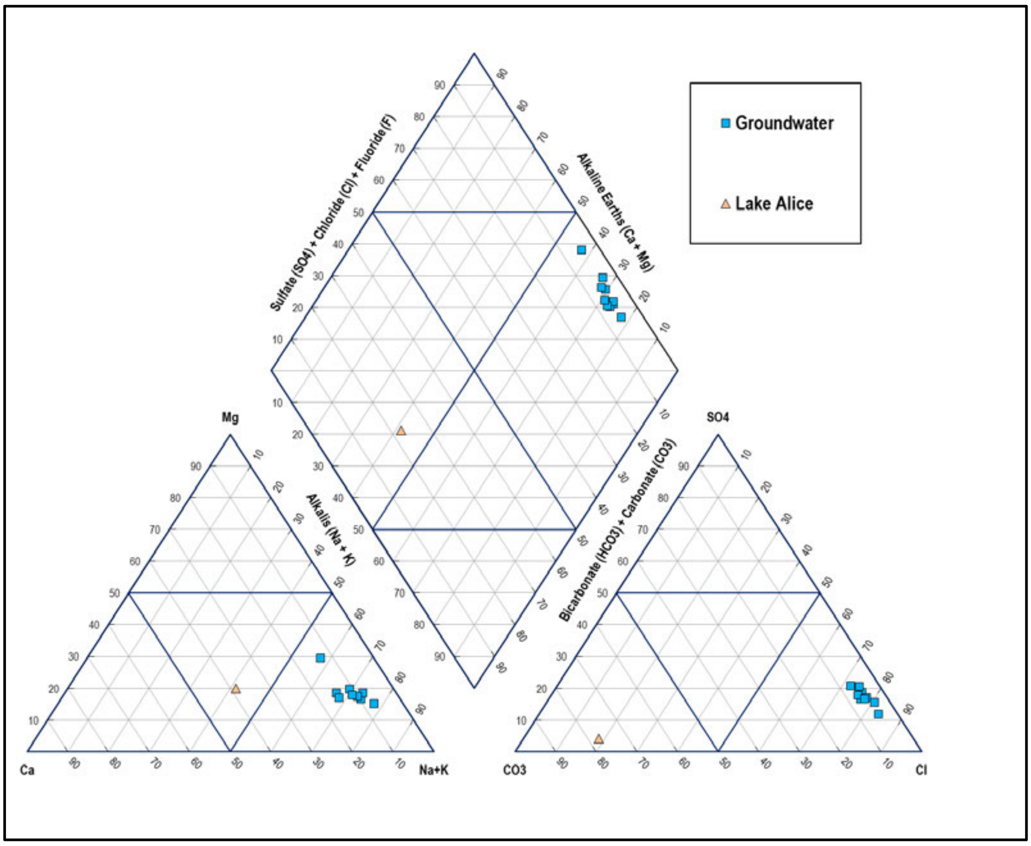

Figure 8-1 Piper Diagram of Lake Alice and Groundwater Bores at Nobles Nob

Groundwater levels and water quality at Nobles Nob have been monitored monthly since October 2021. The results suggest that groundwater levels are approximately 59-60 m below ground, indicating no possibility of a connection between groundwater and the shallow Lake Alice. The lithological records from bore NNMW011, located 20 m north of Lake Alice, suggest approximately 15 m of clay between the surface and groundwater (see Figure 8-2). This layer of clay acts as an impermeable layer, thereby restricting the chances of surface water ingressing down. This together with the depth of groundwater further indicates there is no potential for any interaction between Lake Alice and groundwater.

The water quality results suggest that the water type and ionic composition of water in Lake Alice are very different from the groundwater at Nobles Nob. This, coupled with the depth to groundwater and the impermeable clay layer below the lake, confirm that there are no connections, interactions, or contributions of groundwater with Lake Alice. Any changes in the groundwater level due to Noble Nob Pit dewatering is therefore highly unlikely to impact Lake Alice.

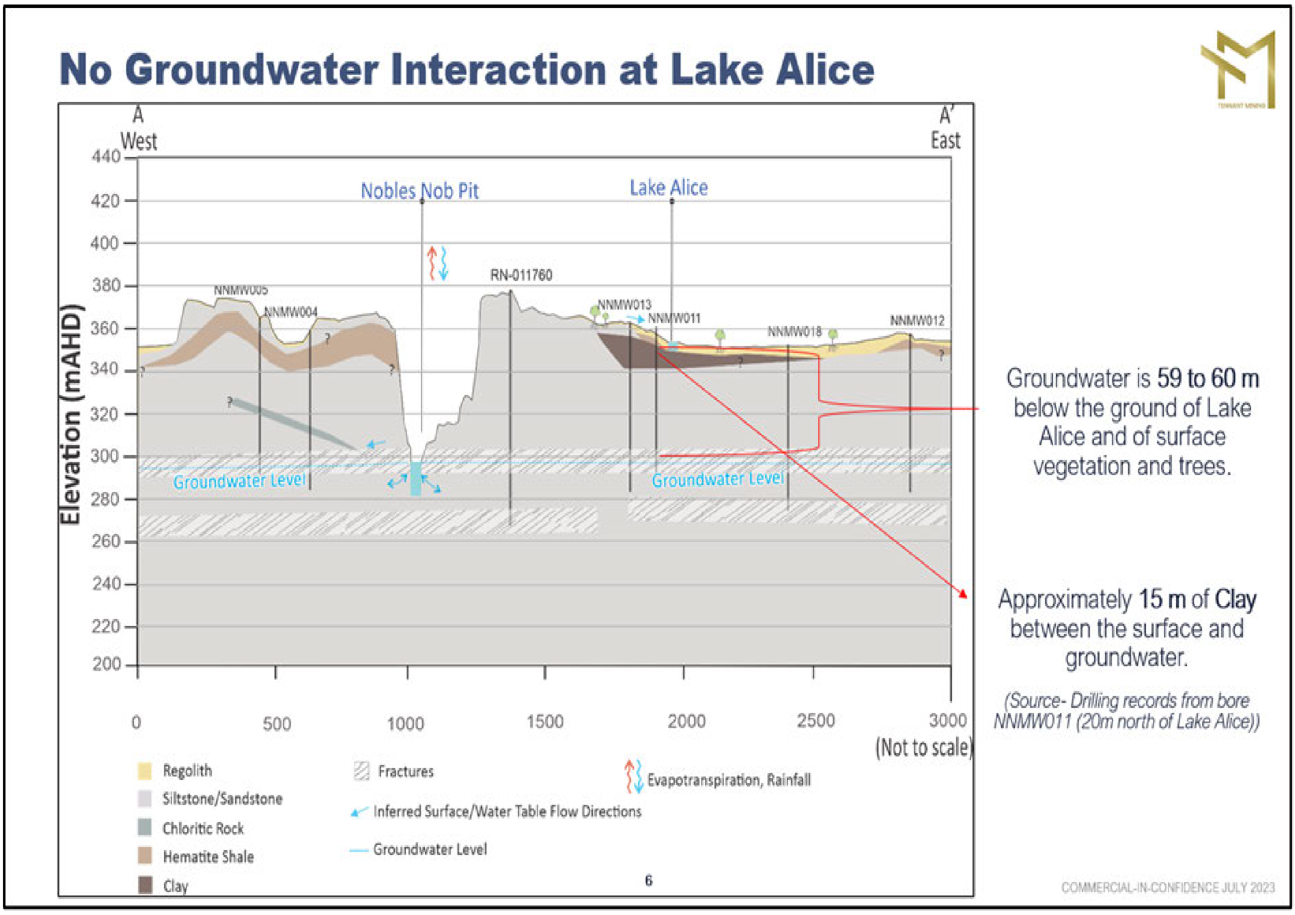

Figure 8-2 Conceptual Cross-Section showing Groundwater Level and Lake Alice at Nobles Nob

Surface flows of contaminated water to Lake Alice was the other main potential source of impact that was considered in the environmental risk assessment of the lake. This has been avoided by placing infrastructure away from the lake. Any remaining risk will be mitigated by managing any potential contaminated surface flows to the lake through site surface water diversion, erosion and sediment controls. As stated above, an Erosion and Sediment Control Plan has been prepared for the Nobles Nob site, which has been certified by a Certified Professional in Erosion Sediment Control (CPESC) from EcOz. Controls will be closely monitored, particularly during significant rainfall events. To ensure that these control measures are effective, TCMG has implemented a water quality monitoring program across the Project site (see Appendix N), which includes water quality monitoring at Lake Alice and surrounding groundwater bores, [redacted]

The majority of site works will occur away from Lake Alice. Dust emissions are therefore considered to be of low concern to the lake. TCMG has, however, developed a Dust Management Plan (see Appendix O). Dust control measures using water carts will be implemented during all ground disturbing works to prevent contamination of the site including Lake Alice, from dust emissions. A dust depositional monitoring network has also been set up across the Project site, including a station adjacent to the lake to ensure that the dust control measures are working effectively. The dust monitoring and water quality monitoring programs will be continued throughout the life of the Project to ensure that no adverse impacts to Lake Alice occur as a result of Project activities.

In summary, given that Lake Alice is a perched lake, it is unlikely to be impacted by pit dewatering or groundwater contamination resulting from site activities. Any potential for contamination from surface water runoff or dust emissions are unlikely due to the placement of site works away from Lake Alice, and will be further managed through site controls. Given the low likelihood of impacts, and implementation of site controls and monitoring programs, the residual risk to Lake Alice from proposed site activities is considered to be low.

9 REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENT

The proposed Project has been assessed against the requirements for formal environmental assessment under the NT *Environment Protection Act 2019* (EP Act) and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Based on the findings of environmental and technical studies undertaken by suitably qualified persons and the advice of environmental, technical and subject matter experts, it has been determined that no formal environmental assessment of the Project is required.

As outlined within Section 3 and throughout this MMP, TCMG has undertaken numerous studies and assessments to understand the physical, environmental and socio-economic environment of the Project area, including the significant history of disturbance of the site due to historical mining activities, as outlined within Sections 3.2.1 and 3.2.2 of this MMP. Based on this, and the proposed Project activities as outlined in Sections 4-7 of this MMP, a Conceptual Site Model of the Project was developed (see section 8.2) which highlights the potential contaminants and impacts of concern, potential sources, pathways, and environmental receptors.

To understand the potential for the identified Project aspects to result in environmental impacts, TCMG undertook comprehensive specialised environmental assessments and studies – as well as review of past environmental studies and assessments of the Project site. All such studies and assessments were undertaken by suitably qualified technical experts in the relevant fields, some of which are outlined within Section 3 and the Appendices of this MMP.

In consideration of the results of these studies, and the relevant statutory and non-statutory requirements (as outlined in Section 2), a comprehensive risk assessment of the Project has been undertaken (as shown in Section 8.3 and Appendix J). A summary of the assessments undertaken for key environmental aspects and impacts are outlined in more detail within Section 8.4, which includes aspects or impacts of importance to key stakeholders.

The risk assessment of the Project included consideration of the potential impacts of the Project against the requirements of the EPBC Act and the NT EP Act. Further details are outlined below.

9.1 Requirements Under the EPBC Act

Assessment is required under the EPBC Act where there is the potential for nationally and internationally important flora, fauna, ecological communities, and heritage places to be impacted. These are termed Matters of National Environmental Significance (MNES). As stated in the Australian Government Matters of National Environmental Significance – Significant impact guidelines (DotE 2013):

> *Under the EPBC Act an action will require approval from the minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance.*

Within these guidelines MNES are defined as:

- *world heritage properties*
- *national heritage places*
- *wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)*
- *nationally threatened species and ecological communities*
- *migratory species*
- *Commonwealth marine areas*
- *the Great Barrier Reef Marine Park*
- *nuclear actions (including uranium mining)*

- *a water resource, in relation to coal seam gas development and large coal mining development.*

Extensive environmental and technical studies and assessments undertaken by suitably qualified technical experts in the relevant fields have not identified any MNES with the potential to be impacted by the Project. The Project therefore does not require referral under the EPBC Act.

9.2 Requirements Under the NT EP Act

In consideration of the requirements of the NT EP Act, the NT EPA's Environmental Impact Assessment Guidance for Proponents states that:

> *Proposals that have the potential to have a significant impact on the environment require referral to the Northern Territory Environment Protection Authority (NT EPA) in accordance with the Environment Protection Act 2019 (EP Act) and the Environment Protection Regulations 2020 (EP Regulations).*

As outlined in the NT EPA guidance, under the EP Act:

> *A proponent must refer a proposal to the NT EPA if it has the potential to have a significant impact on the environment (including a variation to a proposal / action) or meets a referral trigger* [Note: No referral triggers have been declared to date].

It is the responsibility of the proponent to satisfy its obligations under the EP Act and EP Regulations and refer a proposal to the NT EPA if it has the potential to have a significant impact on the environment, or if it meets a referral trigger. Accordingly, the proponent's consideration needs to include, but not be limited to, the following:

- *Definitions of impact (significant impact, direct, indirect and cumulative impact) under the EP Act;*
- *Minister's declared environmental objectives* [Note: There are currently no environmental objectives gazetted];
- *NT EPA's Environmental Factors and Objectives guidance; and*
- *NT EPA's Pre-referral Screening Tool.*

Based on the environmental and technical studies and risk assessments undertaken by suitably qualified technical experts in the relevant fields, the Project was assessed in relation to the EP Act definitions of impact, the NT EPA's Factors and Objectives guidance (NT EPA 2022a) and using the NT EPA Pre-referral Screening Tool (NT EPA 2022b). This assessment was undertaken in a workshop together with EcOz Environmental in 2021 based on the scope of works outlined in the first MMP version - and most recently by qualified environmental and technical experts within TCMG in 2023 for the scope of works included in the MMP amendment.

The outcome of the assessment in both cases concluded that none of the proposed activities on site have the potential to have a significant impact on the receiving environment and that any potential sources of impacts can be adequately mitigated, managed and reduced. All of the NT EPA environmental objectives are expected to be met – which have been adopted as the environmental objectives of the Project's environmental management system. It was therefore assessed that the Project does not require referral by the proponent to the NT EPA. Further detail of the assessment against each factor and objective is given in Section 9.3 below.

9.3 NT EPA Factors and Objectives

The NT EPA defines environmental factors as *broad divisions of the environment that may be impacted by a proposed action* (NT EPA 2022a). A total of 14 environmental factors categorised under five themes of Land, Water, Sea, Air and People have been identified for consideration within environmental assessment. An environmental objective for each factor has been developed that reflects the expected outcomes for these parts of the environment. These objectives provide an indicator against which to assess whether the objects of the EP Act can be achieved and are used by the NT EPA to judge whether the environmental impact of a proposed action may be significant and ultimately whether a proposed action is likely to be acceptable (NT EPA 2022a). The NT EPA's environmental factors and objectives are outlined within Figure 9-1 below.

THEME	FACTOR	ENVIRONMENTAL OBJECTIVE
LAND	Landforms	Conserve the variety and integrity of distinctive physical landforms.
	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
WATER	Hydrological processes	Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.
	Inland water environmental quality	Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.
	Aquatic ecosystems	Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
SEA	Coastal processes	Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.
	Marine environmental quality	Protect the quality and productivity of water, sediment and biota so that environmental values are maintained.
	Marine ecosystems	Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
AIR	Air quality	Protect air quality and minimise emissions and their impact so that environmental values are maintained.
	Atmospheric processes	Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.
PEOPLE	Community and economy	Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.
	Culture and heritage	Protect sacred sites, culture and heritage.
	Human health	Protect the health of the Northern Territory population.

Figure 9-1 NT EPA Environmental Factors and Objectives, taken from the Environmental Impact Assessment General Technical Guidance (NT EPA 2022a).

The Project risk assessment outlines the initial and residual risk ratings arising from Project aspects, for each of the NT EPA factors and objectives, which align with the environmental objectives of the Project. In all cases the residual environmental risks were assessed to be Acceptable or Tolerable (Low to Moderate Risk). Indicating that no high or significant residual risks are expected as a result of Project activities. A more detailed summary of TCMG's consideration of Project aspects and potential impacts against each of the NT EPA's factors and objectives is given in Sections 9.3.1 – 9.3.5 below.

9.3.1 Project Assessment – Land

Factor: Landforms

The environmental objective for this factor is to *Conserve the variety and integrity of distinctive physical landforms*.

There are no distinctive physical landforms within the area of proposed Project mining activities. Further, given the extent of historical mining disturbance of the site and Project planning which utilises areas of historical disturbance, the proposed Project activities will not significantly alter the natural physical landforms of the site. The Nobles Nob pit is an existing mine legacy feature. The proposed expansion of the Nobles Nob pit will expand this size of the pit, however this expansion will be in to surrounding areas that have been significantly disturbed and do not contain any unique landforms.

Placement of waste rock will be on to an existing waste rock dump rather than into a new area – with an expected increase in height of approximately 10-25 m across this area, therefore not representing a significant change in landform. Processing of the Southern WRD and Northern Tailings will remove deposits that have historically altered the site – and will be replaced by tailings deposits, resulting in little net change in landform from current. All dry stack tailings landforms and the waste rock dump will be contoured to blend in with the surrounding topography.

Given there are no distinctive landforms within the Project area, and the use of areas of historical disturbance, the NT EPA environmental objective for the factor of Landforms is expected to be met.

Factor: Terrestrial Environmental Quality

The environmental objective for this factor is to *Protect the quality and integrity of land and soils so that environmental values are supported and maintained*.

Integral to Project planning has been the utilisation of areas of historical mining disturbance and turning historical waste deposits into resources. The only area of new disturbance and new vegetation clearance is the 4 ha area for the solar field. This is therefore the only area of proposed disturbance of an intact land and soil system, although still likely to be historically impacted to some extent by surrounding land uses. The integrity of soils in this area following clearing of vegetation will be maintained through windrow contouring of the soil and implementation of erosion and sediment controls. The integrity of the land and soil system will be restored through rehabilitation of this area at closure of the solar field.

For all other Project activities, they will occur within areas of significant historical disturbance, and are not expected to represent a risk to the quality and integrity of land or soils. In some cases, Project activities have the potential to improve the integrity of land and soils by removing potential sources of contamination. For example, visible observations of leaching have been made from the Northern Tailings following rainfall events, and removal of this material for processing will therefore remove a potential source of contamination.

Similarly, some areas of historical rehabilitation of waste rock and tailings are not to contemporary standards. Following mining activities, TCMG will undertake rehabilitation of all areas of Project disturbance to contemporary industry standards, which is expected to improve the environmental value of these areas.

Risks of contamination to soils will be carefully managed, as further outlined within Section 11.9 of the Environmental Management Plan below, to ensure that Project activities do not impact the quality or integrity of soils. Including appropriate storage and bunding of all hazardous materials, and contingency planning for any unlikely contamination events, with readiness of spill kits and emergency response planning (see Section 12).

Erosion and sediment controls will be implemented across the site appropriate to each stage of Project activities (the current ESCP is included within Appendix M). The ESCP will be updated and recertified to reflect updates in Project planning prior to works being undertaken. Progressive ESCP plans for construction and operation will be developed with contractors specific to the site works and environmental conditions at the time. Controls will be used to capture any surface water runoff around any potential contaminant sources, including around the waste rock deposition, tailings storage, and ROM pad areas.

Given the disturbance history of the site, there is potential for Project activities and rehabilitation to improve the quality and integrity of land and soils within the Project area. Considering this together with the management controls that will be implemented to prevent contamination or erosion of soils – the NT EPA environmental objective for the factor of Terrestrial Environmental Quality is expected to be met.

Factor: Terrestrial ecosystems

The environmental objective for this factor is to *Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning*.

The environmental values represented at the Project site are significantly impacted by historical mining disturbance. Disturbance to vegetation is particularly evident. Although areas of reasonably healthy remnant vegetation remain or have regrown, the majority of the immediate Project area is moderately to severely disturbed. Leaching of historical tailings and lower vegetation cover within rehabilitated areas is evident in some areas. The current environmental condition of the area is therefore degraded.

As outlined for the Factor of Terrestrial Environmental Quality above, the proposed Project activities have the potential to remove some of the mine legacy issues such as any potential leaching from the Northern Tailings. Rehabilitation to contemporary standards at the completion of the Project is expected to improve ecological integrity and functioning through improved soil conditions, and restoration of vegetation to similar levels of density and diversity to those of surrounding natural vegetation. Removal of weeds from the Project site, which TCMG is currently undertaking, will also improve habitat values for both flora and fauna within the Project site.

The only area of new disturbance and new vegetation clearance is the 4 ha area for the solar field. No unique habitat values have been identified within this area, and no flora or fauna of conservation significance are expected to be found within this area (see Section 8.4.3 for further details). Clearance and use of this area is therefore not expected to remove any unique environmental values. Topsoil from this area will be stockpiled prior to construction of the solar field and used in rehabilitation. The habitat values of this area will be restored through rehabilitation at closure of the solar field.

Given the small area of new disturbance and lack of unique ecological values expected to be impacted by Project activities, the NT EPA environmental objective for the factor of Terrestrial Ecosystems is expected to be met. Compared to the current highly disturbed environmental condition of the site, rehabilitation and management outcomes have the potential to improve the ecological integrity of terrestrial ecosystems at the Project site.

9.3.2 Project Assessment – Water

Factor: Hydrological Processes

The environmental objective for this factor is to *Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained*.

There are no perennial surface streams within a 5 km radius of the Project area, and the only permanent surface water bodies are the Nobles Nob pit and Lake Alice. Hydrological processes considered within the Project area therefore relate to groundwater. Potential impacts to Lake Alice are considered within inland water quality and aquatic ecosystems below. The main source of potential impact to groundwater hydrological processes is from proposed water extraction for mine dewatering and to meet Project water supply requirements.

In consideration of the potential impacts of Project activities to groundwater, TCMG undertook a rigorous pit dewatering assessment using a complex analytical model, as outlined in Appendix F. The results of the assessment indicate that the proposed dewatering of Nobles Nob Pit is expected to have no adverse impacts on the groundwater system at Nobles Nob, except changes in groundwater level. Any such impacts will be constrained locally, within a radius of influence of 0.6 km to 2.8 km, and the proposed pit dewatering is unlikely to deplete the aquifer or impact the water supply of the Tennant Creek township or the region. The Nobles Nob aquifer is expected to naturally recharge and recover to current levels with rainfall following the conclusion of dewatering activities, as evidenced by the recovery of the water table to current groundwater levels following the cessation of historical mining and dewatering of the Nobles Nob pit.

TCMG's assessment to understand the impacts of extracting water from the Nobles Nob Pit included the context of the wider region. The developed analytical model included scenarios to understand the best-case and worst-case impacts of the dewatering activities. Being conservative, the worst-case scenario was adopted to represent the potential risk, and appropriate measures to mitigate the potential impacts were recommended. The radius of drawdown is therefore likely to be smaller than what was predicted, but being conservative, TCMG has outlined the worst-case scenario to understand the potential impacts on the wider region. The hydraulic conductivity values used in the models included the range recorded in the Warramunga Province. Various publicly available studies and previous groundwater investigations were considered to understand the hydrogeological context of the Warramunga Province (e.g. Rockwater 1989; Rose 1973; Rose & Willis 1973; Verhoeven 1976; and Verhoeven & Knott 1980). These studies found that the permeability of these aquifers is low, and the water quality is unsuitable for human consumption (Rockwater 1989; Verhoeven & Knott 1980). Measurements of airlift yields recorded during drilling of monitoring bores by TCMG and registered bores at TCMG's tenements are generally less than 1 L/s (only 2 out of 10 bores recorded yield of >1 L/s), which agrees with the findings of previous studies that groundwater permeability in the area is low. The findings from these studies suggest that any drawdown impacts on the aquifer are likely to be localised.

Due to the area's history of mining and grazing, the majority of the area around the Nobles Nob Project site is moderately to highly disturbed, with the area around the Nobles Nob pit significantly impacted by historical mining activities. All registered bores within 2.5 km of the Nobles Nob pit are mine-related bores, and there are no declared water users in the area. Given the natural salinity of the groundwater, this makes it unsuitable for most uses including stock watering or human consumption.

Given the above assessment, which indicates that expected impacts of water extraction are expected to be localised and temporary in nature – and unlikely to affect other water users in the area – the NT EPA environmental objective relating to the factor of Hydrological Processes is expected to be met.

Factor: Inland Water Environmental Quality

The environmental objective for this factor is to *Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained*.

The environmental risk assessment of the Nobles Nob Project undertaken by TCMG considered the potential for contaminant sources to impact groundwater quality in the local area through surface flow and ingress into the groundwater. Potential contaminant sources considered included the processing plant, fuel storage, tailings storage, waste rock, and the ROM pad. One sensitive receptor was identified, [redacted], Lake Alice.

Project planning has avoided and mitigated these risks wherever possible, including the placement of infrastructure away from Lake Alice and the use of dry stack tailings technology, which removes the risk of dam failure and significantly reduces the risk of contamination to groundwater. The potential for saline, acid and metalliferous drainage was assessed within a waste rock characterisation study (Umwelt 2021a), as further discussed in Section 8.4.1 above. The potential for acidic or saline drainage was assessed to be unlikely. There was some metal enrichment seen in waste rock samples taken, however given the low acidity, the likelihood of metalliferous leachate is considered low. Further, groundwater characteristics were assessed (Umwelt 2021b) and infiltration of any contaminated runoff from the identified contaminant sources into groundwater is considered unlikely given the low rainfall and the presence of clay layer below the main processing area.

Any remaining environmental risk from surface water runoff during rainfall events will be mitigated using surface water drainage controls to capture any runoff from potential contaminant sources and prevent any runoff towards Lake Alice (as further outlined in Section 8.4.4 above). A water quality monitoring program has been implemented to assess and manage risks to groundwater quality over the life of the Project.

Given that the likelihood of saline, acid or metalliferous drainage is considered to be low, infiltration to groundwater unlikely, and surface water controls and regular water quality monitoring will be implemented, the risks to groundwater quality resulting from proposed Project activities are considered to be well mitigated, managed and reduced. The NT EPA environmental objective relating to the factor of Inland Water Environmental Quality is therefore expected to be met.

Factor: Aquatic Ecosystems

The environmental objective for this factor is to *Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning*.

The environmental studies and risk assessment undertaken by TCMG considered the potential for Project activities to impact aquatic ecosystems. The potential for groundwater-dependent ecosystems (GDEs) within or near to the Project area were assessed using various government approved tools, such as the Atlas of Groundwater Dependent Ecosystems (BOM 2012) and the NR Maps desktop tool. GDEs refer to ecosystems that rely on groundwater, either permanently or intermittently. This includes surface expressions of groundwater in the forms of springs and wetlands and below-ground systems, such as caves. Both of these tools indicated no known GDEs or springs within 10 km of the Nobles Nob pit (Umwelt 2021b). This is not surprising given that groundwater on site and within the wider Warramunga Province is typically over 50 meters below ground level, and highly saline. Given the localised nature of any expected impacts of water extraction, with a maximum radius of influence of 2.8 km, no GDEs are therefore expected to be impacted by water extraction or other Project activities.

Other than GDEs, the only permanent surface water bodies within a 5 km radius of the Project site are the Nobles Nob pit and Lake Alice. As further described in Section 8.4.4 above, Lake Alice is a perched lake fed by rainfall [redacted]. As such, Lake Alice holds [redacted] environmental [redacted] value and was the key aquatic ecosystem considered within risk assessment of the Project. Rigorous assessment has been undertaken to ensure no impacts are expected at Lake Alice (see Section 8.4.4 for further detail). Through site planning, surface water, erosion and sediment, and dust control measures, TCMG considers that the risks to Lake Alice have been well avoided, mitigated, managed, and reduced, and no adverse residual impacts are expected. [redacted] agreed by TCMG, to undertake regular monitoring of water quality at Lake Alice to ensure that no adverse impacts occur.

Given that no GDEs are known within 10 km of the Project area, the localised nature of the groundwater system, and the rigorous assessment and mitigation of any potential impacts to Lake Alice, the NT EPA environmental objective relating to the factor of Aquatic Ecosystems is expected to be met.

9.3.3 Project Assessment – Sea

The project site is located within central Australia, approximately 500 km from the nearest coastal location. The NT EPA environmental factors and objectives related to the theme of Sea are therefore not relevant to the Project.

9.3.4 Project Assessment – Air

Factor: Air Quality

The environmental objective for this factor is to *Protect air quality and minimise emissions and their impact so that environmental values are maintained*.

The environmental factor with the potential to impact air quality is the production of dust during Project activities – including during earthworks, construction, extraction, and processing. A dust management plan (DMP) has been developed for the Project (the current version is included in Appendix O) which outlines a range of mitigation measures that will be implemented to reduce the risk of dust emissions during Project works. Mitigation measures that will be implemented include:

- wetting down of active work areas with water trucks
- covering of stockpile
- reduced vehicle speeds
- windrow of cleared areas
- avoid clearing during dry and windy conditions
- minimisation of the time between clearing and construction works
- loads will be covered during transportation
- minimising drop heights when loading and unloading material
- operators to remain within dust filtered cab areas during operations as much as possible.

To ensure that the dust mitigation measures being implemented are effective, visual site monitoring will be conducted during all active site works. Dust depositional monitoring is also being undertaken across the Project site and will continue throughout the life of the Project. Four depositional dust monitoring stations have been established on site, which have been placed: upwind of project activities to assess the background levels of dust; downwind of the project activities to assess the level of dust leaving the Project site; and adjacent to each of the identified sacred sites to ensure they are not being impacted by dust deposition. Further details are outlined within the DMP in Appendix O. This DMP will be updated as required to remain current as Project planning and implementation progresses.

It is expected that the dust mitigation measures will effectively reduce environmental or human health impacts from dust produced by Project activities. Ongoing site monitoring will be implemented to ensure that this is the case and will be used to guide and adjust management activities as required. It is therefore expected that the impacts to air quality from Project activities will be adequately avoided, managed, and mitigated – and the NT EPA environmental objective for the factor of Air Quality is therefore expected to be met.

Factor: Atmospheric Processes

The environmental objective for this factor is to *Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050*.

TCMG has considered emissions reduction technology from the start of Project planning and is currently developing an ESG Framework to set emissions targets, which will guide the development of an emissions reductions plan to minimise greenhouse gas emissions throughout the Project. These will be developed to align with the NT Government's goal of achieving net zero emissions by 2050; as well as the greenhouse gas emission reduction targets within the Commonwealth *Climate Change Bill 2022* of a 43% reduction against a 2005 baseline by 2030, and net zero emissions by 2050.

The majority of Project emissions will result from energy use on site, and from fuel consumption from transportation. A hybrid renewable energy production plan has been developed to supply Project energy requirements, which will be implemented in a staged manner from the start of Project implementation. Use of solar energy with battery storage during daylight hours will significantly reduce the carbon emissions of the Project compared to diesel generators alone. TCMG is committed to reducing its carbon footprint and will continue to find and assess technologies to improve carbon efficiencies, including within transportation, throughout the life of the Project. The Project is relatively small in scale and is not expected to exceed the National Greenhouse and Energy Reporting (NGER) reporting thresholds based on current Project planning.

Given the expected emissions of the Project are relatively low for a Facility as defined by NGER reporting thresholds, and Project planning to minimise greenhouse gas emissions, the NT EPA environmental objective for the factor of Atmospheric Processes is expected to be met.

9.3.5 Project Assessment – People

Factor: Community and Economy

The environmental objective for this factor is to *Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians*.

TCMG is committed to developing this Project in a way that grows the prosperity of local people through partnership, employment, training, and commercial enterprise. TCMG sees an opportunity to bring prosperity back to the Barkly region after nearly 20 years without larger scale mining activity. With a long pipeline of projects in the region, there is an opportunity for the Barkly region to grow and prosper from the revitalisation of the mining industry, one that has shaped so much of what Tennant Creek is today. As an early mover, TCMG is committed to improving the overall capacity and capability in the Barkly Region. By leveraging community engagement, local employment, and industry collaboration, to return benefits to the local community in a sustainable way, that smooths the typical boom-bust cycle of mining experienced in the past. TCMG has developed a Territory Benefits Plan which outlines its commitments to achieve the following objectives:

1. **Community Benefits:** Deliver benefits to the community through collaboration, contribution, participation and an enduring positive legacy.
2. **Employment Benefits:** Employ as many Traditional Owners, Barkly Region Aboriginal and other residents, and Territorians as we can.
3. **Procurement Benefits:** Use as many Barkly Region Indigenous Business Enterprises and Barkly Region Enterprises in our supply chain as possible.
4. **Industry Benefits:** Collaborate with other major projects, local businesses andacross industry sectors to build a sustainable economyin the Barkly Region.

TCMG has already begun implementation of a number of initiatives to date towards achievement of these objectives. Such as use of local suppliers and contractors to support local businesses; employment of local people within Tennant Creek; relocation of staff from interstate to Tennant Creek; and establishment of a local workforce village within the township of Tennant Creek, so that TCMG staff are becoming a part of the local community. TCMG has developed and is leading a range of local workforce development programs and initiatives in the region, to begin to grow the pipeline of employment and training. As well as beginning implementation of a community sponsorship program to contribute toward a thriving and healthy Barkly region. These programs and initiatives will continue to grow as the Project progresses.

Through its commitments to deliver benefits to the Barkly region, TCMG intends to contribute to the enhancement and wellbeing of current and future generations within the region, and hence meet the requirements of the NT EPA objective for the factor of Community and Economy.

Factor: Culture and Heritage

The environmental objective for this factor is to *Protect sacred sites, culture and heritage*.

TCMG is committed to protecting the cultural heritage and sacred sites of Traditional Owners across the Project site, and across all of its broader activities. As outlined within Section 3.2.4 and Appendix C, TCMG has received a CLC Sacred Sites Clearance Certificate and an AAPA Authority Certificate for the Project site. The CLC and AAPA each separately consulted with and took instructions from Traditional Owners in relation to these sacred site clearance processes. These certificates evidence the consent and support of Traditional Owners for TCMG's Project and proposed activities at its Nobles and Juno Project sites.

Each certificate includes identification of sacred sites with exclusion zones, restricted works areas and conditions which TCMG has used to inform its Project planning, placing of site infrastructure and TCMG's cultural heritage protection and management planning, protocols and processes. TCMG has consulted with Traditional Owners and the CLC, and received Traditional Owners instructions during liaison committee meetings on their preferred access routes to allow Traditional Owners free unrestricted access to their sacred sites – as well as their preferred signage and marking to restrict access of TCMG Project personnel from sacred sites restricted work areas and exclusion zones.

A cultural heritage management plan has been developed to ensure that all requirements of sacred site certificates are adhered to, and heritage values are protected. The requirements of this plan will be communicated to all personnel entering the site. Included within the plan are protections of the sacred sites and restricted work areas; as well as an unexpected finds procedure to be followed in the event that any unknown archaeological remains or values are uncovered or disturbed during works.

In addition to the protection of sacred sites and heritage values on site, TCMG values the protection of cultural heritage in all of its activities. As further outlined within Section 3.2.3, TCMG has undertaken extensive stakeholder engagement, and has committed to ongoing, regular consultation with Traditional Owners to inform its operations. Including consultation to inform and guide TCMG's progressive closure, rehabilitation and restoration plans and activities across all its Project sites in the Tennant Creek region. TCMG is also committed to embedding cultural awareness and cultural safety into all hiring, workforce, procurement, and training systems. All regular TCMG site staff have undergone cross-cultural heritage awareness training, and an induction program will be developed specific to the Project site for all personnel to undertake prior to operating on site.

TCMG has received excellent feedback on its engagement approach to date and has developed relationships and ongoing engagement with Traditional Owners of the Nobles Nob Project site, and Aboriginal Elders of the Tennant Creek region. Given the extensive engagement and sacred site clearance and heritage management process implemented, and the genuine ongoing commitments TCMG has made to the protection and respect of cultural heritage and practices, the NT EPA environmental objective for the factor of Culture and Heritage is expected to be met.

Factor: Human Health

The environmental objective for this factor is to *Protect the health of the Northern Territory population*.

The protection of human health and workplace safety is TCMG's first priority in all of its operations and activities. An integrated workplace health, safety, environment, quality, compliance management system has been developed for the Project using the online management system *Skytrust*. This includes all health and safety requirements, inductions, inspections and audits, plant and equipment monitoring, risk register and reporting. All TCMG staff and contractors will be required to complete all health and safety induction modules and relevant training prior to undertaking works on site.

Other than workplace health and safety hazards, environmental aspects and impacts identified with the potential to cause harm to human health include handling and storage of hazardous materials on site; contaminated spills or leaching of contaminants or wastewater with the potential to come in contact with people; dust emissions; and noise and vibration. TCMG has developed an environmental management system including waste management, wastewater management, and hazardous materials and dangerous goods management as outlined in Sections 11.7-1.9 of this MMP; air quality management and noise and vibration management as outlined in Sections 11.3-11.4; dust management as outlined in Appendix O; and erosion sediment control and water quality management as outlined in Section 11.1 and Appendices M and N. Through implementation of these management measures, the risks to human health are able to be avoided, mitigated and managed. Human health is therefore being protected throughout Project activities, through environmental management as well as workplace health and safety management – and the NT EPA objective for the factor of Human Health is therefore expected to be met.

10 ENVIRONMENTAL MANAGEMENT SYSTEM

TCMG activities will be carried out so as to protect the health of management, staff, employees, contractors, key stakeholders and community while paying proper regard to the protection and management of the environment. The primary goal of TCMG's operations other than health and safety is to maintain the highest environmental standards.

TCMG has developed and is implementing an Environmental Management System (EMS) as outlined within this section of the MMP, together with the Environmental Management Plan in Section 11, detailed impact specific management plans that have been developed where required, and contingency and closure planning as outlined in Sections 12-13. TCMG has also developed and is implementing a Stakeholder Engagement Management System including a Stakeholder Engagement and Communication Plan and extensive stakeholder engagement has been undertaken to date and is ongoing.

TCMG has received ISO 14001 certification of its EMS, which provides assurance that this system meets international standards in the management of its environmental responsibilities. This EMS is set up to ensure that TCMG will continue to monitor, report, and improve its environmental management performance throughout the life of the Project.

Aspects of TCMG's EMS are outlined below.

10.1 Environmental Policy

Refer to Appendix P for TCMG's Environmental Policy.

10.2 Environmental Management Structure

TCMG will maintain over-arching responsibility for complying with this MMP, implementing the EMS and adhering to the conditions of all approvals, permits and licences issued for the Project. The Project Manager will be responsible for implementation of the EMS and environmental compliance for all staff and contractors.

10.3 Environmental Objectives

The environmental objectives of the Project are to align with the NT EPA environmental factors and objectives, as shown in Figure 9-1 above. As identified within the Conceptual Site Model and stakeholder consultation, the objectives of most relevance to the Project are those relating to the factors of:

- Terrestrial environmental quality
- Terrestrial ecosystems
- Hydrological processes
- Inland water quality
- Air quality
- Community and economy
- Culture and heritage

These objectives have been used to inform the development of the environmental management system and will be used to assess the adequacy of the management system throughout Project implementation.

10.4 Environmental Commitments

There are statutory requirements for this Project under the MM Act, as well as a range of statutory and non-statutory requirements as detailed in Section 2 of this MMP. Section 11 below outlines the over-arching Project Environmental Management Plan (EMP) identifying planned environmental management activities.

TCMG will continue to commit to environmental management over subsequent MMP submissions. The following commitments will form part of the ongoing Project:

- TCMG will maintain over-arching responsibility for complying with this MMP and the conditions of all approvals, permits and licences issued for the Project. The Mine Manager will be responsible for environmental compliance for all staff and contractors.
- All of the proposed mining activities and processing will be within the mineral lease boundaries.
- Mining Authorisation and MMP approval will be sought prior to undertaking any mining activities within the Project area not within the scope of this MMP. All conditions of mining authorisations will be implemented.
- Amendments to this MMP will be made for any relevant changes to Project planning within the scope of this MMP, such as processing of additional external ores. Characterisation of all ores and assessment of potential impact will be undertaken, including those coming from external satellite sites, prior to processing those ores at the Nobles Nob plant.
- Separate mining approvals will be sought for mining of additional deposits such as Rising Sun and Weabers Find. Separate approvals will be maintained for exploration activities.
- All required approvals under the *Water Act 1992* will be sought prior to undertaking these activities. Including all groundwater extraction and any relevant water discharge. All activities will be undertaken in accordance with the licences or approvals granted. A water extraction licence has been granted to TCMG for extraction activities at Juno mine site. All extraction activities will be in accordance with licence conditions. An application to extract groundwater has been submitted to DEPWS for dewatering of the Nobles Nob pit. All extraction activities will be in accordance with licence conditions.
- An Approval Application form for Wastewater works will be submitted to the DOH Environmental Health Division prior to installation of a wastewater treatment system on site.
- All site activities will be in accordance with the conditions of the sacred sites clearance certificates granted by AAPA and CLC for the Project area (as shown in Appendix C).
- All conditions of the PETA land access agreement will be implemented.
- All commitments outlined within TCMG's Territory Benefits Plan will be implemented to the best of TCMG's ability, including implementation of TCMG's Procurement Policy and Workforce Strategy.
- ISO 14001 certification will be maintained for TCMG's EMS.
- The Erosion and Sediment Control Plan (ESCP) will be implemented, including preparation of progressive ESCPs for construction and operation prior to commencement of site clearing and construction works. The current version is included in Appendix M. This will be updated to reflect changes in Project planning and remain current prior to any works being undertaken. The up-to-date version will be submitted to DITT for approval with each new version.
- The Quality Management Plan (WQMP) will be implemented. The current version is included in Appendix N. This will be updated to reflect changes in Project planning and remain current prior to any works being undertaken. The up-to-date version will be submitted to DITT for approval with each new version.
- The Dust Management Plan (DMP) will be implemented. The current version is included in Appendix O. This will be updated to reflect changes in Project planning and remain current prior to any works being undertaken.
- The Weed Management Plan will be implemented. Weed management will be undertaken for the duration of the Project to control weed infestations on site. All plant, equipment and vehicles will be cleaned prior to arriving at the Project area to ensure they are free of organic materials that may contain seeds. The presence of existing weeds across the Project site have been assessed and weed management undertaken in 2022 and 2023. Areas of weed infestation will be the target of ongoing weed management efforts.

- The access road will be maintained throughout the Project via grading and dust suppression activities.
- During the first rainfall event following the commencement of drystack tailings deposition, runoff water from the drystack tailings area will be taken for basic testing to ensure that management procedures are adequate.
- Water quality samples will be collected of the water being reused in the plant to ensure that it hasn't unexpectedly accumulated or concentrated toxins or pollutants.
- All relevant Project personnel, contractors and visitors will undertake a site induction detailing the essential environmental management information for the Project. This will include an explanation of the environmental management structure, environmental policy and requirements of this MMP.
- Emergency and incident response procedures will be presented during inductions and include spill response, equipment failure, storms and fire, and information on reporting requirements.
- Scheduled toolbox meetings with Project workers will keep employees informed of safety and environmental issues, and will ensure continued awareness of environmental management activities.
- All incidents which cause or have the potential to cause material or serious environmental harm will be reported to The Northern Territory Department of Industry, Tourism and Trade (DITT) as required under Section 29 of the MM Act.
- A register of incidents will be maintained during operations for the Project which will include details about the incident, how it occurred, where and when it occurred, physical actions taken to rectify, remediate or rehabilitate, and operational actions to address the future management of incidents of this type. Where required, accidents and incidents will be reported to DITT via a Notification of an Environmental Incident form.
- TCMG will progressively rehabilitate Project areas as the Project progresses.
- The agreed end land use is for the site to be safe and stable.
- The site will be assessed after the first substantial rain event post closure, so as to remedy any potential rehabilitation issues and ensure that the stability of the tailings storage facility has not been impacted. Corrective actions will be taken if required.
- When appropriate TCMG will provide a report on rehabilitation success to start the process towards relinquishment of the site and return of the bond.
- A care and maintenance program would be developed within one week of any temporary suspension of operations.

10.5 Environmental Training and Education

All relevant Project personnel, contractors and visitors will be required to undertake a site induction detailing the essential environmental management information for the Project. This will include an explanation of the environmental management structure, environmental policy, and requirements of this MMP.

Emergency and incident response procedures will be presented during inductions and include information on spill response, equipment failure, storms and fire, and reporting requirements.

Scheduled toolbox meetings with Project workers will keep employees informed of safety and environmental issues, and will ensure continued awareness of environmental management activities.

10.6 Environmental Monitoring

Environmental monitoring will be carried out on an ongoing basis for the life of the Project, as appropriate for each environmental aspect and impact, and each stage of Project works. Further detail is provided in the

Project EMP in Section 11 below, and the associated impact specific EMPs. Monitoring will be carried out in accordance with the relevant Project management plan and relevant industry standards, by TCMG staff or contractors who have been trained by suitably qualified professionals.

10.7 Environmental Decision Framework

TCMG's EMS decision framework is shown in Figure 10-1 below. This decision framework outlines how the Environmental Management System and Environmental Management Plans will be used to inform decisions and management, and identifies who is responsible throughout the process.

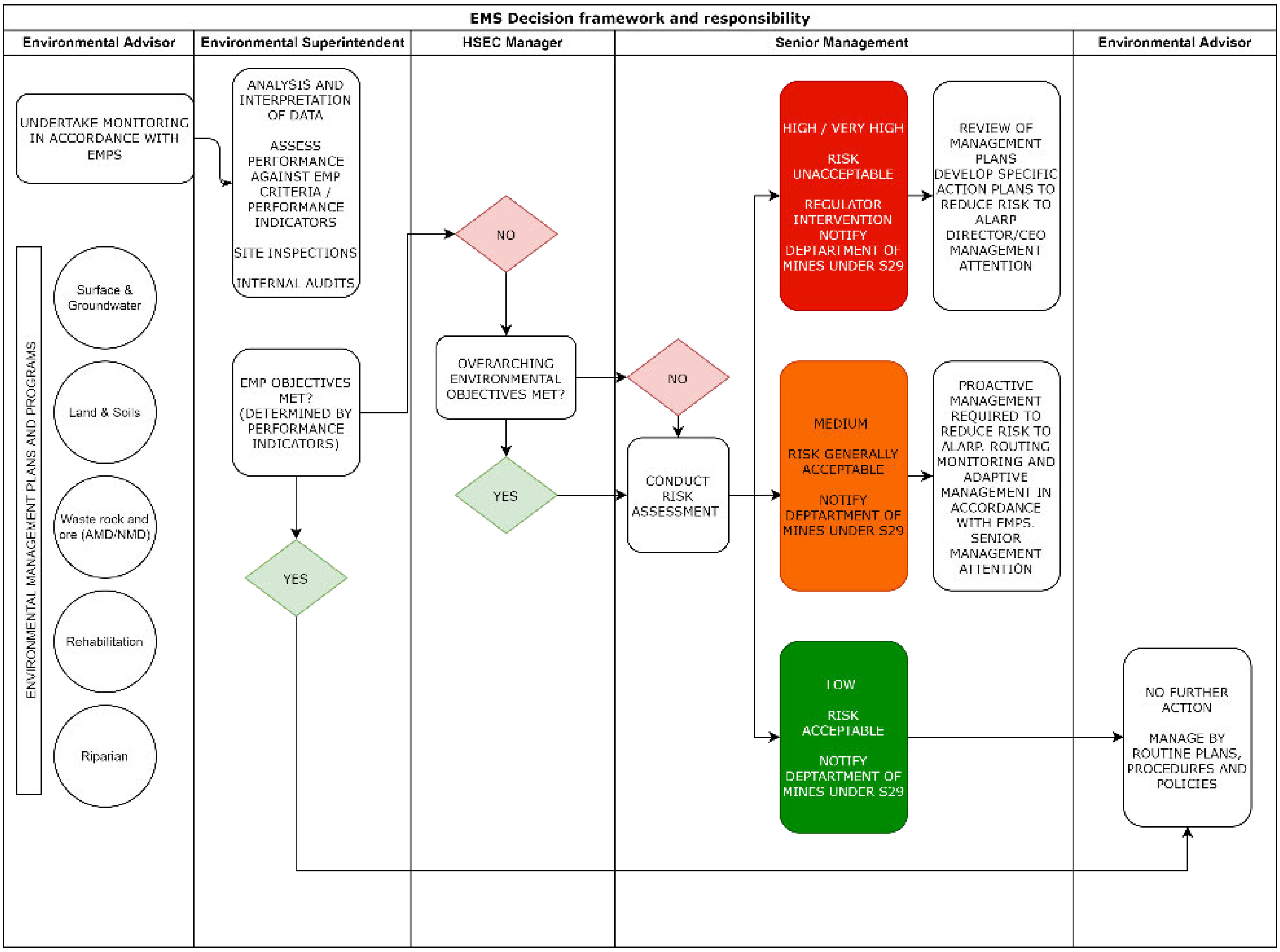

Figure 10-1 Decision framework

10.8 Environmental Record Keeping

Records will be kept by TCMG on an ongoing basis to demonstrate implementation of the EMS and maintain transparency. Including records of all:

- Environmental monitoring
- Environmental management actions
- Environmental accidents or incidents
- Stakeholder engagement
- Community complaints

TCMG is using an online management system called *SkyTrust* to record, track and manage aspects of safety and environmental compliance and management – including environmental monitoring, control, and incidences. TCMG is also using an online management system called *Consultation Manager* to record, track and manage stakeholder engagement activities – including consultation meetings and community complaints.

10.9 Environmental Reporting

TCMG will undertake regular environmental reporting to relevant stakeholders including to meet statutory reporting requirements, ESG reporting requirements of investors and industry bodies, and to maintain community engagement. Table 10-1 below indicates the statutory reporting requirements for the Project which will be implemented at the required frequency. Incident reporting is outlined within Section 12.3 below.

Table 10-1 Statutory Reporting Requirements

Statutory Reporting	Required By	Frequency	Responsible Person
Mining Management Plan	Department of Industry, Tourism and Trade	Annually	Project Manager
Employment, Injury and Safety Statistics	NT Worksafe	Annually	Project Manager
Tenement Annual Reports	Department of Industry, Tourism and Trade	Annually	Tenement Administrator
National Pollutant Inventory Reporting	Department of Industry, Tourism and Trade	Annually	Project Manager
Production Statistics	Department of Industry, Tourism and Trade	Annually	Project Manager
Water Sampling Raw Results	Department of Industry, Tourism and Trade	Quarterly	Project Manager
Water Quality Report	Department of Industry, Tourism and Trade	Annually	Project Manager
Water Extraction Rates	Department of Environment, Parks and Water Security	Quarterly	Project Manager

10.10 Review of Environmental Management System

TCMG will review the adequacy and efficacy of its EMS and EMPs on an ongoing basis, to continue to monitor its environmental performance and identify where improvements can be made. Any environmental incidences, near misses, or community complaints will trigger a review of the relevant management aspects and plans. As will any significant changes to Project planning, or progress through the stages of Project implementation.

When preparing annual reporting on this MMP, any updates made to improve the EMS in the preceding year will be reported upon.

11 ENVIRONMENTAL MANAGEMENT PLAN

This section provides information regarding the implementation of environmental management measures to ensure the potential risks to the receiving environment are mitigated. The tables below provide a summary of how this EMP will be implemented to address the potential impacts associated with the Project operations. This includes the management actions, targets / performance indicators, monitoring, corrective actions and contingencies, and reporting and record keeping mechanisms. Detailed management plans have also been developed for key environmental aspects or impacts including:

- Water Quality Management Plan
- Erosion Sediment Control Plan
- Dust Management Plan
- Cultural Heritage Management Plan
- Weed Management Plan

11.1 Soil Erosion and Sediment Management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Development and implementation of an Erosion and Sediment Control Plan (ESCP). This plan will be developed in accordance with the International Erosion Control Association Australasia (2008) - Best Practice Erosion and Sediment Control (BPESC); and will be certified by a Certified Practitioner (CPESC). • Erosion and sediment control measures will be maintained regularly and after rainfall events. • Erosion and sediment control measures will not be removed until disturbed areas have been stabilised. • The contemporary ESCP will be implemented. The current version is included in Appendix M. This will be updated to reflect changes in Project planning and remain current prior to any works being undertaken.	• No detection of erosion within the Project area • No sedimentation of surrounding environments	• Visual monitoring for erosion within the Project area • Water quality performance will be monitored through the Water Quality Monitoring Plan (WQMP).	• Fix erosion issues and review ESCP and amend where necessary	• Incident reporting records • Water quality database

11.2 Water Quality and Quantity

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• An ESCP will be implemented to prevent sediment entering watercourses. • Fuel, oils and chemicals will be appropriately stored and bunded according to the National Standard for the Storage and Handling of Workplace Dangerous Goods and any other relevant Australian standards. Including the Australian Standards for The storage and handling of flammable and combustible liquids (AS 1940); Tanks for flammable combustible liquids (AS 1962); The storage and handling of corrosive substances (AS 3780); and The storage and handling of toxic substances (AS/NZS 4452). • Fit for purpose spill kits to be positioned at refuelling and storage areas. • All personnel on site will be trained in use of spill kits, in the event of a spill. • The contemporary Water Quality Management Plan (WQMP) will be implemented. The current version is included in Appendix N. This will be updated to reflect changes in Project planning and remain current prior to any works being undertaken.	• No detection of erosion within the Project area • No sedimentation of surrounding environments • No indication of spills of chemicals or hazardous substances. • Any spill of stored product is contained and remediated through the spill response procedure. • No leaks from equipment. • No contamination of groundwater. • No leaching from tailings storage facility.	• Visual monitoring for erosion within the Project area • Regular inspections of chemical and hazardous substance storage areas through operational activities. • Water quality performance will be monitored through the WQMP.	• Fix erosion issues and review ESCP and amend where necessary • Review storage and handling practices for chemicals and hazardous substances. • Increase the amount of bunding and containment for chemical and hazardous substance storage areas. • Increase the number, capacity or type of spill kit materials.	• Incident reporting records • Water quality database

11.3 Air Quality

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Dust generated during site activities will be managed through dust suppression activities. • A Dust Management Plan (DMP) will be implemented to prevent and monitor dust emissions on site. • The contemporary DMP will be implemented. The current version is included in Appendix O. This will be updated to reflect changes in Project planning and remain current prior to any works being undertaken. • Community notification will be undertaken, where work is likely to cause impact on the public and nearby residents. • No burning of vegetation or other materials will be permitted on site. • Exhaust emissions from plant and equipment will be minimised by maintaining equipment in accordance with manufacturer's specifications and undertaking periodic visual checks of exhaust systems. • Any vehicle transporting waste or other materials that may produce odours or dust will be covered during transportation.	• No complaints regarding dust and air quality	• Visual monitoring for dust within the Project area • Regular inspections of plant and equipment.	• Implement more dust suppression activities where required • Plant and equipment maintenance where required	• Incident reporting records • Complaints database

11.4 Noise and Vibration

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• All reasonable practical steps will be undertaken to reduce Project activity noise and vibration from the site.	• No complaints regarding noise and vibration	• Regular inspections of plant and equipment.	• Implement noise monitoring if required due to complaints • Plant and equipment maintenance where required	• Incident reporting records • Complaints database

11.5 Flora and Fauna

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Clearing of vegetation for the solar field will be kept to the minimum area required for infrastructure construction and maintenance • Minimal ground disturbance other than removal of vegetation • Construction of solar field and underlying drainage to avoid erosion and sedimentation resulting from the cleared area • Enforce speed limits on site access roads.	• Top soil remains in situ below solar field • No detection of erosion within the solar field area • No sedimentation of surrounding environments • No incidents of fauna strike	• Daily inspections during clearance works • Regular inspections of solar field and surrounds for erosion and sedimentation • Regular inspections of working areas for fauna strike	• Review equipment used for clearing and construction of solar field • Review solar field drainage • Review speed limits across site • Review induction/staff training	• Incident reporting records • Incident report to be completed for all fauna injuries or death.

11.6 Cultural and Historical Heritage

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Copies of AAPA and CLC Certificates and access Permits will be kept on site at all times • Conditions attached to any AAPA Certificate will be complied with, such as: • All works are to be confined to the 'subject' land identified on the Certificate. • All activities conducted by the Company are covered in the 'Purpose of Use' on the certificate. • All conditions on the Certificate are adhered to. • The Company, its employees and all subcontractors are aware of the conditions of the Certificate. • A stop works will be implemented if artefacts are located during activities on site. The PM will be notified immediately, who will then liaise with the NT Heritage Branch, for further instructions.	• No damage to cultural or historical artefacts or sites	• Regular inspections of working areas	• Review staff inductions and training	• Incident reporting records • Report/liaise with NT Heritage Branch

11.7 Waste Management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Waste generated from site activities will be sorted and amounts estimated and recorded. • Remove from the site and dispose of all waste materials, including green waste, food scraps and other putrescible wastes, Project waste, chemicals and effluent in an appropriate manner, in approved legal waste disposal sites or facilities. • Where available, waste suitable for reuse or recycling will be reused or recycled. • Materials and products with recycled content will be proposed for the works wherever these are cost and	• No waste issues on site	• Regular inspections of working areas	• Review staff inductions and training • Review waste management actions	• Waste records

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
performance competitive and they are environmentally preferable to the non-recycled alternative. • Waste oil will be sent to approved recyclers, or a licenced disposal facility. • Waste and containers not able to be recycled will be disposed of at a licensed landfill facility.				

11.8 Wastewater Management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Wastewater from amenities will be directed to a septic system designed and constructed in accordance with the Code of Practice for Onsite Wastewater Management • Sewage treatment plant operated in accordance with relevant standards and maintained to manufacturers recommendations • Management of sewage wastewater in accordance with approved standards and Department of Health code of practice and guidelines • A registered certified plumber will conduct any upgrades required to the wastewater management system (septic) • Development of irrigation management plan for management of grey water	• Design specifications and installation meets requirements • Maintenance and monitoring of Sewage treatment plant in accordance with manufactures recommendations • Plumber registered and certified is upgrades undertaken • No significant impacts on water quality (bacteriological) based on assessment using criteria in Water Quality Monitoring Plan	• Wastewater effluent quality testing prior to irrigation of grey water to ensure sewage treatment plant is functioning appropriately	• Review sewage treatment plant procedures • Registered certified plumber to undertake an inspection and maintenance as required to sewage treatment plant • Review irrigation procedures	• Maintenance records of sewage treatment plant • Incident register • Water quality database • Report to regulators in accordance with approval and licence conditions.

11.9 Hazardous Materials and Dangerous Goods

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• The handling, storage and transport of hazardous materials and dangerous goods will be in accordance with all relevant legislation, manufacturer's instructions and relevant Safety Data Sheets (SDSs). • Fuel, oils and chemicals will be appropriately stored and bunded according to the National Standard for the Storage and Handling of Workplace Dangerous Goods and any other relevant Australian standards. Including the Australian Standards for The storage and handling of flammable and combustible liquids (AS 1940); Tanks for flammable combustible liquids (AS 1962); The storage and handling of corrosive substances (AS 3780); and The storage and handling of toxic substances (AS/NZS 4452). • Employ transporting, handling, storage and application methods that will prevent chemical, fuel and lubricant spillage on the site and adjoining areas. • Spill clean-up equipment and materials, appropriate for the type and quantities of chemicals used on site, must be kept on site at all times during the works and in a readily accessible location. • Clean up spills in accordance with the spill response as follows: • Locate the source of the spill, identify the volume and type of spill; • Assess the risk to workers and the environment from the spill to ensure appropriate PPE and containment measures are implemented; • Control and contain the spill by isolating and/or removing the source; • Clean the spill using spill kit absorbent material if practical, or installing bunds; and • Collect all contaminated material and dispose of contaminated spill control material, and/or contaminated materials to an appropriately licence waste facility. • Report significant spills, or spills that entered a waterway to the NT EPA Pollution Hotline. • Report spills and all environmental incidents to DITT under S29 of the MM Act.	• No contamination from spills/use on site	• Regular inspections of working areas	• Review staff inductions and training • Review transport, use and storage of chemicals onsite and amend where necessary	• Incident reporting records • Report significant spills, or spills that entered a waterway to the NT EPA Pollution Hotline.

11.10 Weeds and Pest Management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• All declared weeds will be managed in accordance with the Weeds Management Act. • Identification of any declared weed will be reported to the Weeds Branch in accordance with the NT Weeds Management Act. • Weed treatment will be in accordance with the NT Weed Management Handbook. • Weed hygiene will be implemented to control movement of machinery, vehicles and personnel in a manner which avoids movement of weed plants, seeds or contaminated soil from infested areas into un-infested areas. • Machinery and equipment will arrive at and depart from the site in a clean condition, free of seed or mud, and pests (i.e. cane toads), with inspection records. • Wastes will be contained and managed on site, including domestic wastes to prevent the introduction of pest species to the Project area. This will include the use of lidded waste containers, regular removal of wastes from site, and inspections of waste containment areas to monitor for pest species. • A Weed Management Plan (WMP) will be implemented to prevent spread, control and monitor weed infestations on site. This will be updated throughout the Project to reflect changes in Project planning and remain current prior to any works being undertaken.	• No new weed occurrences at site • No pests hanging around waste at site	• Regular inspections of working areas for weeds • Regular inspections for pests, especially around waste storage areas	• Review staff inductions and training • Review waste management actions • Review weed management actions	• Weed records

11.11 Fire Management

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• No fires will be lit on site. • Water cart on standby during periods of high fire danger. • A water storage tank will be kept on site with water available for use as emergency fire control. • Where fires are accidentally started, they will be extinguished immediately, if appropriate and safe to do so. • Hot works such as welding not to be undertaken on days of total fire ban or high winds. • Smokers appropriate disposal of cigarettes • Vehicles will be maintained.	• No fires started on site	• Regular inspections of working areas to ensure smokers are disposing of butts appropriately, and to ensure no hot works occur during total fire bans or high winds	• Review staff inductions and training • Review management actions	• Incident reporting records

11.12 Environmental Induction and Training

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• All site staff and contractors will be made aware of this MMP, any environmentally sensitive areas, any culturally significant areas, and their environmental responsibilities.	• No environmental incidents on site	• Regular inspections of working areas	• Review staff inductions and training • Review management actions	• Incident reporting records

11.13 Community Liaison

Management actions	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Members of the affected community will be notified of the proposed works prior to their commencement. • Complaints received will be recorded and attended to promptly. On receiving a complaint, works will be reviewed to determine whether issues relating to the complaint could be avoided or minimised, and works methods will be amended accordingly. • A register of complaints will be kept by the Company that records: • Date and time of complaint • Method by which complaint was made (i.e. telephone, letter, meeting, etc.) • Name, address, contact telephone number of complainant • Details of complaint • Action taken in response to the complaint, including follow up contract with the complainant • Any monitoring to confirm the complaint has been satisfactorily resolved • If no action was taken, the reason for no action being taken.	• No complaints received	• Regular inspections of working areas	• Review staff inductions and training • Review management actions	• Incident reporting records

12 CONTINGENCY PLANNING

12.1 Environmental Emergency Preparedness and Response

The Project Manager is the contact person for all emergencies and environmental incidents. All incidents which cause or have the potential to cause material or serious environmental harm will be reported to DITT as required under Section 29 of the MM Act.

The details of the designated contact persons for emergencies and environmental incidents are included in Table 12-1 below. This includes contacts for reporting environmental incidents (including non-urgent problems such as dust/noise), heritage and Aboriginal cultural heritage incidents, and contacts for provision of advice.

Table 12-1 Emergency contact details

Contact	Contact Details
Project Manager	Andy Harrington 0474 299 626 aharrington@tennantmining.com.au
DITT Mining Operations	Darwin Office 08 8999 6528 mineral.info@nt.gov.au
Aboriginal Areas Protection Authority (AAPA)	Alice Springs Office 08 8951 5023 enquiries.aapa@nt.gov.au
Central Land Council (CLC)	Alice Springs Office 08 8951 6211 Mining.Admin@clc.org.au
Heritage Branch (Department of Territory Families, Housing and Communities)	Darwin Office 08 8999 5039 heritage.branch@nt.gov.au
NT Police/Fire/Ambulance	000
NT Fire Rescue Service	08 8999 3473
Tennant Creek Fire Station	08 8962 0903
St John Ambulance Tennant Creek	08 8963 2800
Tennant Creek Hospital	08 8962 4399
Royal Flying Doctor Service	1300 669 569
NT EPA Pollution Hotline	1800 064 567 pollution@nt.gov.au

12.2 Spill Response Procedure

In the event of any spill, the following procedure is to be implemented:

- Locate the source of the spill, identify the volume and type of spill;
- Assess the risk to workers and the environment from the spill to ensure appropriate PPE and containment measures are implemented;
- Control and contain the spill by isolating and/or removing the source;
- Clean the spill using spill kit absorbent material if practical, or installing bunds;

- Collect all contaminated material and dispose of contaminated spill control material, and/or contaminated materials to an appropriately licenced waste facility; and
- Report significant spills, or spills that entered a waterway to DITT via a Notification of an Environmental Incident form.

Appropriately stocked spill containment equipment kits will be available in all works areas. All personnel on site will be trained in the use of spill kits.

12.3 Incident Reporting

A register of incidents will be maintained during operations which will include details about the incident, how it occurred, where and when it occurred, physical actions taken to rectify, remediate or rehabilitate, and operational actions to address the future management of incidents of this type.

In the event of a serious accident or incident the DITT Chief Executive Officer will be notified of the occurrence as soon as practicable as required by section 29 of the MM Act.

Where required, environmental accidents and incidents will be reported to DITT via a Notification of an Environmental Incident form as required under S29 of the MM Act. Any significant pollution events will also be reported to the NT EPA Pollution Hotline.

13 CLOSURE PLANNING

The Project proposes to recover ores from the existing Southern WRD, existing Northern Tailings and an expansion of the existing Nobles Nob Pit. The majority of the Project site has been previously cleared of native vegetation and topsoil removed prior to the commencement of historical mining and ore processing operations. With the exception of a 4 ha area proposed to be cleared for a solar field. The main aim for rehabilitation is to rehabilitate the site to a safe, stable and sustainable state upon completion of the Project.

Given the extensive history of disturbance of the site (as further outlined in Section 3.2.1), including a legacy of mine site issues such as waste left on site and potential leaching of tailings – rehabilitation will likely improve the overall habitat value of the site at the conclusion of the Project compared to its current state. Mining of the Northern tailings will remove the main existing source of potential leachate located on the Nobles Mob mining tenements. The staged dry stack tailings storage solution proposed will allow for progressive rehabilitation of the staged areas – and will rapidly form stable landforms, allowing for earlier rehabilitation compared to traditional tailings dams, and avoid delays in closure that can be caused waiting for tailings dams to stabilise.

13.1 Planned Closure Strategy

13.1.1 Expected Disturbance Areas

The Project site layout involves the following major infrastructure components:

- Nobles Nob Pit
- Southern WRD
- Northern Tailings
- Processing plant area (including fuel storage, power station, ROM pad)
- Sump, process water pond and raw water pond
- Dry stack tailings areas
- Northern WRD (section used for deposition of waste rock from the Nobles Nob Pit)
- Solar field
- Workshop/laydown area
- Office/ablutions area

As shown on Figure 1-4, the Project area is very compact and restricted, and other than the solar field, has previously been disturbed. The total disturbance area of the Project is approximately 58.86 ha.

13.1.2 Completion Criteria

Completion criteria are important to ensure that a clear definition of successful rehabilitation is established for each rehabilitation area.

The completion criteria for TCMG is to leave the Project site as a safe and structurally sound facility, that fits in with the surrounding environment. Closure and relinquishment of the site by TCMG will be based on the following activities having occurred:

- Removal of all remaining infrastructure;
- Ensuring that the dry stack landforms are structurally sound and rehabilitated appropriately;
- Groundwater monitoring around the dry stack landforms and the Nobles Nob pit indicates no new or ongoing contamination concerns;
- Rehabilitation of all drill pads and holes; and
- Rehabilitation of all disturbed areas.

Rehabilitation will be deemed successful when post rehabilitation monitoring has been undertaken and there is no evidence of any erosion issues, groundwater monitoring results show no new issues with the dry stack landforms or Nobles Nob pit, and the re-vegetated areas are showing successful growth with a similar percentage cover to that of the surrounding environment.

13.1.3 Post Mining Land Use

Upon closure TCMG will return the land to a safe and stable environment, available for the use of the landowners. The expected post-closure land use is for the continuation of the pre-mining land use, suitable for pastoral, tourist, or other mining or economic uses. The open pit will remain a legacy feature and will be left to prevent sterilisation of remaining ore. The open pit will be left in a safe and stable state with appropriate fencing for public safety. Post-closure land use will be guided by consultation with the landowners, being the Warumungu Aboriginal Trust. Initial discussions have been held with representatives of the Trust, facilitated through the CLC, and will continue as the Project progresses to help guide rehabilitation and closure objectives and activities, and the preferred post-closure land use.

13.1.4 Rehabilitation Implementation

All infrastructure will be removed at completion of mining activities within the Project area. Including the process plant, fuel storage and power station, wastewater treatment and potable water treatment facilities, workshop, office and any other buildings. Any remaining sections of the Southern WRD, Northern Tailings, ROM pad, and any other remaining ore or rock stockpiles, will be utilised around the TSF, returned to the pit or simply levelled and stabilised. Similarly, the process water dam and any other excavated or otherwise disturbed areas other than the pit will be levelled and stabilised appropriately.

All cleared and disturbed areas will be contoured to blend into the surrounding terrain, and to allow establishment of vegetation. All cleared and disturbed areas will be revegetated to be self-sustaining and provide good habitat value for native flora and fauna species, with similar percentage vegetation cover to that of the surrounding environment. All rehabilitation and closure works will be carried out in accordance with industry best practice including the up-to-date Australian Government guidelines for Leading Practice Sustainable Development Program for the Mining Industry – for Mine Rehabilitation and Closure.

Substrate and Topsoil

Within historically disturbed areas, there is no known topsoil stored from historical mining activities. Within areas of new disturbance, being the solar field, and any rehabilitated areas that have a newly built soil bank, topsoil will be removed following clearing works. This will be undertaken in as many disturbance areas as possible. This will provide topsoil for use in rehabilitation - and beneath the solar field, will also reduce issues with sprouting and vegetation control beneath the solar field during operations.

Any removed topsoil will be appropriately stockpiled on site for use in progressive rehabilitation. Stockpiled topsoil will be prioritised for use in the earliest stages of rehabilitation possible to minimise storage time and maximise the viability of stored seed to improve rehabilitation outcomes. The earliest stages of rehabilitation will be the completion of each stage of dry stack tailings – the stockpiled topsoil will be used for these areas if the habitat conditions are suitable to the vegetation type.

Within areas where no stored topsoil is available for use, existing waste rock material will be used for capping and surface substrate. Waste rock material is deemed appropriate as a substrate for revegetation of local vegetation types, as they tend to be hardy flora such as *Triodia* species adapted to rocky soil conditions.

Ripping and Seeding

All areas to be rehabilitated will be ripped to a depth of 300 mm to create habitable micro-environments for seeds, and improved germination rates. Following ripping of the substrate, areas to be rehabilitated will then be seeded. Seed collection from the surrounding environment will be undertaken during the appropriate seasonal conditions prior to planned rehabilitation, to ensure that the seeds used for rehabilitation are representative of the local vegetation species and genotypes. Collected seeds will be stored in climate-controlled conditions appropriate to retain seed viability. Seed mixes will be made up for each rehabilitation area that are representative of the surrounding vegetation complexes and appropriate for the habitat conditions of the area to be rehabilitated.

Tailings

Dry stack tailings will be used as an environmentally stable and clean tailings solution. Tailings will be dried prior to disposal, and compacted as they are stacked, to reduce permeability and create a stable landform. This will significantly reduce the time taken to establish a stable landform compared to traditional tailings dams. As each staged area reaches completion, they will be included within progressive rehabilitation.

Dry stack landforms will be rehabilitated by covering with capping material and any suitable topsoil stockpiled on site, ripping and seeding as outlined above. The final height and contour of the dry stack landforms will be designed to blend in with the surrounding topography. The final slope and compaction will be designed to ensure dry stack landforms are safe and stable at completion. Further details are included within the Nobles Nob Groundwater Impact Assessment included in Appendix L, and detailed engineering designs of the dry stack tailings areas are currently being developed by TCMG.

Nobles Nob Pit

The expansion of the Nobles Nob pit will be designed to ensure that it is safe and stable for operation during works, and that it is left in a safe and stable state at completion. If safe to do so, a pit ramp will be maintained to allow safe access into the pit for water sampling. Appropriate fencing and signage will be erected around the pit to ensure public and landowner safety.

Northern WRD

Any new waste rock produced will be placed on the existing Northern WRD so as to create a stable landform, and blend in to the existing WRD. [redacted] The existing WRD is stabilised with no evidence of erosion [redacted] – it will be ensured that this continues to be the case during and at completion of Project works.

Drill Pads

Most drill pads and holes will be subsumed by subsequent mining activities. Where this is not the case, all drill pads and holes will be rehabilitated including capping, ripping and seeding as required.

Solar Field

Initial discussions with Territory Generation, the Power and Water Corporation, Traditional Owners and other local stakeholders have occurred relating to the potential future retention and operation of the solar field. If an understanding is reached and it is the preference of the landowners, TCMG is willing to consider options for retention of the solar field on site, and transference of ownership to the interested party. This could add to the value of end land use, contribute to Tennant Creek's renewable energy production through grid connection, and achievement of Australian and Northern Territory Government renewable energy targets. If this is the preferred option of landowners, the appropriate approvals will be sought at that point in time. If the solar field is not retained for use on site at the time that TCMG reaches closure, TCMG will decommission and remove all equipment and rehabilitate this area including ripping and seeding.

13.2 Unplanned Closure Strategy

If for some reason the site was to go into an unplanned closure, operations will cease and all equipment and infrastructure will be removed from site.

In the event the site is placed in care and maintenance, environmental monitoring of surface and groundwater will continue to take place, as will the routine inspections of erosion and sediment controls. The site will be inspected monthly to ensure that there are no risks of ongoing environmental harm. Should the site be nominated for closure, the planned closure strategy will be implemented.

If an unforeseen closure occurs TCMG will notify DITT of the closure before any action is taken. When notifying DITT, the following information will be provided:

- The reason for the closure or suspension;
- The current status of operations and all landforms within the Project;
- The closure activities to be undertaken and the status of those activities; and
- Progress on development of the relevant plans.

13.3 Rehabilitation Monitoring

Rehabilitation monitoring will focus on erosion, groundwater monitoring and the structural stability of the dry stack landforms, Nobles Nob pit and other extraction areas, and the waste rock dump.

Visual inspections of rehabilitation areas will take place six months after rehabilitation has taken place, as well as after the first large rainfall event following rehabilitation and closure of the Project.

Before site disturbance and after rehabilitation photographs will be taken and included as appendices in the MMP each year to demonstrate that rehabilitation activities have been carried out. Photographs will:

- be labelled with location identification name/number;
- include the date when the photograph was taken;
- be taken from the same point and be consistent in orientation (i.e., from the north east corner of the drill pas facing south west); and
- include an identifying feature or reference point for comparison (i.e., a tree in the foreground or a hill in the background).

13.3.1 Previous Rehabilitation Prior to TCMG

Some rehabilitation of the Project area has been undertaken by previous holders of the tenements such as the removal of old buildings, rehabilitation of drill holes and surface disturbance areas. Previous disturbance and the rehabilitation status of historical mine activities are outlined in Table 13-1. TCMG assume responsibility for the management and rehabilitation of the Nobles Nob mining tenements it holds.

Table 13-1 Previous Disturbance and Rehabilitation Status of Historical Mine Activities

Site	Disturbance	Rehabilitation Status	Further Rehabilitation Activities Required
Juno	Buildings	Buildings dismantled and removed from site	Concrete foundations to be removed or buried
	Headframe	Headframe removed from site.	Headframe concrete footings remain and are to be removed or buried
	Surface disturbance	Rehabilitation has been conducted	Monitor regrowth, seeding and weed management if required
Nobles Nob	Open pit	No rehabilitation conducted	Maintain fence and bunding around the open pit
	Tailings dams	Rehabilitation has been conducted	Monitor regrowth, seeding and weed management if required
	Surface disturbance	Ripping and rehabilitation of some areas has been conducted	Monitor regrowth, seeding and weed management if required
			Finalise rehabilitation of drill pads, collars, sumps and tracks

13.3.2 Rehabilitation Register

A Rehabilitation Register summarising the rehabilitation status of all disturbances will be provided as an appendix in each MMP amendment and annual Environmental Mining Report. This is the first MMP amendment for TCMG for this Project. No mining activities have been undertaken to date, and no rehabilitation has been completed. Exploration activities have been undertaken to date, as outlined in Section 7.2 of this MMP. These drill holes have been capped and made safe. The drill pads have not yet been rehabilitated as further drilling is planned in 2023, and mining activities are proposed over much of the drill pad areas.

13.4 Costing of Closure

Section 43A of the MM 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 the Government to ensure it remains consistent with the level of disturbance caused by the Project at any specific time.

Appendix Q details the security calculation for the Project.

13.4.1 Background for Costing of Closure Activities

Table 13-2 presents the disturbance area inventory for the Project. The total disturbed operational area is estimated to be 58.86 ha. Note there is overlap between the disturbance area of Mining area # 1 (Southern WRD) and Dry stack tailings Stage #2 – and overlap between Mining area #2 (Northern Tailings) and Dry stack tailings Stage #3. The smaller areas in each case have therefore not been included within the total disturbance area calculation.

Table 13-2 Disturbance area inventory

Disturbance Area Inventory	
Whole of site summary	**Total Area (ha)**
Lease surface area (total)	355
Lease surface area (Noble Nob)	253
Lease surface area (Juno)	102
Disturbed operational area	58.86
Above grade landforms	**Total Area (ha)**
Dry stack tailings Stage #1	5.4
Dry stack tailings Stage #2	8.4 (not included in the total disturbance area calculation, as located within the larger Mining Area #1)
Dry stack tailings Stage #3	11.4
Mining area #1 (existing Southern WRD)	8.9
Mining area #2 (existing Northern Tailings)	5.5 (not included in the total disturbance area calculation, as located within the larger Dry stack tailings Stage #3)
Mining area #3 (Nobles Nob pit expansion)	5.6

Disturbance Area Inventory	
Waste rock dump (Northern WRD - from Nobles Nob pit expansion)	11
Haul roads	N/A
Access roads (Nobles Nob)	2.5
Access roads (Juno)	1.3
Water ponds/dams/drains	0.6
Area of infrastructure (total)	8.16
Process Plant Area	0.95
Crushing Plant Area	0.45
Mining Infrastructure Area	4.5
Water extraction	0.3
Other (water pipeline)	1.96
Solar field	4

13.4.2 Security Estimate

The DITT Security Calculation Tool has been used to determine the security calculation for the Project. Security calculations have been based on the total disturbance footprint for the Project as outlined in Table 13-2 above. The security calculation determined the total security required is [redacted]. The calculation spreadsheets along with any assumptions are provided in Appendix Q and is summarised in Table 13-3 below.

Table 13-3 Summary of security calculation

Security Calculation	
Domains	**Calculated Cost**
1: Site Infrastructure	[redacted]
2: Extractive Workings - Sand, Clay and Gravel	[redacted]
3: Hard Rock Pits and Quarries	[redacted]
4: Underground Workings	[redacted]
5: Tailings Storage Facilities and Dams	[redacted]
6: Stockpiles and Waste Rock Dumps	[redacted]
7: Exploration	[redacted]
8: Access and Haul Roads	[redacted]
9: River Diversions	[redacted]
Decommissioning and Post Closure Management	[redacted]
Sub-Total - All Domains	[redacted]
CONTINGENCY @ 15%	[redacted]
TOTAL COST	[redacted]

10% Discount	[redacted]
Amended amount	[redacted]
1% levy	[redacted]

It is proposed for the security amount to be paid in 8 stages, according to the sequencing of planned stages of site works. With the amount for each stage paid in advance of that stage of works commencing, to account for any planned disturbance in advance. Site works will not commence until the security bond amount for that stage has been paid. The amounts included in each stage of works are outlined in Table 13-4 below. See Appendix Q for further details.

Table 13-4 Staged security deposit according to site disturbance

Stage of planned works	Domain	Management area	Description	Amount	Total Amount for Stage	With contingency	With discount
1: Exploration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2: Earthworks	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Initial earthworks to clear and level, preparation of ground	[redacted]	[redacted]	[redacted]	[redacted]			
	[redacted]	[redacted]	[redacted]	[redacted]			
3: Construction	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Construction of plant, infrastructure and dams, solar array	[redacted]	[redacted]	[redacted]	[redacted]			
4: Operations	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Plant operations, TSF stage 1	[redacted]	[redacted]	[redacted]	[redacted]			
5: Solar array	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
6: Nobles Nob pit expansion	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Pit works, waste rock dump	[redacted]	[redacted]	[redacted]	[redacted]			
7: TSF Stage 2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8: TSF Stage 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
				Total	[redacted]	[redacted]	[redacted]

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APPENDIX A TENNANT GOLD JUNO AGREEMENT

Department of Environment, Parks
and Water Security
4th Floor Goyder Building
25 Chung Wah Terrace
Palmerston NT 0830

Dear Sir/Madam,

RE: Ground water extraction licence Juno mine site tenements MCC284; MLC154; MLC155; MLC45; MLC46; MLC47; MLC578; MLC579; MLC652; and MLC68.

As the tenement holder of the Juno mine site tenements, Tennant Gold Pty Ltd gives full permission to Tennant Consolidated Mining Group (TCMG) to access and perform all activities required on the tenements listed above, other than active mining.

This is as per the existing option agreement between Tennant Gold and TCMG.

Yours Sincerely,

Alex Bajada
Director

Nomination of an operator of a mine site

This form is to be completed by a Title Holder appointing an Operator in accordance with section 10 of the *Mining Management Act 2001.*

Title Holder			
Title Holders Name	Tennant Gold Pty Ltd		
ACN	108 557 339	**ABN**	
Postal Address	PO Box 1779, West Perth WA		
Contact Person	Alex Bajada		
Phone (business) Include area code	(08) 9429 2900	**Phone (mobile)**	041 . 990 9999.
Email	abajada@cabbel.co		
Mining Interest/s (i.e. Title numbers)	MLC's 45, 46, 47, 68, 154, 155, 578, 579, 652 & MCC284		
Operator			
Name of Operator Use ASIC-ABR registered name if a company	Tennant Consolidated Mining Group Pty Ltd	**ACN/ABN**	645 263 547

Confirmation of Title Holders Nomination of Operator			
We, the authorised officers of the Title Holder confirm the Title Holder has, by written agreement(s) with the Operator • Appointed the Operator in accordance with section 10 of the Mining Management Act; and • Conferred on the Operator the right of the Title Holder to take and use water in accordance with section 81 of the Mineral Titles Act.			
Title Holder Signature /Director Signature	[signature]		
Name (please print)	Alex Bajada - Director	**Date**	02/03/2022
Director / Company Secretary Signature	[signature]		
Name (please print)	Roland Berzins – Company Sectary	**Date**	02/03/2022

NORTHERN TERRITORY GOVERNMENT

Confirmation of Operators Acceptance of Appointment

We, the authorised officers of the Operator, confirm the Operator has:

- Accepted the appointment and complied with section 10 of *Mining Management Act 2001*; and
- Accepted the Title Holders rights to take and use water pursuant to section 81 of the *Mineral Titles Act* and in accordance with the *Mining Management Act 2001* accepts responsibility for meeting the environmental obligations.

Operators Signature / Director Signature	
Name (please print)	Peter Main
Director / Company Secretary Signature	
Name (please print)	Marty Costello
Date	2/3/2022

Email your completed form to mineralinfo.ITT@nt.gov.au

APPENDIX B GROUNDWATER ASSESSMENT REPORT NOBLES NOB MINE

umwelt
Environmental & Social Consultants

GROUNDWATER ASSESSMENT REPORT

Nobles Nob Mine

FINAL

December 2021

GROUNDWATER ASSESSMENT REPORT

Nobles Nob Mine

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tennant Consolidated Mining Group

Project Director:	Claire Stephenson
Project Manager:	Ashish Mishra
Technical Director:	Claire Stephenson
Technical Manager:	Ashish Mishra
Report No.	21728 R02
Date:	December 2021

Environmental & Social Consultants

Document Status

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	Name	Date	Name	Date
Final	Claire Stephenson	30/11/2021	Claire Stephenson	01/11/2021
Final-V2	Claire Stephenson	13/12/2021	Claire Stephenson	13/12/2021

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1.0 Introduction

Tennant Creek Project is a mining interest owned by Tennant Consolidated Mining Group (TCMG). The Tennant Creek Project includes the historical Nobles Nob Gold Mine in Northern Territory, located approximately 13 kilometres (km) southeast of Tennant Creek township. Gold was initially extracted at Nobles Nob from underground operations commencing in the early 1930's and then via open-cut methods from the 1960's. Open-cut mining at Nobles Nob concluded in 1985, although gold production continued until 1992.

TCMG are proposing to recommence operations at Nobles Nob. To obtain approvals, TCMG is required to submit a Mining Management Plan (MMP) under the NT *Mining Management Act 2005*. The primary purpose of the MMP is to formalise the actions to be taken and strategies to be implemented to manage potential impacts to the environment, including groundwater.

Umwelt Australia Pty Ltd (Umwelt) were engaged by TCMG to prepare a groundwater assessment to support the MMP. This report presents the hydrogeological understanding of the Nobles Nob Mine based on available information, and outlines potential impacts that may occur to groundwater as a result of the proposed mining activities and proposed management and mitigation measures.

1.1 Data Availability

The groundwater assessment was conducted based on available site data and additional field data collected for the purpose of the study.

The available information for the site included the following:

- Site geological mapping and model
- Baseline Fauna Survey Final Report (Excalibur, 2010)
- Process Description Report (COMO, 2021)
- Geological logs of the groundwater bores

The additional site work and field data collection conducted for the site included:

- Waste rock sampling and analysis – TCMG collected 26 samples, which included 25 samples from existing waste rock material and one sample from historical run-of-mine pad material. The samples were submitted to SGS laboratory for analysis. Umwelt conducted a review of the laboratory results to characterise the geochemical properties of the waste and host rock material and potential for acid rock drainage. The analysis report and laboratory results are presented in **Appendix A**.
- Bore installation – Installation of 10 groundwater monitoring bores across the site in May/June 2021 by May Drilling and overseen by TCMG, informed by a bore design plan prepared by AGE Consultants. Bore installation details are included in **Appendix B**.
- Bore development and water quality sampling – Airlifting and development of the newly installed groundwater monitoring network conducted by TCMG in early October 2021. Groundwater quality samples were collected from the developed bores by Umwelt on 12 and 13 October 2021, with field parameters recorded and samples submitted to SGS for laboratory analysis. Water quality results are summarised in **Appendix C**, along with the complete laboratory reports.

- Hydraulic testing – slug testing conducted by Umwelt for the recently installed monitoring bores. This included rising and falling head tests, undertaken in October 2021. Results were analysed using Waterloo HGA Plus (AquiferTest v10.0) software to estimate horizontal hydraulic conductivity for the target geology at each bore. The report and analysis results are presented in **Appendix D**.

All available data was reviewed and utilised to inform this assessment of potential groundwater impacts.

1.2 Site Details

1.2.1 Location and Land Use

The Nobles Nob Mine is located within the Tennant Creek Goldfield, approximately 13 km southeast of Tennant Creek in Northern Territory, Australia. Tennant Creek is approximately 504 km north of Alice Springs and 978 km south of Darwin (**Figure 1.1**).

Due to the history of mining and grazing within the area, the vegetation within the Nobles Nob tenements is disturbed (Tennant Gold Resource, 2018). The majority of the area around the Nobles Nob open-cut mine is moderately disturbed and significantly impacted by previous mining activities (Tennant Gold Resource, 2018). As the site is not located in any agricultural station, the land use after the closure of the mine is expected to be suitable for grazing and other pre-mining uses, with the open-pit left in a safe state (Tennant Gold Resource, 2018).

1.2.2 Previous Mining Activities

Gold mining at Nobles Nob commenced in the 1930's, with several small underground gold mines operated in the area. These small operations included Rising Sun, Shaft 12, Kimberly Kids, and Weaber's Find (Tennant Gold Resource, 2018). In 1934, the first shaft was sunk to the depth of 50 feet (~15 meters) to start large-scale mining. In 1968, following the collapse of the crown pillar, the mine was modified into an open pit with a new mill on site, with site site in operation until September 1992. Over this time, 2,140,000 tonnes of ore were processed at Nobles Nob, producing approximately 1,169,775 ounces of gold.

1.3 Proposed Activities

The Project includes excavation of existing waste rock from the Mineralised Waste Rock Dump (refer to **Figure 1.1**) for reprocessing. The historical tailings dams (refer **Figure 1.1**) may also be utilised for reprocessing. No new mining/extraction of ore at Nobles Nob Pit or underground is proposed as part of the current Project activities reviewed as part of this assessment.

The excavated waste rock material and tailings will then be reprocessed within the Proposed Processing Area (refer **Figure 1.1**). The design and layout of the Proposed Processing Area is being finalised by ATC Williams but is understood to comprise:

- Processing Plant - designed based on an estimated throughput of 0.7 million tonnes per annum (COMO, 2021). The processing will include crushing and milling of the ore before processing and discharge of tailings.

- Tailings Storage Area – tailings slurry from the processing plant will be pumped to a tailings storage area, where it will be filtered using Geotube dewatering tubes. These Geotubes will retain the solid particles, while allowing the liquid to discharge (COMO, 2021). The discharged liquid will be captured by a recovery pump located at the base of the Geotube stacking area.

- Process Water Ponds - the recovery pump will return the discharged water to the process water ponds for re-use (COMO, 2021).

The operations at Nobles Nob will be supplied with raw water from Juno mine, located approximately 4 km northwest. The raw water will be used to top up the process water and for dust suppression and wash down purposes across the Nobles Nob site (COMO, 2021).

1.4 Relevant Legislation

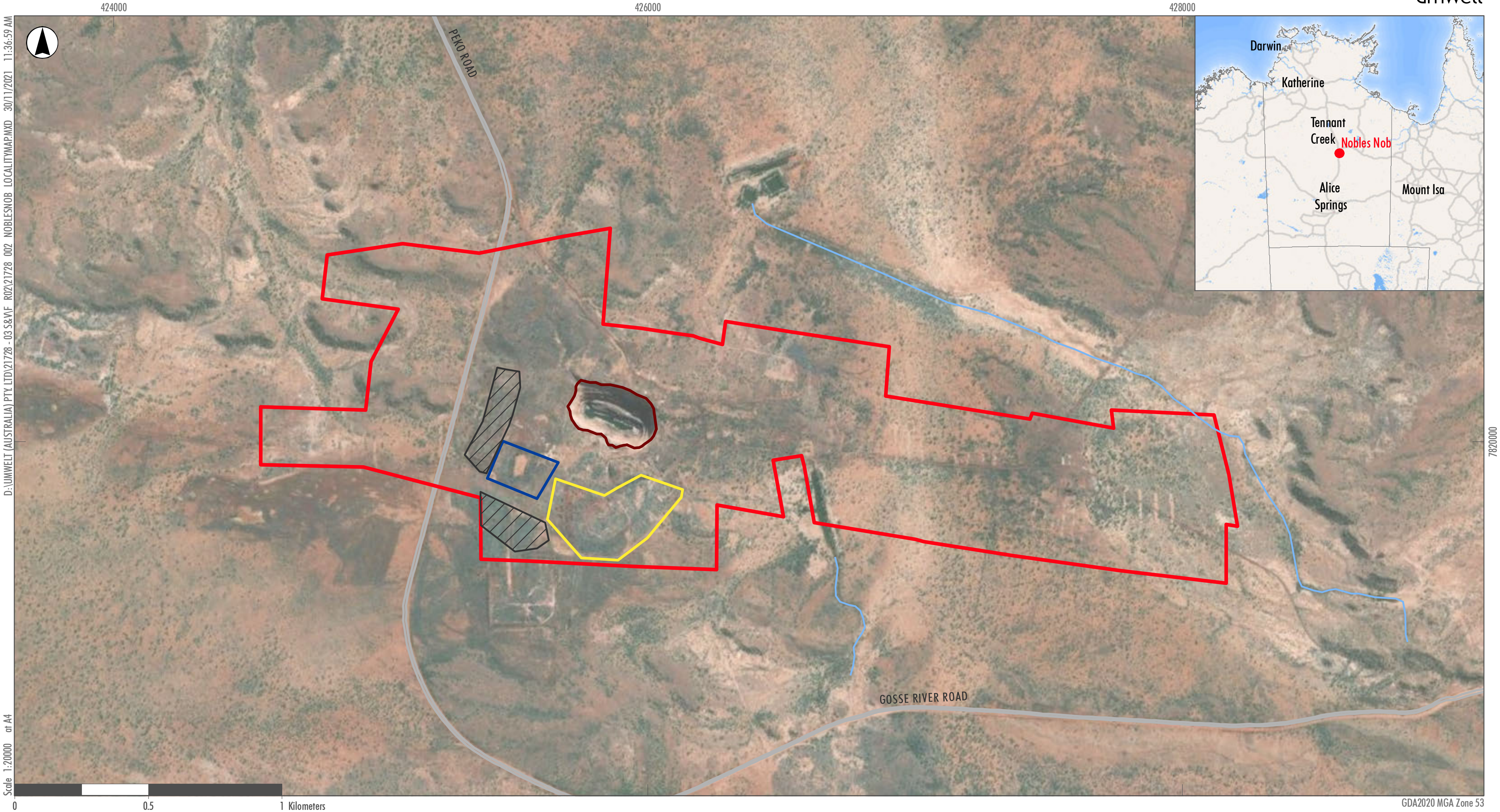
Exploration and mining operations in NT must be authorised under the *Mining Management Act 2001* (MMA). Under the MMA, a Mining Management Plan (MMP) must be submitted to the Department of Tourism, Industry and Trade (DITT) for authorisation. This groundwater assessment has been prepared to support the MMP for Nobles Nob proposed activities as specified in **Section 1.3**.

Environmental Protection Act 2019 (NT) (EP Act) came into force as of 29 June 2020 and aims to protect the environment of the Territory, promote ecologically sustainable development by establishing a framework for assessing potential environmental impacts of development projects. As outlined in Part 4 of the EP Act, an environmental impact assessment is required where a proposed action has the potential to have a significant impact on the environment or meets referral criteria. It is understood the Project has not been referred. However, findings from this preliminary assessment may be used in future to inform a referral process.

The *Waste Management and Pollution Control Act 1998* (NT) provides for the protection of the environment through the encouragement of effective waste management, pollution prevention and control practices. An Environmental Protection approvals and licenses are issued by the NT Environmental Protection Agency (EPA). It is understood that the proposed activities may relate to activities that require an environmental protection approval under Part 1, Schedule 2 of the *Waste Management and Pollution Control Act 1998.*

The Water Act provides the legislative framework for water planning and entitlements for most water resources in the NT. The Water Act also provides for the investigation, allocation, use, control, protection, management and administration of surface water and groundwater resources. The Nobles Nob tenement is within the Tennant Creek Water Control District, which is a designated water management area under the *Water Act 1992*. As a water control district, a license is required to extract or intercept surface water or groundwater water. There is currently no water allocation plan in place for the Tennant Creek Water Control District.

Environment Protection and Biodiversity Conversation Act 1999 (Cth) (EPBC Act) provides a framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and other matters, defined in the EPBC Act as matters of national environmental significance (MNES). It is understood that there are no MNES identified in the vicinity of the Project area.



Legend

- Extent of Mine
- Historical Mineralised Waste Rock Dump
- Nobles Nob Pit Area
- Proposed Processing Area
- Historical Tailings to be Mined
- Roads
- Watercourse

FIGURE 1.1

Site Layout and Proposed Activities

Image Source: ESRI Basemap (2021) Data source: Department of ENvironment, Parks and Water Security (2020)

2.0 Site Characteristics

2.1 Climate

The area is characterised by a hot arid climate, with evapotranspiration exceeding rainfall throughout the year. The mean monthly temperature data was retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), presented in **Table 2.1**. Mean monthly maximum temperature ranges from 24.6°C during the winter (June) to 37.2°C in the summer (December). The maximum temperature recorded at this station was 45.6°C in January 2014, with a minimum of 8°C recorded during June 2007 (BoM, 2021).

Table 2.1 Mean Monthly Temperature 1969 to 2021

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (˚C)	36.8	35.9	34.6	31.9	27.7	24.6	24.8	27.6	31.8	35	36.7	37.2
Mean minimum temperature (˚C)	25	24.5	23.4	20.5	16.4	13	12.4	14.4	18.5	21.8	23.9	24.9

Mean has been calculated using monthly data from 1969 to 2021

Rainfall data has been retrieved from the publicly available Scientific Information for Landowners (SILO) database. The monthly average rainfall and evapotranspiration data has been retrieved from the nearest SILO station Tennant Creek Airport (Latitude -19.64, Longitude 134.18), from 01/01/1900 to 01/10/2021.

The SILO database generally provides a complete long-term dataset and is therefore helpful in assessing long term rainfall trends in the vicinity of the site. This dataset is interpolated from quality checked observational time-series data collected at nearby stations by the Bureau of Meteorology. Based on the SILO dataset, the average annual rainfall is 383 mm, with evaporation exceeding rainfall during each month of the year (**Table 2.2** and **Figure 2.1**).

Table 2.2 Monthly Average of Rainfall and Evapotranspiration at Tennant Creek Airport

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SILO Rainfall	96.74	91.08	50.18	11.81	10.36	6.56	5.03	2.00	5.36	14.95	30.23	58.14	382.45
SILO ET	350.17	291.84	321.21	287.54	232.83	186.81	198.92	250.05	307.12	358.69	371.79	371.63	3528.60
SILO fao56 ET	213.65	182.77	191.34	167.69	138.37	115.27	126.32	156.08	185.14	215.50	220.75	224.11	2136.98

Note: ET – Evapotranspiration. All values are in mm.

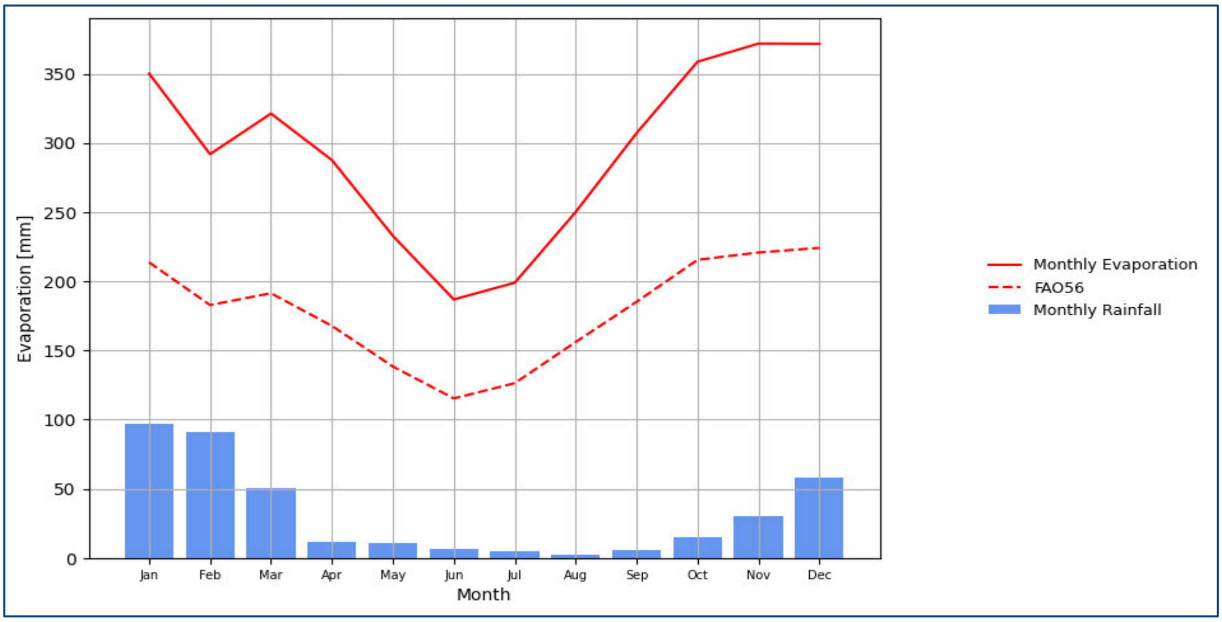


Figure 2.1 Graph Showing Monthly Average rainfall and Evaporation

The SILO dataset was used to calculate the cumulative rainfall deviation (CRD). The CRD is a summation of the monthly departure of rainfall from the long-term average monthly rainfall. A rising trend in slope in the CRD plot indicates periods of above-average rainfall, whilst a declining slope indicates periods when rainfall is below average.

The CRD in **Figure 2.2** has been calculated based on the long-term average monthly rainfall from 1900 to 2021. The CRD indicates that the area has experienced a period of generally above-average rainfall from 2000 to 2016, and generally below-average rainfall since 2016. There exists a strong seasonality in rainfall, with the majority of rainfall occurring over the wet season, between November and March.

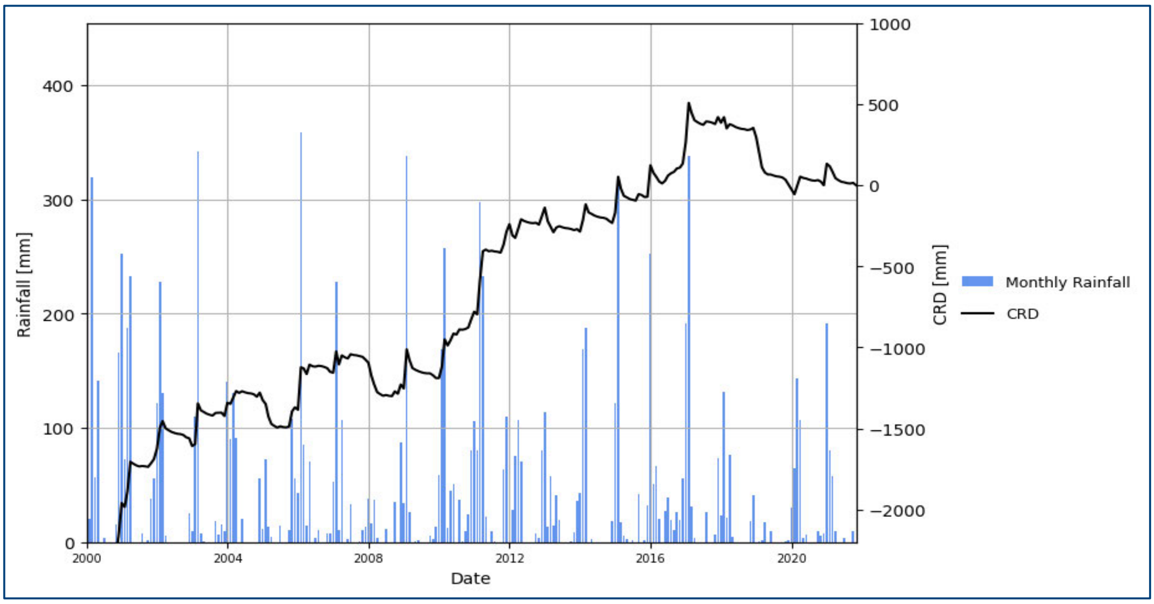


Figure 2.2 Monthly Rainfall (2000-2021) and CRD

2.2 Topography and Drainage

Land surface elevation, informed from LiDAR data, shows that the area around Nobles Nob comprises plains, rises, and low hills, which are associated with the McDougall Ranges. Elevation throughout the site ranges from approximately 295 mAHD to 380 mAHD. The rest of the region towards the west of Nobles Nob appears to be dominated by level to undulating plains, associated mainly with dune fields and sand plains of the Tanami Desert (**Figure 2.3**).

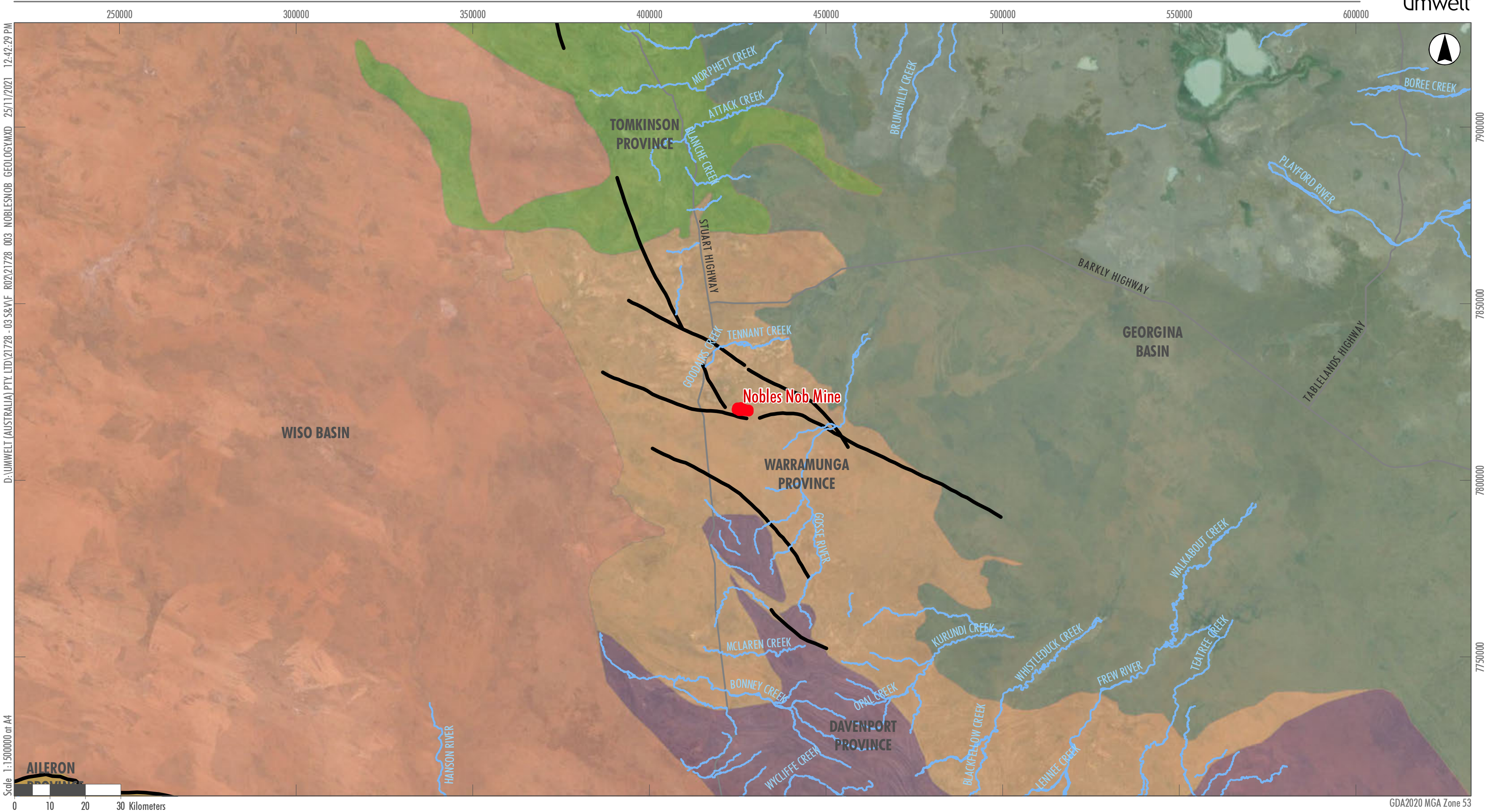
Several watercourses and surface drainages are mapped in the area (**Figure 2.3**); however, these watercourse and drainages are poorly defined. There is no natural permanent surface water around Nobles Nob (Tennant Gold Resource, 2018). Some surface drainage occurs briefly during the wet season.

2.3 Geology

The Tennant Creek region is within the Proterozoic Tennant Creek Inlier and is comprised of orogenic rocks of the Warramunga, Tomkinson, and Davenport provinces (McPherson et al., 2020; Ahmad & Dunster, 2013). The Wiso Basin is located to the west of the Warramunga Province, whereas the Georgina basin is located to the east (**Figure 2.3**).

The rocks of the Warramunga Province are divided into the Warramunga Formation, and the correlative Junalki Formation and Woodenjerrie Beds. The lithological units in the Warramunga Formation are tuffaceous/volcanilithic sandstone metagreywacke and siltstone, along with banded argillaceous ironstone (haematite shale), slate, and minor schist (Donellan , 2013). The Warramunga Formation commonly strikes east-west with variable dip (McPherson et al., 2020; Ahmad & Dunster, 2013). These rocks have been intruded by various granites and deformed by the Tennant Event of 1850 millions years ago (Ma) (ADL, 1970).

Gold-copper-bismuth mineralisation in the area has been found to be hosted by fine-grained haematitic mudstones and shaley siltstones. The Nobles Nob ore body lies within the Warramunga Group, comprising sediments, volcanic lavas and volcaniclastic sediments. The mineralisation at Tennant Creek is generally small but of high grade and is hosted by fine-grained haematitic mudstones and shaley siltstones (Excalibur 2012). The mineralisation occurs within lenticular, ellipsoidal or pipelike bodies rich in magnetite and/or hematite. These are replacement bodies that cut across sedimentary structures and have been referred to as "ironstones". These zones of rich gold mineralisation are characterised by strong magnetite alteration below the base of oxidation. Above the base of oxidation, the magnetite is chemically weathered to haematite. Gold is generally very fine-grained in fresh deposits but very coarse and nuggety in the oxidised deposits (Excalibur 2012).



Legend

- Faults
- Roads
- Watercourse

Geological Regions

- Aileron Province
- Davenport Province
- Georgina Basin
- Tomkinson Province
- Warramunga Province
- Wiso Basin

FIGURE 2.3

Site Geology

Image Source: ESRI Basemap (2021) Data source: NTGS (2018)

2.4 Hydrogeological Understanding

2.4.1 Previous Investigations and Available Data

Publicly available reports indicated several groundwater investigations were carried out in the 1970s and 1980s to understand the water supply for Tennant Creek township (Rockwater, 1989; Rose, 1973; Rose & Willis, 1973; Verhoeven, 1976; Verhoeven & Knott, 1980). A hydrogeological investigation by McPherson et al. (2020) was also undertaken in the Tennant Creek region as part of the Exploring for The Future (EFTF) program, focused on understanding groundwater resources across Australia. However, this study focused on the borefields (Cabbage Gum and Kelly Well) that supplies water to Tennant Creek town and did not include data from Nobles Nob area. The Cabbage Gum and Kelly Well bore fields are located approximately 25 kilometres south of Tennant Creek.

The publicly available reports provided indicative information on the hydrogeology of the region. However, no records of any previous groundwater supply studies or impact assessments for Nobles Nob were available as part of this assessment.

2.4.2 Groundwater Monitoring

TCMG installed 10 monitoring bores in May/June 2021 to monitor the water quality of groundwater at Nobles Nob. The details of the bores are presented in **Table 2.3**, and locations are shown in **Figure 2.4**.

A review of registered bores within 2.5 km of the Nobles Nob pit was also undertaken using the NR Maps desktop tool (https://nrmaps.nt.gov.au/nrmaps.html). Details of the registered bores are also presented in **Table 2.3.** The review of registered bores identified 16 registered bores within 2.5 km of Nobles Nob. Of these 16 bores, two are historical angular exploration holes (RN007139 and RN007140), three are historical Stope holes (RN003774, RN003775, and RN003776). The remaining bores are noted as being installed as historical mine water production bores; however, most note that no water was encountered. As per the NR Maps, none of the 16 registered bores are noted as potentially being used for stock water supply.

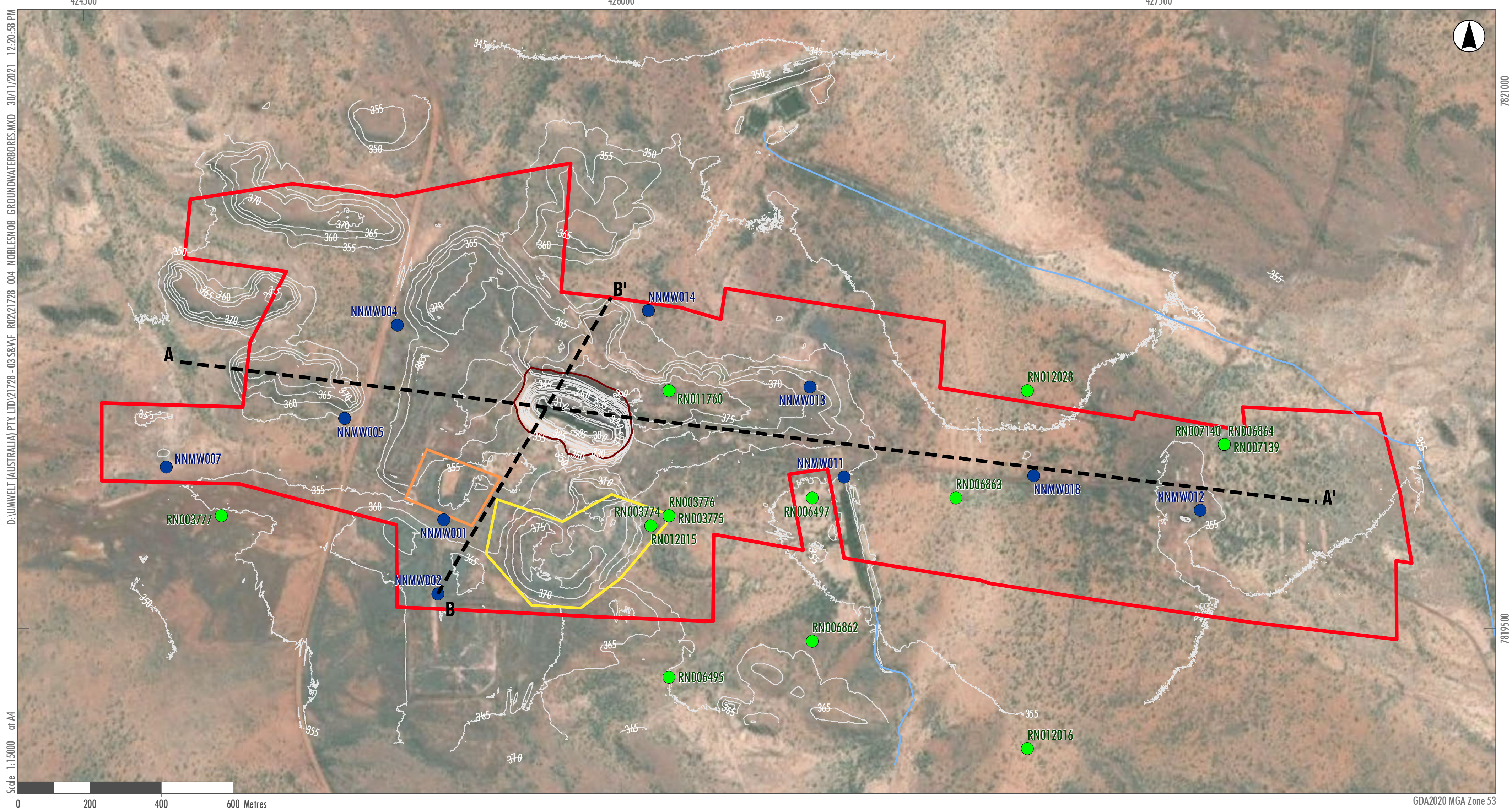
Table 2.3 Groundwater Monitoring Bores and Registered Bores at Nobles Nob

Bore ID	Date completed	Easting*	Northing*	Depth	Screen Interval	Water Bearing Unit	Yield (L/s)	Depth of water Strike (m)
Monitoring Bores								
NNMW001	6/06/2021	425505	7819803	102	90 - 102	Sandstone	0.01	90 (also at 76m, 0.001 L/s yield)
NNMW002	9/6/2021	425488	7819596	77.9	65.9 - 77.9	Sandstone	0.05	72
NNMW004	4/6/2021	425374.9	7820346	75	63 - 75	Sandstone	0.11	69.4 (damp at 63m)
NNMW005	3/6/2021	425228.6	7820086	70	58 - 70	Sandstone	0.53	62.6
NNMW007	2/6/2021	424730.8	7819950	95.8	83.8 - 95.8	Sandstone	0.13	90 (also at 18m with 0.001 L/s and at 66m with 0.0001 L/s yield)
NNMW011	29/5/2021	426621.8	7819922	66	54 - 66	Sandstone	1	59
NNMW012	31/5/2021	427616.9	7819830	76.6	64.4 - 76.4	Sandstone	0.2	68
NNMW013	7/6/2021	426527.3	7820174	78	66 - 78	Sandstone/ Siltstone	0.2	72
NNMW014	30/5/2021	426075.9	7820387	69.6	57.6 - 69.6	Hematite Shale	0.2	63.6

Bore ID	Date completed	Easting*	Northing*	Depth	Screen Interval	Water Bearing Unit	Yield (L/s)	Depth of water Strike (m)
NNMW018	1/6/2021	427151.5	7819926	78	66 - 78	Sandstone	1.9	70
Registered Bores within 2.5 km								
RN006863	26/11/69	426927	7819869	100.6	NA	Slate	1	74.06
RN006864	28/11/69	427677	7820019	152.4	NA	Siltstone	0.1	74.37
RN007139	11/5/70	427677	7820019	131.1	NA	No Water Encountered	0	-
RN007140	19/5/70	427677	7820019	112.8	NA	No Water Encountered	0	-
RN006496	5/5/69	424127	7819169	91.4	NA	No Water Encountered	0	-
RN006862	24/11/69	426527	7819469	123.4	NA	Siltstone	0.9	80.77
RN006495	6/5/69	426127	7819369	99.1	NA	No Water Encountered	0	-
RN003777	11/6/63	424877	7819819	112.8	NA	Greywacke (sandstone)	0.5	73.15
RN012016#	6/10/78	427127	7819169	106.8	NA	Greywacke (sandstone)	0.1	85.7
RN003776†	14/05/63	426127	7819819	32	NA	No Water Encountered	0	-
RN012015#	5/02/90	426076	7819792	97.6	NA	Siltstone	2	75.7
RN003775†	16/6/63	426127	7819819	25.9	NA	No Water Encountered	0	-
RN006497	7/5/69	426527	7819869	100.6	NA	Siltstone	1	60.96
RN011760#	18/11/77	426127	7820169	110	NA	Siltstone	3.2	72
RN003774†	10/3/63	426127	7819819	23.2	NA	No Water Encountered	0	-
RN012028#	25/11/78	427127	7820169	91	NA	Siltstone	2	82 (also at 76

*Coordinates in GDA2020 MGA Zone 53.

abandoned/backfilled. † Stope holes located at the same location. NA- Not Available



Legend

- Extent of Mine
- Historical Mineralised Waste Rock Dump
- Nobles Nob Pit Area
- Proposed Processing Area
- Monitoring Bore
- Registered Bore
- Cross Section
- Contours

FIGURE 2.4

Groundwater Bores at Nobles Nob

Image Source: ESRI Basemap (2021) Data source: NTGS (2018)

2.4.3 Hydrogeological Units

Based on the analysis of aquifer yields, bore logs and lithology, the following hydrogeological units have been identified at Nobles Nob:

- Shallow weathered horizon
- Deep fractured sandstone/siltstone

Groundwater can also occur associated with faults; however, no-fault structures have been mapped within 2 km of Nobles Nob.

The groundwater bearing units are discussed further in **Sections 2.4.3.1** and **2.4.3.2**.

2.4.3.1 Shallow Weathered Horizon (Regolith)

The CSIRO regolith depth mapping indicates regolith depth up to 3 metres around the pit (0 to 1 m close to the pit, and 2-3 m for slightly away from the pit). This is consistent with the drilling logs of bore NNMW001, NNMW004 and NNMW005 that recorded 0-3 metres of regolith. As per the CSIRO regolith depth mapping, higher regolith depth is mapped for the area where bore NNMW018 is located (approximately 10-20m). However, the drill logs of bore NNMW018 suggests approximately 3 metres of laterite, followed by 3 metres of clay, before reaching the siltstone at 6 metres below ground. Observations on the extent of the weathering at 6 metres below are not provided. Overall, the drill logs and regolith depth mapping suggest that the area's regolith depth is not very deep.

Previous studies (e.g. Rockwater, 1989; Verhoeven & Knott, 1980) have indicated that groundwater might occur in the shallow weathered horizon of the Warramunga Formation. However, the drilling records from the monitoring and registered bores generally suggest that no groundwater was encountered at shallow depths. Registered bores drilled at shallow depths (<32m) also did not encounter any groundwater.

An exception to this was bore NNMW007, which was noting as having encountered water at 18 meters below ground level (mbgl) during drilling (**Table 2.3**). The yield was 0.001 L/sec, which is extremely low. Groundwater was also encountered at this bore at 66 mbgl (0.0001 L/sec) and 90 mbgl (0.13 L/sec). Nearby bore bore NNMW005, which is located around 500 m east of NNMW007, did not encounter water until 62.6 meters below ground (**Table 2.3**). Similarly, registered bore RN003777 located around 200 m south of NNMW005 also recorded groundwater intersection at 73.15 m depth.

The presence of water may relate to the local geology, with the bore log for NNMW007 recording a weathered quartz vein from 12 - 15 m depth, which was logged as comprising fine sand overlying sandstone and siltstone. The bore was constructed with the screen from 83.8 to 95.8 m depth. The groundwater level after the installation was 61.14 m, and subsequent monitoring in October 2021 indicates that water in bore NNMW007 was measured at 61.04 m depth (refer to **Section 2.4.5**). This indicates that if a shallow water table is present at this location, it is likely hydraulically separate from the deeper fractured rock aquifer.

2.4.3.2 Deep Fractured Sandstone/Siltstone Aquifer

The groundwater monitoring bores and registered bores within 2.5 km of Nobles Nob suggest that the primary groundwater bearing unit on site is within the local scale fractured sandstone/siltstone of Warramunga Group. This is consistent with the findings of previous studies around the Tennant Creek area that found that groundwater occurred within Warramunga Group siltstones, schists and granites, and Gum Ridge Formation limestone and chert (Verhoeven, 1976; Verhoeven & Knott, 1980). These studies also found that the permeability of these aquifers is low, and the quality is unsuitable for human consumption (Rockwater, 1989; Verhoeven & Knott, 1980). Measurements of airlift yields recorded during drilling of monitoring bores and registered bores are generally less than 1 L/s (only 2 out of 10 bores recorded yield of > 1 L/s), which agrees with the findings of previous studies that groundwater permeability in the area is low.

The information provided in the drilling records and water level readings post-installation were also reviewed. Groundwater in this aquifer is generally first encountered between approximately 70 to 80 meters below ground level (refer **Table 2.3**). The bottom of Nobles Nob open pit, which is approximately 80 m below the surface, has a permanent pool of water (Tennant Gold Resource, 2018), possibly indicating the water table in the region. The review suggests that the water level in all bores, except NNMW002 and NNMW011, was recorded higher than the depth at which groundwater was encountered, suggesting the confined nature of the aquifer.

2.4.4 Hydraulic Parameters

To estimate the hydraulic parameters of the groundwater system, slug tests were undertaken at 10 monitoring bores at Nobles Nob. Slug tests estimate the hydraulic conductivity of the aquifers, which is the measure of the permeability of the aquifers. It presents how easily water can pass through the aquifer, i.e., high hydraulic conductivity denotes a highly permeable aquifer. The slug tests were undertaken between 13 and 17 October 2021 (refer **Appendix D**). The slug tests were processed using Aquifer Test (HydroGeoAnalysis Plus) software and results analysed using Bouwer-Rice (1976) and Hvorslev (1951) methods. The results of the slug tests are also presented in **Table 2.4**.

The values of hydraulic conductivity range from 0.0105 m/day at bore NNMW002 to 0.681 m/day at Bore NNMW018 (refer **Table 2.4**). Bores NNMW011 and NNMW012, located towards the east of the Nobles Nob Pit, recorded hydraulic conductivity values of 0.387 m/day and 0.355 m/day, respectively. This range is consistent with previous studies into the Warramunga Formation (e.g., Rockwater, 1989; Verhoeven & Knott, 1980).

Table 2.4 Results of the Slug Tests

Bores	Hydraulic Conductivity (m/day)	Method	Screen Length (m)	Transmissivity (m^2/day)
NNMW001	0.0162	Hvorslev	12	0.194
NNMW002	0.0105	Bouwer & Rice	12	0.126
NNMW004	0.321	Hvorslev	12	3.852
NNMW005	0.559	Hvorslev	12	6.708
NNMW007	0.0591	Hvorslev	12	0.709
NNMW011	0.387	Bouwer & Rice	12	4.644
NNMW012	0.355	Hvorslev	12	4.260
NNMW013	0.411	Hvorslev	12	4.932

Bores	Hydraulic Conductivity (m/day)	Method	Screen Length (m)	Transmissivity (m^2/day)
NNMW014	0.11	Hvorslev	12	1.320
NNMW018	0.681	Hvorslev	12	8.172
Average (Confined)	0.314			3.768
Average (Unconfined)	0.199			2.385
Average (All)	0.291			3.492

2.4.5 Groundwater Levels and Flow Direction

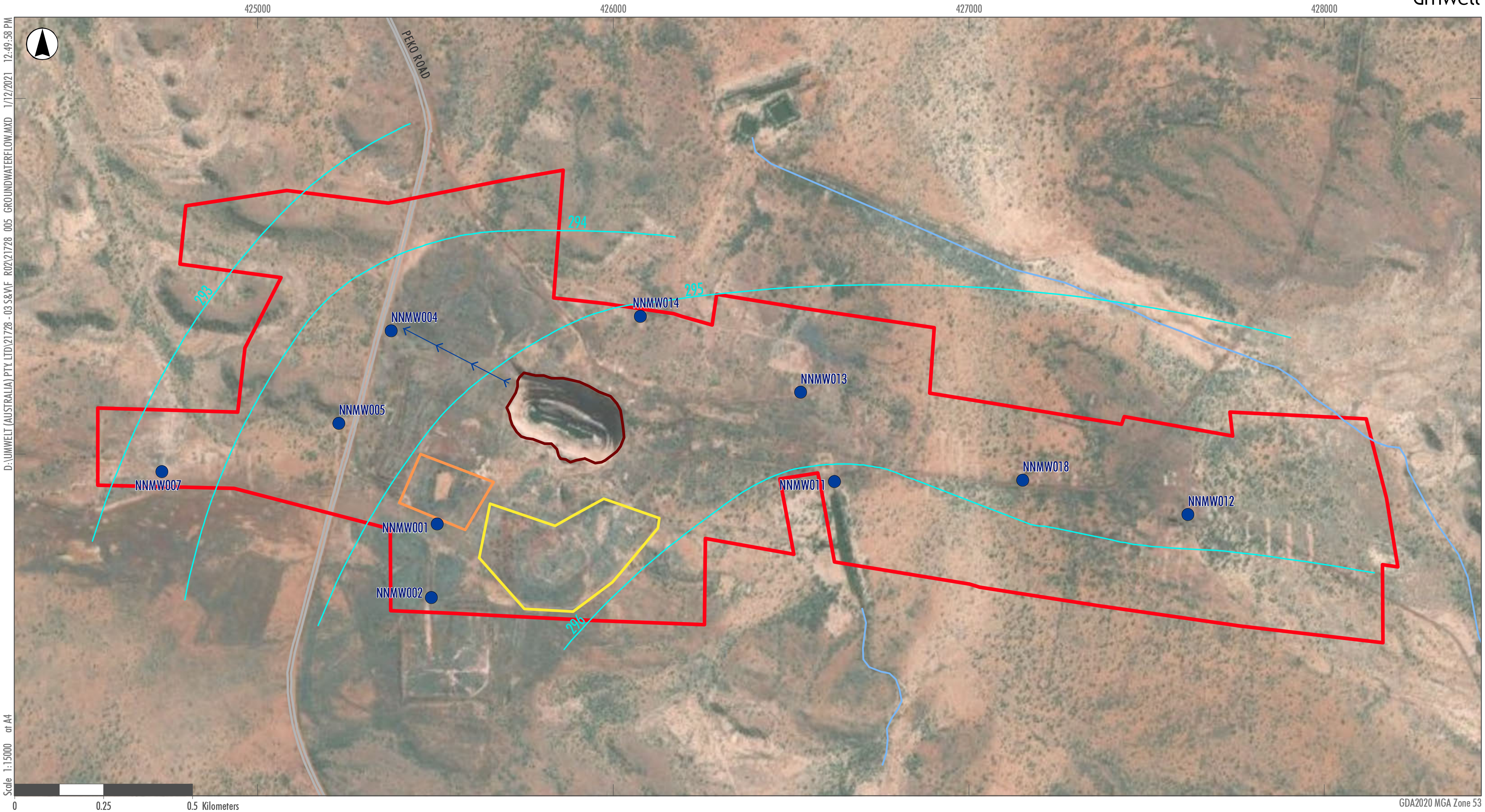
The groundwater level was measured after the installation of the groundwater bores and during the October 2021 monitoring event. The results of the groundwater level are presented in **Table 2.5**. The elevation of groundwater in October 2021 ranges from approximately 293 mAHD at NNMW007 to approximately 296 mAHD at NNMW011. There is no water level reading available for the Nobles Nob pit in October to compare. A recent LiDAR reading, from May 2021 following the wet season, indicated a level at around 296 mAHD. There is no seasonal data available for the groundwater bores as yet; however, the available level indicates a relatively flat groundwater gradient in the area.

There is minimal information regarding groundwater flow directions in the fractured rock aquifers of the Warramunga Group. However, regionally it has been reported that groundwater flows from the southeast to the northwest, in line with surface topography (McPherson et al., 2021). The groundwater levels at Nobles Nob, retrieved from the monitoring data in October 2021, also suggest that the overall flow is from the east towards the west-northwest, mirroring the regional groundwater flow direction and overall surface topography (**Figure 2.5**).

Table 2.5 Groundwater Levels at Nobles Nob

Bore _ID	Easting*	Northing*	Casing Top RL (mAHD)	SWL after Drilling (mbtoc#)	RL after Drilling (mAHD^)	SWL Oct 21 (mbtoc#)	RL Oct 21 (mAHD^)
NNMW001	425505.04	7819803.37	357.09	68.18	288.91	61.8	295.29
NNMW002	425488	7819596.41	363.924	68.99	294.934	68.775	295.149
NNMW004	425374.93	7820346.45	351.62	57	294.62	56.69	294.93
NNMW005	425228.61	7820085.77	354.08	59.8	294.28	59.87	294.21
NNMW007	424730.83	7819950.05	354.51	61.14	293.37	61.04	293.47
NNMW011	426621.8	7819921.77	355.91	59.71	296.2	59.885	296.025
NNMW012	427616.88	7819829.56	359.13	63.2	295.93	63.22	295.91
NNMW013	426527.28	7820174.17	366.01	70.06	295.95	70.18	295.83
NNMW014	426075.85	7820387.3	354.14	58.64	295.5	58.7	295.44
NNMW018	427151.54	7819925.64	351.22	55.17	296.05	55.22	296

*Coordinates in GDA2020 MGA Zone 53. # mbtoc- meters below top of casing. ^ mAHD – meters Australian Height Datum.



Legend

- Extent of Mine
- Historical Mineralised Waste Rock Dump
- Nobles Nob Pit Area
- Proposed Processing Area
- Roads
- Watercourse

FIGURE 2.5

Groundwater Flow Contours

Image Source: ESRI Basemap (2021) Data source: Department of ENvironment, Parks and Water Security (2020)

2.4.6 Groundwater Quality

The information on groundwater quality around Nobles Nob is limited. Post-installation of the groundwater bores at Nobles Nob, only one round of sampling was undertaken in October 2021. The results of the groundwater quality from the October 2021 sampling event are discussed below. One round of water quality samples from Nobles Nob pit was also collected in 2018, and the results are also discussed in the sections below.

2.4.6.1 Physicochemical

The pH values observed in the groundwater bores ranged from 6.53 at NNMW011 to 7.12 pH units at NNMW007 (**Table 2.6**). The field EC values ranged from 4,537 µS/cm at NNMW002 to 14,980 µS/cm at NNMW005 (**Table 2.6**) with an average of 10,455 µS/cm. The total dissolved solids (TDS) concentrations were also high in the groundwater bores, ranging from 3,200 mg/L to 8,700 mg/L. This is consistent with the previous studies that also found that water quality in the Warramunga Group is highly saline and is unsuitable for human consumption (Rockwater, 1989; Verhoeven & Knott, 1980).

Compared to the groundwater bores, the water in the Nobles Nob pit collected in 2018 and the water from Lake Alice in October 2021 recorded very low EC (99 µS/cm at Lake Alice and 140 µS/cm) and TDS (60 mg/L at Lake Alice and 84 mg/L at Nobles Nob Pit). This might be due to the fact that the samples were collected from near-surface, and higher EC/TDS values could be expected further down the water profile as saline water often sinks to the bottom. It could also be possible that water in the pit and Lake Alice could represent rainfall runoff. It is recommended that gradient sampling of pit water using a hydrasleeve be undertaken to understand further the water composition and recharge source within the pit and Lake Alice.

2.4.6.2 Major Ions

Major ion concentrations were also laboratory analysed for all 10 groundwater bores. Amongst the cations, the sodium concentration was recorded the highest at all bores, ranging from 560 mg/L at NNMW002 to 2,100 mg/L at NNMW004 and NNMW005. Amongst the anions, the chloride concentration was the highest ranging from 1,300 mg/L at NNMW002 to 3,700 mg/L at NNMW005, followed by sulfate ranging from 240 mg/L at NNMW002 to 1,100 mg/L at NNMW011. Carbonate concentrations were below the limit of reporting at all bores.

The major ion data suggests that the water type of all groundwater bores is sodium chloride type (**Figure 2.6**). Sodium chloride (Na-Cl) dominated water in the groundwater bores reflect low recharge and influence of evaporative processes.

Compared to the groundwater bores, the water in the Nobles Nob pit collected in 2018 and the surface water from Lake Alice (SWLA) in October 2021 record a different proportion of major ions. The dominant cation in Nobles Nob pit is potassium (13 mg/L) followed by calcium (7.3 mg/L). The dominant anion in Nobles Nob pit water is bicarbonate (52 mg/L). The stiff diagram of Nobles Nob suggest the water type is Ca-HCO_3+CO_3 (**Figure 2.7**). This likely reflects the influence of rainfall recharge to the open pit.

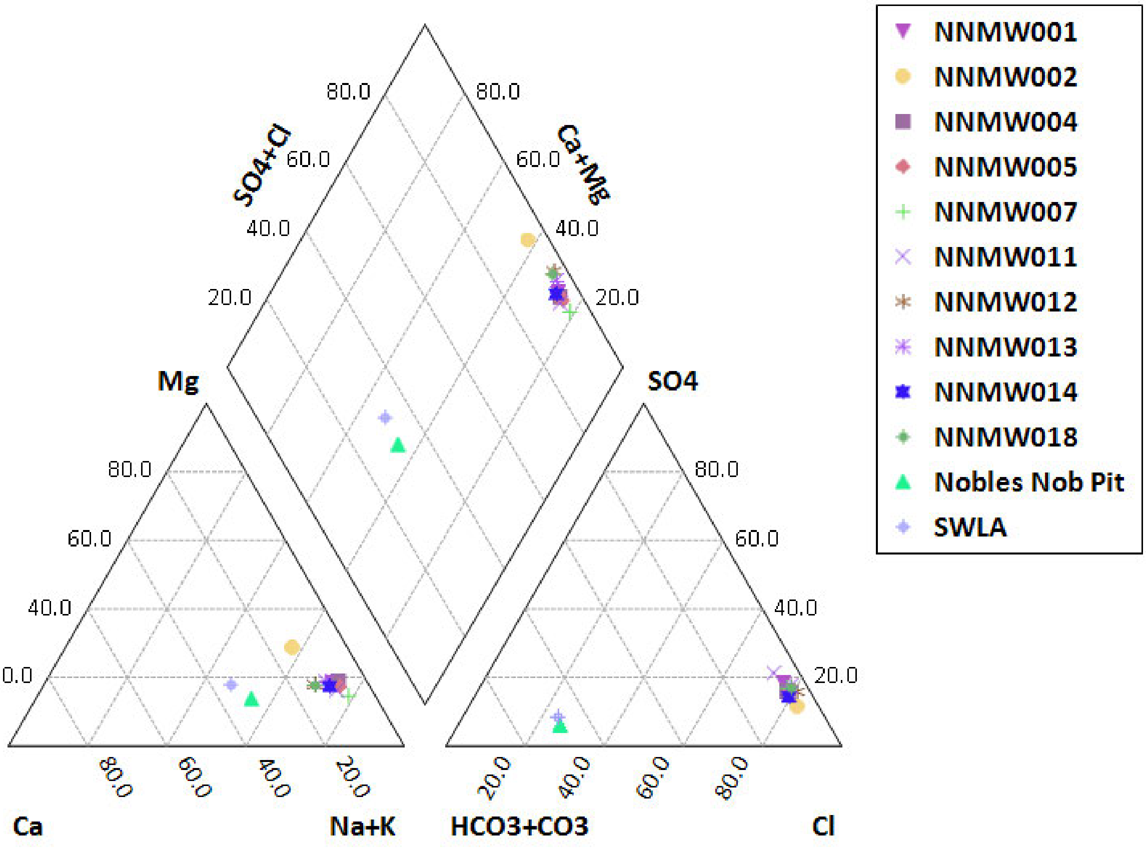


Figure 2.6 Piper Diagram of Groundwater Bores at Nobles Nob

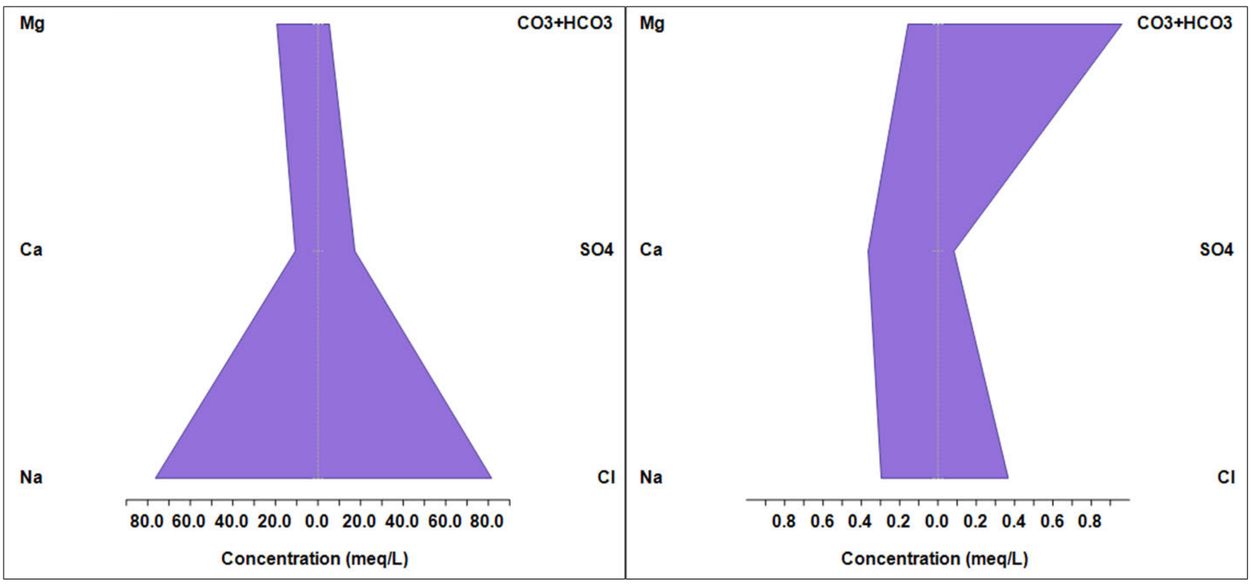


Figure 2.7 Stiff Diagram of Groundwater Bores (Left) and Nobles Nob Pit (Right)

2.4.6.3 Metals and Metalloids

Results for dissolved and total metals from samples collected in October 2021 are presented in **Table 2.6** and summarised as follows.

The concentration of many metals was recorded below the limit of reporting (LOR) in all bores. These include dissolved and total concentrations of arsenic, mercury, and silver (**Table 2.6**). It is recommended that monitoring at Nobles Nob be continued to understand site-specific occurrence and variation in concentrations of metals in groundwater. The median concentrations of most metals were recorded higher than the Nobles Nob pit, which was sampled in 2018. This reflects the influence of rainfall capture to the pit, with groundwater contribution likely to below.

All bores recorded free cyanide concentrations below the LOR (**Table 2.6**), whereas the total cyanide concentration was below LOR in 7 out of 10 bores. Bores NNMW001, NNMW004, and NNMW005 recorded the concentration of total cyanide above LOR. The presence of cyanide at these bores might be attributed to the fact that these bores are located very close to the historical tailings deposits. Cyanide concentrations were not available for the Nobles Nob pit.

Table 2.6 Summary of the Groundwater Quality at Nobles Nob

Parameters	Unit	Groundwater Bores at Nobles Nob				Nobles Nob Pit**
		Non-detect (%)	Min	Median	Max	
Field EC	µS/cm	0	4537	10360	14890	-
Field pH	pH unit	0	6.53	6.865	7.12	-
Lab EC	µS/cm	0	4700	11000	14000	140
Lab pH	pH unit	0	7.4	7.8	7.9	6.9
Sulfur as Sulfate SO_4	mg/L	0	240	885	1100	4
Total Dissolved Solids	mg/L	0	3200	6600	8700	84
Aluminium	mg/L	0	0.012	0.02	0.043	<0.01
Arsenic*	mg/L	100	5.00E-04	0.0045	0.0045	<0.001
Cadmium	mg/L	30	0.00015	0.00035	5.00E-04	<0.0001
Chromium	mg/L	80	0.001	0.0015	0.0034	<0.001
Cobalt	mg/L	10	0.0015	0.014	0.18	<0.001
Copper	mg/L	60	0.0015	0.0015	0.01	0.001
Iron	mg/L	90	0.01	0.01	0.02	0.003
Lead	mg/L	80	5.00E-04	0.0015	0.006	<0.001
Manganese	mg/L	0	0.016	0.665	4.3	<0.005
Mercury	mg/L	100	2.50E-05	2.50E-05	2.50E-05	-
Nickel	mg/L	40	0.0015	0.0035	0.012	<0.001
Selenium	mg/L	0	0.01	0.018	0.037	<0.001
Silver	mg/L	100	5.00E-05	7.50E-05	0.000125	-
Vanadium	mg/L	80	0.001	0.0015	0.005	-
Zinc	mg/L	30	0.0025	0.0075	0.024	<0.01
Total Aluminium	mg/L	0	0.094	0.93	3.3	4.6
Total Arsenic*	mg/L	100	5.00E-04	0.0045	0.0045	0.002
Total Cadmium	mg/L	30	0.00015	4.00E-04	5.00E-04	<0.0001

Parameters	Unit	Groundwater Bores at Nobles Nob				Nobles Nob Pit**
		Non-detect (%)	Min	Median	Max	
Total Chromium	mg/L	50	0.0015	0.00225	0.005	0.009
Total Cobalt	mg/L	10	0.0015	0.017	0.18	0.004
Total Copper	mg/L	20	0.0015	0.0045	0.025	0.011
Total Iron	mg/L	0	0.13	1.03	2.5	13
Total Lead	mg/L	20	0.0015	0.004	0.006	0.011
Total Manganese	mg/L	0	0.024	0.7	4.4	0.23
Total Mercury	mg/L	100	2.50E-05	2.50E-05	2.50E-05	-
Total Nickel	mg/L	30	0.0015	0.004	0.014	0.003
Total Selenium	mg/L	0	0.011	0.0195	0.038	<0.001
Total Silver	mg/L	100	5.00E-05	7.50E-05	0.000125	-
Total Vanadium	mg/L	30	0.0015	0.0045	0.008	-
Total Zinc	mg/L	0	0.006	0.013	0.029	0.017
Free Cyanide	mg/L	100	0.002	0.002	0.002	-
Total Cyanide	mg/L	70	0.002	0.002	0.039	-

Note: *the LOR for arsenic in the analysis was variable. ** Nobles Nob Pit was sampled in 2018. < denotes below Limit of Reporting.

2.5 Recharge

Recharge to the aquifers around Nobles Nob is primarily from rainfall infiltration through the ground surface. However, it is challenging to assess water level responses in groundwater bores to rainfall events due to the lack of water level readings. The Nobles Nob pit also potentially acts as a point of recharge for the area.

It is also likely that recharge occurs to the aquifers through direct infiltration from creek beds further away from the site. This is also consistent with the strong correlation between sodium and chloride, which indicates that recharge water is also Na-Cl rich. Usually, indirect recharges are common in arid areas (Harrington et al., 2002). As rainfall in the Tennant Creek area is episodic and low, and as the evapotranspiration rates are high throughout the year, recharge from rainfall will be during high-intensity rainfall periods.

2.6 Discharge

A recent study (McPherson et al., 2020) conducted approximately 25 kilometres south of Tennant Creek found that the groundwater discharge across all the bore fields in the study area occurred in the following ways:

- Underflow to the Wiso Basin (southeast to northwest trend).
- Evapotranspiration and diffuse discharge where groundwater is close to the surface.
- Groundwater pumping from the Cabbage Gum and Kelly Well bore fields.

In the Nobles Nob area, the discharge is mainly through evapotranspiration. Diffuse discharge occurs where groundwater is shallow (e.g., less than 10 m below ground surface), which is not the case at Nobles Nob. The average water level is approximately 60 to 70 metres below ground. The Nobles Nob pit might also act as a source of discharge, given the rate of evaporation in the area is high.

Pumping at the Cabbage Gum and Kelly Well bore fields is the other source of groundwater discharge from the system, across Tennant Creek region. However, the low permeability and saline nature of the groundwater around Nobles Nob indicates that the groundwater system at Nobles Nob is not connected to the bore fields that are being pumped.

2.7 Groundwater-Surface Water Interaction

The points at which the groundwater system and the surface water systems come in contact with each other is often referred to as groundwater-surface water interactions. This can be either groundwater expressed at the surface in the form of springs, permanent pools etc.; or where groundwater is recharged by the surface water, such as rivers recharging the aquifers through bedrock or outcrop etc.

The assessment of springs through the Atlas of Groundwater Dependent Ecosystems (BOM, 2012) and the NR Maps tool indicated no known springs or permanent water bodies within 10 km of the Nobles Nob pit.

2.8 Environmental Values and Use of Groundwater

Historical mining and grazing have been the primary use of the land, and therefore the use of groundwater around Nobles Nob is restricted to these activities.

As per the findings of previous studies (e.g., Rockwater, 1989; Rose, 1973; Rose & Willis, 1973; Verhoeven, 1976; Verhoeven & Knott, 1980), the quality and low permeability of groundwater from the Warramunga Group limits its usage. That is why the water for Tennant Creek Township is pumped from the Cabbage Gum, and Kelly Well bore fields, which are approximately 25 kilometres south of Tennant Creek. As mentioned in **Section 2.4.2**, all the registered bores within 2.5 km of Nobles Nob pit are mine related bores, and there are no declared groundwater users in the area.

Assessment of groundwater-dependent ecosystems (GDEs) around Nobles Nob suggests that there are no GDEs within a 10 km of the Nobles Nob Pit. The GDEs refer to ecosystems that rely on groundwater, either permanently or intermittently. This includes surface expressions of groundwater in the forms of springs and wetlands and below ground systems, such as caves.

2.9 Conceptual Hydrogeological Model

A conceptual hydrological model for the site was developed based on the available background information and groundwater data presented in **Section 2.0**, which includes climate trends, topography, drainage, geology, and hydrogeological characteristics.

The topography at the Nobles Nob site varies from approximately 285 mAHD to approximately 380 mAHD, reducing in elevation away from the Nobles Nob pit. There are no surface water features in the area, except the Nobles Nob pit and Lake Alice located close to bore NNMW011.

From the background information, the main groundwater bearing unit on site is associated with local scale fractured and weathered rock aquifer that occurs in sandstone/siltstone of the Warramunga Formation. Drilling records of the monitoring bores on site, installed in May/June 2021 suggests that groundwater in this aquifer is generally first encountered between approximately 70 to 80 meters below ground level.

Cross sectional models illustrating inferred groundwater levels and flow directions, interpolated geology, groundwater conditions and interaction with the pit are shown in **Figure 2.8** and **Figure 2.9**. The alignment of the conceptual models is shown in **Figure 2.4**. The cross-sections show a relatively flat groundwater gradient at site, and mapping in **Figure 2.5** indicates a general gradient towards the northwest consistent with the regional flow direction.

Figure 2.8 and **Figure 2.9** illustrate that the Nobles Nob pit is recharged by rainfall, with levels likely controlled by evaporation. The available water quality data from the Nobles Nob pit is very different compared to the groundwater quality recorded at the monitoring bores, indicating potentially low groundwater contributions. However, additional temporal spread of groundwater and surface water data should also be collected to confirm this interaction.

Available information indicates that the proposed processing plant (proposed near bore NNMW001) will be in an area that has a thick layer (> 30 m) of clay. This clay layer will act as a natural aquitard and restrict recharge and seepage from surface to the fractured rock aquifer. However the extent and condition of this clay layer should be verified.

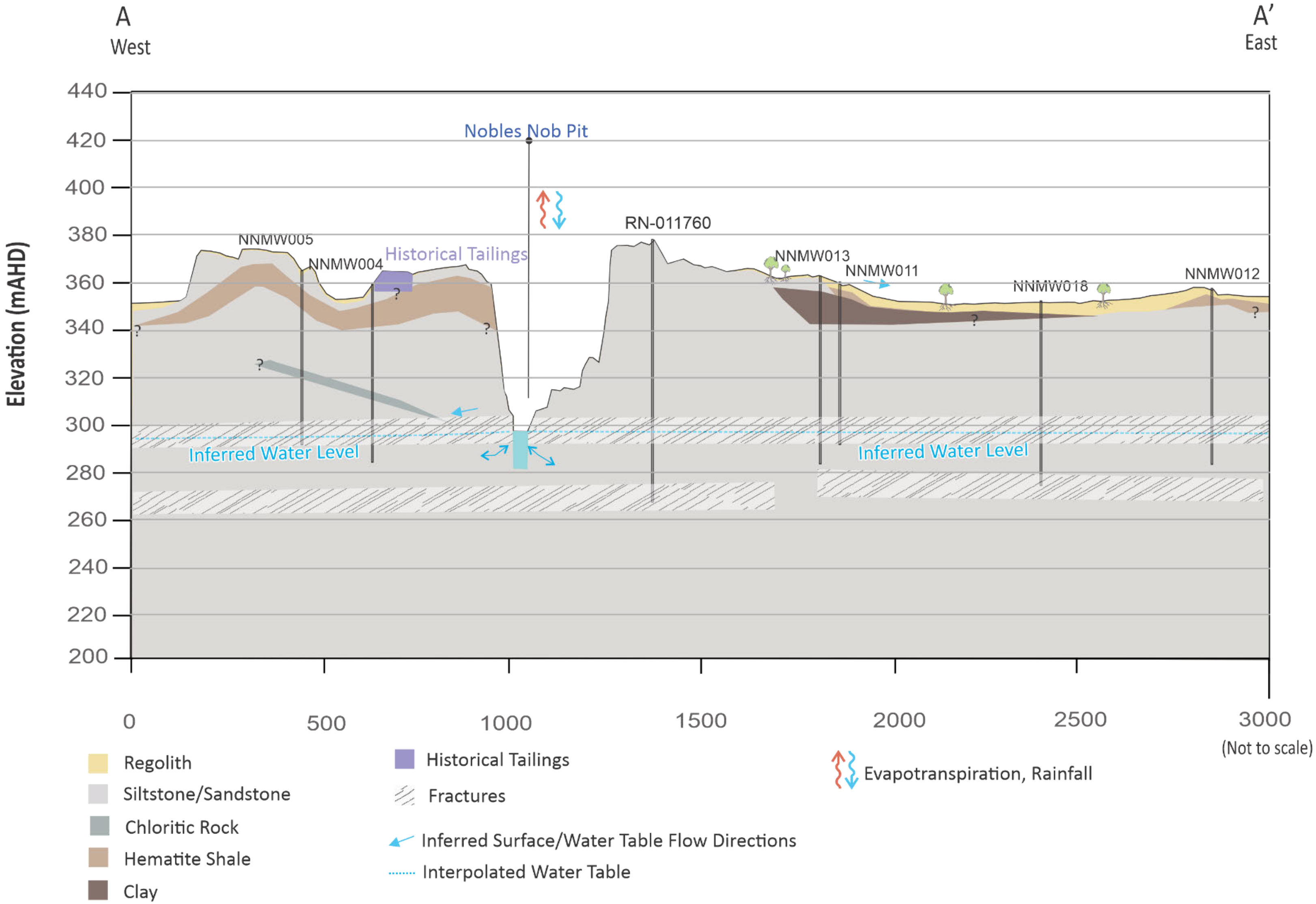


Figure 2.8 Conceptual Model A-A' – West to East

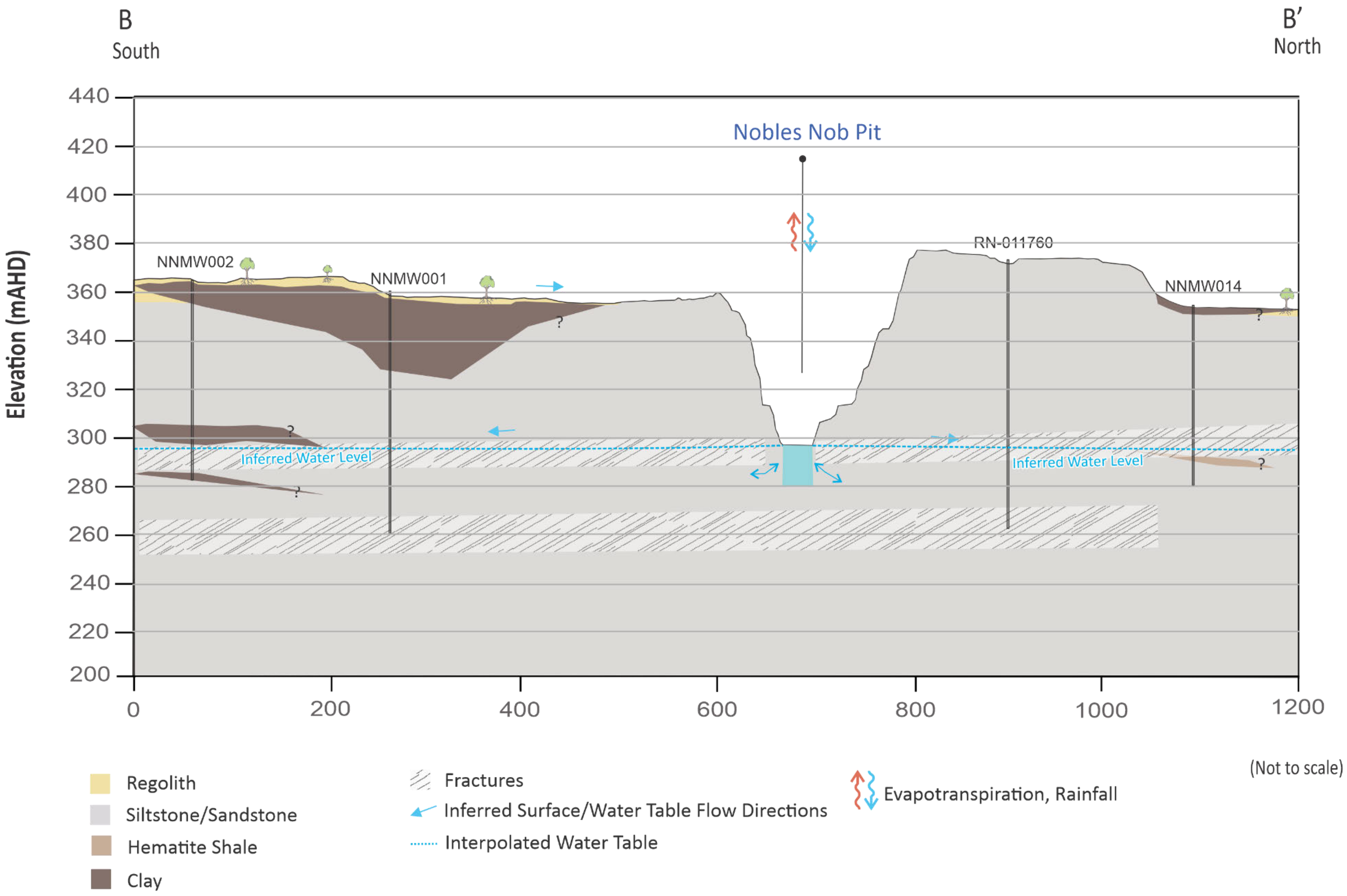


Figure 2.9 Conceptual Model B-B' – South to North

3.0 Predicted Impacts of Proposed Activities on Groundwater

3.1 Groundwater Affecting Activities and Potential Impacts

3.1.1 Processing Plant and Tailings Storage

TCMG is planning to process existing waste and tailings material at Nobles Nob by setting up a processing plant within the Proposed Processing Area (**Figure 1.1**). The processing will include crushing and milling of the existing waste rocks, before processing and discharge of tailings. As per the plan, the tailings will be pumped to the tailings storage area, where they will be filtered using Geotube dewatering tubes. These Geotubes will retain the solid particles while allowing the liquid to discharge (COMO, 2021). The discharged liquid will be captured by a recovery pump located at the base of the Geotube stacking area. The recovery pump will return the discharged water to the process water ponds for re-use (COMO, 2021).

As the processing plant uses cyanide, the discharged water from the Geotubes might contain high concentrations of cyanide and other metals (both dissolved and total). There is a potential of impact on groundwater quality from the discharged water from the Geotubes. Communications with TCMG have indicated that the Geotubes and the drainage ponds collecting discharged water will be designed with a high density polyethylene (HDPE) liner to inhibit seepage. In addition, as presented in **Figure 2.9,** the geological log for bore NNMW001 indicates the presence of a thick sequence of low permeability clays at the surface. The liner and clays (where present) will inhibit potential seepage to groundwater, which occurs around 61 m below the surface. However, management and mitigation measures are recommended to verify the performance of the liner and for ongoing monitoring.

3.1.2 Process Water Storage

The operations at Nobles Nob will also be storing process water on-site and will be distributed throughout the plant. As per the report by COMO (2021), the process water will be used for the following:

- Mill discharge
- Trommel Screen Spray water
- General hosing

The process water will be sourced from a raw water supply and from the tailings discharge water from the Geotubes. As the discharged tailing water might contain a high amount of cyanide and elevated metal concentrations, there is a potential for impact on groundwater quality. Umwelt understands that the bottom of the process water dams will be lined with HDPE liner, which should prevent leakage of dam water into the underlying water-bearing unit. In addition, as presented in **Figure 2.9** and discussed above, low permeability clays occur at the surface around the Proposed Processing Area. The liner and clays (where present) will inhibit potential seepage to groundwater, which occurs around 61 m below the surface. However, management and mitigation measures are recommended to verify the performance of the liner and for ongoing monitoring.

3.1.3 Storage of Ore/Run-Of-Mine Stockpile

The ores and run-of-mine (ROM) will be stored around the processing area and ROM pad in stockpiles before processing. Although the timeframe of this storage will be small, there is the potential of leachate running from these ores and waste rocks stockpiles during rainfall events. The assessment of the waste rock samples indicated that the likelihood of acidic drainage from these waste rocks is unlikely (Umwelt, 2021a). However, there is a potential for metalliferous drainage enriched in aluminium and zinc (Umwelt, 2021b).

Since the groundwater on site is over 50 m below the surface, it is unlikely to be impacted by these leachates. It is more likely that the leachate from the stockpiles will travel at the surface, and it is recommended that systems to intercept this surface flow (such as sumps and diversion drains etc.) should be installed. It is noteworthy that these waste rocks have already experienced weathering, minimising the potential for leachate and geochemical changes in these samples. Furthermore, as the Nobles Nob area does not experience much rainfall, the likelihood of this happening is fairly low, but cannot be completely ruled out.

4.0 Management and Mitigation Measures

As outlined in **Sections 2.9** and **3.0**, the main potential risks and impacts relevant to groundwater relate to changes in water quality. The proposed activities (refer to **Section 1.3**) do not include any interception or abstraction of groundwater; therefore, there are no predicted impacts on groundwater levels or availability. Due to this, the management and mitigation measures are focused on groundwater quality aspects. This section presents the proposed monitoring network, monitoring frequency and parameters, quality assurance and assessment and reporting protocols relevant to groundwater.

4.1 Proposed Groundwater Monitoring Program

4.1.1 Proposed Monitoring Network

The existing groundwater monitoring network at Nobles Nob comprises 10 monitoring bores installed in May/June 2021. The existing groundwater bore network consists of two monitoring bores, NNMW001 and NNMW002, around the proposed processing plant and tailings storage area. Both these monitoring bores are also designed to monitor groundwater at a depth of 90-102 metres (NNMW001) and 65.9-77.9 metres (NNMW002) below ground level. These bores were sampled only once in October 2021 since their installation. Details on the existing bores is included in **Table 4.1**, and locations are shown in **Figure 2.4**.

The total depth of the existing bores ranged from 66 m to 102 mbgl and targeted the regional groundwater table. There is potential for water to be present in the shallow weathered horizon in localised areas, as identified at NNMW007 and discussed in **Section 2.4.3.1**. Therefore, it is proposed that an additional four shallow bores be installed for early detection of potential seepage relevant to site activities in the proposed processing plant and tailings storage area. These shallow bores would also help confirm the degree of hydraulic connectivity to the regional groundwater table targeted by the deeper bores.

The tentative depth and screen intervals of the proposed shallow bores are proposed in **Table 4.1**. These details will be finalised once the design and location of the processing plant, process water ponds, tailings storage are finalised.

Table 4.1 also presents the proposed monitoring program, including water level montoring and water quality monitoring frequency. Further details on the monitoring program is included in **Section 4.1.2**.

Table 4.1 Proposed Monitoring Program

Bore ID	Easting*	Northing*	Depth (m)	Screen Interval	Stratigraphy	Purpose	SWL	WQ
Proposed 1	TBC	TBC	~ 10	~ 4 - 10	Weathered horizon – water table	Early detection of potential seepage from proposed Proposed Processing Area. Locations to be determined based on final plan designs.	Daily (logger) and Monthly (manual)	Monthly
Proposed 2	TBC	TBC	~ 10	~ 4 - 10				
Proposed 3	TBC	TBC	~ 20	~ 11 - 20				
Proposed 4	TBC	TBC	~ 20	~ 11 - 20				
NNMW001	425505	7819803	102	90 - 102	Sandstone	Located south of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Daily (logger) and Monthly (manual)	Monthly
NNMW002	425488	7819596	77.9	65.9 - 77.9	Sandstone			
NNMW004	425374.9	7820346	75	63 - 75	Sandstone	Located north-west and down-gradient of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Daily (logger) and Monthly (manual)	Monthly
NNMW005	425228.6	7820086	70	58 - 70	Sandstone	Located west and down-gradient of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Monthly (manual)	Monthly
NNMW007	424730.8	7819950	95.8	83.8 - 95.8	Sandstone	Located west of the Proposed Processing Area. Monitoring groundwater levels and quality, for detection of potential changes in water quality due to site activities	Monthly (manual)	Monthly
NNMW014	426075.9	7820387	69.6	57.6 - 69.6	Hematite Shale	Located north of the existing open-cut. To monitor groundwater levels and quality trends in response to existing mine features and verify regional flow directions and influence from historical mining.	Monthly (manual)	Monthly
NNMW011	426621.8	7819922	66	54 - 66	Sandstone	Background reference bore. To monitor groundwater level and quality trends up-gradient of site.	Quarterly (manual)	Quarterly
NNMW012	427616.9	7819830	76.6	64.4 - 76.4	Sandstone			
NNMW013	426527.3	7820174	78	66 - 78	Sandstone/Siltstone			
NNMW018	427151.5	7819926	78	66 - 78	Sandstone			

Note: TBC – To be confirmed *mbgl – metres below ground level* *SWL – Standing water level monitoring program* *WQ – Water quality monitoring program*

4.1.2 Groundwater Monitoring Frequency and Parameters

The frequency of monitoring for the proposed network is shown in **Table 4.1**. A monthly frequency has been proposed for selected bores for the initial 12 months of monitoring, in order to collect sufficient baseline data. Following the 12 months of data collection, the monitoring frequency should be reviewed and refined.

Groundwater level monitoring will be conducted to capture natural groundwater level fluctuations (such as responses to rainfall) and detect any potential groundwater level impacts. It has also been proposed that the proposed shallow proposed bores and the two existing deeper bores near the Proposed Processing Area be equipped with dataloggers to collect daily timeseries water level data and can be downloaded on a monthly basis and verified against manual dipped levels. This will help to verify the water table response to rainfall events and degree of hydraulic connection between the shallow weathered horizon and deeper regional groundwater table.

Groundwater quality sampling should conducted to detect any changes in groundwater quality relevant to the proposed site activities. In order to better understand the groundwater quality characteristics on-site, it is recommended that the groundwater samples be analysed from the sampling suite outlined in **Table 4.2**.

As discussed in **Section 3.1** and the waste rock characterisation results (**Appendix A**), the main potential contaminants of concern include cyanide associated with the processing plant and aluminium and zinc associated with the waste rock material. These analytes have been included in **Table 4.2**, along with additional metals to provide a baseline dataset. It is recommended that the analyte suite be reviewed after the initial 12 months of data is collected to further refine based on relevant site water quality results.

Table 4.2 Groundwater Parameters for Monitoring

Parameters
Standing Water level (SWL)**
pH*
Electrical Conductivity*
Major Anions - Na, K, Ca, Mg, hardness
Major Cations - Cl, SO4, Alkalinity (CO3-, HCO3-, total alkalinity)
Total Dissolved Solids*
Total and Dissolved Metals
Aluminium
Arsenic
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Manganese
Mercury
Nickel
Selenium

Parameters
Vanadium
Zinc
Free and Total Cyanide

Note: *Both field and laboratory measurements are to be recorded. ** only field measurement in mbtoc.

4.1.3 Groundwater Monitoring

Groundwater monitoring and sampling should be conducted in accordance with *Australian and New Zealand Standard for Groundwater Sampling (AS/NZS 5667.11:1998)* and *Methodology for the Sampling of Groundwater* developed by Department of Primary Industry and Resources (DPIR) of the Northern Territory.

4.1.4 Monitoring Data Management

It is recommended that the data gathered from the groundwater monitoring be collated into a database which includes:

- A site plan showing sampling location.
- Periodic photos from sampling locations during the sampling event.
- Tabulated results of the monitoring compared with appropriate background levels (when available).
- All data collected during each monitoring round.
- A record of the chain of custody of the samples from sampling through to analysis.
- Laboratory analysis certificates.

In addition to the above-mentioned list, the following records should also be kept for each sampling event:

- Field sheets with all field observations for each bore sampled.

4.2 Quality Assurance and Quality Control

As a quality assurance and control measure, a blind duplicate sample should be collected every 10 samples for the groundwater monitoring at Nobles Nob. The date and time of the sample should not be disclosed to the laboratory. Interpretation of the results from the blind duplicate is based on the reproducibility assessment method, which provides a measure of precision. The analytical values from the original sample and its duplicate are compared by calculating the relative per cent difference (RPD) for each parameter as follows:

$$RPD\ (\%) = \left[\frac{Sample - Duplicate}{(Average\ of\ Sample\ and\ Duplicate)}\right] * 100$$

The RPD then uses the limit of reporting (LOR) to identify thresholds for valid reproducibility. These include:

- Mean of sample and duplicate <10 times LOR: There is no RPD limit (i.e., reproducibility is valid)
- 10 times LOR < Mean of sample and replicate < 20 times LOR: The RPD range limit is 0%-50% for a valid duplicate

- Mean of sample and replicate > 20 times LOR: The RPD range limit is 0% - 20% for a valid duplicate.

If the RPD exceeds the threshold percentage, the results are considered unreliable and require further investigation. Only one duplicate sample is needed to be collected per sampling event.

4.3 Groundwater Assessment Protocols

4.3.1 Assessment Criteria

The groundwater quality monitoring results should be assessed against criteria, which will provide an early warning for any potential impacts through changes in the groundwater quality. Due to the lack of available groundwater data at Nobles Nob, developing site-specific criteria is not possible. It is recommended that the criteria to assess groundwater quality be developed following sufficient observations, with a minimum of 12 months of groundwater data.

For the period until sufficient groundwater data is available, interim groundwater triggers levels have been proposed in accordance with ANZECC & ARMCANZ (2000) guideline values for livestock drinking water, and Australian drinking water guidelines (NHMRC, NRMMC, 2011)(**Table 4.3**).

Table 4.3 Proposed Interim Trigger Levels

Parameters	Trigger Level	Units
pH*	6 - 9	pH Units
EC**	5970	µS/cm
Total Dissolved Solids (TDS)**	4000	mg/L
Sulfate	1000	mg/L
Aluminium	5	mg/L
Arsenic	0.5	mg/L
Cadmium	0.01	mg/L
Chromium	1	mg/L
Cobalt	1	mg/L
Copper	1	mg/L
Iron*	0.2	mg/L
Lead	0.1	mg/L
Manganese*	0.2	mg/L
Mercury	0.002	mg/L
Nickel	1	mg/L
Selenium	0.02	mg/L
Zinc	20	mg/L
Free Cyanide^	0.007	mg/L
Total Cyanide#	0.08	mg/L

Note: * Trigger Level for pH, Iron, and Manganese has been derived from ANZECC Irrigation guideline values (ANZECC & ARMCANZ, 2000)
** Trigger level for TDS has been adapted from the levels specified for Beef cattle. Trigger Level for EC has been calculated using conversion from adapted TDS using equation 4.6 of ANZECC & ARMCANZ (2000)
^Trigger level for Free Cyanide has been derived from ANZG (2018) default guideline value for aquatic ecosystem (95% level of species protection).
#Trigger level for Total Cyanide has been adapted from Australian drinking water guidelines (NHMRC, NRMMC, 2011).

4.3.2 Investigation Criteria

In order to manage the groundwater on-site, the groundwater monitoring results should be assessed with criteria outlined in **Section 4.3.1 above**, which will provide an early warning for any potential changes in the groundwater quality.

Based on the available groundwater data, it is recommended that the criteria to trigger an investigation should be the following:

- If the groundwater quality results exceed the triggers mentioned in **Table 4.3** for three (3) consecutive monitoring events.
- If the groundwater quality results exhibit an increasing temporal trend in three (3) consecutive monitoring events.

4.3.3 Investigation Procedures

It is recommended that when an investigation criterion is triggered, the bore and the analyte should be investigated. An investigation should assess the potential for environmental harm and should include a written report outlining:

- Details of the investigations carried out, including source and cause of the criterion.
- Actions taken to prevent environmental harm.

4.4 Reporting and Review

It is recommended that yearly reporting summarising the monitoring network's water level and quality results should be undertaken. The existing monitoring program should be reviewed annually by an appropriately qualified person to determine if it continues to meet the requirements. The review may also include:

- A review of the adequacy of the monitoring locations, frequencies, and development of groundwater quality triggers.
- Recommendations for any required increase in monitoring bore locations to monitor quality/drawdown impacts adequately.
- Revision of monitoring parameters and/or frequency, if required.
- Expanding the existing groundwater monitoring network over time to enable ongoing groundwater impact evaluations.

As required, this monitoring program may be updated or revised based on the outcomes of the review process.

5.0 Conclusion and Recommendations

Based on the limited available groundwater data, a preliminary hydrogeological assessment for Nobles Nob has been undertaken in this report. The finding for the report suggests that groundwater level and quality at existing groundwater monitoring bores at Nobles Nob should be continued to be monitored monthly. It is recommended that the water level in the Nobles Nob pit should be surveyed during one of the monitoring rounds for better comparison of groundwater level in bores and water level in the pit.

Adequacy of the existing monitoring plan should be reviewed again once the design and location of the processing plants are finalised, and additional shallow bores should be installed where necessary. It is also recommended that the monitoring frequency, parameters, and groundwater assessment criteria should be reviewed annually by a suitably qualified person.

It is also recommended that sufficient baseline groundwater data should be collected, and appropriate quality triggers should be developed, which can provide early signs of any impact on groundwater quality from the proposed activities.

6.0 References

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APPENDIX A

Nobles Nob WRC Report

This report is included in Appendix H of this MMP.

APPENDIX B

Statement of Bore

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tenant Mining	Bore Registration No:	RN
Street address /NT Parcel:	935 Peko Rd Tennant Creek 3735	Bore Name:	NNMW001
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☒	Easting: 425505.04	Northing: 7819803.37	Latitude(DMS):	Longitude(DMS):

From	To	Particulars of Strata
0	3	GRAVEL
3	33	CLAY
33	54	SANDSTONE
54	60	SANDSTONE/SILTSTONE
60	66	SANDSTONE
66	72	SANDSTONE/SILTSTONE
72	102	SANDSTONE

Name of Drilling Company: ~~F. May~~ May Drilling

Name of Driller: Frederick May.

Name of supervising driller

Date Commenced: 4/6/2021

Date Completed: 6/6/2021

Depth Drilled: 102m (m)

Completion Depth: 102m (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☒ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air.
12	102	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	110	4.8mm Steel
0	~~[illegible]~~ 102	101	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
90	102	101	2mm	Hand Slotted

Casing Suspended: Yes☐ No ☐

Method:

Height of Casing above GL: (m)

(m)

Top of Packer Set at: (m)

Length of Packer: (m)

Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% B Grout.
87	89	Bentonite Seal
89	102	3-5mm Sand pack.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
	76	.001						
90	102	.01						

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐

Left at:

Completion Yield: (L/s) Method: Duration (hrs):

Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION RN:

N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐	Survey ☐	Other ☐
Property Location:	Section No: Portion No:	Lot No: LTO Code: Lease No:	Town of: Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐ MGA Zone: Index Map Number:	GDA2020 ☐ Easting: Northing:	 Latitude (DMS): Longitude (DMS):
Date Registered:	Dept Officer:	Signature:	

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant ~~Creek~~ Mining
Street address /NT Parcel:	935 Peko Rd Tennant Creek 3735
Bore Registration No :	RN
Bore Name:	NNMW002
BCP Permit No:	BCP

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☒	Easting: 425488	Northing: 7819596.4	Latitude(DMS):	Longitude(DMS):

From	To	Particulars of Strata
0	12	CLAY
12	27	SANDSTONE
27	33	SANDSTONE/SILTSTONE
33	39	SANDSTONE
39	42	SANDSTONE/SILTSTONE
42	45	SANDSTONE
45	48	SANDSTONE/SILTSTONE
48	57	SANDSTONE
57	60	SANDSTONE/SILTSTONE
60	72	CLAY
72	75	SANDSTONE
75	78	CLAY

Name of Drilling Company: May Drilling

Name of Driller: Frederick May

Name of supervising driller

Date Commenced: 7/6/2021

Date Completed: 9/6/2021

Depth Drilled: 78 (m)

Completion Depth: 77.9 (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☑

Specify:

HOLE DIAMETER / DRILLING FLUID

From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air S&F Foam
12	78	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	250	4.8mm Steel
0	78	101	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
66	78	101	2mm	Hand Slotted

Casing Suspended: Yes☐ No ☑

Method: Seated on Bottom

Height of Casing above GL: .7 (m)

(m)

Top of Packer Set at: (m)

Length of Packer: (m)

Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% Bent Grout.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
72	78	.05						

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐

Left at:

Completion Yield: (L/s) Method: Duration (hrs):

Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION	RN:

↑ N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture ☐	Public Water Supply ☐	Cultural ☐	Rural Stock and Domestic ☐
Aquaculture ☐	Environment ☐	Industry ☐	Mning ☒ Petroleum ☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

Very Soft. Altered Clays. 72 - 78m Dark Brown clays "Very Different"

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision | Signature of Driller under supervision | Date: / /

Name and Licence# of Licensed Driller: | Signature of Licensed Driller: | Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐	Survey ☐	Other ☐
Property Location:	Section No: / Portion No:	Lot No: LTO Code: / Lease No:	Town of: / Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐ / MGA Zone: / Index Map Number:	GDA2020 ☐ / Easting: / Northing:	Latitude (DMS): / Longitude (DMS):
Date Registered:	Dept Officer:	Signature:	

Remarks:

STATEMENT OF BORE

NORTHERN TERRITORY GOVERNMENT

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	**Bore Registration No :**	**RN**
Street address /NT Parcel:	935 Peko Rd Tennant Creek 3735	**Bore Name:**	NNMW 004
		BCP Permit No:	**BCP**

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☒	Easting: 425375	Latitude(DMS):
					Northing: 7820086	Longitude(DMS):

From	To	Particulars of Strata
0	3	SANDSTONE/SILTSTONE
3	12	SANDSTONE
12	21	HEMATITE SHALE
21	24	SANDSTONE/SILTSTONE
24	51	SANDSTONE
51	57	CHLORITE ROCK
57	75	SANDSTONE

Name of Drilling Company: May Drilling
Name of Driller: Frederick May
Name of supervising driller

Date Commenced: 3/6/2021
Date Completed: 4/6/2021
Depth Drilled: 75 (m)
Completion Depth: 75 (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER / **DRILLING FLUID**

From (m)	To (m)	Dia. (mm)	Type
0	12m	310	Air
12	75	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	75	101	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
63	75	101	2mm	Hand Slotted

Casing Suspended: Yes ☐ No ☑
Method: Seated on Bottom
Height of Casing above GL: .7m (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% Bento Grout
61	75	3-6mm Sand
59	61	Bentonite Seal

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
63.	63.6	Damp						
	69.4	0.11		1/2				

Cumulative Yield:

Completion Yield: 0.11 (L/s) Method: Air lift. Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

STRATA / WATER SAMPLES

Have been ☐ Will be ☐
Left at:

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

↑
N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic ☐			
Aquaculture	☐	Environment	☐	Industry	☐	Mning	☒	Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision Signature of Driller under supervision Date: / /

Name and Licence# of Licensed Driller: Signature of Licensed Driller: Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐	Survey ☐	Other ☐	
Property Location:	Section No: Portion No:	Lot No: Lease No:	LTO Code:	Town of: Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐ MGA Zone: Index Map Number:	Easting: Northing:	GDA2020 ☐ Latitude (DMS): Longitude (DMS):	
Date Registered:	Dept Officer:	Signature:		
Remarks:				

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko Rd 3735 Tennant Creek	Bore Name:	NNMW005
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☐	Easting: 425229	Northing: 7820086	Latitude(DMS):	Longitude(DMS):

From	To	Particulars of Strata
0	3	CLAY
3	6	SANDSTONE
6	12	HEMATITE SHALE
12	36	SANDSTONE
36	39	CHLORITE ROCK
39	48	SANDSTONE
48	51	CHLORITE ROCK
51	54	SANDSTONE/SILTSTONE
54	69	SANDSTONE
69	71	SILTSTONE

Name of Drilling Company:

Name of Driller:

Name of supervising driller

Date Commenced: 2/6/2021

Date Completed: 3/6/2021

Depth Drilled: (m)

Completion Depth: (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air
12	70.2	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	70.1	101	PN 12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
58	70	101	2mm	Hand Slotted.

Casing Suspended: Yes ☐ No ☑

Method: Seated on Bottom

Height of Casing above GL: .7m (m)

(m)

Top of Packer Set at: (m)

Length of Packer: (m)

Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% Bentonite grout
54	56	Bentonite Seal
56	70	3-6mm Sand pack

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
62.6	64	.53		.5				

Cumulative Yield:

STRATA / WATER SAMPLES

Have been ☐ Will be ☐

Left at:

Completion Yield: .53 (L/s) Method: Duration (hrs):

Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture ☐	Public Water Supply ☐	Cultural ☐	Rural Stock and Domestic ☐
Aquaculture ☐	Environment ☐	Industry ☐	Mning ☒ Petroleum ☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision Signature of Driller under supervision Date: / /

Name and Licence# of Licensed Driller: Signature of Licensed Driller: Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐	Survey ☐	Other ☐

Property Location:	Section No: Portion No:	Lot No: LTO Code: Lease No:	Town of: Hundred of:

Coordinate Location Verified:	Datum: GDA94 ☐	GDA2020 ☐	
	MGA Zone:	Easting:	Latitude (DMS):
	Index Map Number:	Northing:	Longitude (DMS):

Date Registered: Dept Officer: Signature:

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No:	RN
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735	Bore Name:	NNMW007
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☒	Easting: 424731	Northing: 7819450	Latitude(DMS):	Longitude(DMS):

From	To	Particulars of Strata
0	12	CLAY
12	21	SILTSTONE / SANDSTONE
21	27	SANDSTONE
27	30	SILTSTONE
30	39	HEMATITE SHALE
39	42	SANDSTONE / SILTSTONE
42	87	SANDSTONE
87	90	CHLORITE ROCK
90	96	SANDSTONE

Name of Drilling Company: May Drilling
Name of Driller: Frederick May
Name of supervising driller:

Date Commenced: 1/6/2021
Date Completed: 2/6/2021
Depth Drilled: 96 (m)
Completion Depth: 95.8 TD,GL (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☒ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER From (m)	To (m)	Dia. (mm)	DRILLING FLUID Type
0	12	310	Air
12	96	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	95.8	101 mm	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
83.8	95.8	101	2mm	Hand Slotted.

Casing Suspended: Yes ☐ No ☒
Method: Seated on Bottom
Height of Casing above GL: .7m (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	Grout.
83.8	95.8	3-6mm Gravel Pack
81	82.8	Bentonite

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
18	24	.001						
	66	.0001						
90	96	.13		1/2				

Cumulative Yield:

Completion Yield: .13 (L/s) Method: Air Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

STRATA / WATER SAMPLES
Have been ☐ Will be ☐
Left at:

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION RN:

↑
N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture ☐	Public Water Supply ☐	Cultural ☐	Rural Stock and Domestic ☐
Aquaculture ☐	Environment ☐	Industry ☐	Mning ☒ Petroleum ☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision Signature of Driller under supervision Date: / /

Name and Licence# of Licensed Driller: Signature of Licensed Driller: Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located: GPS ☐ Survey ☐ Other ☐

Property Location: Section No: Portion No: Lot No: Lease No: LTO Code: Town of: Hundred of:

Coordinate Location Verified: Datum: GDA94 ☐ GDA2020 ☐ MGA Zone: Index Map Number: Easting: Northing: Latitude (DMS): Longitude (DMS):

Date Registered: Dept Officer: Signature:

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No:	RN
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735	Bore Name:	NNMW011
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☒	Easting: 426622	Northing: 7819922	Latitude(DMS):	Longitude(DMS):

From	To	Particulars of Strata
0	3	CLAY
3	6	HEMATITE SHALE
6	21	CLAY
21	66	SANDSTONE

Name of Drilling Company: May Drilling
Name of Driller: Frederick May
Name of supervising driller

Date Commenced: 28/5/2021
Date Completed: 29/5/2021

Depth Drilled: (m)
Completion Depth: (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER From (m)	To (m)	Dia. (mm)	DRILLING FLUID Type
0	12	310	Air
0	66	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel.
0	66	101	C12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
54	66	101	2mm	Hand Slotted

Casing Suspended: Yes ☐ No ☑
Method: Seated on Bottom
Height of Casing above GL: .7m (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	Grout.
52	66	3-6mm Sand.
50	52	Bentonite.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
59	60	1			Salty.			

Cumulative Yield:

Completion Yield: 1 (L/s) Method: Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

STRATA / WATER SAMPLES

Have been ☐ Will be ☐
Left at:

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION	RN:

↑
N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture ☐	Public Water Supply ☐	Cultural ☐	Rural Stock and Domestic ☐
Aquaculture ☐	Environment ☐	Industry ☐	Mning ☒ Petroleum ☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision Signature of Driller under supervision Date: / /

Name and Licence# of Licensed Driller: Signature of Licensed Driller: Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY				
How Located:	GPS ☐	Survey ☐		Other ☐
Property Location:	Section No: Portion No:	Lot No: Lease No:	LTO Code:	Town of: Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐ MGA Zone: Index Map Number:	Easting: Northing:	GDA2020 ☐	Latitude (DMS): Longitude (DMS):
Date Registered:	Dept Officer:	Signature:		
Remarks:				

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735	Bore Name:	NNMW012
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☒	Easting: 427617	Northing: 7819829.6	Latitude(DMS):	Longitude(DMS):

From	To	Particulars of Strata
0	3	CLAY
3	9	HEMATITE SHALE
9	18	SILTSTONE
18	27	SANDSTONE
27	30	SILTSTONE
30	33	SANDSTONE
33	36	SILTSTONE
36	48	SANDSTONE
48	54	SILTSTONE
54	78	SANDSTONE

Name of Drilling Company: May Drilling

Name of Driller: Frederick May.

Name of supervising driller

Date Commenced: 30/5/2021

Date Completed: 31/5/2021

Depth Drilled: 76.6m (m)

Completion Depth: 76.4m (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air
12	76.6	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	76.4	101mm	C12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
64.4	76.4	2mm	101	Hand Slotted

Casing Suspended: Yes ☐ No ☑

Method: Seated on Bottom

Height of Casing above GL: .7m (m)

(m)

Top of Packer Set at: (m)

Length of Packer: (m)

Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
63.4	76.4	3-6mm Gravel pack
0	12m	Bentonite grout.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (μS/cm)	pH	Bottle (No.)
68	70	.2			Salty.			

Cumulative Yield: .2

STRATA / WATER SAMPLES

Have been ☐ Will be ☐

Left at:

Completion Yield: .2 (L/s) Method: Duration (hrs):

Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION	RN:

N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☑ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture ☐	Public Water Supply ☐	Cultural ☐	Rural Stock and Domestic ☐
Aquaculture ☐	Environment ☐	Industry ☐	Mning ☒ Petroleum ☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision Signature of Driller under supervision Date: / /

Name and Licence# of Licensed Driller: Signature of Licensed Driller: Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐	Survey ☐	Other ☐
Property Location:	Section No: Portion No:	Lot No: LTO Code: Lease No:	Town of: Hundred of:
Coordinate Location Verified:	Datum: GDA94☐ MGA Zone: Index Map Number:	GDA2020☐ Easting: Northing:	 Latitude (DMS): Longitude (DMS):
Date Registered:	Dept Officer:	Signature:	
Remarks:			

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735	Bore Name:	NNMW13
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☒	Easting: 426527	Latitude(DMS):
					Northing: 7820174	Longitude(DMS):

From	To	Particulars of Strata
0	6	~~[illegible]~~ SANDSTONE / SILTSTONE
6	18	CLAY
18	30	SANDSTONE
30	33	SILTSTONE / SANDSTONE
33	66	SANDSTONE / SILTSTONE
66	69	SILTSTONE / SANDSTONE
69	78	SANDSTONE / SILTSTONE

Name of Drilling Company: May Drilling
Name of Driller: Seamus May
Name of supervising driller

Date Commenced: 7/6/2021
Date Completed: 8/6/2021
Depth Drilled: (m)
Completion Depth: (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER From (m)	To (m)	Dia. (mm)	DRILLING FLUID Type
0	12	310	Air
12	78	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	78	101	PN12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
66	78	101	2mm	Hand Slotted

Casing Suspended: Yes ☐ No ☐
Method:
Height of Casing above GL: (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	5% Grout Bentonite
64	78	3-6mm Sand Pack
62	64	~~[illegible]~~ Bentonite Seal

WATER BEARING BEDS

Depth From (m)	To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
72	78	.24						

Cumulative Yield:

Completion Yield: (L/s) Method: Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

STRATA / WATER SAMPLES

Have been ☐ Will be ☐
Left at:

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION	RN:

N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐
Aquaculture	☐	Environment	☐	Industry	☐	Mning ☒ Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision Signature of Driller under supervision Date: / /

Name and Licence# of Licensed Driller: Signature of Licensed Driller: Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐	Survey ☐	Other ☐

Property Location:	Section No: Portion No:	Lot No: LTO Code: Lease No:	Town of: Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐ MGA Zone: Index Map Number:	GDA2020 ☐ Easting: Northing:	 Latitude (DMS): Longitude (DMS):

Date Registered:	Dept Officer:	Signature:

Remarks:

NORTHERN TERRITORY GOVERNMENT

STATEMENT OF BORE

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	Bore Registration No :	RN
Street address /NT Parcel:	935 Peko RD, Tennant Creek 3735	Bore Name:	NNMW 014
		BCP Permit No:	BCP

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☒	Easting: 426076	Northing: 7820387	Latitude(DMS):	Longitude(DMS):

From	To	Particulars of Strata
0	9	CLAY
9	15	SANDSTONE
15	18	VOLCANIC TUFF
18	24	SANDSTONE
24	27	SILTSTONE
27	60	SANDSTONE / SILTSTONE
60	66	HEMATITE SHALE
66	72	SANDSTONE

Name of Drilling Company: May Drilling

Name of Driller: Frederick May.

Name of supervising driller

Date Commenced: 29/5/2021

Date Completed: 30/5/2021

Depth Drilled: 69.6 (m)

Completion Depth: 69.4 (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☐

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air
12	69.6	200	Air

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	69.6	101 mm	C12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
57.6	69.6	101	2 mm	Hand Slotted

Casing Suspended: Yes☐ No ☑

Method: Seated on Bottom

Height of Casing above GL: .7m (m)

(m)

Top of Packer Set at: (m)

Length of Packer: (m)

Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	Grout.
69.6	52	3-6mm Sand.
52	50	Bentonite.

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
63.6	66	.2			Salty.			

Cumulative Yield:

Completion Yield: .2 (L/s) Method: Duration (hrs):

Completion SWL from GL: (m) Depth of Lift (m):

STRATA / WATER SAMPLES

Have been ☐ Will be ☐

Left at:

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION	RN:

N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☒ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture ☐	Public Water Supply ☐	Cultural ☐	Rural Stock and Domestic ☐
Aquaculture ☐	Environment ☐	Industry ☐	Mning ☒ Petroleum ☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision Signature of Driller under supervision Date: / /

Name and Licence# of Licensed Driller: Signature of Licensed Driller: Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐	Survey ☐	Other ☐

Property Location:	Section No: Portion No:	Lot No: LTO Code: Lease No:	Town of: Hundred of:

Coordinate Location Verified:	Datum: GDA94 ☐	GDA2020 ☐	
	MGA Zone:	Easting:	Latitude (DMS):
	Index Map Number:	Northing:	Longitude (DMS):

Date Registered:	Dept Officer:	Signature:

Remarks:

STATEMENT OF BORE

NORTHERN TERRITORY GOVERNMENT

Pursuant to section 53 of the Water Act and section 11 of the Water Regulations

Name of Owner:	Tennant Mining	**Bore Registration No :**	**RN**
Street address /NT Parcel:	935 Peko Rd, Tennant Creek 3735	**Bore Name:**	NNMW018
		BCP Permit No:	**BCP**

Coordinate of Bore:	GDA2020 ☐	GDA94 ☒	WGS84 ☐	Zone: 52 ☐ 53 ☒	Easting: 427152	Northing: 7819926	Latitude(DMS):	Longitude(DMS):

From	To	Particulars of Strata
0	3	LATERITE
3	6	CLAY
6	21	SILTSTONE
21	24	VOLCANIC TUFF
24	30	SANDSTONE
30	39	HEMATITE SHALE
39	75	SANDSTONE

Name of Drilling Company: May Drilling
Name of Driller: Frederick May
Name of supervising driller

Date Commenced: 31/5/2021
Date Completed: 1/6/2021
Depth Drilled: 78 (m)
Completion Depth: 78 (m)

METHOD OF DRILLING

Auger ☐ Rotary Air ☑ Rotary Mud ☐ Sonic ☐ Other ☐
Specify:

HOLE DIAMETER			**DRILLING FLUID**
From (m)	To (m)	Dia. (mm)	Type
0	12	310	Air
12	78	200	

PARTICULARS OF CASING

From (m)	To (m)	ID Dia (mm)	Type
0	12	210	4.8mm Steel
0	78	101	C12 PVC

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From (m)	To (m)	ID Dia (mm)	Aperture(mm)	Type
78	66	101	2mm	Hand Slotted

Casing Suspended: Yes☐ No ☑
Method: Seated on Bottom
Height of Casing above GL: .7m (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From (m)	To (m)	Type
0	12	Grout.
65	78	3-6mm Gravel Pack
63	65	Bentonite

WATER BEARING BEDS

Depth From (m)	Depth To (m)	Yield (L/s)	SWL (m)	Duration (hrs)	Quality	EC (µS/cm)	pH	Bottle (No.)
70	74.6	~~1.9~~ 0.19			Fair			

Cumulative Yield: 1.9

STRATA / WATER SAMPLES
Have been ☐ Will be ☐
Left at:

Completion Yield: 1.9 (L/s) Method: Duration (hrs):
Completion SWL from GL: (m) Depth of Lift (m):

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

SKETCH AND BRIEF DESCRIPTION OF THE BORE'S LOCATION **RN:**

↑ N

FINAL CONSTRUCTION STATUS

Constructed and Capped ☐ Decommissioned ☐ *(Jump to 'Additional Information' to provide more Decommissioning Method details)*

THE TYPE OF BORE *(Multiple Selection Acceptable)*

Production Bore ☐ Investigation Bore ☐ Monitoring Bore ☑ Other ☐ Specify:

THE PROPOSED USE OF PRODUCTION BORE *(Optional and Multiple Selection Acceptable)*

Agriculture	☐	Public Water Supply	☐	Cultural	☐	Rural Stock and Domestic	☐		
Aquaculture	☐	Environment	☑	Industry	☐	Mning	☐	Petroleum	☐

Bore RN permanently displayed on completed bore?	Yes ☐ No ☐	Surface Slab Completed?	Yes ☐ No ☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

I hereby declare that the information provided in this application and accompanying documents is to the best of my knowledge, true and correct

Name and Licence# of Driller under supervision Signature of Driller under supervision Date: / /

Name and Licence# of Licensed Driller: Signature of Licensed Driller: Date: / /

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

FOR OFFICIAL USE ONLY

How Located:	GPS ☐	Survey ☐	Other ☐

Property Location:	Section No:	Lot No:	LTO Code:	Town of:
	Portion No:	Lease No:		Hundred of:
Coordinate Location Verified:	Datum: GDA94 ☐	GDA2020 ☐		
	MGA Zone:	Easting:	Latitude (DMS):	
	Index Map Number:	Northing:	Longitude (DMS):	

Date Registered:	Dept Officer:	Signature:

Remarks:

APPENDIX C

Laboratory Results

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Matt Golovanoff
Client	TENNANT MINING
Address	PO BOX 37 WEST PERTH WA 6005
Telephone	0414867084
Facsimile	(Not specified)
Email	matt@tennantmining.com.au
Project	**Water Analysis - 12-13 October 2021**
Order Number	(Not specified)
Samples	12

LABORATORY DETAILS

Manager	Anthony Nilsson
Laboratory	SGS Cairns Environmental
Address	Unit 2, 58 Comport St Portsmith QLD 4870
Telephone	+61 07 4035 5111
Facsimile	+61 07 4035 5122
Email	AU.Environmental.Cairns@sgs.com
SGS Reference	**CE155426 R0**
Date Received	18 Oct 2021
Date Reported	02 Nov 2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(3146/19038)

For determination of soluble metals, filtered sample was not received so samples were laboratory filtered on receipt. This may give soluble metals results that do not represent the concentrations present at the time of sampling.
Metals - The Limit of Reporting (LOR) has been raised due to interferences from the sample matrix.
Cyandie subcontracted to SGS Perth Environmental, 28 Reid Rd Perth Airport WA, NATA Accreditation Number 2562, Site Number 898, PE155587.

SIGNATORIES

Alyson BERGAMO
Senior Laboratory Technician

Anthony NILSSON
Operations Manager

Jon DICKER
Manager Northern QLD

Maristela GANZAN
Quality Coordinator

Mitsuko BALDWIN
Metals Team Leader

Parameter	Units	LOR	CE155426.001 Water 12 Oct 2021 NNMW001	CE155426.002 Water 12 Oct 2021 NNMW002	CE155426.003 Water 13 Oct 2021 NNMW004	CE155426.004 Water 13 Oct 2021 NNMW005

pH in water Method: AN101 Tested: 19/10/2021

Parameter	Units	LOR	.001	.002	.003	.004
pH**	pH Units	0.1	7.8	7.4	7.9	7.8

Alkalinity Method: AN135 Tested: 19/10/2021

Parameter	Units	LOR	.001	.002	.003	.004
Bicarbonate Alkalinity as HCO3	mg/L	5	360	140	390	430
Carbonate Alkalinity as CO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as OH	mg/L	5	<5	<5	<5	<5
Total Alkalinity as CaCO3	mg/L	5	300	120	320	350
Bicarbonate Alkalinity as CaCO3	mg/L	5	300	120	320	350
Carbonate Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5

Chloride by Discrete Analyser in Water Method: AN274 Tested: 20/10/2021

Parameter	Units	LOR	.001	.002	.003	.004
Chloride, Cl	mg/L	1	3000	1300	3200	3700

Conductivity and TDS by Calculation - Water Method: AN106 Tested: 19/10/2021

Parameter	Units	LOR	.001	.002	.003	.004
Conductivity @ 25 C	µS/cm	5	11000	4700	11000	14000
Total Dissolved Solids (by calculation)	mg/L	2	-	-	-	-

Acidity and Free CO2 Method: AN140 Tested: 19/10/2021

Parameter	Units	LOR	.001	.002	.003	.004
Acidity to pH 8.3	mg CaCO3/L	5	27	30	28	40

Total Dissolved Solids (TDS) in water Method: AN113 Tested: 25/10/2021

Parameter	Units	LOR	.001	.002	.003	.004
Total Dissolved Solids Dried at 175-185°C	mg/L	10	7300	3200	7100	8700

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Sample Number			CE155426.001	CE155426.002	CE155426.003	CE155426.004
Sample Matrix			Water	Water	Water	Water
Sample Date			12 Oct 2021	12 Oct 2021	13 Oct 2021	13 Oct 2021
Sample Name			NNMW001	NNMW002	NNMW004	NNMW005

Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Aluminium, Al	mg/L	0.005	**0.016**	**0.012**	**0.015**	**0.024**
Calcium, Ca	mg/L	0.1	**220**	**120**	**180**	**190**
Iron, Fe	mg/L	0.02	<0.02	<0.02	<0.02	-
Magnesium, Mg	mg/L	0.1	**270**	**150**	**290**	**260**
Manganese, Mn	mg/L	0.005	**3.6**	**1.1**	**0.70**	**0.39**
Potassium, K	mg/L	0.1	**84**	**21**	**96**	**79**
Sodium, Na	mg/L	0.5	**2000**	**560**	**2100**	**2100**
Sulfur asSulfate, SO4	mg/L	0.5	**980**	**240**	**870**	**990**
Zinc, Zn	mg/L	0.005	**0.008**	**0.006**	**0.007**	**0.012**
Total Hardness by Calculation	mg CaCO3/L	1	**1600**	**930**	**1600**	**1600**

Metals in Water (Total) by ICPOES Method: AN022/AN320 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Total Aluminium	mg/L	0.005	**0.094**	**3.3**	**0.30**	**1.1**
Total Iron	mg/L	0.02	**0.13**	**2.5**	**0.37**	**1.7**
Total Manganese	mg/L	0.005	**3.9**	**1.9**	**0.74**	**0.49**
Total Zinc	mg/L	0.005	**0.014**	**0.010**	**0.009**	**0.023**

Metals in Water (Dissolved) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Arsenic, As	mg/L	0.003	<0.009↑	<0.006↑	<0.009↑	-
Cadmium, Cd	mg/L	0.0001	**0.0004**	**0.0002**	<0.0003↑	-
Chromium, Cr	mg/L	0.001	<0.0030↑	<0.0020↑	<0.0030↑	-
Cobalt, Co	mg/L	0.001	**0.054**	**0.017**	**0.050**	-
Copper, Cu	mg/L	0.001	**0.003**	**0.003**	<0.003↑	-
Lead, Pb	mg/L	0.001	**0.003**	<0.002↑	<0.003↑	-
Nickel, Ni	mg/L	0.001	**0.006**	**0.012**	<0.003↑	-
Selenium, Se	mg/L	0.002	**0.037**	**0.010**	**0.025**	-
Vanadium, V	mg/L	0.001	<0.003↑	<0.002↑	<0.003↑	-

Metals in Water (Total) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Total Arsenic, As	mg/L	0.003	<0.009↑	<0.006↑	<0.009↑	-
Total Cadmium, Cd	mg/L	0.0001	**0.0005**	**0.0003**	<0.0003↑	-
Total Chromium, Cr	mg/L	0.001	<0.003↑	**0.003**	<0.003↑	-
Total Cobalt, Co	mg/L	0.001	**0.055**	**0.019**	**0.051**	-
Total Copper, Cu	mg/L	0.001	**0.004**	**0.006**	<0.003↑	-
Total Lead, Pb	mg/L	0.001	**0.003**	**0.005**	<0.003↑	-
Total Nickel, Ni	mg/L	0.001	**0.007**	**0.014**	<0.003↑	-
Total Selenium, Se	mg/L	0.002	**0.038**	**0.012**	**0.025**	-
Total Vanadium, V	mg/L	0.001	<0.003↑	**0.007**	**0.003**	-

Trace Metals (soluble) in saline water by ICPMS Method: AN318 Tested: 29/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Arsenic	mg/L	0.001	-	-	-	<0.001
Cadmium	mg/L	0.001	-	-	-	<0.001
Chromium	mg/L	0.001	-	-	-	**0.003**
Cobalt	mg/L	0.001	-	-	-	**0.18**
Copper	mg/L	0.001	-	-	-	**0.010**
Iron	mg/L	0.01	-	-	-	**0.02**
Lead	mg/L	0.001	-	-	-	<0.001
Nickel	mg/L	0.001	-	-	-	**0.004**
Selenium	mg/L	0.002	-	-	-	**0.013**
Vanadium	mg/L	0.001	-	-	-	**0.002**
Zinc	μg/L	5	-	-	-	-

Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Total Arsenic	mg/L	0.001	-	-	-	<0.001
Total Cadmium	mg/L	0.001	-	-	-	<0.001
Total Chromium	mg/L	0.001	-	-	-	**0.005**
Total Cobalt	mg/L	0.001	-	-	-	**0.18**
Total Copper	mg/L	0.001	-	-	-	**0.025**

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Sample Matrix			Water	Water	Water	Water
Sample Date			12 Oct 2021	12 Oct 2021	13 Oct 2021	13 Oct 2021
Sample Name			NNMW001	NNMW002	NNMW004	NNMW005

Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021 (continued)

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Total Iron	mg/L	0.01	-	-	-	-
Total Lead	mg/L	0.001	-	-	-	**0.005**
Total Nickel	mg/L	0.001	-	-	-	**0.004**
Total Selenium	mg/L	0.002	-	-	-	**0.014**
Total Vanadium	mg/L	0.001	-	-	-	**0.005**
Total Zinc	µg/L	5	-	-	-	-

Metals (dissolved) in Water by GF AAS Method: AN304 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0001	<0.0002↑	<0.0003↑

Metals (total-acid soluble) in Water by GF AAS Method: AN022/AN304 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Total (acid soluble) Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0001	<0.0002↑	<0.0003↑

Mercury (dissolved) in Water Method: AN311(Perth)/AN312 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005

Mercury (total) in Water Method: AN311(Perth) /AN312 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Total Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005

Calculation of Anion-Cation Balance (SAR Calc) Method: AN121 Tested: 29/10/2021

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Sum of Cation Milliequivalents*	meq/L	-	**124**	**44.3**	**128**	**127**
Sum of Anion Milliequivalents*	meq/L	-	**111**	**44.1**	**114**	**131**
Anion-Cation Balance	%	-100	**5.5**	**0.2**	**5.9**	**-1.8**

Parameter	Units	LOR	CE155426.001	CE155426.002	CE155426.003	CE155426.004
Sample Matrix			Water	Water	Water	Water
Sample Date			12 Oct 2021	12 Oct 2021	13 Oct 2021	13 Oct 2021
Sample Name			NNMW001	NNMW002	NNMW004	NNMW005
Cyanide Forms in Water by CFA Method: AN296 Tested: 22/10/2021						
Free Cyanide (pH 6)	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	**0.021**	<0.004	**0.025**	**0.039**

Parameter	Units	LOR	Sample Number: CE155426.005 Sample Matrix: Water Sample Date: 13 Oct 2021 Sample Name: NNMW007	CE155426.006 Water 12 Oct 2021 NNMW011	CE155426.007 Water 12 Oct 2021 NNMW012	CE155426.008 Water 12 Oct 2021 NNMW013

pH in water Method: AN101 Tested: 19/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
pH**	pH Units	0.1	7.9	7.7	7.7	7.8

Alkalinity Method: AN135 Tested: 19/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Bicarbonate Alkalinity as HCO3	mg/L	5	310	420	240	250
Carbonate Alkalinity as CO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as OH	mg/L	5	<5	<5	<5	<5
Total Alkalinity as CaCO3	mg/L	5	250	350	190	210
Bicarbonate Alkalinity as CaCO3	mg/L	5	250	350	190	210
Carbonate Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5

Chloride by Discrete Analyser in Water Method: AN274 Tested: 20/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Chloride, Cl	mg/L	1	2700	2800	3500	2800

Conductivity and TDS by Calculation - Water Method: AN106 Tested: 19/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Conductivity @ 25 C	µS/cm	5	9900	11000	12000	10000
Total Dissolved Solids (by calculation)	mg/L	2	-	-	-	-

Acidity and Free CO2 Method: AN140 Tested: 19/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Acidity to pH 8.3	mg CaCO3/L	5	12	55	20	16

Total Dissolved Solids (TDS) in water Method: AN113 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Total Dissolved Solids Dried at 175-185°C	mg/L	10	6100	6700	8100	6500

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name			
			CE155426.005 Water 13 Oct 2021 NNMW007	CE155426.006 Water 12 Oct 2021 NNMW011	CE155426.007 Water 12 Oct 2021 NNMW012	CE155426.008 Water 12 Oct 2021 NNMW013

Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Aluminium, Al	mg/L	0.005	**0.020**	**0.021**	**0.024**	**0.018**
Calcium, Ca	mg/L	0.1	**140**	**200**	**350**	**210**
Iron, Fe	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Magnesium, Mg	mg/L	0.1	**180**	**220**	**280**	**230**
Manganese, Mn	mg/L	0.005	**0.18**	**0.016**	**4.3**	**1.1**
Potassium, K	mg/L	0.1	**83**	**83**	**80**	**76**
Sodium, Na	mg/L	0.5	**1800**	**1900**	**2000**	**1600**
Sulfur asSulfate, SO4	mg/L	0.5	**790**	**1100**	**920**	**830**
Zinc, Zn	mg/L	0.005	<0.005	**0.008**	**0.014**	<0.005
Total Hardness by Calculation	mg CaCO3/L	1	**1100**	**1400**	**2000**	**1500**

Metals in Water (Total) by ICPOES Method: AN022/AN320 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Total Aluminium	mg/L	0.005	**0.76**	**0.15**	**1.9**	**2.0**
Total Iron	mg/L	0.02	**0.66**	**0.16**	**2.3**	**1.7**
Total Manganese	mg/L	0.005	**0.21**	**0.024**	**4.4**	**1.2**
Total Zinc	mg/L	0.005	**0.008**	**0.014**	**0.018**	**0.006**

Metals in Water (Dissolved) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Arsenic, As	mg/L	0.003	<0.009↑	<0.009↑	<0.009↑	<0.009↑
Cadmium, Cd	mg/L	0.0001	**0.0004**	**0.0003**	**0.0004**	<0.0003↑
Chromium, Cr	mg/L	0.001	**0.0034**	<0.0030↑	<0.0030↑	<0.0030↑
Cobalt, Co	mg/L	0.001	**0.006**	<0.003↑	**0.018**	**0.011**
Copper, Cu	mg/L	0.001	<0.003↑	<0.003↑	<0.003↑	**0.005**
Lead, Pb	mg/L	0.001	<0.003↑	<0.003↑	**0.006**	<0.003↑
Nickel, Ni	mg/L	0.001	<0.003↑	<0.003↑	**0.005**	**0.006**
Selenium, Se	mg/L	0.002	**0.017**	**0.019**	**0.014**	**0.030**
Vanadium, V	mg/L	0.001	<0.003↑	<0.003↑	<0.003↑	<0.003↑

Metals in Water (Total) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Total Arsenic, As	mg/L	0.003	<0.009↑	<0.009↑	<0.009↑	<0.009↑
Total Cadmium, Cd	mg/L	0.0001	**0.0005**	**0.0004**	**0.0004**	<0.0003↑
Total Chromium, Cr	mg/L	0.001	**0.004**	<0.003↑	**0.004**	**0.004**
Total Cobalt, Co	mg/L	0.001	**0.007**	<0.003↑	**0.022**	**0.015**
Total Copper, Cu	mg/L	0.001	<0.003↑	**0.004**	**0.005**	**0.017**
Total Lead, Pb	mg/L	0.001	<0.003↑	**0.004**	**0.006**	**0.004**
Total Nickel, Ni	mg/L	0.001	<0.003↑	**0.003**	**0.006**	**0.009**
Total Selenium, Se	mg/L	0.002	**0.019**	**0.020**	**0.014**	**0.034**
Total Vanadium, V	mg/L	0.001	**0.004**	<0.003↑	**0.008**	**0.005**

Trace Metals (soluble) in saline water by ICPMS Method: AN318 Tested: 29/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Arsenic	mg/L	0.001	-	-	-	-
Cadmium	mg/L	0.001	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-
Cobalt	mg/L	0.001	-	-	-	-
Copper	mg/L	0.001	-	-	-	-
Iron	mg/L	0.01	-	-	-	-
Lead	mg/L	0.001	-	-	-	-
Nickel	mg/L	0.001	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-
Vanadium	mg/L	0.001	-	-	-	-
Zinc	µg/L	5	-	-	-	-

Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Total Arsenic	mg/L	0.001	-	-	-	-
Total Cadmium	mg/L	0.001	-	-	-	-
Total Chromium	mg/L	0.001	-	-	-	-
Total Cobalt	mg/L	0.001	-	-	-	-
Total Copper	mg/L	0.001	-	-	-	-

Parameter	Units	LOR	CE155426.005 Water 13 Oct 2021 NNMW007	CE155426.006 Water 12 Oct 2021 NNMW011	CE155426.007 Water 12 Oct 2021 NNMW012	CE155426.008 Water 12 Oct 2021 NNMW013

Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021 (continued)

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Total Iron	mg/L	0.01	-	-	-	-
Total Lead	mg/L	0.001	-	-	-	-
Total Nickel	mg/L	0.001	-	-	-	-
Total Selenium	mg/L	0.002	-	-	-	-
Total Vanadium	mg/L	0.001	-	-	-	-
Total Zinc	μg/L	5	-	-	-	-

Metals (dissolved) in Water by GF AAS Method: AN304 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0002↑	<0.0003↑	<0.0002↑

Metals (total-acid soluble) in Water by GF AAS Method: AN022/AN304 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Total (acid soluble) Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0002↑	<0.0003↑	<0.0002↑

Mercury (dissolved) in Water Method: AN311(Perth)/AN312 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005

Mercury (total) in Water Method: AN311(Perth) /AN312 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Total Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005

Calculation of Anion-Cation Balance (SAR Calc) Method: AN121 Tested: 29/10/2021

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Sum of Cation Milliequivalents*	meq/L	-	**103**	**114**	**131**	**99.7**
Sum of Anion Milliequivalents*	meq/L	-	**97.8**	**107**	**122**	**102**
Anion-Cation Balance	%	-100	**2.5**	**3.3**	**3.4**	**-0.9**

Parameter	Units	LOR	CE155426.005	CE155426.006	CE155426.007	CE155426.008
Sample Matrix			Water	Water	Water	Water
Sample Date			13 Oct 2021	12 Oct 2021	12 Oct 2021	12 Oct 2021
Sample Name			NNMW007	NNMW011	NNMW012	NNMW013
Cyanide Forms in Water by CFA Method: AN296 Tested: 22/10/2021						
Free Cyanide (pH 6)	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004

Parameter	Units	LOR	CE155426.009 Water 12 Oct 2021 NNMW014	CE155426.010 Water 12 Oct 2021 NNMW018	CE155426.011 Water 13 Oct 2021 SWLA	CE155426.012 Water 13 Oct 2021 Juno Shaft

pH in water Method: AN101 Tested: 19/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
pH**	pH Units	0.1	7.9	7.9	7.1	7.2

Alkalinity Method: AN135 Tested: 19/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Bicarbonate Alkalinity as HCO3	mg/L	5	360	280	38	49
Carbonate Alkalinity as CO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as OH	mg/L	5	<5	<5	<5	<5
Total Alkalinity as CaCO3	mg/L	5	300	230	31	40
Bicarbonate Alkalinity as CaCO3	mg/L	5	300	230	31	40
Carbonate Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5
Hydroxide Alkalinity as CaCO3	mg/L	5	<5	<5	<5	<5

Chloride by Discrete Analyser in Water Method: AN274 Tested: 20/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Chloride, Cl	mg/L	1	2800	3100	9	4000

Conductivity and TDS by Calculation - Water Method: AN106 Tested: 19/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Conductivity @ 25 C	µS/cm	5	9900	11000	99	14000
Total Dissolved Solids (by calculation)	mg/L	2	-	6500	-	-

Acidity and Free CO2 Method: AN140 Tested: 19/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Acidity to pH 8.3	mg CaCO3/L	5	18	9	10	<5

Total Dissolved Solids (TDS) in water Method: AN113 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Total Dissolved Solids Dried at 175-185°C	mg/L	10	6400	IS	60	11000

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Sample Number			CE155426.009	CE155426.010	CE155426.011	CE155426.012
Sample Matrix			Water	Water	Water	Water
Sample Date			12 Oct 2021	12 Oct 2021	13 Oct 2021	13 Oct 2021
Sample Name			NNMW014	NNMW018	SWLA	Juno Shaft

Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Aluminium, Al	mg/L	0.005	**0.043**	**0.020**	**0.20**	**0.042**
Calcium, Ca	mg/L	0.1	**210**	**320**	**5.8**	**760**
Iron, Fe	mg/L	0.02	<0.02	<0.02	**0.47**	<0.02
Magnesium, Mg	mg/L	0.1	**220**	**250**	**1.8**	**250**
Manganese, Mn	mg/L	0.005	**0.27**	**0.63**	<0.005	**0.29**
Potassium, K	mg/L	0.1	**79**	**73**	**5.7**	**140**
Sodium, Na	mg/L	0.5	**1700**	**1800**	**5.7**	**2200**
Sulfur asSulfate, SO4	mg/L	0.5	**680**	**900**	**4.2**	**1700**
Zinc, Zn	mg/L	0.005	<0.005	**0.024**	<0.005	-
Total Hardness by Calculation	mg CaCO3/L	1	**1400**	**1800**	**22**	**2900**

Metals in Water (Total) by ICPOES Method: AN022/AN320 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Total Aluminium	mg/L	0.005	**1.2**	**0.16**	**0.21**	**0.045**
Total Iron	mg/L	0.02	**1.4**	**0.31**	**0.83**	**0.82**
Total Manganese	mg/L	0.005	**0.30**	**0.66**	**0.021**	**0.29**
Total Zinc	mg/L	0.005	**0.012**	**0.029**	<0.005	-

Metals in Water (Dissolved) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Arsenic, As	mg/L	0.003	<0.009↑	<0.009↑	<0.003	-
Cadmium, Cd	mg/L	0.0001	**0.0004**	**0.0003**	<0.0001	-
Chromium, Cr	mg/L	0.001	<0.0030↑	<0.0030↑	<0.0010	-
Cobalt, Co	mg/L	0.001	**0.005**	**0.008**	<0.001	-
Copper, Cu	mg/L	0.001	<0.003↑	<0.003↑	**0.001**	-
Lead, Pb	mg/L	0.001	<0.003↑	<0.003↑	<0.001	-
Nickel, Ni	mg/L	0.001	<0.003↑	**0.003**	<0.001	-
Selenium, Se	mg/L	0.002	**0.020**	**0.010**	<0.002	-
Vanadium, V	mg/L	0.001	**0.005**	<0.003↑	**0.001**	-

Metals in Water (Total) by ICPOES-USN Method: AN320/AN322 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Total Arsenic, As	mg/L	0.003	<0.009↑	<0.009↑	<0.003	-
Total Cadmium, Cd	mg/L	0.0001	**0.0004**	**0.0004**	<0.0001	-
Total Chromium, Cr	mg/L	0.001	<0.003↑	<0.003↑	<0.001	-
Total Cobalt, Co	mg/L	0.001	**0.006**	**0.009**	<0.001	-
Total Copper, Cu	mg/L	0.001	**0.005**	**0.004**	**0.001**	-
Total Lead, Pb	mg/L	0.001	**0.004**	**0.003**	**0.001**	-
Total Nickel, Ni	mg/L	0.001	<0.003↑	**0.004**	<0.001	-
Total Selenium, Se	mg/L	0.002	**0.027**	**0.011**	<0.002	-
Total Vanadium, V	mg/L	0.001	**0.006**	<0.003↑	**0.001**	-

Trace Metals (soluble) in saline water by ICPMS Method: AN318 Tested: 29/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Arsenic	mg/L	0.001	-	-	-	**0.012**
Cadmium	mg/L	0.001	-	-	-	<0.001
Chromium	mg/L	0.001	-	-	-	**0.002**
Cobalt	mg/L	0.001	-	-	-	<0.001
Copper	mg/L	0.001	-	-	-	**0.006**
Iron	mg/L	0.01	-	-	-	-
Lead	mg/L	0.001	-	-	-	<0.001
Nickel	mg/L	0.001	-	-	-	**0.001**
Selenium	mg/L	0.002	-	-	-	**0.002**
Vanadium	mg/L	0.001	-	-	-	<0.001
Zinc	µg/L	5	-	-	-	<5

Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Total Arsenic	mg/L	0.001	-	-	-	**0.021**
Total Cadmium	mg/L	0.001	-	-	-	<0.001
Total Chromium	mg/L	0.001	-	-	-	**0.003**
Total Cobalt	mg/L	0.001	-	-	-	<0.001
Total Copper	mg/L	0.001	-	-	-	**0.006**

Parameter	Units	LOR	CE155426.009 Water 12 Oct 2021 NNMW014	CE155426.010 Water 12 Oct 2021 NNMW018	CE155426.011 Water 13 Oct 2021 SWLA	CE155426.012 Water 13 Oct 2021 Juno Shaft

Trace Metals (total) in saline water by ICPMS Method: AN318 Tested: 27/10/2021 (continued)

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Total Iron	mg/L	0.01	-	-	-	-
Total Lead	mg/L	0.001	-	-	-	<0.001
Total Nickel	mg/L	0.001	-	-	-	**0.003**
Total Selenium	mg/L	0.002	-	-	-	<0.002
Total Vanadium	mg/L	0.001	-	-	-	<0.001
Total Zinc	µg/L	5	-	-	-	**11**

Metals (dissolved) in Water by GF AAS Method: AN304 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0002↑	<0.0001	<0.0003↑

Metals (total-acid soluble) in Water by GF AAS Method: AN022/AN304 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Total (acid soluble) Silver, Ag	mg/L	0.0001	<0.0002↑	<0.0002↑	<0.0001	<0.0003↑

Mercury (dissolved) in Water Method: AN311(Perth)/AN312 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005

Mercury (total) in Water Method: AN311(Perth) /AN312 Tested: 25/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Total Mercury	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005

Calculation of Anion-Cation Balance (SAR Calc) Method: AN121 Tested: 29/10/2021

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Sum of Cation Milliequivalents*	meq/L	-	**106**	**117**	**1.05**	**159**
Sum of Anion Milliequivalents*	meq/L	-	**98.7**	**111**	**0.979**	**149**
Anion-Cation Balance	%	-100	**3.6**	**2.6**	**3.4**	**3.3**

Parameter	Units	LOR	CE155426.009	CE155426.010	CE155426.011	CE155426.012
Sample Matrix			Water	Water	Water	Water
Sample Date			12 Oct 2021	12 Oct 2021	13 Oct 2021	13 Oct 2021
Sample Name			NNMW014	NNMW018	SWLA	Juno Shaft
Cyanide Forms in Water by CFA Method: AN296 Tested: 22/10/2021						
Free Cyanide (pH 6)	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Acidity and Free CO2 Method: ME-(AU)-[ENV]AN140

Parameter	QC Reference	Units	LOR	MB
Acidity to pH 8.3	LB095161	mg CaCO3/L	5	<5

Alkalinity Method: ME-(AU)-[ENV]AN135

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Bicarbonate Alkalinity as HCO3	LB095170	mg/L	5	5		
	LB095264	mg/L	5	<5 - 6		
Carbonate Alkalinity as CO3	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		
Hydroxide Alkalinity as OH	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		
Total Alkalinity as CaCO3	LB095170	mg/L	5	<5	1 - 8%	106 - 109%
	LB095264	mg/L	5	<5	0 - 8%	98 - 100%
Bicarbonate Alkalinity as CaCO3	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		
Carbonate Alkalinity as CaCO3	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		
Hydroxide Alkalinity as CaCO3	LB095170	mg/L	5	<5		
	LB095264	mg/L	5	<5		

Chloride by Discrete Analyser in Water Method: ME-(AU)-[ENV]AN274

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chloride, Cl	LB095219	mg/L	1	<1	0 - 3%	110%

Conductivity and TDS by Calculation - Water Method: ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity @ 25 C	LB095170	µS/cm	5	<5	0 - 6%	99 - 103%
	LB095264	µS/cm	5	<5	0 - 5%	99 - 101%
Total Dissolved Solids (by calculation)	LB095170	mg/L	2	<10		NA
	LB095264	mg/L	2	<2		NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Mercury (dissolved) in Water   Method: ME-(AU)-[ENV]AN311(Perth)/AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB095413	mg/L	0.00005	<0.00005	0 - 6%	99 - 100%	100 - 104%

Mercury (total) in Water   Method: ME-(AU)-[ENV]AN311(Perth) /AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Mercury	LB095412	mg/L	0.00005	<0.00005	0 - 6%	99 - 100%	99 - 103%

Metals (dissolved) in Water by GF AAS   Method: ME-(AU)-[ENV]AN304

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Silver, Ag	LB095391	mg/L	0.0001	<0.0001	0%	92%

Metals (total-acid soluble) in Water by GF AAS   Method: ME-(AU)-[ENV]AN022/AN304

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total (acid soluble) Silver, Ag	LB095392	mg/L	0.0001	<0.0001	0%	97 - 102%

Metals in Water (Total) by ICPOES   Method: ME-(AU)-[ENV]AN022/AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Aluminium	LB095355	mg/L	0.005	<0.005	1 - 14%	107%	
Total Iron	LB095355	mg/L	0.02	<0.02	3 - 4%	95%	97%
Total Manganese	LB095355	mg/L	0.005	<0.005	1 - 4%	104%	NA
Total Zinc	LB095355	mg/L	0.005	<0.005	1%	109%	100%

Metals in Water (Dissolved) by ICPOES   Method: ME-(AU)-[ENV]AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Aluminium, Al	LB095354	mg/L	0.005	<0.005	2 - 3%	108%	
Calcium, Ca	LB095354	mg/L	0.1	<0.1	2 - 4%	109%	89%
Iron, Fe	LB095354	mg/L	0.02	<0.02	0%	95%	91%
Magnesium, Mg	LB095354	mg/L	0.1	<0.1	1 - 2%	109%	
Manganese, Mn	LB095354	mg/L	0.005	<0.005	1%	104%	85%
Potassium, K	LB095354	mg/L	0.1	<0.1	0 - 4%	104%	
Sodium, Na	LB095354	mg/L	0.5	<0.5	1 - 10%	104%	
Sulfur asSulfate, SO4	LB095354	mg/L	0.5	<0.5			
Zinc, Zn	LB095354	mg/L	0.005	<0.005	1%	109%	94%
Total Hardness by Calculation	LB095354	mg CaCO3/L	1	<1			

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Metals in Water (Dissolved) by ICPOES-USN   Method: ME-(AU)-[ENV]AN320/AN322

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Arsenic, As	LB095356	mg/L	0.003	<0.003	0%	100%
Cadmium, Cd	LB095356	mg/L	0.0001	<0.0001	5%	101%
Chromium, Cr	LB095356	mg/L	0.001	<0.0010	0%	100%
Cobalt, Co	LB095356	mg/L	0.001	<0.001	6%	101%
Copper, Cu	LB095356	mg/L	0.001	<0.001	0%	97%
Lead, Pb	LB095356	mg/L	0.001	<0.001	0%	111%
Nickel, Ni	LB095356	mg/L	0.001	<0.001	5%	98%
Selenium, Se	LB095356	mg/L	0.002	<0.002	1%	93%
Vanadium, V	LB095356	mg/L	0.001	<0.001	0%	101%

Metals in Water (Total) by ICPOES-USN   Method: ME-(AU)-[ENV]AN320/AN322

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Arsenic, As	LB095357	mg/L	0.003	<0.003	0%	101%
Total Cadmium, Cd	LB095357	mg/L	0.0001	<0.0001	14%	97%
Total Chromium, Cr	LB095357	mg/L	0.001	<0.001	0%	98%
Total Cobalt, Co	LB095357	mg/L	0.001	<0.001	5%	98%
Total Copper, Cu	LB095357	mg/L	0.001	<0.001	1%	104%
Total Lead, Pb	LB095357	mg/L	0.001	<0.001	3%	102%
Total Nickel, Ni	LB095357	mg/L	0.001	<0.001	3%	99%
Total Selenium, Se	LB095357	mg/L	0.002	<0.002	7%	108%
Total Vanadium, V	LB095357	mg/L	0.001	<0.001	0%	99%

pH in water   Method: ME-(AU)-[ENV]AN101

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH**	LB095170	pH Units	0.1	6.1 - 7.1	0 - 3%	NA
	LB095264	pH Units	0.1	5.8 - 8.4	0 - 6%	100 - 101%

Total Dissolved Solids (TDS) in water   Method: ME-(AU)-[ENV]AN113

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Dissolved Solids Dried at 175-185°C	LB095386	mg/L	10	<10	0 - 3%	105%	103 - 113%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Trace Metals (soluble) in saline water by ICPMS Method: ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Arsenic	LB095490	mg/L	0.001	<0.001	99%
Cadmium	LB095490	mg/L	0.001	<0.001	104%
Chromium	LB095490	mg/L	0.001	<0.001	
Cobalt	LB095490	mg/L	0.001	<0.001	103%
Copper	LB095490	mg/L	0.001	0.001	99%
Iron	LB095490	mg/L	0.01	<0.01	98%
Lead	LB095490	mg/L	0.001	<0.001	114%
Nickel	LB095490	mg/L	0.001	<0.001	93%
Selenium	LB095490	mg/L	0.002	<0.002	108%
Vanadium	LB095490	mg/L	0.001	<0.001	100%
Zinc	LB095490	μg/L	5	<5	105%

Trace Metals (total) in saline water by ICPMS Method: ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Total Arsenic	LB095491	mg/L	0.001	<0.001	99%
Total Cadmium	LB095491	mg/L	0.001	<0.001	104%
Total Chromium	LB095491	mg/L	0.001	<0.001	
Total Cobalt	LB095491	mg/L	0.001	<0.001	103%
Total Copper	LB095491	mg/L	0.001	0.001	99%
Total Lead	LB095491	mg/L	0.001	<0.001	114%
Total Nickel	LB095491	mg/L	0.001	<0.001	93%
Total Selenium	LB095491	mg/L	0.002	<0.002	108%
Total Vanadium	LB095491	mg/L	0.001	<0.001	100%
Total Zinc	LB095491	μg/L	5	<5	105%

METHOD	METHODOLOGY SUMMARY
AN022/AN304	Total (acid soluble) metals by GF AAS: Unfiltered sample is digested with nitric acid prior to analysis by Graphite Furnace AAS. Referenced to APHA3113B.
AN022/AN320	Total (acid soluble) Metals by ICP-OES: Samples are digested in nitric or nitric and hydrochloric acids prior to analysis for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Total Dissolved Salts can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. SGS use 0.6. Reference APHA 2510 B.
AN106	Salinity may be calculated in terms of NaCl from the sample conductivity. This assumes all soluble salts present, measured by the conductivity, are present as NaCl.
AN113	Total Dissolved Solids: A well-mixed filtered sample of known volume is evaporated to dryness at 180°C and the residue weighed. Approximate methods for correlating chemical analysis with dissolved solids are available. Reference APHA 2540 C.
AN113	The Total Dissolved Solids residue may also be ignited at 550 C and volatile TDS (Organic TDS) and non-volatile TDS (Inorganic) can be determined.
AN121	This method is used to calculation the balance of major Anions and Cations in water samples and converts major ion concentration to milliequivalents and then summed. Anions sum and Cation sum is calculated as a difference and expressed as a percentage.
AN135	Alkalinity (and forms of) by Titration: The sample is titrated with standard acid to pH 8.3 (P titre) and pH 4.5 (T titre) and permanent and/or total alkalinity calculated. The results are expressed as equivalents of calcium carbonate or recalculated as bicarbonate, carbonate and hydroxide. Reference APHA 2320. Internal Reference AN135
AN140	Acidity by Titration: The water sample is titrated with sodium hydroxide to designated pH end point. In a sample containing only carbon dioxide, bicarbonates and carbonates, titration to pH 8.3 at 25°C corresponds to stoichiometric neutralisation of carbonic acid to bicarbonate. Method reference APHA 2310 B.
AN274	Chloride by Discrete Analyse: Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN296	This method is applicable to the determination of free, total and weak acid dissociable cyanide in drinking water, soil and domestic and industrial waste of a variety of matrices by using San++ continuous flow analysis
AN304	Filtered acidified sample analysed by GFAAS, referenced to APHA3113B.

METHOD	METHODOLOGY SUMMARY
AN311(Perth) /AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions taken from unfiltered sample are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN311(Perth)/AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN318	Determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.
AN320	Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components .
AN320	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.
AN320/AN322	ICP-OES (Ultrasonic Nebuliser): After preservation with 10% nitric acid, a wide range of metals and some non-metals in solution can be measured by ICP- Ultrasonic nebulisation. Solutions are aspirated using an ultrasonic nebuliser into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components.
AN320/AN322	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B
AN322	ICP-OES (Ultrasonic Nebuliser): After preservation with 10% nitric acid, a wide range of metals and some non-metals in solution can be measured by ICP- Ultrasonic nebulisation. Solutions are aspirated using an ultrasonic nebuliser into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components.
AN322	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B
Calculation	Free and Total Carbon Dioxide may be calculated using alkalinity forms only when the samples TDS is <500mg/L. If TDS is >500mg/L free or total carbon dioxide cannot be reported. APHA4500CO2 D.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
***	Indicates that both * and ** apply.	NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

APPENDIX D

Nobles Nob Slug Test Report

Environmental & Social Consultants

SLUG TEST REPORT

Nobles Nob Mine

FINAL

November 2021

SLUG TEST REPORT

Nobles Nob Mine

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tennant Consolidated Mining Group

Project Director:	Claire Stephenson
Project Manager:	Ashish Mishra
Technical Director:	Craig Vincent
Technical Manager:	Ashish Mishra
Report No.	21728 R03
Date:	November 2021

umwelt
Environmental & Social Consultants

APPROVED COMPANY ISO 9001
QMS Certification Services

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
1	Craig Vincent	09-11-2021	Craig Vincent	09-11-2021

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1.0 Introduction

Tennant Mining Consolidated Group (TCMG) own and operate the Nobles Nob Project (Nobles Nob) in the Northern Territory, Australia. Umwelt Australia Pty Ltd (Umwelt) was engaged by TCMG to estimate the hydraulic properties at ten groundwater monitoring locations by undertaking slug tests.

1.1 Bores Details

Slug tests were undertaken between 13 October 2021 and 17 October 2021. The details of the groundwater monitoring bores at Nobles Nob are presented in **Table 1.1**.

Table 1.1 Location and Details of Groundwater Bores at Nobles Nob

Bore _ID	Easting*	Northing*	Depth of hole (mbgl**)	Screen		Gravel		Water Level (mbtoc***)
				From	To	From	To	
NNMW001	425505	7819803	102	90	102	89	102	68.18
NNMW002	425488	7819596	77.9	65.9	77.9	65.9	77.9	68.99
NNMW004	425374.9	7820346	75	63	75	61	75	57
NNMW005	425228.6	7820086	70	58	70	56	70	59.8
NNMW007	424730.8	7819950	95.8	83.8	95.8	82.8	95.8	61.14
NNMW011	426621.8	7819922	66	54	66	52	66	59.71
NNMW012	427616.9	7819830	76.6	64.4	76.4	63.4	76.4	63.2
NNMW013	426527.3	7820174	78	66	78	64	78	70.06
NNMW014	426075.9	7820387	69.6	57.6	69.6	52	69.6	58.64
NNMW018	427151.5	7819926	78	66	78	65	78	55.17

*coordinates in WGS 84/UTM zone 53S.
** mbgl – metres below ground level
*** mbtoc – metres below top of casing

2.0 Methodology

2.1 Equipment

The following equipment was used to conduct the slug tests at Nobles Nob:

- Solinst Levelogger 5 Water Level Dataloggers suspended within the bore using wire rope.
- A field computer.
- Slugs (Waterra Well Slugs).
- Water level dipper.

2.2 Test Procedure

Slug tests are undertaken to estimate the hydraulic properties of water bearing horizons by inducing a rapid water level displacement (rise or fall) and measuring the subsequent water level response. A slug test can be performed by either causing a sudden rise of the water level by inserting a slug (known as a falling-head test) or a sudden fall of the water level by withdrawing the slug (known as a rising-head test). In all the groundwater bores at Nobles Nob, both falling-head tests and rising-head tests were performed by inserting a solid slug into the bore. Falling head tests in some bores were also undertaken by injecting a known volume of water into the bore. Water levels were measured at 1-second intervals using the water level datalogger.

2.2.1 Falling-Head Test

During falling-head tests, the water level datalogger was firstly lowered into the bore to record the pre-test water level. The water level dipper was also used to record the water level prior to lowering the slug into the bore. The slug was then rapidly lowered into the bore, causing a sudden rise in the water level. As the water level recovers, the datalogger measures the water level every second. When the water level falls back to the original level, the falling-head test is complete.

For bores with rapid recovery, the falling-head test was conducted by injecting potable water instead of using a solid slug to cause a sudden rise in the water level. An exact amount of water (20 L) was quickly poured into the bore to create a rise in water level. The datalogger measures the fall in water level, and when the water level returns to its original level, the test is completed.

2.2.2 Rising-Head Test

The rising-head test is similar to the falling-head test, but in this case, the slug is rapidly withdrawn from the bore, causing a sudden drop in the water level. As the water level recovers in the bore, the datalogger measures the water level every second. Once the water level returns to its original level, the datalogger is retrieved, and the data is checked and downloaded to the field computer.

2.3 Data Handling

Following the field program, the data from the datalogger was saved on a field computer, using the Solinst levelogger program (v 4.6.1). After each test, the saved datalogger files were exported to comma-separated (.csv) format.

2.4 Data Analyses

The computer program Aquifer Test (Version 10) was used for all the slug test analyses. The program allows for both automatic and manual fitting of a straight-line plot to the measured data. The program has the inbuilt function of using the Hvorslev method and the Bouwer & Rice method. Both these methods are designed to estimate the hydraulic conductivity of an aquifer. The methods assume a fully or partially penetrating bore in a confined or unconfined aquifer.

The program Aquifer Test (Version 10) recommends using Bouwer & Rice for unconfined or leaking confined aquifers and the Hvorslev method for confined aquifers. The analyses in this report have been undertaken using the Hvorslev method for confined conditions and the Bouwer & Rice method for unconfined conditions. Except for monitoring bore NNMW002 and NNMW011, which is screened across an unconfined aquifer, all monitoring bores are interpreted to be screened across confined aquifers and were analysed using the Bouwer & Rice method.

3.0 Results

3.1 Hydraulic Testing

The results of the slug tests are summarised in **Table 3.1** below. The average hydraulic conductivity derived from the rising-head and falling-head tests for each bore is presented in **Table 3.1.** The recovery of water levels in some bores due to the displacement caused by the slug was very quick, and hence, 20 L of tap water was injected into those bores. These includes bore NNMW005, NNMW11, and NNMW18. The hydraulic conductivity results from the slug test at bore NNMW018 were slightly unreliable since the water level recovered quickly and had a lot of noise. Hence the falling-head test data from injecting 20L of water was used in the analysis.

The values of hydraulic conductivity range from 0.0105 m/day at bore NNMW002 to 0.681 m/day at Bore NNMW018 (**Table 3.1**)**.** Bores NNMW011 and NNMW012, located towards the east of the Nobles Nob Pit, recorded hydraulic conductivity values of 0.387 m/day and 0.355 m/day, respectively. This range is consistent with anecdotal evidence that historically, the water supply bore field for Nobles Nob was located in the same area.

Aquifer transmissivity was calculated by multiplying the hydraulic conductivity by the aquifer thickness. The aquifer thickness refers to the distance between groundwater level and bedrock in the unconfined case, and the distance between the bottom of the clay layer and bedrock in the confined case. The complete test analysis results are also presented in **Appendix A**.

Table 3.1 Results of the Hydraulic Testing

Bores	Hydraulic Conductivity (m/day)	Method	Screen Length (m)	Transmissivity (m^2/day)
NNMW001	0.0162	Hvorslev	12	0.194
NNMW002	0.0105	Bouwer & Rice	12	0.126
NNMW004	0.321	Hvorslev	12	3.852
NNMW005	0.559	Hvorslev	12	6.708
NNMW007	0.0591	Hvorslev	12	0.709
NNMW011	0.387	Bouwer & Rice	12	4.644
NNMW012	0.355	Hvorslev	12	4.260
NNMW013	0.411	Hvorslev	12	4.932
NNMW014	0.11	Hvorslev	12	1.320
NNMW018	0.681	Hvorslev	12	8.172

4.0 Summary and Conclusion

The aquifer properties were evaluated according to the Hvorslev and the Bouwer & Rice methods. The computer program Aquifer Test (Version 10) was used for the analyses.

The lowest hydraulic conductivity was observed at bores NNMW001 and NNMW002, located south (south-east) of the Nobles Nob pit. The values ranged from 0.0105 m/day at bore NNMW002 to 0.604 m/day at Bore NNMW018.

5.0 References

Bouwer, H. and Rice, R.C. (1976), "A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells", Water Resources Research, Vol. 12, No. 3, pp. 423-428.

Hvorslev M.J., (1951), *"Time Lag and Soil Permeability in Ground Water Observations"*, U.S. Army Corps of Engineers Waterway Experimentation Station, Bulletin 36.

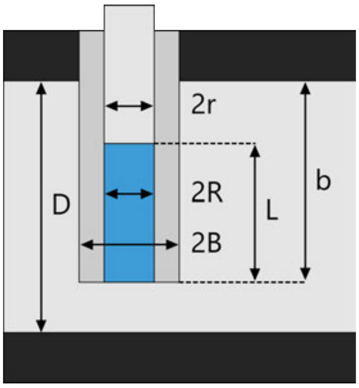
Röhrich T., Waterloo Hydrogeologic Inc, (2002). Aquifer Test v3.5. User's Manual- Advanced Pumping Test & Slug Test Analysis Software.

APPENDIX A

Slug Test Analysis Results

Wells	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

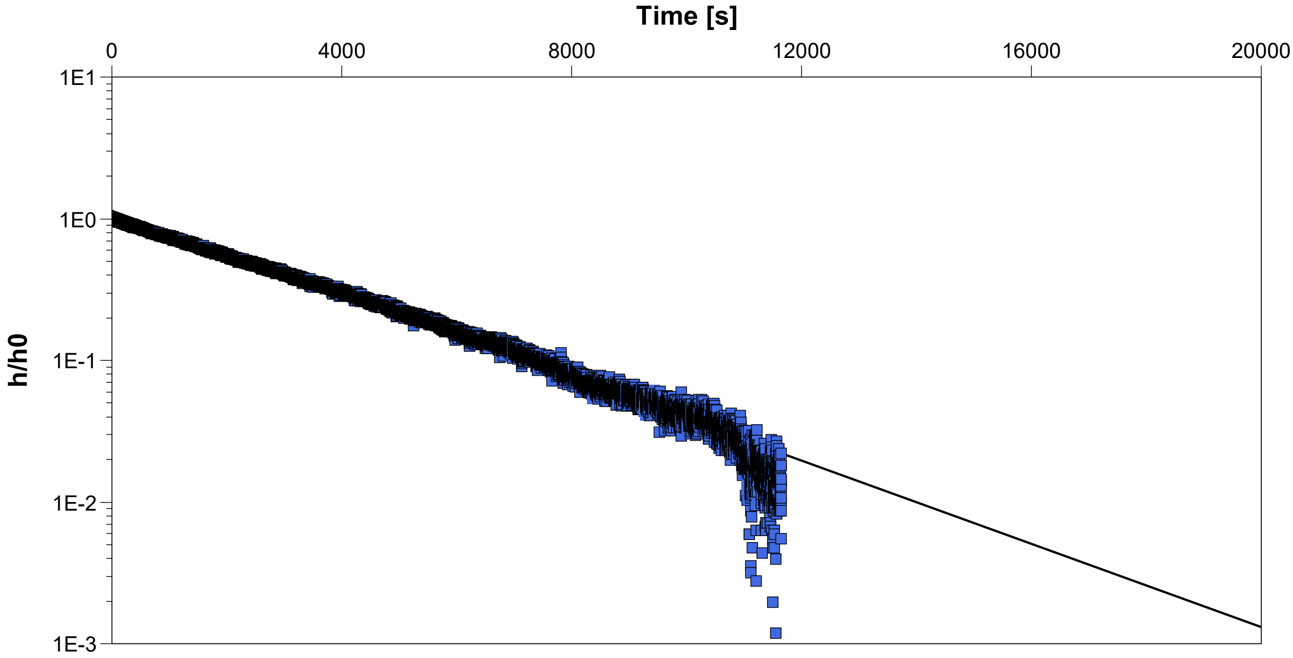
Location: Tennant Creek, NT



	Name	X [m]	Y [m]	Elevation (amsl) [m]	Benchmark [m]	Penetration	L [m]	B [m]
1	NNMW001	425505.04	7819803.37	356.39		Fully	12	0.11
2	NNMW002	425488	7819596.41	363.21		Fully	12	0.11
3	NNMW004	425374.93	7820346.45	351.18		Fully	12	0.11
4	NNMW005	425228.61	7820085.77	353.47		Fully	12	0.11
5	NNMW007	424730.83	7819950.05	354.03		Fully	12	0.11
6	NNMW011	426621.8	7819921.77	355.32		Fully	12	0.11
7	NNMW012	427616.88	7819829.56	358.53		Fully	12	0.11
8	NNMW013	426527.28	7820174.17	365.51		Fully	12	0.11
9	NNMW014	426075.85	7820387.3	353.63		Fully	12	0.11
10	NNMW018	427151.54	7819925.64	350.67		Fully	12	0.11

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW001
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW001-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW001	1.71×10^{-2}	

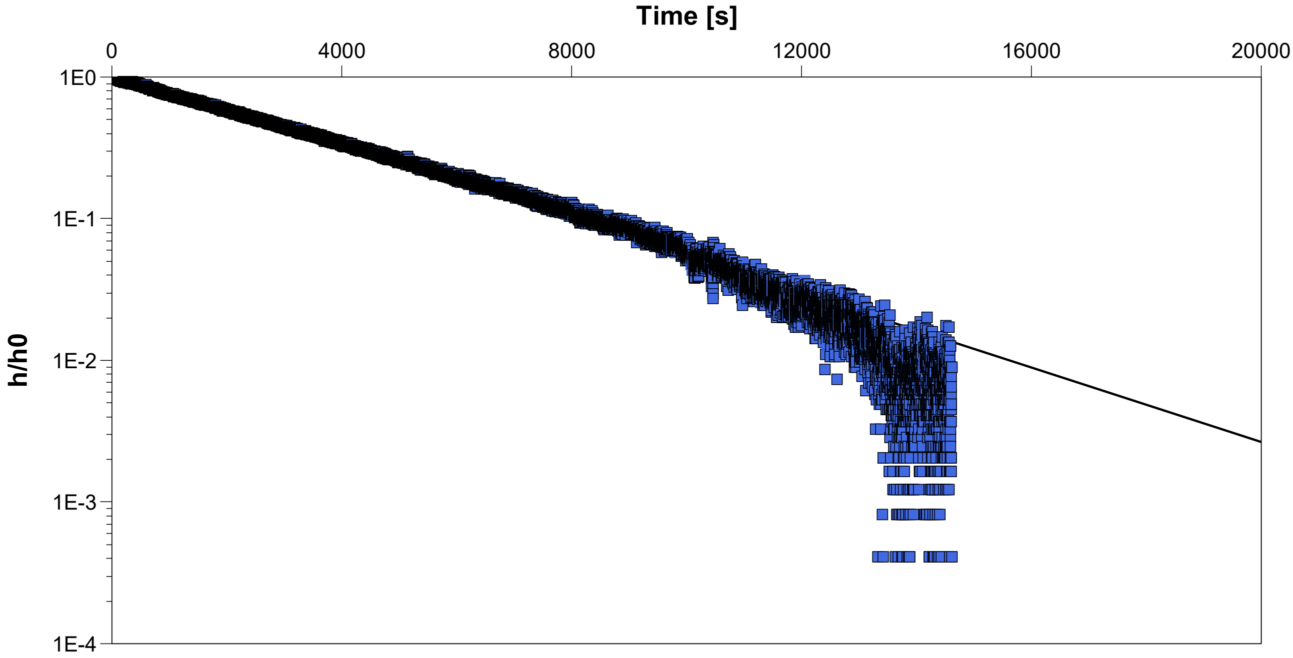
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW001
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW001-FH	AM	8/11/2021	Hvorslev	NNMW001		1.71×10^{-2}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW001
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW001-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW001	1.53×10^{-2}	

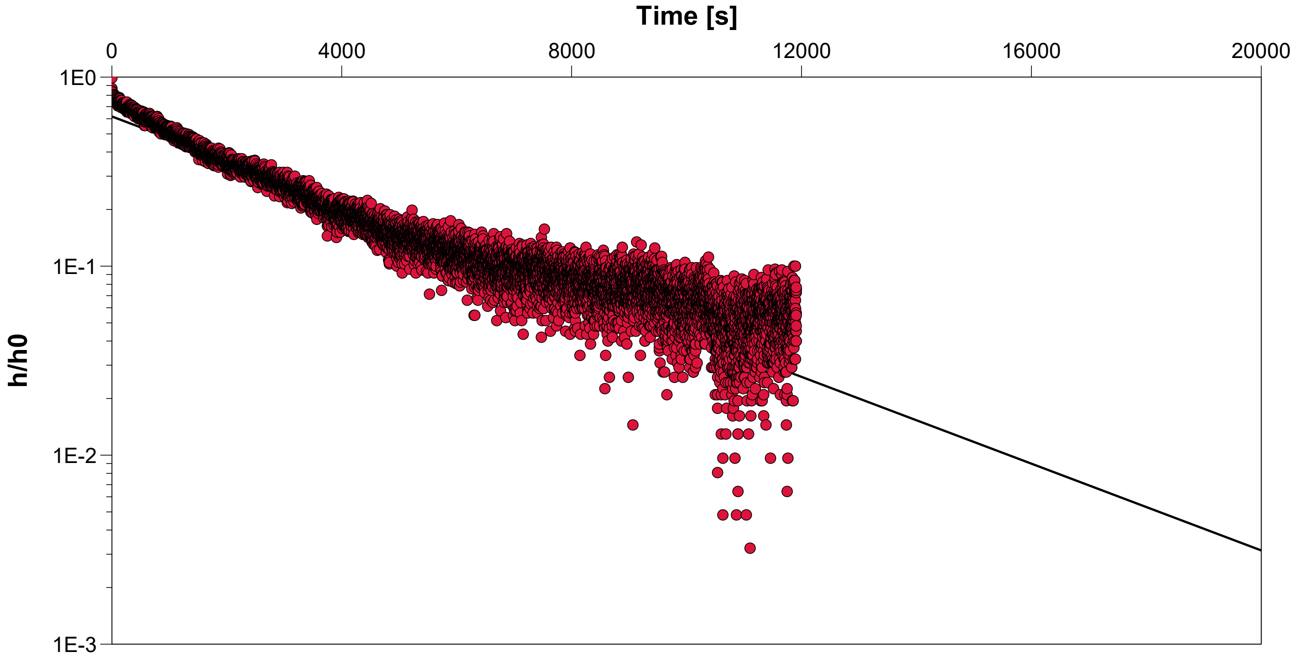
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW001
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW001-RH	AM	8/11/2021	Hvorslev	NNMW001		1.53×10^{-2}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW002
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW002-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW002	1.05×10^{-2}	

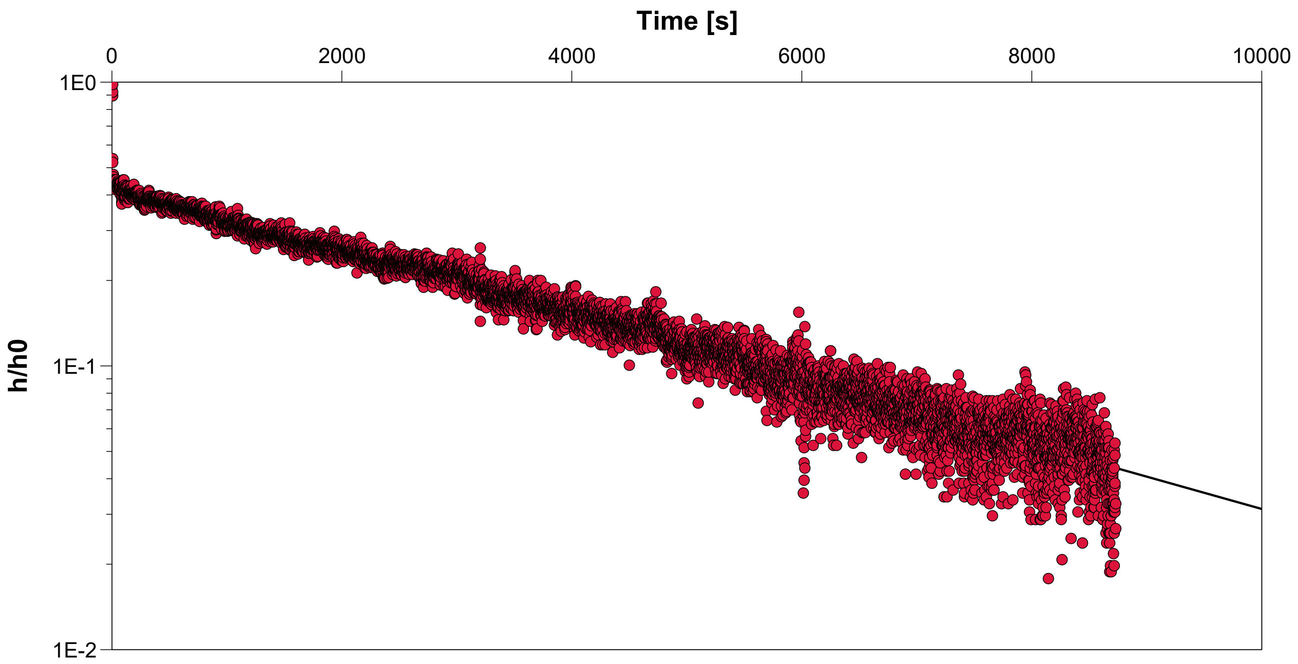
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW002
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW002-FH	AM	8/11/2021	Bouwer & Rice	NNMW002		1.05×10^{-2}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW002
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW002-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW002	1.04×10^{-2}	

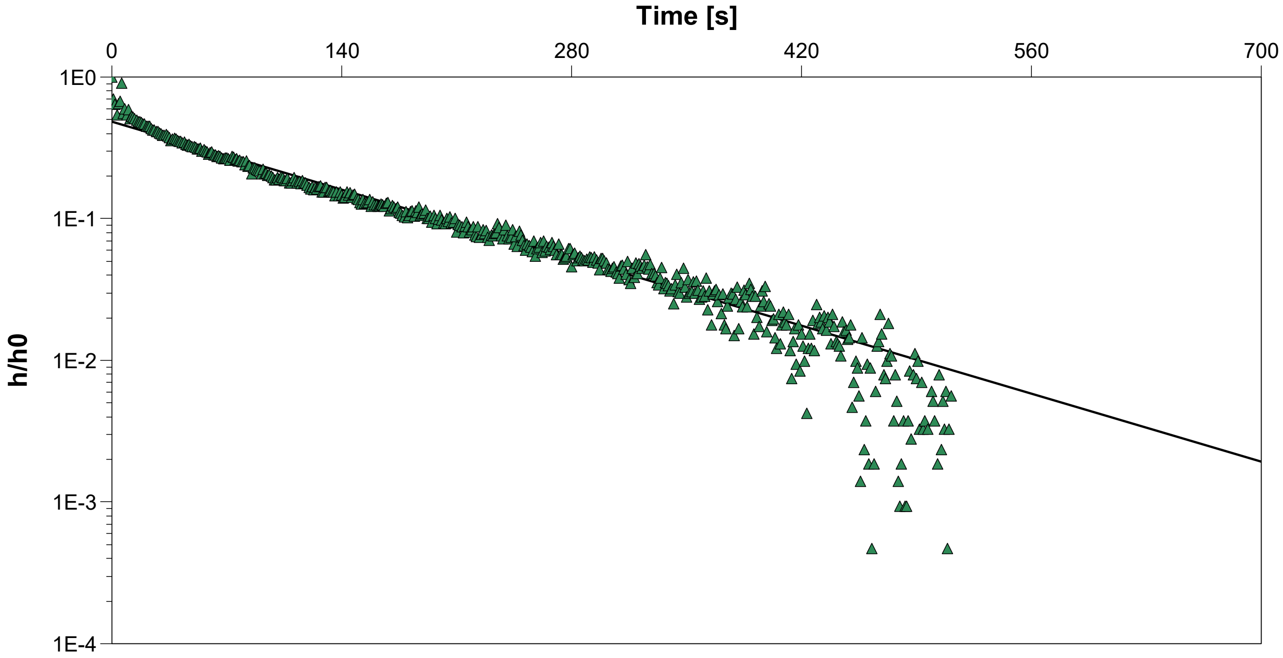
Slug Test - Analyses Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW002
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW002-RH	AM	8/11/2021	Bouwer & Rice	NNMW002		1.04×10^{-2}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW004
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW004-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW004	3.99×10^{-1}	

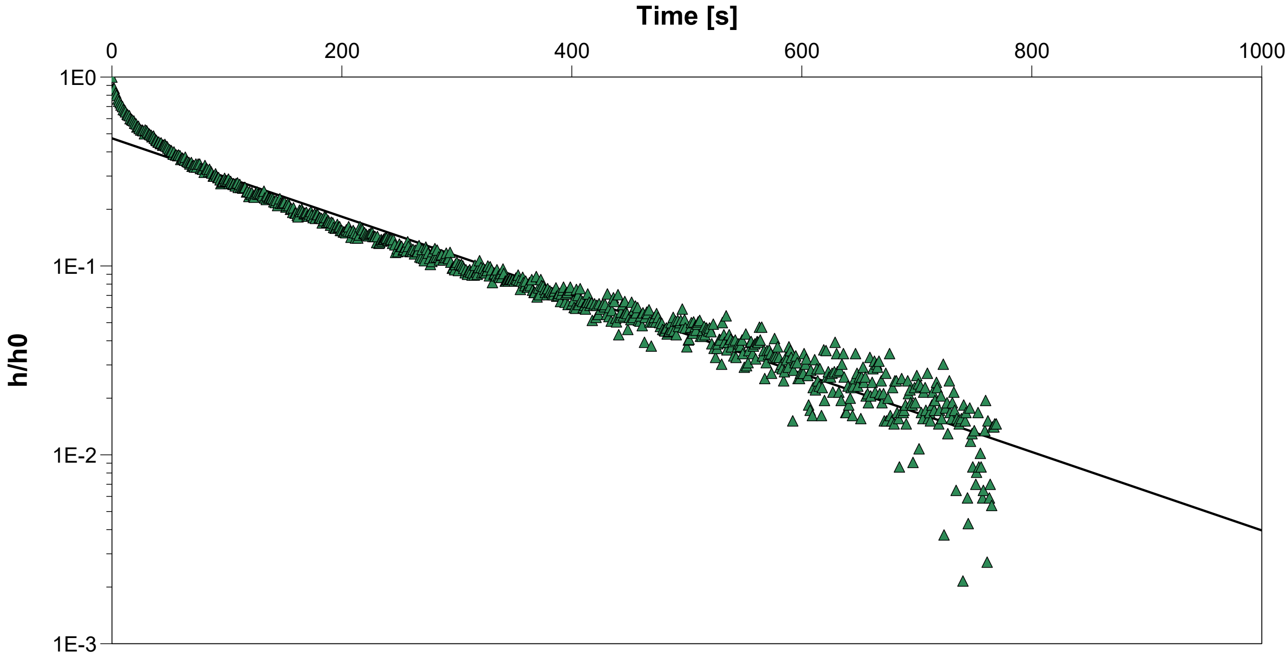
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW004
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW004-FH	AM	8/11/2021	Hvorslev	NNMW004		3.99×10^{-1}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW004
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW004-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW004	2.42×10^{-1}	

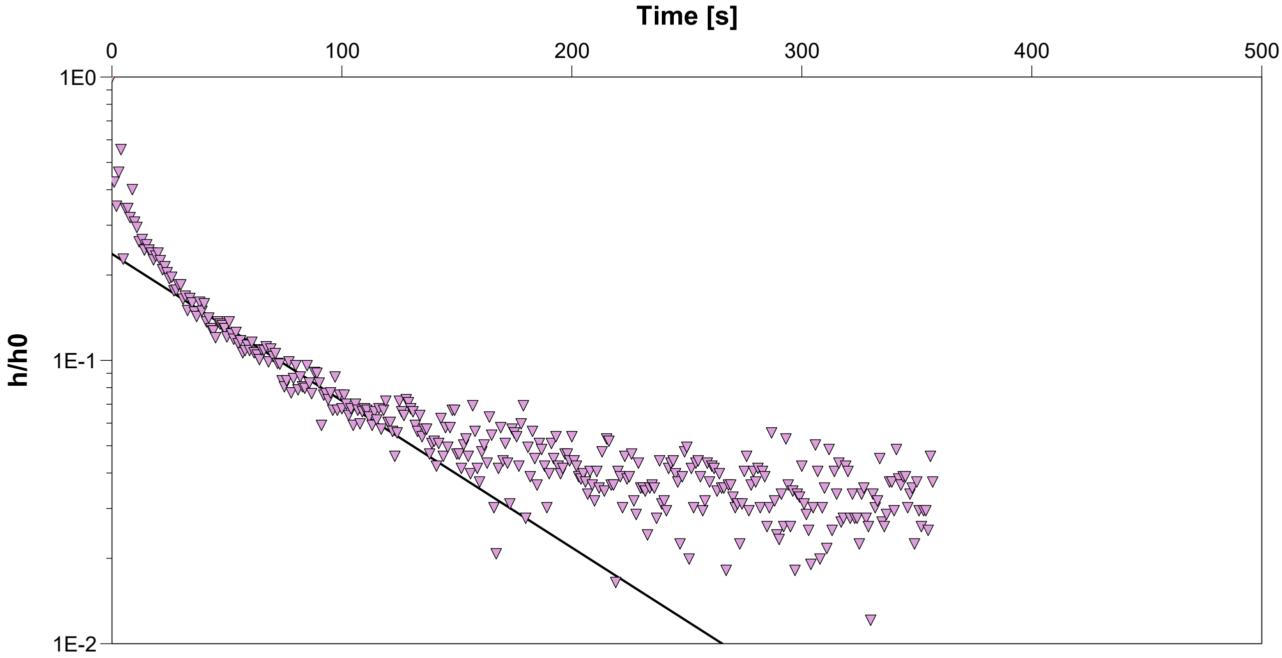
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW004
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW004-RH	AM	8/11/2021	Hvorslev	NNMW004		2.42×10^{-1}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW005-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW005	6.03×10^{-1}	

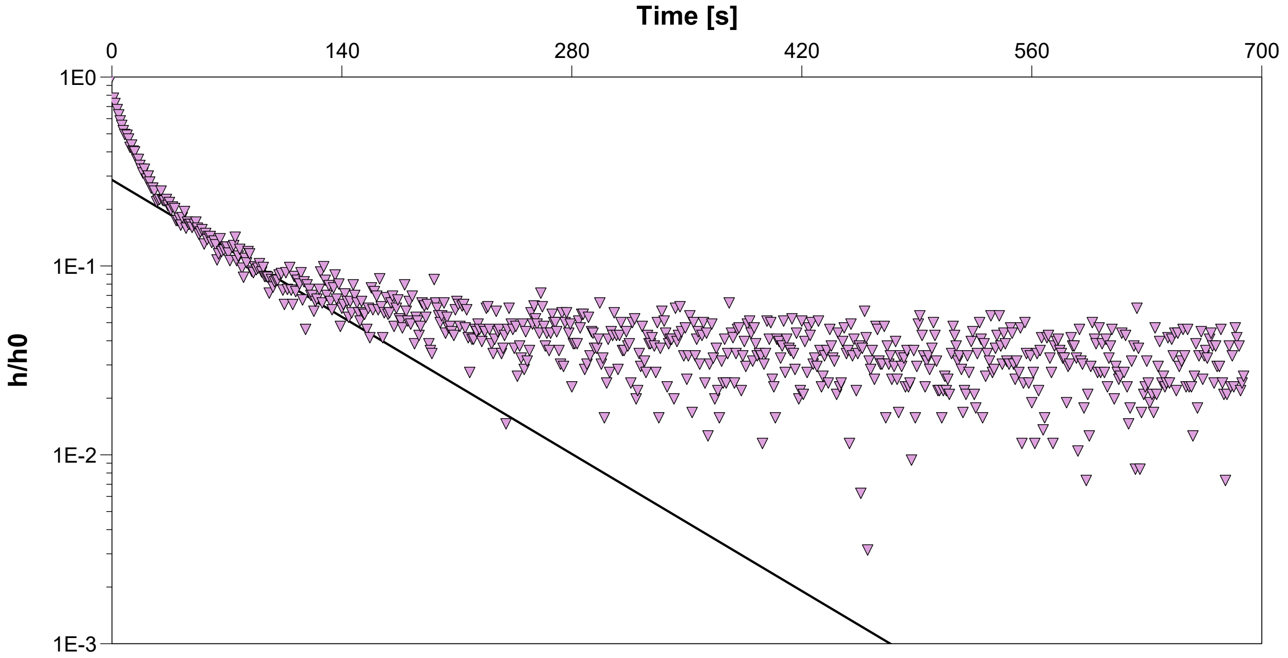
Slug Test - Analyses Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW005-FH	AM	8/11/2021	Hvorslev	NNMW005		6.03×10^{-1}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW005-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]
NNMW005	6.03×10^{-1}

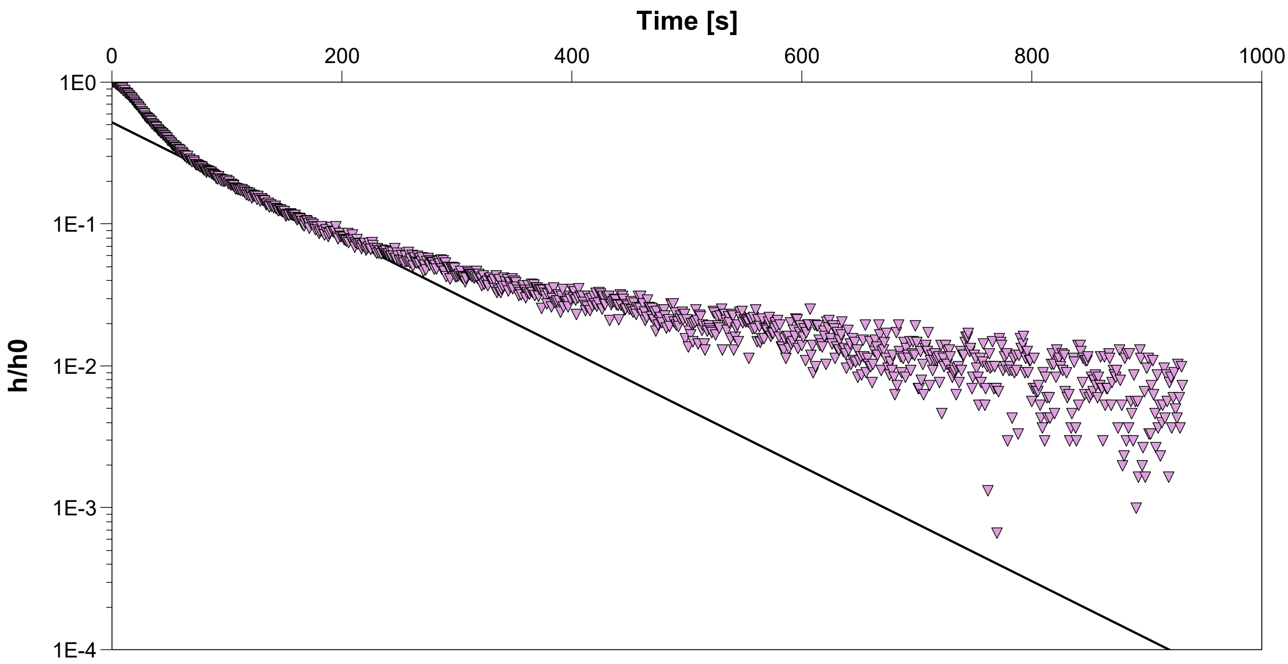
Slug Test - Analyses Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW005-RH	AM	8/11/2021	Hvorslev	NNMW005		6.03×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW005-WInj	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]
NNMW005	4.70×10^{-1}

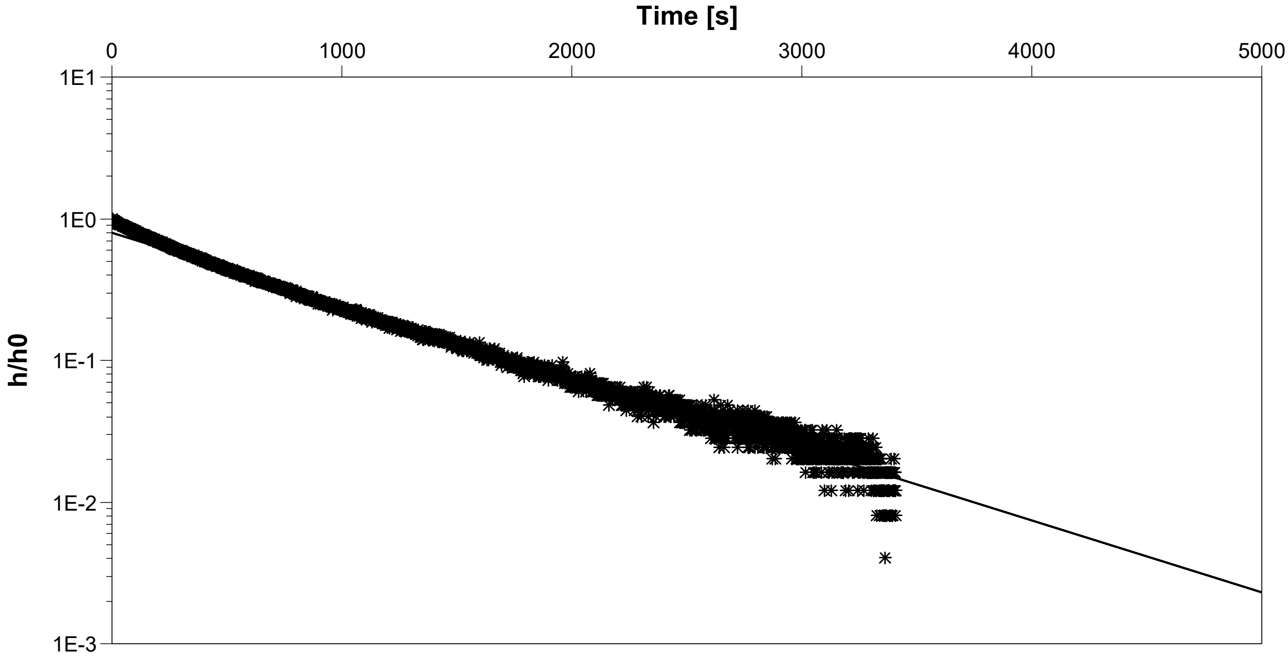
Slug Test - Analyses Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW005
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW005-WInj	AM	8/11/2021	Hvorslev	NNMW005		4.70×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW007
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW007-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW007	5.90×10^{-2}	

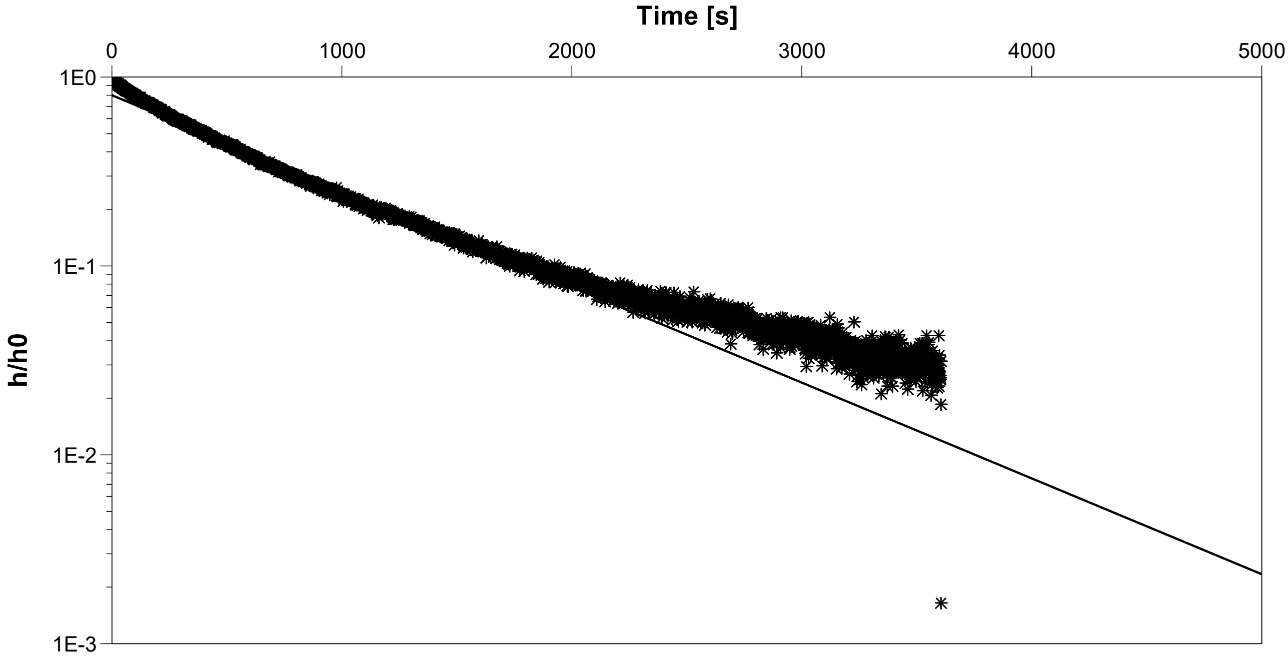
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW007
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW007-FH	AM	8/11/2021	Hvorslev	NNMW007		5.90×10^{-2}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW007
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW007-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW007	5.91×10^{-2}	

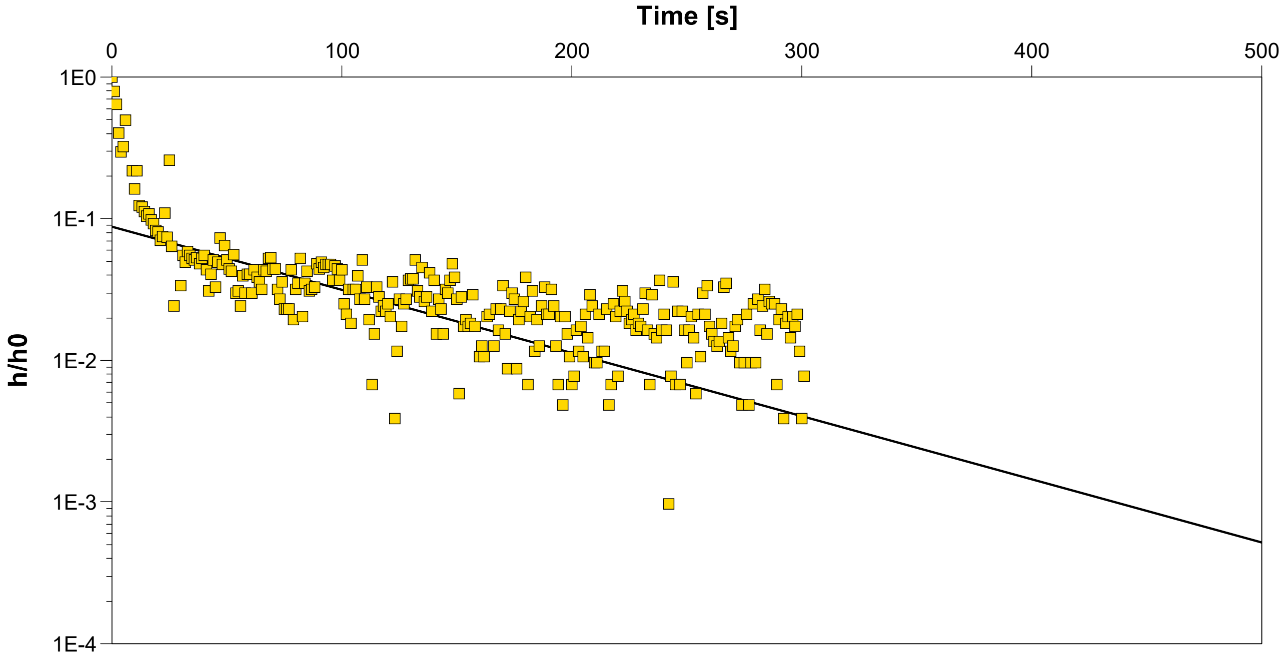
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW007
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW007-RH	AM	8/11/2021	Hvorslev	NNMW007		5.91×10^{-2}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW011-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW011	4.07×10^{-1}	

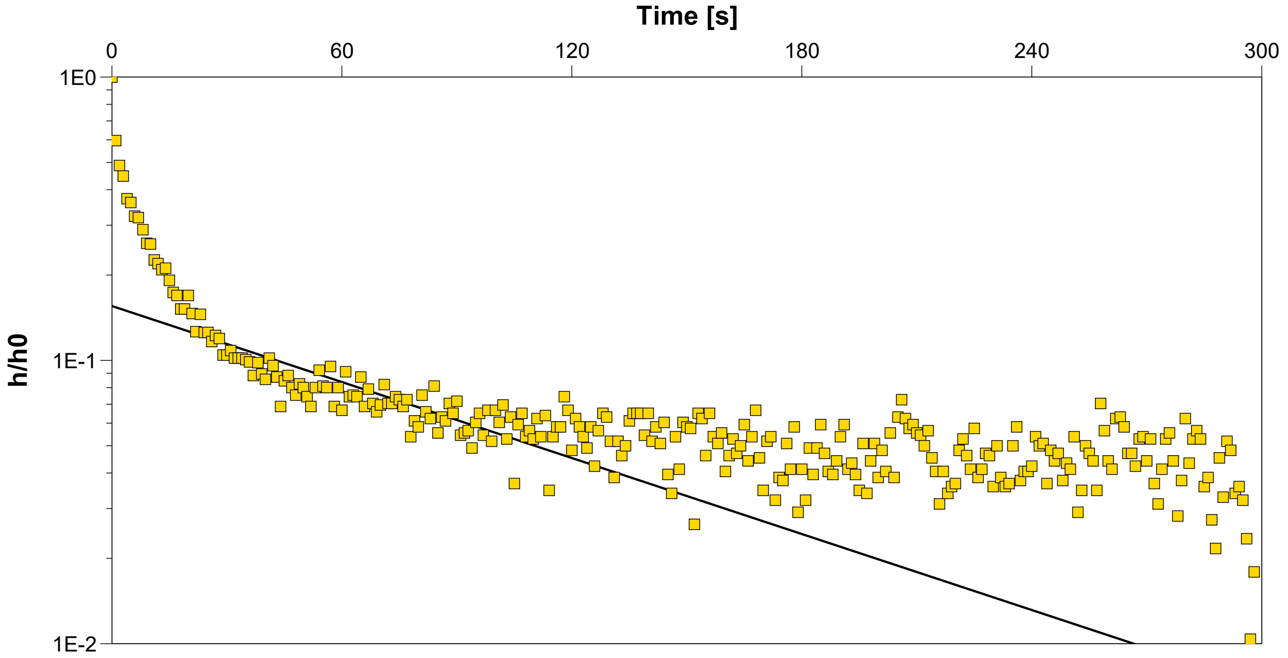
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW011-FH	AM	8/11/2021	Bouwer & Rice	NNMW011		4.07×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW011-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW011	4.08×10^{-1}	

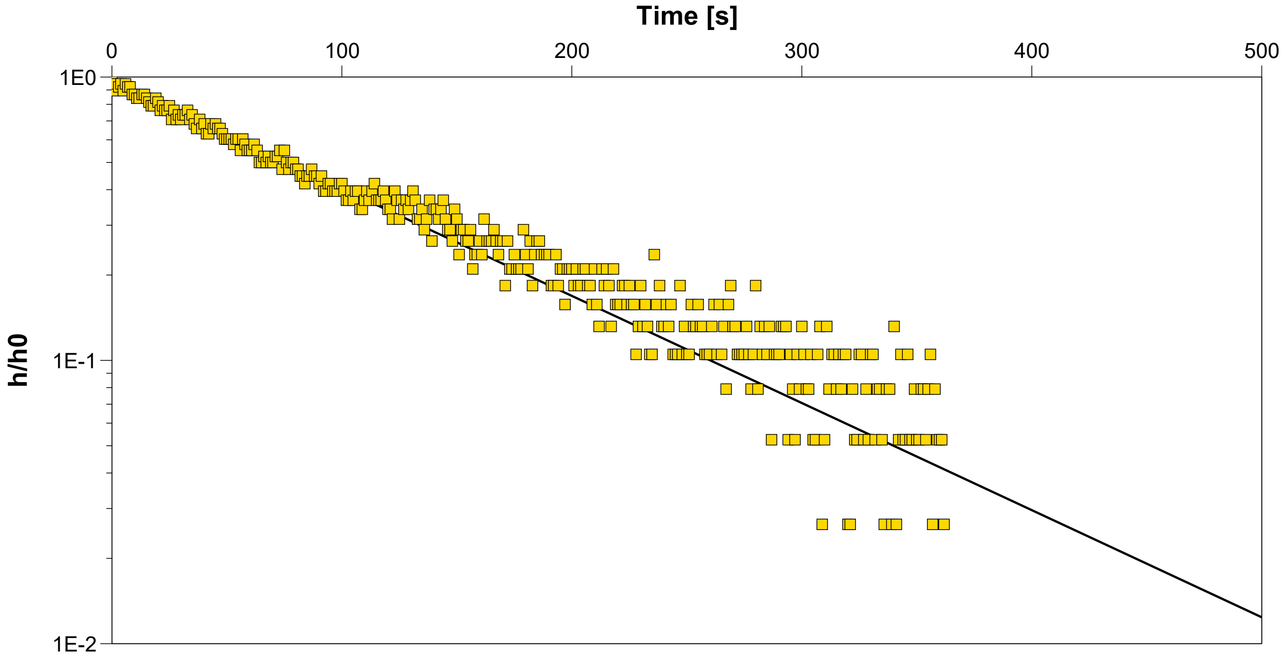
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW011-RH	AM	8/11/2021	Bouwer & Rice	NNMW011		4.08×10^{-1}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW011-WInj	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
NNMW011	3.45×10^{-1}	

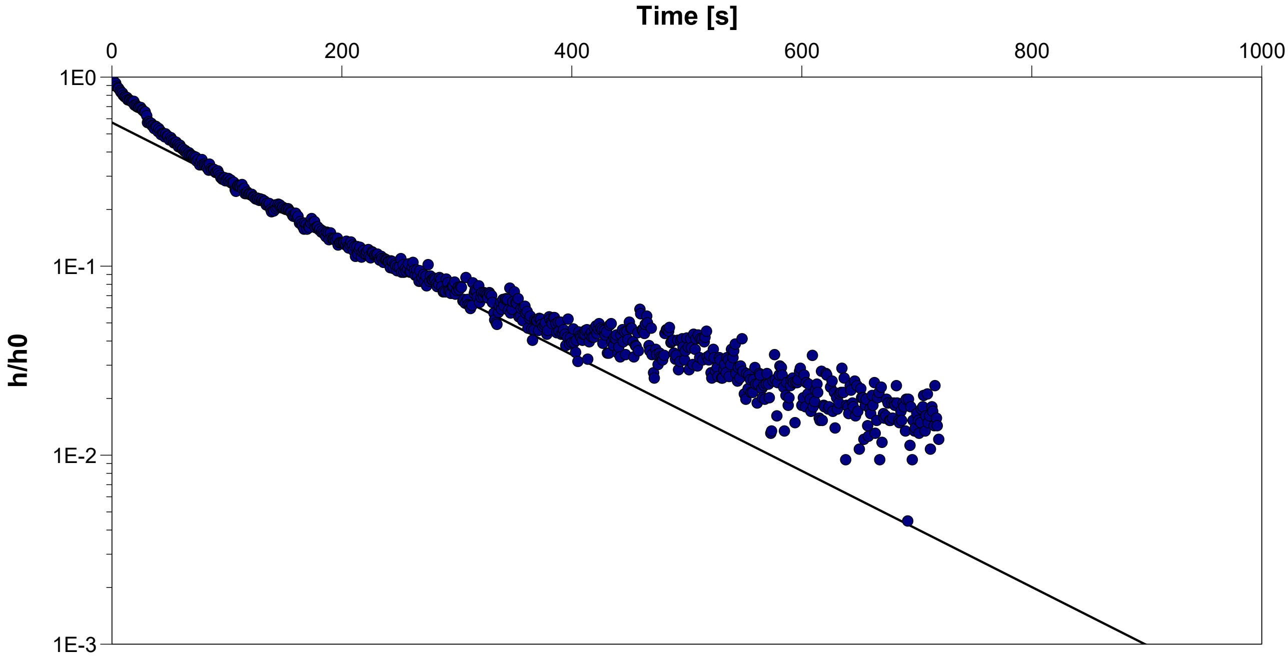
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW011
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW011-WInj	AM	8/11/2021	Bouwer & Rice	NNMW011		3.45×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW012
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW012-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]
NNMW012	3.57×10^{-1}

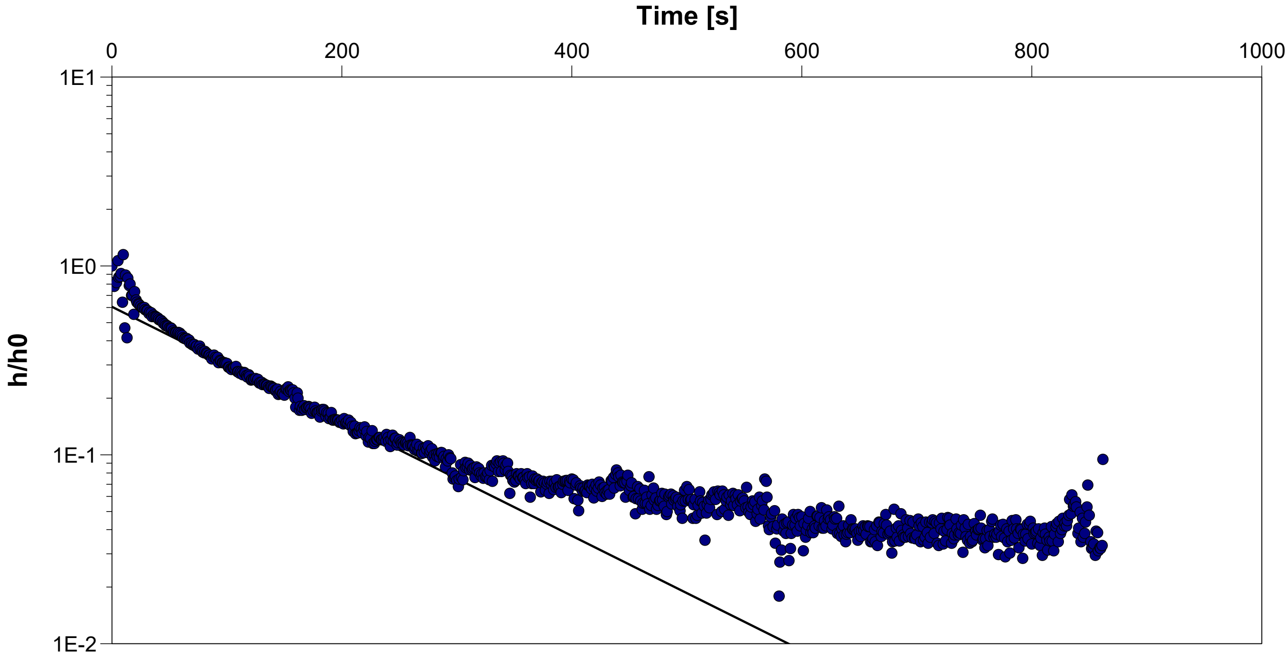
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW012
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW012-RH	AM	8/11/2021	Hvorslev	NNMW012		3.57×10^{-1}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW012
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW012-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW012	3.53×10^{-1}	

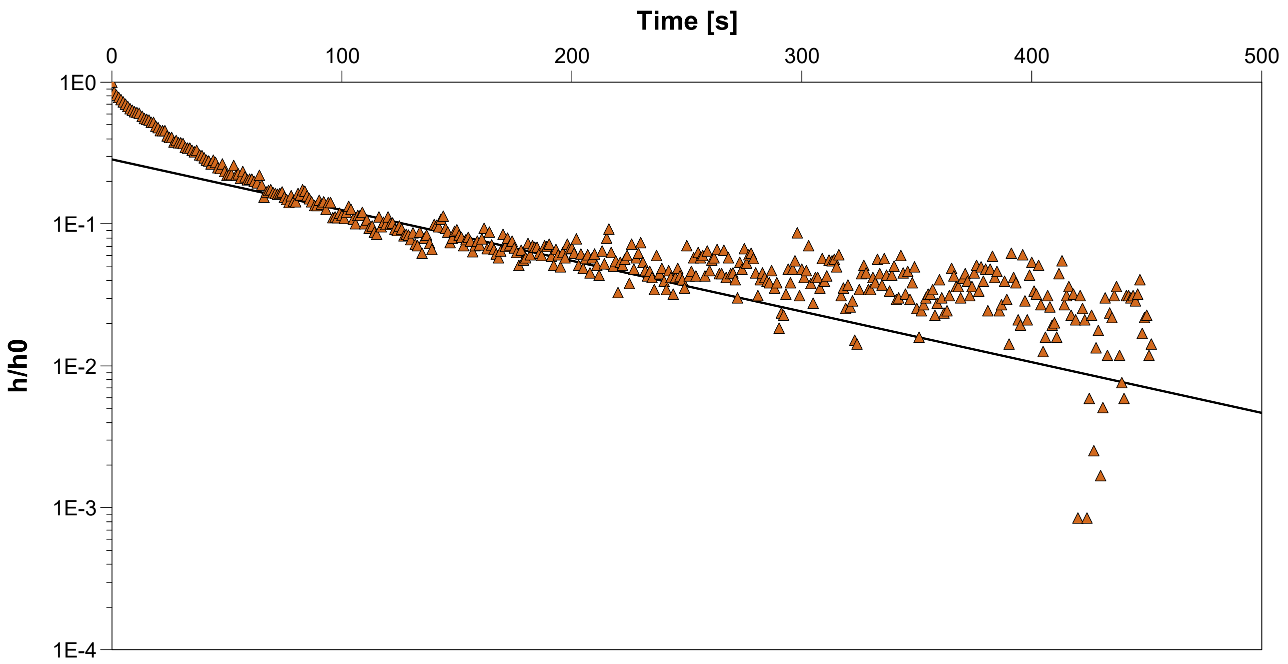
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW012
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW012-FH	AM	8/11/2021	Hvorslev	NNMW012		3.53×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW013
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW013-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

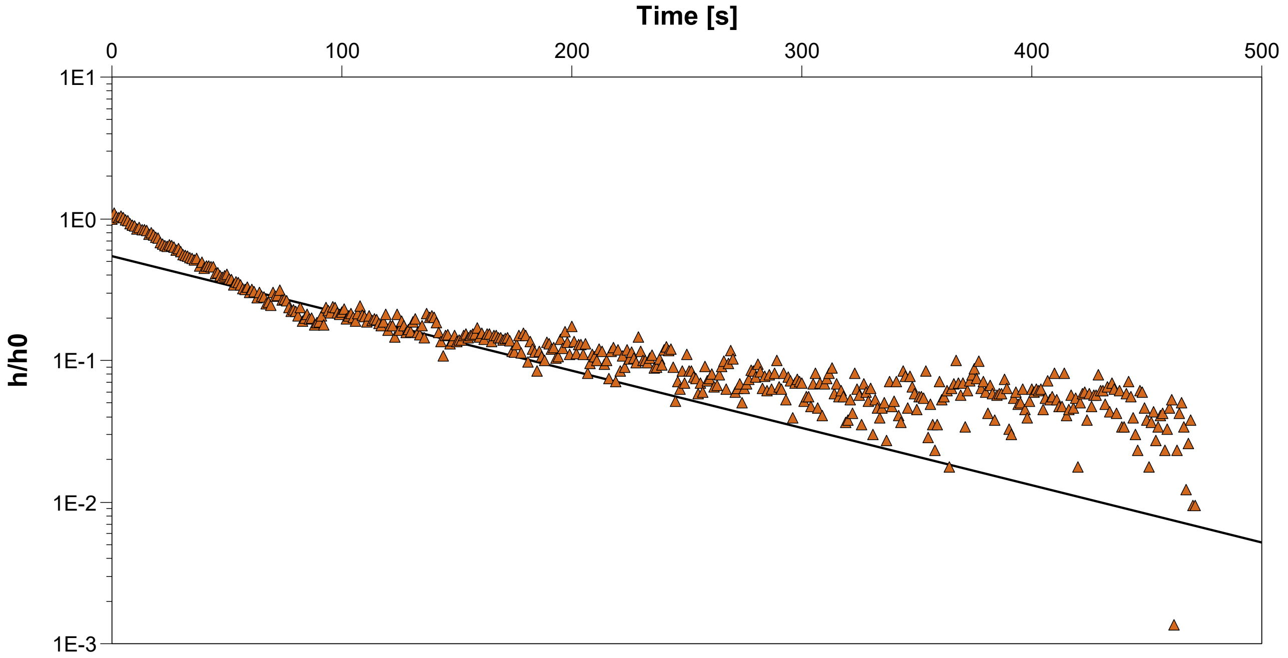
Observation Well	Hydraulic Conductivity [m/d]	
NNMW013	4.15×10^{-1}	

		Slug Test - Analyses Report A
		Project: Nobles Nob Slug Test
		Number: 21728-3
		Client: TCMG
Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW013
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW013-RH	AM	8/11/2021	Hvorslev	NNMW013		4.15×10^{-1}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW013
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW013-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW013	4.70×10^{-1}	

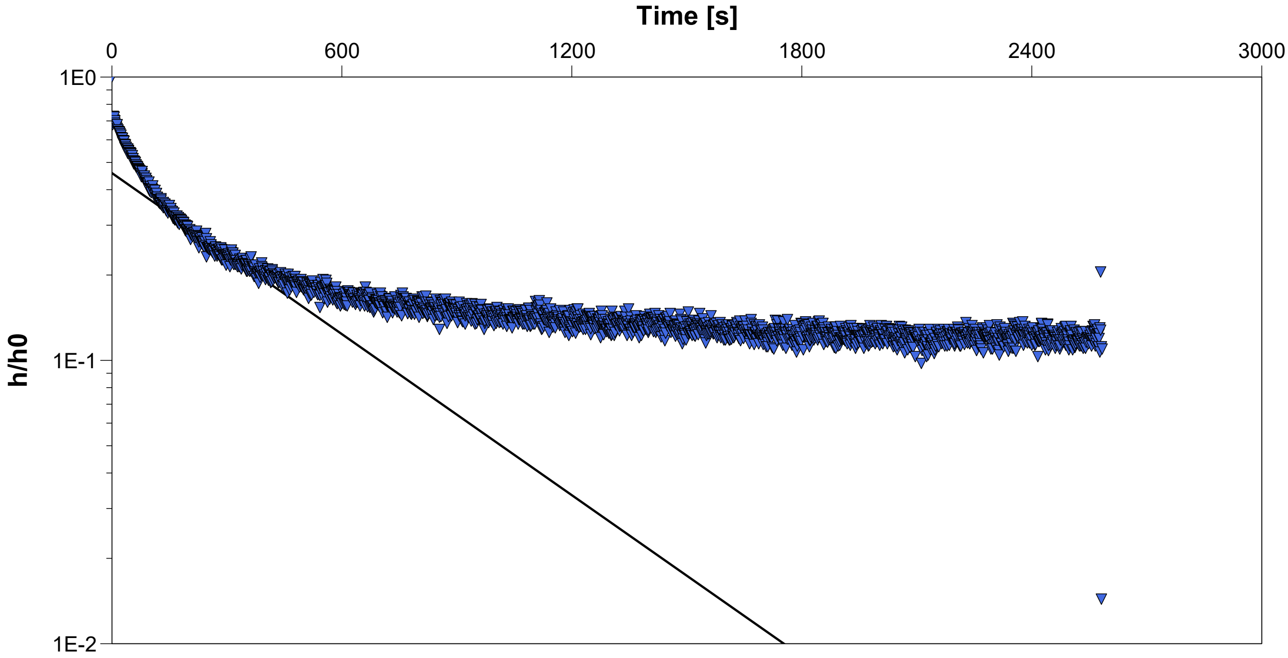
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW013
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW013-FH	AM	8/11/2021	Hvorslev	NNMW013		4.70×10^{-1}	

Slug Test Analysis Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW014
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW014-FH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW014	1.10×10^{-1}	

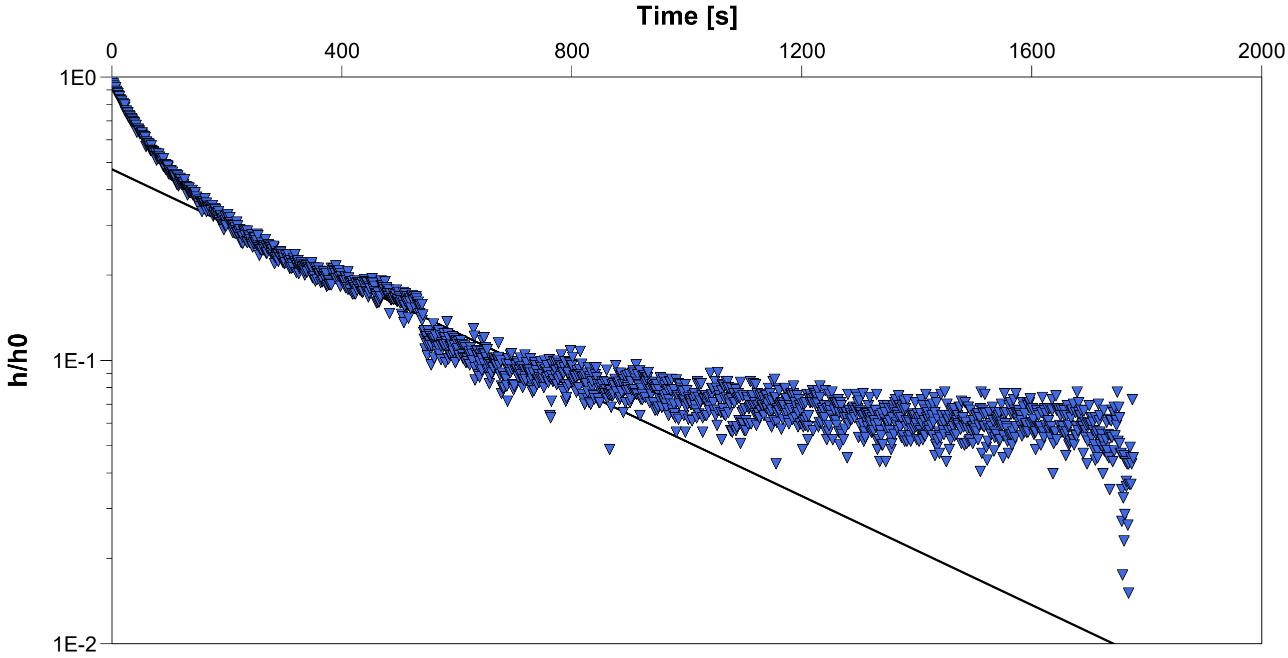
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW014
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW014-FH	AM	8/11/2021	Hvorslev	NNMW014		1.10×10^{-1}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW014
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW014-RH	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW014	1.12×10^{-1}	

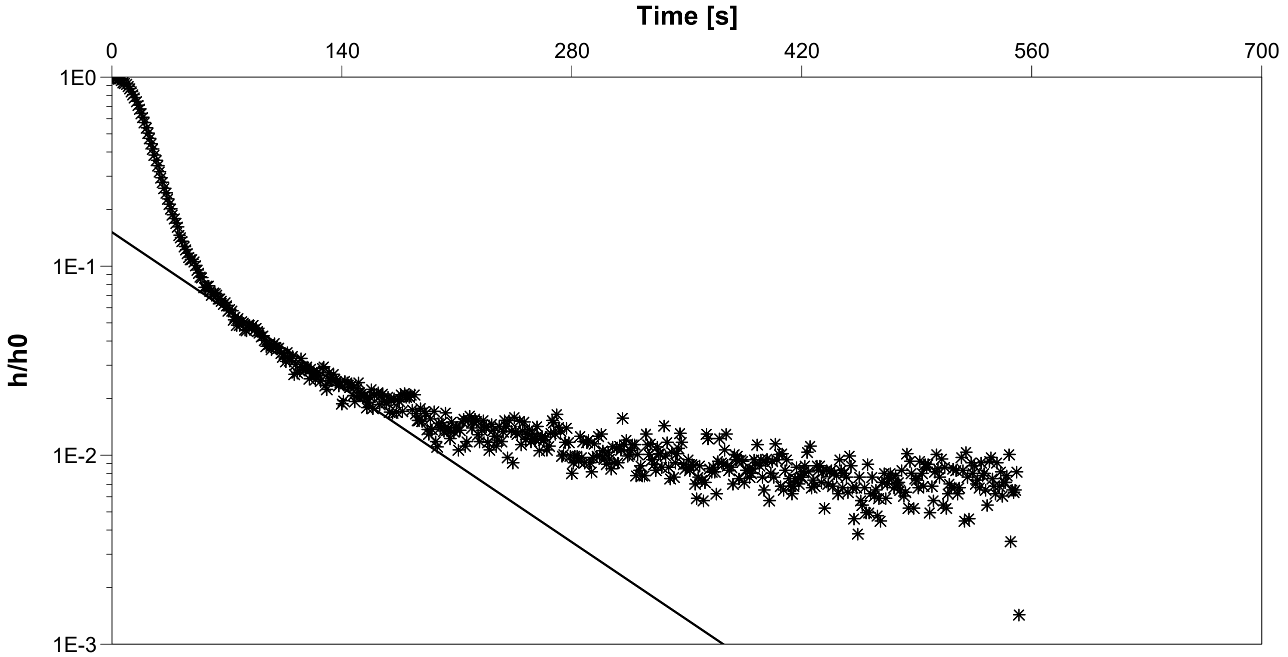
	Slug Test - Analyses Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW014
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW014-RH	AM	8/11/2021	Hvorslev	NNMW014		1.12×10^{-1}	

	Slug Test Analysis Report A
	Project: Nobles Nob Slug Test
	Number: 21728-3
	Client: TCMG

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW018
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Analysis Performed by: AM	NNMW018-Winj	Analysis Date: 8/11/2021
Aquifer Thickness: 12.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
NNMW018	6.81×10^{-1}	

Slug Test - Analyses Report	A
Project: Nobles Nob Slug Test	
Number: 21728-3	
Client: TCMG	

Location: Tennant Creek, NT	Slug Test: Nobles Nob SLug Test	Test Well: NNMW018
Test Conducted by: A.Mishra		Test Date: 13/10/2021
Aquifer Thickness: 12.00 m		

	Analysis Name	Analysis Performed	Analysis Date	Method name	Well	T [m²/d]	K [m/d]	S
1	NNMW018-Winj	AM	8/11/2021	Hvorslev	NNMW018		6.81×10^{-1}	

umwelt

Environmental & Social Consultants

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APPENDIX C SACRED SITES CLEARANCE CERTIFICATES

Sacred Sites certificates have been removed for confidentiality

APPENDIX D OPERATING PLAN FOR SOUTHERN WRD

Operating Plan for Reclaim of the Nobles Nob Southwest Waste Dump

The current situation is shown in Figure 1.

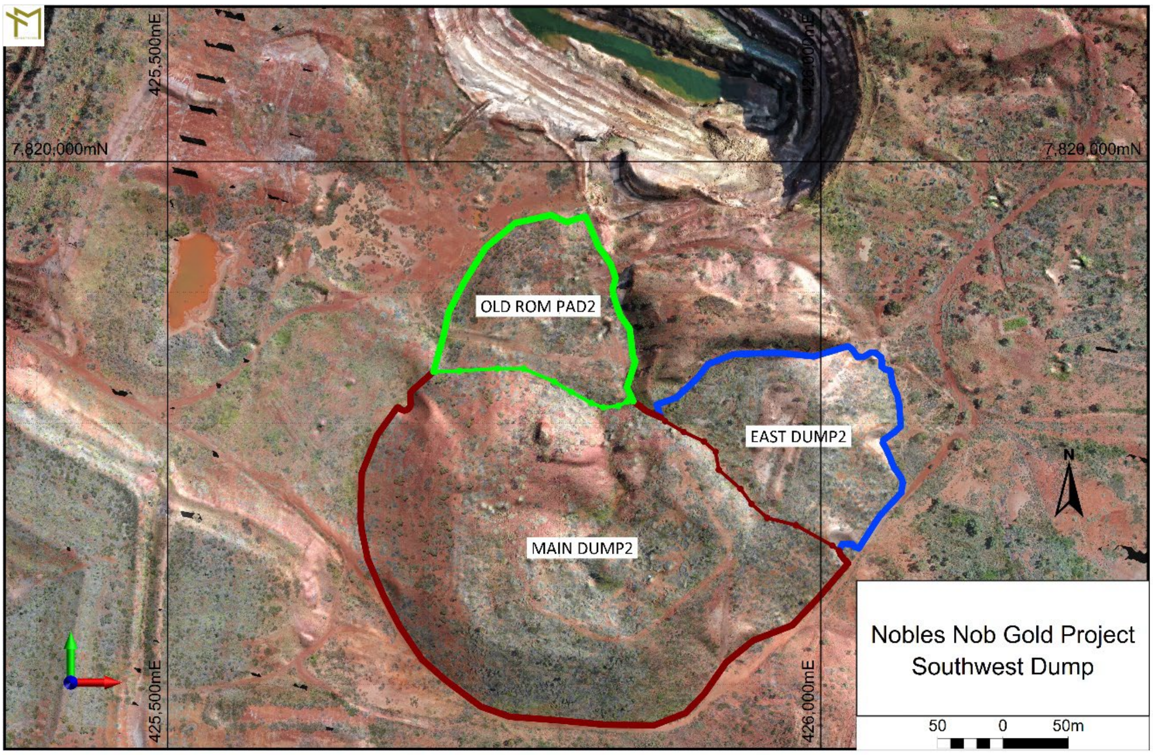


Figure 1: Plan view showing current situation at Noble Nob, with the Southwest Waste Dump (SWD) outlined; the historic Nobles Nob pit is shown in the north of the image

Figure 2 Shows the planned plant site in relation to the dump.

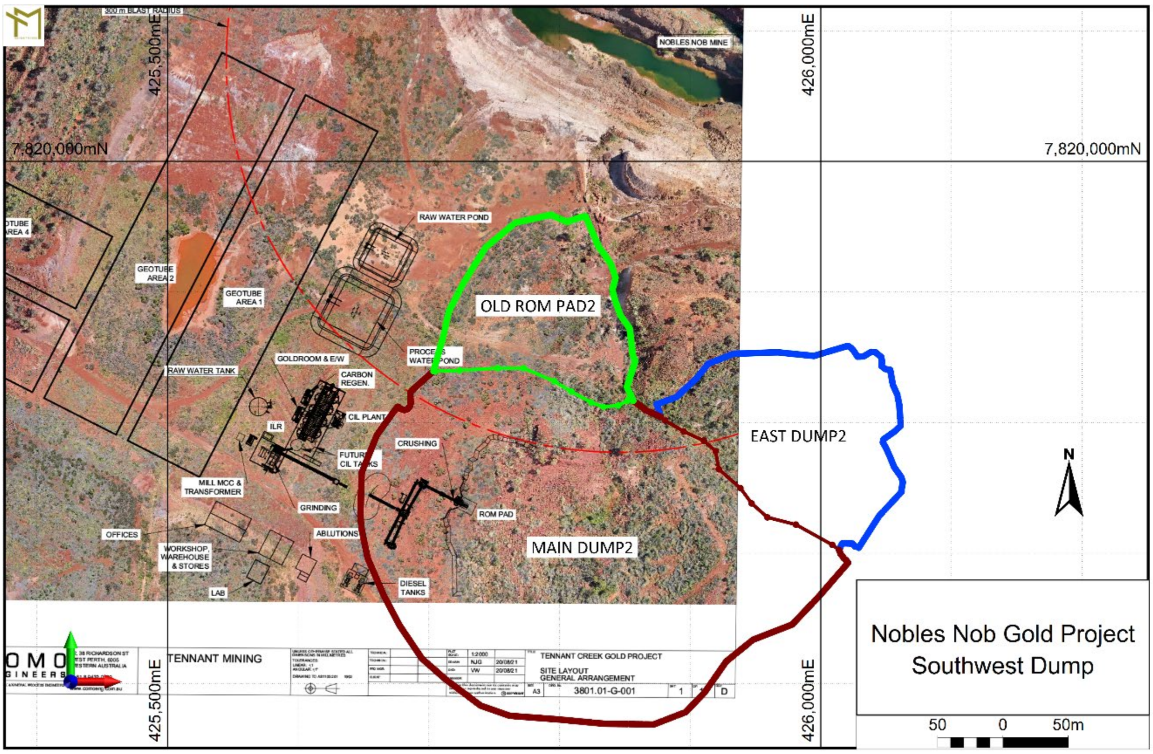


Figure 2: Plan view showing planned plant layout in relation to the SWD

Stage 1 of the dump reclaim will be to move the western slope of the dump in order to create the room for crusher hopper and crushed stockpile (Figure 3). This material will be moved using a temporary ramp up onto the existing dump to the east of the area shown as Stage 1. A loader and a dump truck will be used for this work.

During the dump move, dust will be controlled using a water truck carrying out daily runs at the beginning and end of shift to damp down dust. Further runs will be carried out if this is required. Water will come from the historic Nobles Nob pit.

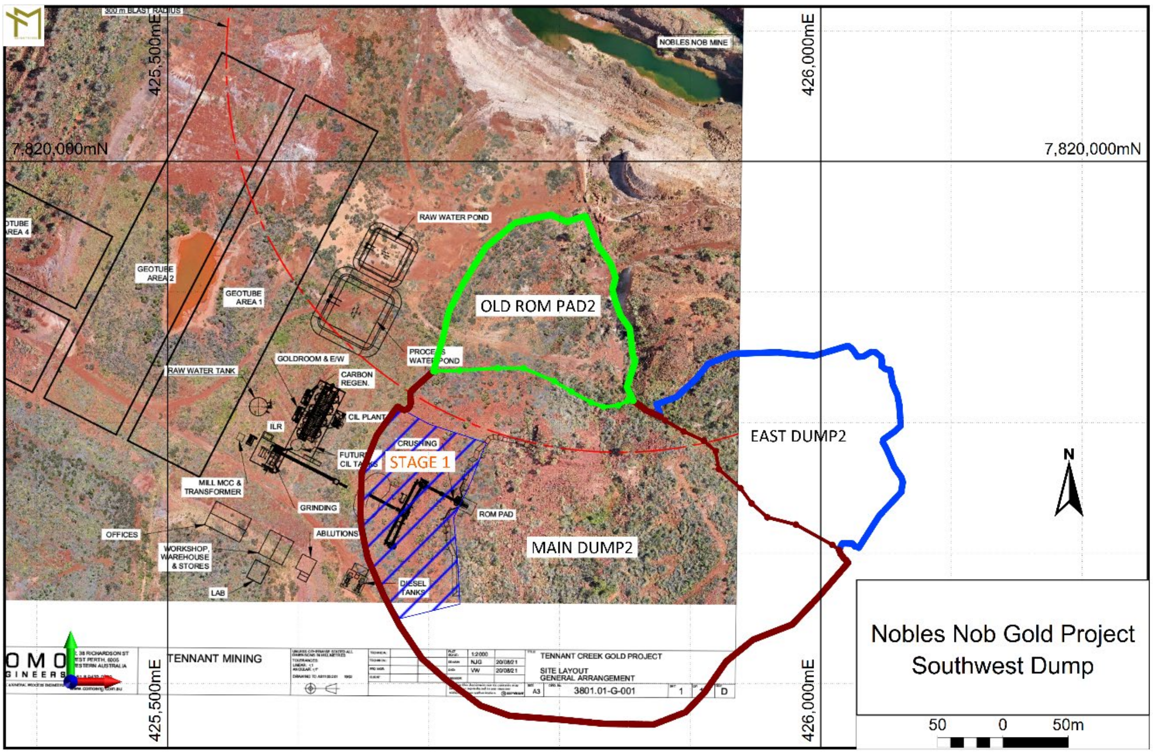


Figure 3: Plan view showing planned plant layout in relation to the SWD and Stage 1 of dump reclamation

Once the crushing circuit is ready for commissioning, reclaim of the dump will progress using a dozer and loader. The dozer will push the dump down to a safe working height (determined by the height of the loader bucket at full lift). The loader will move the dump material and tip into the crusher hopper. The dump reclaim will progress through Stage 2 and then Stage 3 and so on through to Stage 6 (Figure 4).

Dust will be controlled using a water truck carrying out daily runs at the beginning and end of shift to damp down dust. Further runs will be carried out if this is required. Water will come from the historic Nobles Nob pit or from dewatering of the historic Juno mine 3 km to the west.

Once areas of the reclaimed SWD are determined to be complete, then progressive rehabilitation is planned.

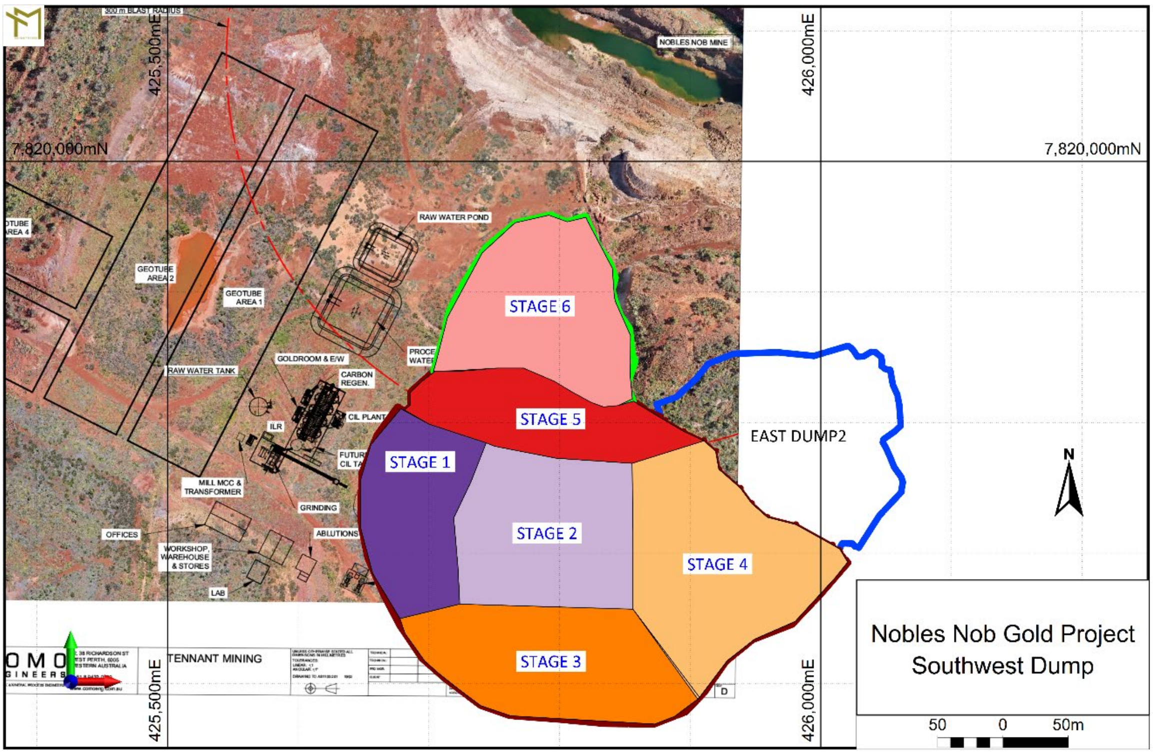


Figure 4: Plan view showing planned plant layout in relation to the SWD and Stages of dump reclamation

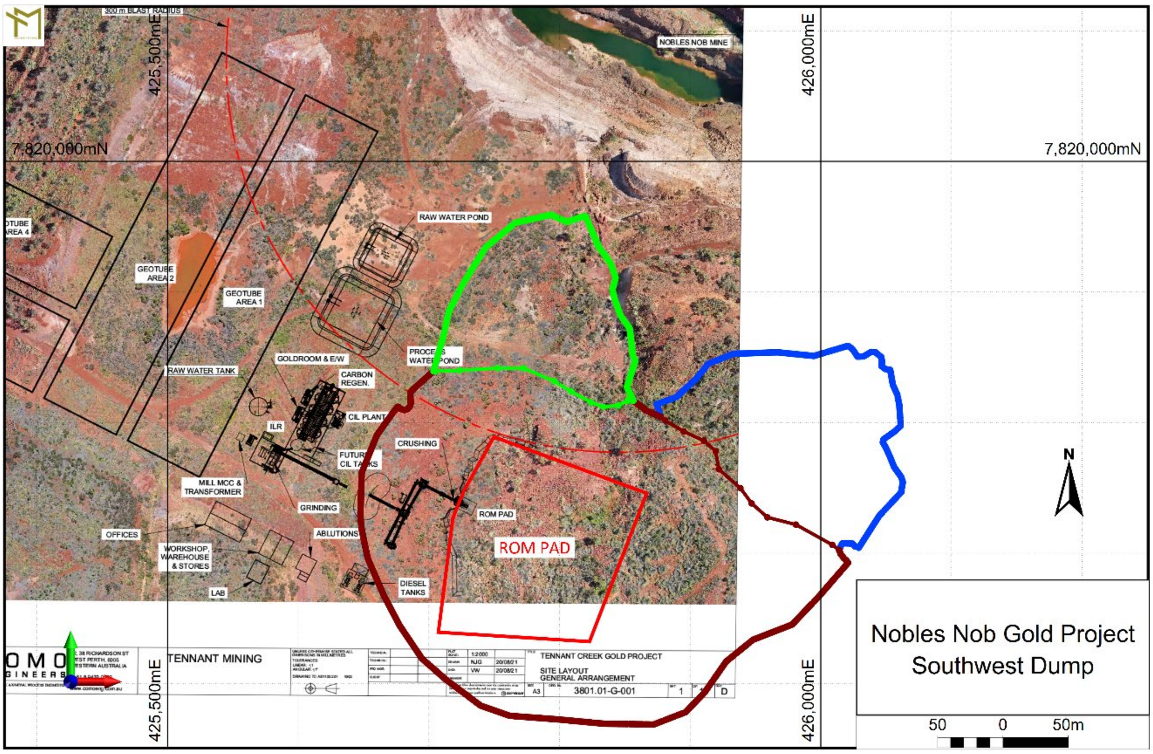


Figure 5: Plan view showing planned plant layout with ROM pad that will be established in the footprint of the reclaimed SWD

APPENDIX E SOURCE OF CAPPING MATERIAL FOR REHABILITATION

Tennant Consolidated Mining Group Pty Ltd
trading as Tennant Mining ABN 72 645 263 547

Department of Industry, Tourism and Trade
Northern Territory Government of Australia
Arid Zone Research Institute,
519 South Stuart Highway
Alice Springs NT 0871

9 May 2022

Dear Sir/Madam,

RE: Source of capping material for rehabilitation of the geotubes tailings storage facility

This letter is to support the source and suitability of the capping material planned to be used to cover the geotubes tailings storage facility for the Nobles Nob Gold Project. The geotubes will be rehabilitated by covering with capping material and revegetating. Capping material will be to a depth of 2 m, which will be carried out in alignment with the closure planning and rehabilitation implementation plan outlined within the Nobles Nob and Juno MMP.

Source of capping material
The total geotubes platform area is 7.5 ha = 75,000 m^2 which includes the geotubes surface area as well as the surrounding drainage footprint. For a 2 m capping layer, a total volume of 150,000 m^3 capping material is therefore needed. This capping material will be sourced from the lower base layer of the Southern Waste Rock Dump (WRD).

The lower layer of the Southern WRD is a lower grade than the upper sections of the dump, at approximately 0.2g/t Au, which is below the grade of material that will be processed. It therefore does not represent a resource and is material that will be exposed as the upper layers of the southern WRD are mined back, therefore representing a good source of capping material.

The volume of material present in the lower layer of the southern WRD is outlined in Table 1 below. The sections mentioned are outlined in the Operating Plan included in Appendix I of the MMP. There is 377,453 m^3 of material available in the lower layer in total, which provides adequate material for the 150,000 m^3 of capping material required.

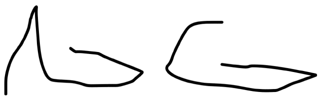
Table 1. Volume of material available in the lower section of the Southern Waste Rock Dump.

Basegrade	**Dump**	**Volume (m^3)**	**Tonnes (t)**
BOT	EAST_DUMP	99,919	189,846
BOT	MAIN_DUMP	240,436	456,829
BOT	OLD_ROM	37,098	70,485
Total		377,453	717,160

Suitability of capping material
The Wasterock Characterisation report included in Appendix C of the MMP analysed 26 samples taken from the Southern WRD. This study concluded that there is some potential of metalliferous drainage, with 6 samples recording metals in significant abundance according

to their geochemical abundance index (GAI). The potential for metalliferous drainage is however significantly reduced in non-acidic conditions. Given that all samples recorded a negative acid producing potential, this indicates that the mobility of these metals is expected to be low, even in aqueous conditions, such as when subjected to rainfall. The study also concluded that saline drainage is unlikely from this material. Based on these results, it is expected that the material in the lower section of the Southern WRD is chemically suitable for use as a capping material, and for subsequent revegetation. The material is course with large particle size that is also geotechnically suitable for capping and revegetation.

Yours Sincerely,



MAUSIMM #317009

Marty Costello
Executive Director

APPENDIX F NOBLES NOB OPEN PIT DEWATERING ASSESSMENT

Nobles Nob Open Pit Dewatering Assessment

Nobles Nob Gold Project

Tennant Consolidated Mining Group Pty Ltd

Version 1.0

March 2023

Acknowledgement of Country

Tennant Mining acknowledges the Traditional Owners of the lands on which we work. We pay our respects to elders, past, present, and emerging.

Disclaimer

Document Control

Version	Personnel	Date
Version 0.1	Dr Ashish Mishra prepared the document	08-03-2023
Version 0.1	S.Murdoch and Y.S. McGuinness reviewed the document	10-03-2023
Version 0.2	Dr Ashish Mishra addressed the comments	10-03-2023
Version 1.0	Dr Ashish Mishra finalised the document for submission	11-03-2023

Table of Contents

Figures

Tables

1.0 Introduction

1.1 Background

The Nobles Nob Gold Project is located approximately 13 kilometres (km) southeast of Tennant Creek township, in the Northern Territory (NT). Gold was initially extracted at Nobles Nob from underground operations commencing in the early 1930s and then through open-pit methods from the 1960s. Open-pit mining at Nobles Nob concluded in 1985, although gold production at Nobles Nob continued until 1992.

Tennant Consolidated Mining Group (TCMG) have the approval to recommence operations at Nobles Nob, which will include extractive mining and reprocessing of the crown pillar stockpile, a small extension of the Nobles Nob Pit, and exploration activities. A Mining Management Plan (MMP) for Nobles Nob was submitted and approved as per the Northern Territory *Mining Management Act 2001*, with mining authorisation (1123-01) granted on 15 August 2022. A Water Extraction Licence was granted to TCMG by the Northern Territory Government's Department of Environment, Parks and Water Security (DEPWS) for the Nobles Nob Gold Project on 19 January 2023, Licence No: L10012.

TCMG is currently assessing the viability of dewatering the Nobles Nob Pit for future mining purposes, and using the extracted water for beneficial use at the site. Based on consultation and advice from the Northern Territory Government's DEPWS, TCMG is applying for a water extraction license to dewater the Nobles Nob Pit. This report assesses the potential impacts of the proposed dewatering activities, to support the water extraction license to dewater the Nobles Nob Pit.

1.2 Objectives

This report aims to present the hydrogeological understanding of the Nobles Nob, and assess the potential impacts that may occur to groundwater due to the proposed dewatering of the Nobles Nob Pit. This report will support the proposed water extraction license application for Nobles Nob Pit dewatering.

This report will develop an analytical model to predict the mine inflows and the amount of drawdown over time and space in response to the pit dewatering, which will enable an understanding of the area of the impact associated with the proposed pit dewatering. The existing Nobles Nob pit is located approximately 13 km southeast of Tennant Creek township.

It is planned to dewater the pit at a rate sufficient to allow preparortory works and a 20 m cutback of the Nobles Pit, and maintain safe working conditions during operations. Rather than becoming waste water to be disposed, it is planned to use the water extracted from the Nobles Nob Pit during pit dewatering, as a supply for the water requirements of the Nobles Nob Gold Project. Hence improving the water use efficiency of the Project, and reducing the amount of water required to be extracted under the existing water licence held by TCMG.

1.3 Relevant Legislation and Guidelines

The relevant legislation and guidelines that were used in the preparation of this assessment are as follows:

- The *Water Act 1992* (Northern Territory) - the *Water Act 1992* outlines the legal framework for allocations, entitlements, and water planning for most water resources in the NT. The investigation, allocation, use, control, protection, management, and administration of surface water and groundwater resources are also covered by the *Water Act*. The Tennant Creek Water Control District, which is a recognised water management region under the *Water Act*

1992, includes the Nobles Nob tenement and suggests that to extract or intercept surface water or groundwater in a water control district, you need a licence. The Tennant Creek Water Control District currently lacks a water allocation strategy.

- The *Mining Management Act 2001* (Northern Territory) - Exploration and mining operations in NT must be authorised under the *Mining Management Act 2001* (MMA). Under the MMA, a Mining Management Plan (MMP) must be submitted to the Department of Tourism, Industry and Trade (DITT) for authorisation. TCMG received the mining authorisation under this act on 15 August 2022.
- The *Environmental Protection Act 2019* (Northern Territory) – the *Environmental Protection Act 2019* (EP Act) came into effect on 29 June 2020 and intends to build a framework for evaluating the potential environmental impacts of development projects in order to protect the Northern Territory's environment and promote ecologically sustainable development. As outlined in Part 4 of the EP Act, an impact assessment is required where a proposed action has the potential to have a significant impact on the environment or meets referral criteria. Although the Nobles Nob project has not been referred, this assessment has been undertaken proactively by TCMG to understand the impacts, if any, from the proposed activities.
- *Waste Management and Pollution Control Act 1998* (Northern Territory) – this act provides the framework for the protection of the environment from waste and pollution, by incorporating effective waste management, pollution prevention and control practices.
- *Environment Protection and Biodiversity Conversation Act 1999* (Cth) (EPBC Act) – The EPBC Act provides a framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and other matters, defined in the EPBC Act as matters of national environmental significance (MNES). It is understood that there are no MNES identified in the vicinity of the Nobles Nob.

1.4 Data Availability

This assessment was undertaken based on available site data and field data collected from Nobles Nob for various previous studies. This includes the following:

- Nobles Nob waste rock analysis report (Umwelt, 2021a).
- Nobles Nob Mine Groundwater Slug Test Report (Umwelt, 2021b).
- Nobles Nob Mine Groundwater Assessment Report (Umwelt, 2021c)- also attached as **Appendix B.**
- Bore installation and construction details, included in **Appendix B.**
- Water quality results from October 2021 to January 2023.

2.0 Site Characteristics

2.1 Location and History

The Nobles Nob Mine is located within the Tennant Creek Goldfield, approximately 13 km southeast of Tennant Creek in Northern Territory, Australia. Tennant Creek is approximately 504 km north of Alice Springs and 978 km south of Darwin (**Figure 1**). The Nobles Nob area encompasses 355 hectares (ha), with 253 ha within Nobles Nob mining tenements and 102 ha within Juno tenements.

Previous disturbances at Nobles Nob occurred during historical mining activities. Nobles Nob was historically mined over 50 years from the late 1930s to the 1980s. Mining commenced in 1939 with underground operations. The collapse of the crown pillar in 1968 led to the construction of a new plant, followed by open-pit operations in 1969. Some of the material from the collapsed crown pillar was recovered, while most of the material was stockpiled in the existing mineralised southern waste rock dump (Southern WRD), located to the south of the Nobles Nob pit.

Open-pit mining continued at Nobles Nob from 1969 through to 1985 with a total production of 1.6Mt of ore at a grade of ~7g/t gold yielding 342,000 ounces of gold. In total, since the 1930s, the Nobles Nob mine produced 2.1Mt of ore at a grade of 17.0 g/t with a total yield of 1.17M ounces of gold and was considered Australia's richest gold mine for many of those years.

2.2 Topography and Drainage

Land surface elevation, informed by LiDAR data, shows that the area around Nobles Nob comprises plains and low hills associated with the McDougall Ranges (Umwelt, 2021c). Elevation throughout the site ranges from approximately 296 mAHD to 380 mAHD. The rest of the region towards the west of Nobles Nob appears to be dominated by level to undulating plains, associated mainly with dune fields and sand plains of the Tanami Desert (Umwelt, 2021c).

Two permanent surface water bodies exist around Nobles Nob (TCMG, 2022; Tennant Gold Resource, 2018), including the Nobles Nob Pit and Lake Alice, [redacted] located approximately 500 m southwest of the pit. Some surface drainage occurs on-site briefly during the wet season. Surface flows across the mine site would predominately be conveyed as sheet flow before channelising and forming local flow paths (ATCW, 2022). Refer to **Figure 2**, which illustrates the existing watercourses and surface drainages in the area.

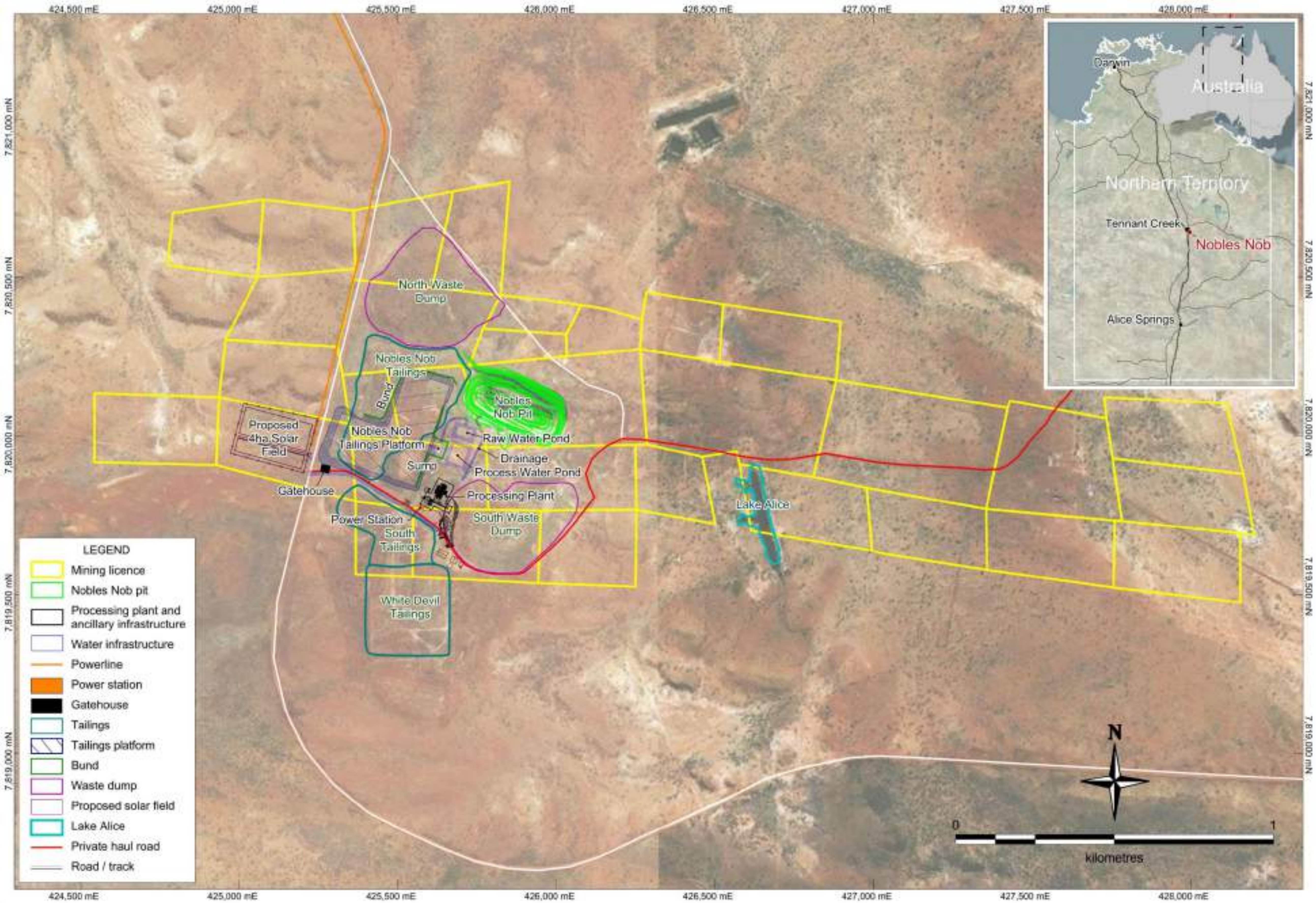


Figure 1 Site Location and Proposed Infrastructure

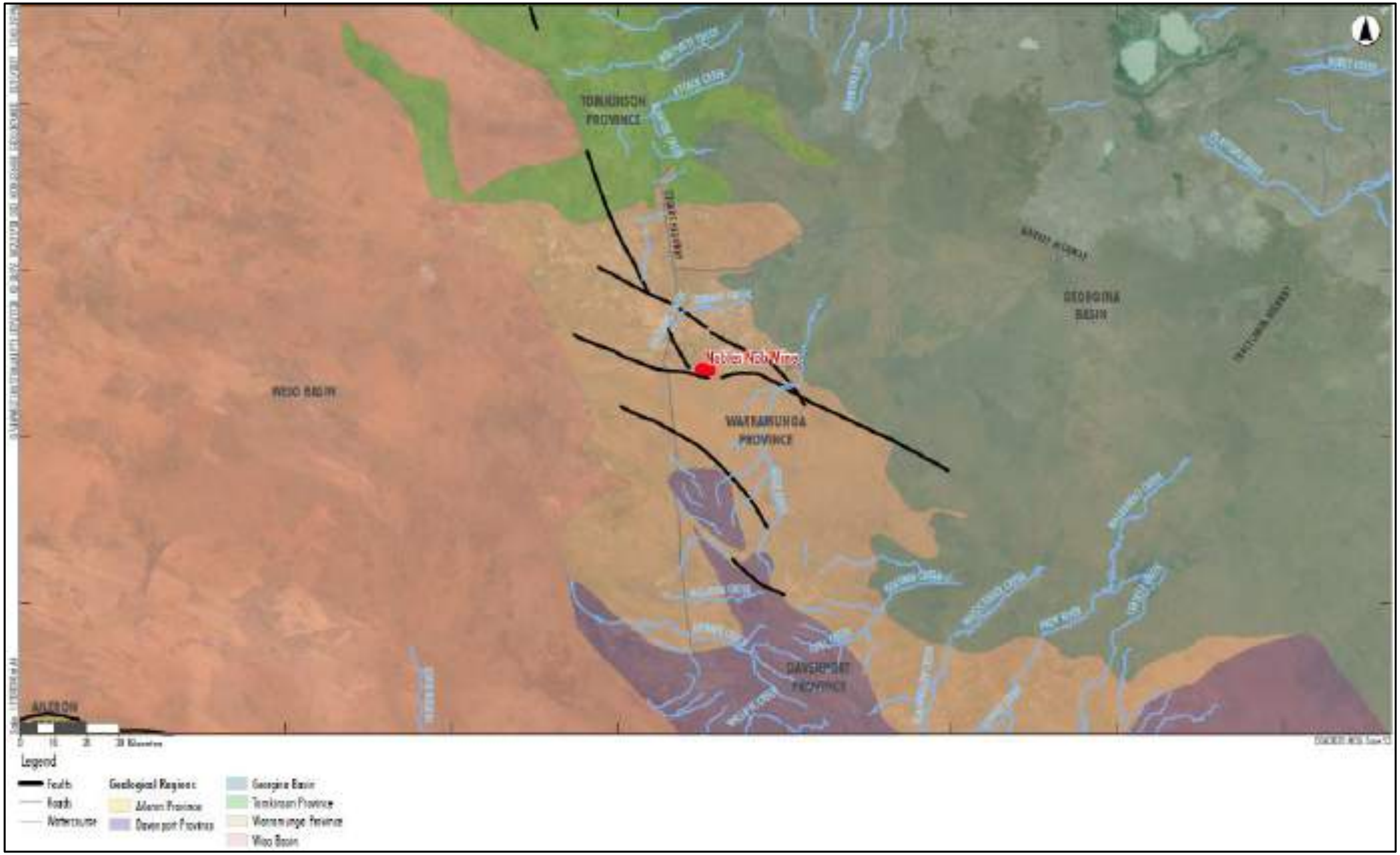


Figure 2 Existing Catchments and Flow Directions (Source: Umwelt, 2021c)

2.3 Climate

The area is characterised by a hot arid climate, with evapotranspiration exceeding rainfall throughout the year. The mean monthly temperature data was retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), presented in **Table 1**. The mean monthly maximum temperature ranges from 24.6°C during the winter (June) to 37.3°C in the summer (December) (BoM, 2022).

Table 1 Mean Monthly Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (˚C)	36.8	35.9	34.7	32	27.7	24.6	24.8	27.6	31.8	35	36.7	37.3
Mean minimum temperature (˚C)	25	24.5	23.4	20.6	16.4	13	12.3	14.4	18.5	21.9	23.9	25

Mean has been calculated using monthly data from Jan 1969 to Oct 2022

Rainfall data has been retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), and from the publicly available Scientific Information for Landowners (SILO) station at Tennant Creek Airport (Latitude -19.64, Longitude 134.18). The monthly average rainfall and evapotranspiration data for the last 20 years have been presented in **Table 2** below.

The SILO database generally provides a complete long-term dataset and is, therefore, helpful in assessing long-term rainfall trends in the vicinity of the site. This dataset is interpolated from quality-checked observational time-series data collected at nearby stations by the Bureau of Meteorology. Based on the SILO dataset, the average annual rainfall over 100 years is 383.9 mm, with evaporation exceeding rainfall during each month of the year (**Table 2** and **Figure 3**). On the other hand, the BoM station data suggests that the mean annual precipitation for the last 20 years is 492 mm.

Table 2 Monthly Average of Rainfall and Evapotranspiration (SILO)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
BOM Rainfall*	147.2	101.4	41.3	12.3	7.0	6.6	4.8	4.0	6.8	18.7	43.6	90.0	492.2
SILO Rainfall	97.7	89.4	49.9	11.7	10.3	6.7	5.0	2.1	5.4	15.6	30.4	59.7	383.9
SILO ET#	348.1	288.7	320.1	286.0	231.3	185.8	198.2	249.1	305.7	359.6	369.1	370.2	3511.9
SILO fao56 ET#	213.1	181.3	191.5	167.7	138.4	115.2	126.2	156.1	185.0	217.0	220.4	224.0	2135.9

All values are in millimetres (mm)
*BoM average is of last 20 years
#ET – Evapotranspiration

The SILO dataset was used to calculate the cumulative rainfall deviation (CRD). The CRD is a summation of the monthly departure of rainfall from the long-term average monthly rainfall. A rising trend in slope in the CRD plot indicates periods of above-average rainfall, whilst a declining slope indicates periods when rainfall is below average. The CRD in **Figure 4** below has been calculated based on the long-term average monthly rainfall from 1900 to 2022. The CRD indicates that the Nobles Nob area has experienced a period of above-average rainfall from 2010 to 2016, and below-average rainfall from 2016 until 2022. In 2022, the average rainfall experience at Nobles Nob was higher than average (**Figure 4**).

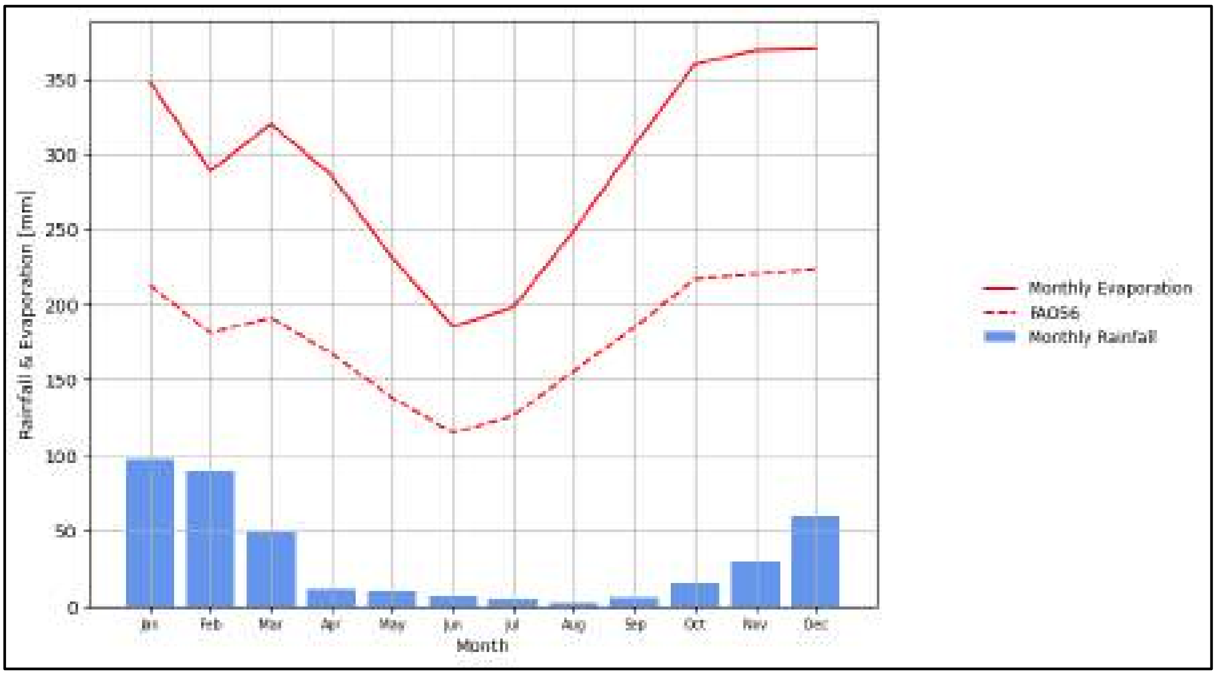


Figure 3 Graph Showing Monthly Average Rainfall and Evapotranspiration

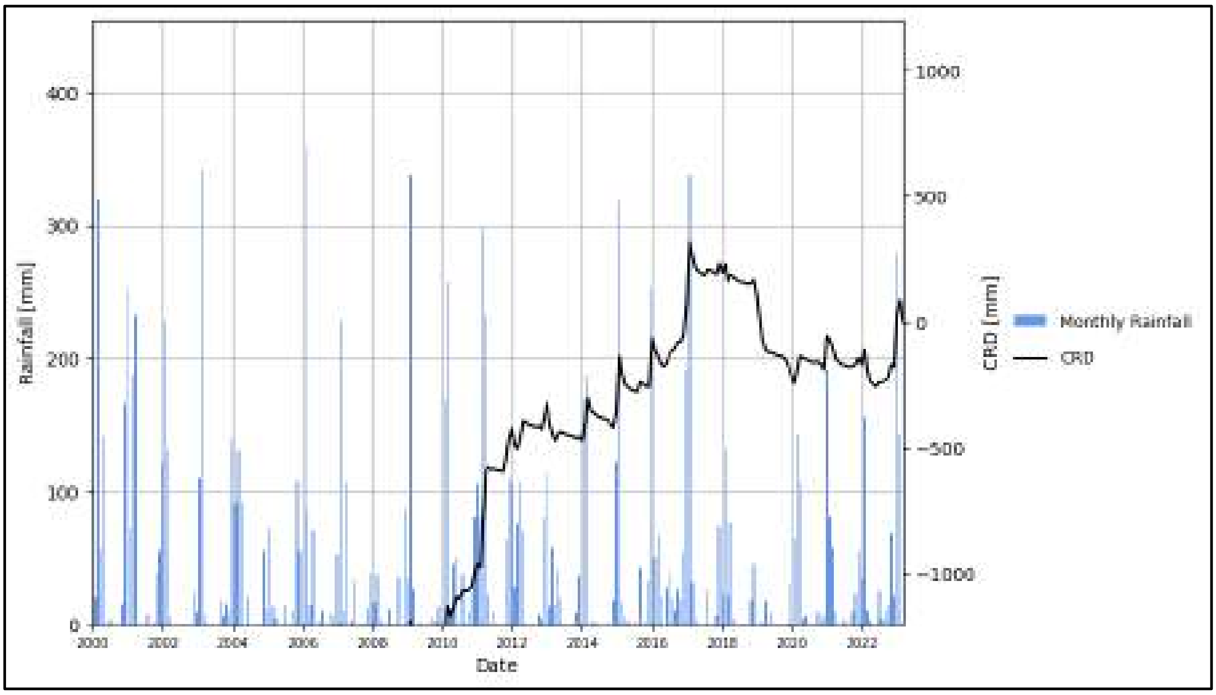


Figure 4 Monthly Rainfall (2000-2022) and CRD at Nobles Nob

2.4 Land System and Soils

Nobles Nob is situated within the Tennant Creek Land System, dominated by sandstone plains and rises characteristic of the Ashburton Range subregion. It is part of the greater Davenport Murchison Ranges bioregion, characterised by plateaux, plains and rises on sandstone, claystone and limestone, and outcrops with shallow stony soils.

According to the Australian Soil Classification, the dominant soils at Nobles Nob are Kandosol, Rudosol and Tenosol.

- Kandosols are often referred to as red, yellow and brown earth. Kandosols are essential for agricultural and horticultural production. They occur throughout the Northern Territory and are widespread across the Top End, Sturt plateau, Tennant Creek and Central Australian regions.
- Rudosols are very shallow soils with minimal soil development. Rudosols include very shallow rocky and gravelly soils across rugged terrain and pure sand soils in deserts.
- Tenosols are weakly developed or sandy soils which are essential for horticulture. These soils show some degree of development (minor colour or soil texture increase in subsoil) down the profile.

2.6 Vegetation

Previous surveys identified the vegetation at Nobles Nob as predominantly eucalypt low open woodland and acacia-sparse shrubland over hummock grassland. The rises on-site host a community of open woodland dominated by snappy gum (*Eucalyptus leucophloia* subsp. *euroa*) over gummy spinifex (*Triodia pungens*) grassland. Plains and drainage communities have a mosaic of *E. pruinosa* and *E. aparrerinja* woodlands (Tennant Gold, 2018). No vegetation communities or ecological communities of listed conservation significance have been recorded within 50 km of Nobles Nob. A search of the NT Flora Atlas identified 22 records of 13 species of listed conservation significance, three of which are considered 'Near Threatened' under the *TPWC Act*: *Lythrum wilsonii, Trianthema glossostigmum,* and *Trianthema. oxycalyptra* var. *oxycalyptra.*

3.0 Hydrogeology

3.1 Existing Groundwater Bores at Nobles Nob

A total of 10 monitoring bores were installed by TCMG in May/June 2021 to monitor the water level and quality of groundwater at Nobles Nob. The details of the bores are presented in **Table 3** below, and the locations are shown in **Figure 5** below.

The hydrogeological assessment at Nobles Nob was undertaken in 2021 (Umwelt, 2021c), in which a review of registered bores within 2.5 km of the Nobles Nob pit was also undertaken using the NR Maps desktop tool (https://nrmaps.nt.gov.au/nrmaps.html). Details of the registered bores are also presented in **Table 3** below. The review of registered bores identified 16 registered bores within 2.5 km of Nobles Nob (Umwelt, 2021c). Of these 16 bores, most were installed for historical mine water production; however, most of them did not encounter any water (Umwelt, 2021c). The NR Maps assessment suggests that none of the 16 registered bores are being used for stock water supply.

Table 3 Groundwater Bores around Nobles Nob

Bore ID	Date completed	Easting*	Northing*	Depth	Screen Interval	Water Bearing Unit	Yield (L/s)
Monitoring Bores							
NNMW001	6/06/2021	425505	7819803	102	90 - 102	Sandstone	0.01
NNMW002	9/06/2021	425488	7819596	77.9	65.9 - 77.9	Sandstone	0.05
NNMW004	4/06/2021	425374.9	7820346	75	63 - 75	Sandstone	0.11
NNMW005	3/06/2021	425228.6	7820086	70	58 - 70	Sandstone	0.53
NNMW007	2/06/2021	424730.8	7819950	95.8	83.8 - 95.8	Sandstone	0.13
NNMW011	29/05/2021	426621.8	7819922	66	54 - 66	Sandstone	1
NNMW012	31/05/2021	427616.9	7819830	76.6	64.4 - 76.4	Sandstone	0.2
NNMW013	7/06/2021	426527.3	7820174	78	66 - 78	Sandstone/ Siltstone	0.2
NNMW014	30/05/2021	426075.9	7820387	69.6	57.6 - 69.6	Hematite Shale	0.2
NNMW018	1/06/2021	427151.5	7819926	78	66 - 78	Sandstone	1.9
Registered Bores							
RN006863	26/11/1969	426927	7819869	100.6	NA	Slate	1
RN006864	28/11/1969	427677	7820019	152.4	NA	Siltstone	0.1
RN007139	11/05/1970	427677	7820019	131.1	NA	No Water Encountered	0
RN007140	19/05/1970	427677	7820019	112.8	NA	No Water Encountered	0
RN006496	5/05/1969	424127	7819169	91.4	NA	No Water Encountered	0
RN006862	24/11/1969	426527	7819469	123.4	NA	Siltstone	0.9
RN006495	6/05/1969	426127	7819369	99.1	NA	No Water Encountered	0
RN003777	11/06/1963	424877	7819819	112.8	NA	Greywacke (sandstone)	0.5
RN012016#	6/10/1978	427127	7819169	106.8	NA	Greywacke (sandstone)	0.1
RN003776†	14/05/1963	426127	7819819	32	NA	No Water Encountered	0
RN012015#	5/02/1990	426076	7819792	97.6	NA	Siltstone	2

RN003775†	16/06/1963	426127	7819819	25.9	NA	No Water Encountered	0
RN006497	7/05/1969	426527	7819869	100.6	NA	Siltstone	1
RN011760#	18/11/1977	426127	7820169	110	NA	Siltstone	3.2
RN003774†	10/03/1963	426127	7819819	23.2	NA	No Water Encountered	0
RN012028#	25/11/1978	427127	7820169	91	NA	Siltstone	2

*Coordinates in GDA2020 MGA Zone 53.

abandoned/backfilled. † Stope holes located at the same location. NA - Not Available

Figure 5 Monitoring and Registered Groundwater Bores at Nobles Nob

3.2 Hydrogeological Units

Based on the analysis of aquifer yields, bore logs and lithology, the primary hydrogeological unit at Nobles Nob is within the local scale fractured sandstone/siltstone of the Warramunga Group (Umwelt, 2021c). The information provided in the drilling records and water level readings post-installation of the groundwater bores at Nobles Nob were also reviewed and suggested the same. Groundwater in this aquifer is generally first encountered between approximately 70 to 80 meters below ground level (Umwelt, 2021c). The drilling records from the monitoring and registered bores generally suggest that no groundwater was encountered at shallow depths. Registered bores drilled at shallow depths (<32m) also did not encounter any groundwater. Measurements of airlift yields recorded during drilling of monitoring bores and registered bores are generally less than 1 L/s (only 2 out of 10 bores recorded a yield of > 1 L/s), suggesting that the permeability in the area is low.

Previous studies around the Tennant Creek area also found groundwater within Warramunga Group siltstones, schists and granites, and Gum Ridge Formation limestone and chert (Verhoeven, 1976; Verhoeven & Knott, 1980). These studies also found that the permeability of these aquifers is low, and the quality is unsuitable for human consumption (Rockwater, 1989; Verhoeven & Knott, 1980).

3.3 Hydraulic Parameters

Slug tests were undertaken at 10 monitoring bores at Nobles Nob in October 2021, to estimate the hydraulic parameters of the groundwater system (Umwelt, 2021b). The values of hydraulic conductivity ranged from 0.0105 m/day at bore NNMW002 to 0.681 m/day at bore NNMW018 (see **Table 4**). Bores NNMW011 and NNMW012, located towards the east of the Nobles Nob Pit, recorded hydraulic conductivity values of 0.387 m/day and 0.355 m/day, respectively. This range is consistent with previous studies into the Warramunga Formation (e.g., Rockwater, 1989; Verhoeven & Knott, 1980), which suggested that the permeability in the area is low.

Table 4 Hydraulic Conductivity of Groundwater Bores at Nobles Nob

Bores	Hydraulic Conductivity (m/day)	Method	Screen Length (m)	Transmissivity (m^2/day)
NNMW001	0.0162	Hvorslev	12	0.194
NNMW002	0.0105	Bouwer & Rice	12	0.126
NNMW004	0.321	Hvorslev	12	3.852
NNMW005	0.559	Hvorslev	12	6.708
NNMW007	0.0591	Hvorslev	12	0.709
NNMW011	0.387	Bouwer & Rice	12	4.644
NNMW012	0.355	Hvorslev	12	4.260
NNMW013	0.411	Hvorslev	12	4.932
NNMW014	0.11	Hvorslev	12	1.320
NNMW018	0.681	Hvorslev	12	8.172
Average (All)	***0.291***			***3.492***

3.4 Groundwater Levels and Flow Direction

The groundwater level has been measured at groundwater bores monthly (and quarterly at some bores) since October 2021. The results of the groundwater level from October 2021 to January 2023 are presented in **Figure 6**. The elevation of groundwater ranges from approximately 293 mAHD at

NNMW007 to approximately 296 mAHD at NNMW011, NNMW012 and NNMW018. There is no water level reading available for the Nobles Nob Pit. A LiDAR reading from May 2021 indicated water level at around 296 mAHD (Umwelt, 2021c). The data available for the groundwater bores indicates that the groundwater gradient is relatively flat in the area. The average groundwater level in the bores east of the Nobles Nob pit (i.e., bores NNMW011, NNMW012, NNMW013, NNMW014, and NNMW018) is 295.85 mAHD, which is higher compared to the average groundwater level of 294.61 mAHD recorded in the bores located towards west of Nobles Nob pit (i.e., NNMW001, NNMW002, NNMW004, NNMW005, and NNMW005).

The groundwater levels at Nobles Nob further suggest that the overall flow is from the east towards the west-northwest, mirroring the regional groundwater flow direction and overall surface topography. This is in agreement with the other studies that suggested that the regional groundwater flow is from the southeast to the northwest, in line with regional surface topography (McPherson et al., 2021).

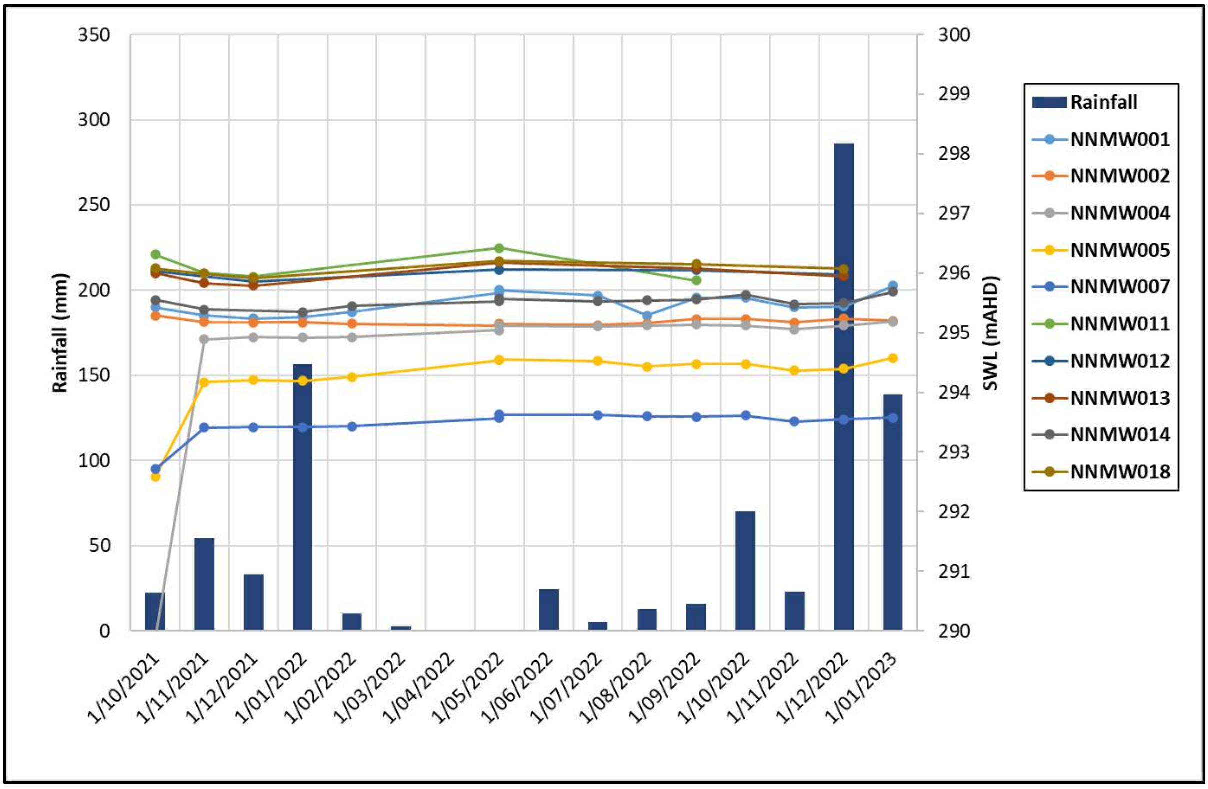


Figure 6 Groundwater Levels and Rainfall at Nobles Nob

3.5 Groundwater Quality

The groundwater quality has been measured at groundwater bores monthly (and quarterly) since October 2021. The results of the groundwater quality are discussed below. In addition to the groundwater bores, one round of water quality samples from Nobles Nob Pit was also collected in 2018, and the results are also discussed in the sections below.

3.5.1 Physicochemical and Major Ions

The pH values observed in the groundwater bores ranged from 6.6 at NNMW002 to 8 pH units at NNMW007 (**Table 5**). The electrical conductivity (EC) values ranged from 4,400 µS/cm at NNMW002 to 15,000 µS/cm at NNMW005. The total dissolved solids (TDS) concentrations were also high in the groundwater bores, ranging from 2,700 mg/L to 11,000 mg/L. This is consistent with the previous studies that also found that water quality in the Warramunga Group is highly saline and unsuitable for human consumption (Umwelt, 2021c, Rockwater, 1989; Verhoeven & Knott, 1980).

Compared to the groundwater bores, the water in the Nobles Nob pit collected in 2018 and the water from Lake Alice since October 2021 recorded very low EC (42 to 99 µS/cm at Lake Alice and 140 µS/cm at Nobles Nob Pit) and TDS (30 to 120 mg/L at Lake Alice and 84 mg/L at Nobles Nob Pit). The low EC in the Nobles Nob Pit might be due to the fact that the samples were collected from near-surface, and higher EC/TDS values could be expected further down the water profile as saline water often sinks to the bottom. It could also be possible that water in the pit and Lake Alice could represent fresh rainfall runoff just before sampling. Gradient sampling of pit water will be undertaken during pit dewatering to understand the water composition and stratification.

Major ion concentrations were also monitored for all 10 groundwater bores. Amongst the cations, the sodium concentration was recorded the highest at all bores, ranging from 450 mg/L at NNMW002 to 3,100 mg/L at NNMW005. Amongst the anions, the chloride concentration was the highest ranging from 1,200 mg/L at NNMW002 to 4,600 mg/L at NNMW005, followed by sulfate ranging from 210 mg/L at NNMW002 to 1,600 mg/L at NNMW011. Carbonate concentrations were below the limit of reporting at all bores, while bicarbonate results ranged from 96 mg/L at NNMW002 to 520 mg/L at NNMW007. The major ion data suggests that the water type of all groundwater bores is sodium chloride type (**Figure 7**). Sodium chloride (Na-Cl) dominated water in the groundwater bores reflect low recharge and influence of evaporative processes.

Compared to the groundwater bores, the water in the Nobles Nob Pit collected in 2018 and the surface water from Lake Alice (SWLA) since October 2021 record a different proportion of major ions. The dominant cation in Nobles Nob Pit is potassium (13 mg/L), followed by calcium (7.3 mg/L). The dominant anion in Nobles Nob Pit water is bicarbonate (52 mg/L). The Piper diagram of Nobles Nob Pit suggests the water type is Ca-HCO3+CO3 (**Figure 7**). The dominant cation in Lake Alice is sodium, followed by calcium, and the dominant anion is bicarbonate (HCO3), followed by chloride. The water type of Lake Alice, plotted in the Piper diagram, is very different from the composition of groundwater at Nobles Nob, indicating that any connection or interaction between Lake Alice and the groundwater is highly unlikely (**Figure 7**).

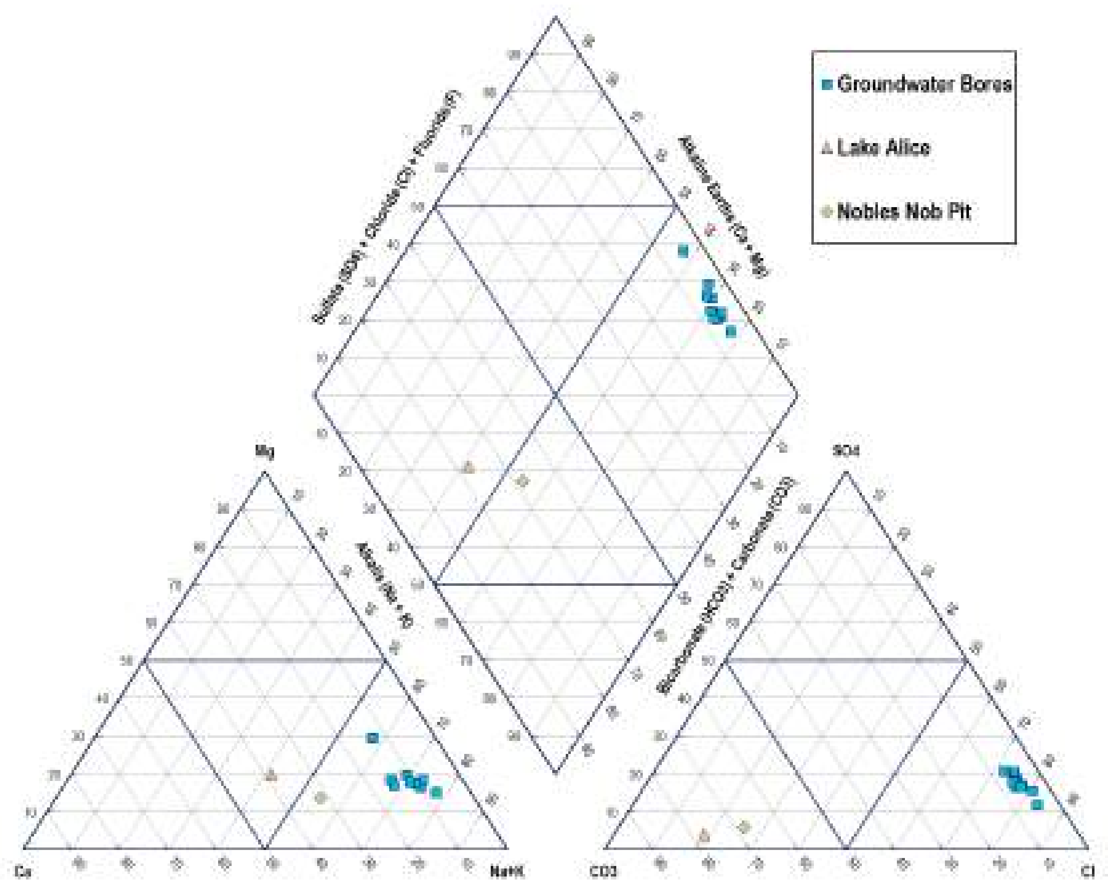


Figure 7 Piper Diagram of Groundwater Bores at Nobles Nob

3.5.2. Metals and Metalloids

Results for dissolved and total metals from samples collected since October 2021 are presented in **Table 5** and summarised below.

The concentration of many metals was below the limit of reporting (LOR) in all bores. These include dissolved and total concentrations of arsenic, beryllium, mercury, silver, and vanadium (**Table 5**). All bores, except bores NNMW001, NNMW004, and NNMW005, recorded free and total cyanide concentrations below the LOR in most of the monitoring events (**Table 5**). The concentration of free and total cyanide was highest at bore NNMW005. The presence of cyanide at the bores NNMW001, NNMW004, and NNMW005 might be attributed to the fact that these bores are located very close to the historical tailings deposits. Cyanide concentrations were not available for the Nobles Nob Pit.

Table 5 Summary of Groundwater Quality at Nobles Nob

Parameters	Unit	Groundwater Bores				Nobles Nob Pit**
		Non-detect (%)	Min	Median	Max	
Lab EC	µS/cm	0	4400	9850	15000	140
Lab pH	pH unit	0	6.6	7.4	8	6.9
Sulfur as Sulfate SO4	mg/L	0	210	845	1600	4
Total Dissolved Solids	mg/L	0	2700	6600	11000	84
Aluminium	mg/L	0	0.012	0.025	0.06	<0.01

Arsenic	mg/L	98.3	5.00E-04	0.0015	0.0045	<0.001
Cadmium	mg/L	74.1	0.00005	0.00015	7.00E-04	<0.0001
Chromium	mg/L	78.4	0.00025	0.001	0.007	<0.001
Cobalt	mg/L	6.0	0.0005	0.011	0.29	<0.001
Copper	mg/L	58.6	0.0005	0.0015	0.017	0.001
Iron	mg/L	63.2	0.0025	0.01	2.5	0.003
Lead	mg/L	84.5	5.00E-04	0.0005	0.006	<0.001
Manganese	mg/L	1.7	0.0025	0.41	8.1	<0.005
Mercury	mg/L	93.1	2.50E-05	2.50E-05	1.50E-04	-
Nickel	mg/L	37.1	0.0005	0.002	0.013	<0.001
Selenium	mg/L	14.7	0.0005	0.011	0.037	<0.001
Silver	mg/L	89.6	2.50E-05	7.50E-05	0.004	-
Vanadium	mg/L	83.8	0.0005	0.0005	0.005	-
Zinc	mg/L	22.0	0.0025	0.008	0.063	<0.01
Total Aluminium	mg/L	0.0	0.03	0.155	3.3	4.6
Total Arsenic	mg/L	96.6	5.00E-04	0.0015	0.0045	0.002
Total Cadmium	mg/L	70.7	0.00005	1.50E-04	1.70E-03	<0.0001
Total Chromium	mg/L	70.7	0.00025	0.0015	0.008	0.009
Total Cobalt	mg/L	2.6	0.0005	0.015	0.32	0.004
Total Copper	mg/L	31.0	0.0005	0.002	0.035	0.011
Total Iron	mg/L	1.5	0.01	0.315	3.9	13
Total Lead	mg/L	58.6	0.0005	0.001	0.011	0.011
Total Manganese	mg/L	0.0	0.006	0.44	8.1	0.23
Total Mercury	mg/L	90.5	2.50E-05	2.50E-05	1.60E-04	-
Total Nickel	mg/L	26.7	0.0005	0.003	0.014	0.003
Total Selenium	mg/L	13.2	0.0005	0.011	0.049	<0.001
Total Silver	mg/L	87.0	2.50E-05	7.50E-05	0.0025	-
Total Vanadium	mg/L	48.5	0.0005	0.001	0.008	-
Total Zinc	mg/L	15.4	0.0025	0.01	0.07	0.017
Free Cyanide	mg/L	86.2	0.002	0.002	0.024	-
Total Cyanide	mg/L	57.8	0.002	0.002	0.15	-

** Nobles Nob Pit was sampled in 2018. < denotes below Limit of Reporting

3.6 Recharge and Discharge

Recharge to the aquifers around Nobles Nob is primarily from rainfall infiltration through the ground. As rainfall in the Tennant Creek area is episodic and low, and as the evapotranspiration rates are high throughout the year, recharge from rainfall will be during high-intensity rainfall periods. This is further illustrated in **Figure 6**, where the groundwater level responds to rainfall events (e.g., in December 2022). The average groundwater level is approximately 60 metres below ground, so the response is small. In the Nobles Nob area, the discharge is mainly through evapotranspiration.

3.7 Environmental Values and Groundwater Use

A review of the previous studies (e.g., Rockwater, 1989; Rose, 1973; Rose & Willis, 1973; Verhoeven, 1976; Verhoeven & Knott, 1980) suggested that the quality and low permeability of groundwater from the Warramunga Group limits its usage. That is the reason why the water supply for Tennant Creek Township is pumped from the Cabbage Gum, and Kelly Well borefields, which are approximately 25 kilometres south of Tennant Creek. All the registered bores within 2.5 km of Nobles Nob Pit are mine related bores, and there are no declared groundwater users in the area. Historical mining and grazing have been the primary use of the land, and therefore the use of groundwater around Nobles Nob is restricted to these activities (Umwelt, 2021c).

The assessment of groundwater-dependent ecosystems (GDEs) and springs through the Atlas of Groundwater Dependent Ecosystems (BOM, 2012) and the NR Maps desktop tool indicated no known

GDEs or springs within 10 km of the Nobles Nob pit (Umwelt, 2021c). The GDEs refer to ecosystems that rely on groundwater, either permanently or intermittently. This includes surface expressions of groundwater in the forms of springs and wetlands and below-ground systems, such as caves.

There are no permanent surface water features in the area, except the Nobles Nob Pit and Lake Alice located close to bore NNMW011. The available water quality data from Lake Alice is very different compared to the groundwater quality recorded at the groundwater bores, indicating unlikely groundwater connections, interactions or contributions.

4.0 Groundwater Analytical Model

Pit dewatering is often associated with a decline in groundwater levels, often referred to as drawdown. This section of the report will include analytical modelling of the volume of water to be withdrawn, and the predicted area that will experience drawdown from this withdrawal.

4.1 Methodology

An analytical model was developed to predict the mine inflows and the area that will experience drawdown over time and space in response to the pit dewatering, and to assess the risks associated with the proposed pit dewatering. The methodology is based on the Marinelli and Niccoli (2000) analytical solutions and assumes steady-state flow. The solution is well suited for this assessment as it considers the effect of decreased saturated thickness near the pit walls, distributed recharge to the water table, and upward flow through the bottom of the pit. The analytical method used here assumes steady-state, horizonal, and axially symmetrical flow towards the area of the pit (**Figure 8**), within a porous media.

This Marinelli and Niccoli (2000) analytical solution allows for vertical conductivity; however, for the purposes of this model, the hydro-stratigraphic units at Nobles Nob were assumed to be isotropic. This means the horizontal and the vertical conductivity were assumed to be the same. The Marinelli and Nicolli (2000) solution also assumes the pit geometry as a circular cylinder. Although these assumptions are not an accurate representation of the conditions on a local scale, on a more comprehensive spatial scale, the estimates from these types of models are effective in providing representative predictions of drawdown impact. It is also noteworthy that this model assumes steady state conditions and will overestimate the extent of drawdown when the mine life is short, as in the case of Nobles Nob.

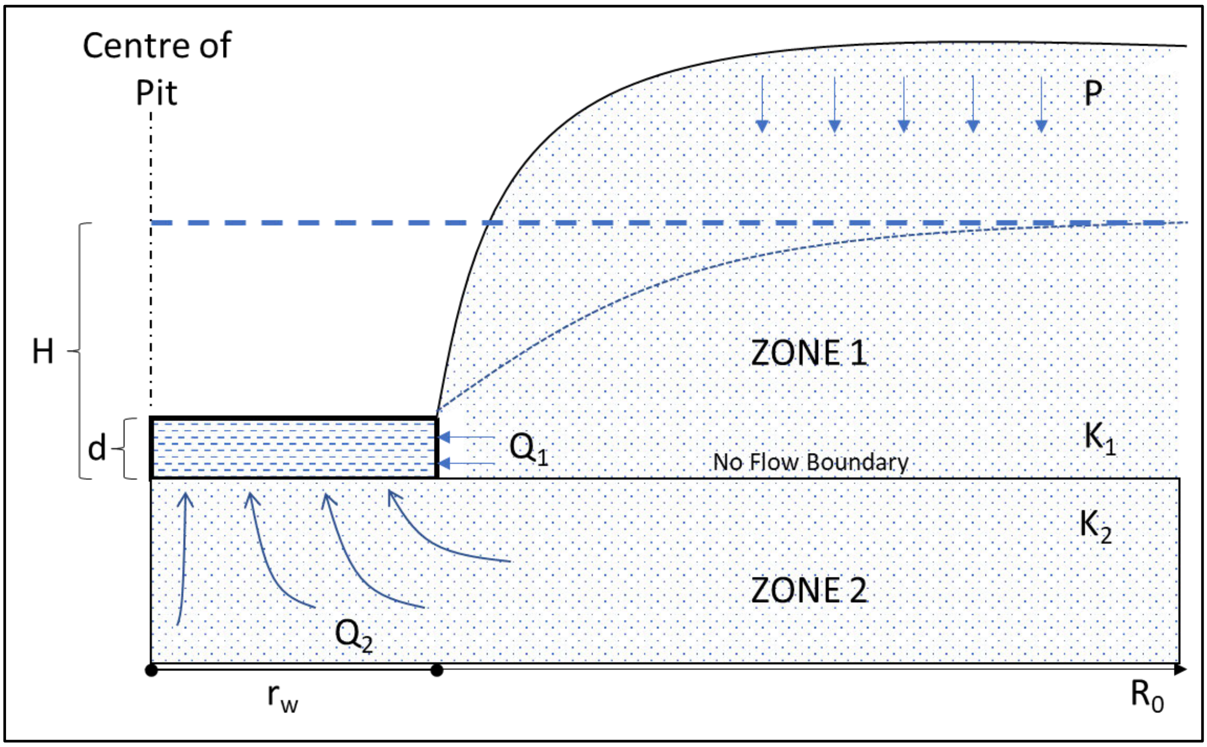


Figure 8 Pit Inflow Analytical Model

The Marinelli and Niccoli (2000) analytical method used for pit inflow predictions involves the calculation of total inflow (Q_t) as the summation of Q_1 and Q_2 according to the following formula:

$$Q_1 = P \,.\, \pi \,.\, (R_0^2 - r_w^2)$$

$$Q_2 = 4\, r_w \,.\, (K_1/m).\ (H\text{-}d)$$

And the radius of influence was derived using the following formula:

$$H = \sqrt{h_s^{\,2} + \frac{P}{K_{h1}}\left[R_0^{\,2}\ln\left(\frac{R_0}{r_w}\right) - \frac{R_0^{\,2} - r_w^{\,2}}{2}\right]}$$

Where,

- Q_1 = Inflow from pit walls (m^3/s)
- Q_2 = Inflow from pit bottom (m^3/s)
- H = height of radius of influence (m)
- d = Depth of ponded area (m)
- K_1 = Hydraulic conductivity- horizontal (m/s)
- K_2 = Hydraulic conductivity- vertical (m/s)
- P = Distributed recharge (m/s)
- r_w = Radius of pit (m)
- R_0 = Radius of influence (m)
- h_s = Saturated thickness of the mine wall (seepage face) (m)

4.2 Input Parameters

For this assessment, two scenarios have been modelled, which are:

- **Scenario 1** – the Nobles Nob Pit is dewatered ~10 m below the current water level, to the pit floor.
- **Scenario 2** – the Nobles Nob Pit is dewatered 30 m below the current water level.

Pit dewatering is proposed to dewater the groundwater levels to the pit floor for approximately 6 months, after which the pit dewatering progresses to 30 m below the existing groundwater table as the Nobles Nob Pit reaches the next stages of pit progression for open-cut mining.

The input parameters used in the analytical solution are discussed in the sections below and are presented in **Table 6** below.

4.2.1 Recharge Rate

The rate of recharge is typically low for terrains with hard rock and arid climates, as observed in Tennant Creek. As such, the estimated recharge rate is assumed to be approximately 1.5% of mean annual rainfall. The BoM station data suggests that the mean annual precipitation for the last 20 years is 492 mm, which translates to 0.00135 m/day or 1.56×10^{-8} m/s.

Assuming the recharge rate is 1.5% of the mean annual rainfall, the recharge rate is 2.02×10^{-5} m/day or 2.34×10^{-10} m/s. Taking a conservative approach, the model has also included the scenario where the recharge rate is 1% of the mean annual rainfall.

4.2.2 Hydraulic Conductivity

The hydraulic conductivity values from the bores are used in this analytical model. The hydraulic conductivity values ranged from 0.0105 m/day at bore NNMW002 to 0.681 m/day at bore NNMW018. When compared to the values observed in rest of the bores at Nobles Nob, bore NNMW018 recorded very high hydraulic conductivity, and bores NNMW001 and NNMW002 recorded very low hydraulic conductivity values. As such, the values recorded in bores NNMW018, NNMW001 and NNMW002 are less likely to be representative, and might denote localised values. As such, the mean value of the hydraulic conductivity values recorded at all the remaining bores was used in this model. The mean value of all the remaining bores is 0.314 m/day or 3.63 x 10^{-6} m/s. Taking conservative approach, the lowest hydraulic conductivity of 0.1 m/day or 1.15 x 10^{-6} m/s observed in bore NNMW014 (located closest to the pit) has also been included in the analytical solutions.

4.2.3 Height of Radius of Influence and Depth of Ponded Area

The depth of the ponded area for the pit is assumed to be zero. The height at the radius of influence is the difference between the level of the regional water table and the base of the pit. These are also outlined in **Table 6** below.

Table 6 Input Parameters for Pit Model

PARAMETERS	VALUES
Height of water table or radius of influence (H)	Scenario 1 – 10 m Scenario 2 – 30 m
Depth of ponded area (d)	Scenario 1 – 0 m Scenario 2 – 0 m
Rainfall (mean annual 2002-2022)	0.001347945 m/day or 1.56012E-08 m/s
Recharge (P) - 1% of Rainfall *(minimum)*	1.34795E-05 m/day or 1.56012E-10 m/s
Recharge (P) - 1.5% of Rainfall *(likely)*	2.02192E-05 m/day or 2.34018E-10 m/s
Hydraulic conductivity (K) – Low	0.1 m/day or 1.15741E-06 m/s
Hydraulic conductivity (K) – Average *(likely)*	0.314 m/day or 3.63426E-06 m/s
Radius pit	107 m
Bottom of pit floor	~286 mAHD
Water Level around the Pit	~295 mAHD
Area of Pit (measured)	4065 m^2

4.3 Model Results

4.3.1 Radius of Influence

The radius of influence is the maximum extent of the cone of depression, and denotes the distance from the centre of pit, where the influence of the pit dewatering on the groundwater level ends. The radius of influence is often used to understand the extent of the impact on groundwater from dewatering activities.

The range of predicted radii of influence for Scenario 1, where the pit water level is dewatered ~10 m below the current level, is between 624 m and 1,122 m (**Table 7**). The model includes conditions where when the hydraulic conductivity around the pit is 0.1 m/day, the radius of influence is 722.9 m (when recharge rate is 1% of the mean annual rainfall) and 623.9 m (when recharge rate is 1.5% of the mean annual rainfall). The most likely conditions, where the hydraulic conductivity is likely to be 0.314 m/day, and the recharge rate is 1.5% of the mean annual rainfall, the radius of influence is expected to be ~959 m (**Table 7**).

For the Scenario 2, where the pit water level is dewatered ~30 m below the current level, the predicted radii of influence ranged between 1,454 m and 2,763 m (**Table 7**). Under most likely conditions, where the hydraulic conductivity is likely to be ~0.314 m/day, and the recharge rate is 1.5% of the mean annual rainfall, the radius of influence is expected to be ~2,332 m (**Table 7**).

Table 7 Calculated Radii of Influences from Analytical Model

Radii of Influence		
Scenario 1 - Drawdown of 10 m	**K- 0.1 m/day (low)**	**K- 0.314 m/day (likely)**
Recharge - 1 %	722.9 m	1121.9 m
Recharge - 1.5% (likely)	623.9 m	**958.9 m**
Scenario 2 - Drawdown of 30 m	**K- 0.1 m/day (low)**	**K- 0.314 m/day (likely)**
Recharge - 1 %	1714.9 m	2762.9 m
Recharge - 1.5% (likely)	1454.9 m	**2331.9 m**

K – hydraulic conductivity of groundwater
Cells highlighted in green denotes more likely estimates

4.3.2 Rate of Inflow

The maximum rate of predicted groundwater extraction from the Nobles Nob Pit corresponds to the estimated pit inflow at pit water levels. The inflow estimates, once the groundwater is lowered to pit floor, range between 5.2 L/s and 16.22 L/s (**Table 8**), whereas the inflow estimates range from 16.3 L/s to 50.65 L/s, when the groundwater level in the pit is lowered to 30 m below existing levels (**Table 8**). The inflow estimates during the second scenario are higher due to a greater hydraulic gradient in the second scenario.

At any given stage, inflow is greater at higher assumed hydraulic conductivity values and with greater recharge rates (**Table 8**). Given the climatic conditions and the rock types, the recharge rate of 1.5% and the hydraulic conductivity value of 0.314 m/day produce a reasonable range of inflow for the Nobles Nob analytical model. However, without better constraints on observed drawdown and metered pit inflow data at Nobles Nob Pit for validation, it is impossible to predict actual inflow rates. It is noted that, relative to radius of influence, the inflow rate is more sensitive to assumptions about pit geometry. Thus, the low estimates of inflow shown in **Table 8** are considered more representative predictions and have been used in the extraction plan to dewater Nobles Nob Pit.

Table 8 Calculated Pit Inflow Rates from Analytical Model

Pit Inflow		
Scenario 1 - Drawdown of 10 m	**K- 0.1 m/day (low)**	**K- 0.314 m/day (likely)**
Recharge - 1 %	5.2 L/s	16.16 L/s
Recharge - 1.5% (likely)	5.23 L/s	16.22 L/s
Scenario 2 - Drawdown of 30 m	**K- 0.1 m/day (low)**	**K- 0.314 m/day (likely)**
Recharge - 1 %	16.30 L/s	50.39 L/s
Recharge - 1.5% (likely)	16.41 L/s	50.65 L/s

K – hydraulic conductivity of groundwater
Cells highlighted in green denotes more likely estimates

4.4 Proposed Groundwater Extraction Rates

In order to dewater the groundwater from Nobles Nob Pit from the existing level to the Pit floor, the rate of groundwater extraction will have to occur at a 5.2 L/s. At this rate, the existing water in the Nobles Nob Pit should lower to the level of the Pit floor (~10 m below the existing water level) in ~90 days. At this stage, the inflow will be equal to the rate of extraction. It is planned to continue this rate to maintain a dry pit and safe working conditions during Pit preparatory works, until the operation phase commences at Nobles Nob. Once mining operations commences, the extraction rate will be increased to 16.41 L/s to maintain dewatering to ~20 m below the existing Pit floor (~30 m below the existing water level). The proposed monthly and annual extraction rates of groundwater to dewater Nobles Nob Pit are outlined in **Table 9** below. This is based on estimates of pit inflow and water availability, and current understanding of the groundwater storage and aquifer recharge rate. These rates will be adjusted if actual inflow rates during pit dewatering are different.

The expected water demands of the Nobles Nob Gold Project are estimated to be approximately 3.5 L/s during initial construction, ramping up to ~ 4.5 L/s for operational phase. This differs to the previous project water requirement estimates, due to changing the tailings storage technology from geotubes to drystack tailings, which has an overall lower water demand, and allows improved water reuse and efficiency. This includes the water demands for processing operations, dust suppression and other site water demands. The water requirement is expected to increase further once satellite mining operations commence. Based on the estimated rates of inflow, reuse the extracted water will provide sufficient water supply for all water requirements of the Nobles Nob Gold Project.

Table 9 Proposed Extraction Volume (ML) of Groundwater

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
2023						13.6	14.0	14.0	13.6	14.0	13.6	14.0	**96.7**
2024	44.0	39.7	44.0	42.5	44.0	42.5	44.0	44.0	42.5	44.0	42.5	44.0	**517.5**
2025	44.0	39.7	44.0	42.5	44.0	42.5	44.0	44.0	42.5	44.0	42.5	44.0	**517.5**
2026	44.0	39.7	44.0	42.5	44.0	42.5	44.0	44.0	42.5	44.0	42.5	44.0	**517.5**
2027	44.0	39.7	44.0	42.5	44.0	42.5	44.0	44.0	42.5	44.0	42.5	44.0	**517.5**
2028	44.0	39.7	44.0	42.5	44.0	42.5	44.0	44.0	42.5	44.0	42.5	44.0	**517.5**

All volume in Mega Litres (1 ML = 1,000,000 L)
Cells highlighted in pink denotes groundwater level in the pit at pit floor (~10m drawdown)
Cells highlighted in yellow denotes groundwater level in the pit at 30 m below existing water level(~30m drawdown)

5.0 Potential Impacts of Pit Dewatering

5.1 Prediction of Impacts on Groundwater

The dewatering of the Nobles Nob pit is most likely going to impact the groundwater levels around the site. However, the impact of the dewatering is going to be localised. For the purpose of this assessment, the radius of influence is adopted as the immediately affected area, that will experience any potential drawdown (i.e., the area within the radius of influence). As stated earlier, the radius of influence is the radius, outside of which, the impact on groundwater levels due to the pit dewatering is negligible. The results indicate that the radius of the immediately affected area ranges from 624 m to 2,763 m, depending on the K values and recharge rates used to approximate the hydraulic conditions of the site. As noted above, the model predictions from K values 0.314 m/day and a recharge rate of 1.5% are likely representative. However, taking a conservative approach, the maximum radius of influence observed in the model has been considered to assess the impacts.

Figure 9 below outlines the potential extent of the maximum radius of influence. It is evident that the area within the radius of influence, which may experience groundwater level changes associated with pit dewatering, does not include any significant environmental values or groundwater users. As mentioned in **Section 3.7**, the quality and low permeability of groundwater from the Warramunga Group limits its usage, and there are no declared groundwater users or known GDEs within 10 km of the Nobles Nob Pit. As such, the maximum radius of influence of 2.763 km does not include any declared groundwater users or known GDEs.

Lake Alice, [redacted] located approximately 500 m southwest of the pit, is within the radius of influence (both minimum and maximum). However, water quality results suggest that the water type and ionic composition of water in Lake Alice are very different from the groundwater at Nobles Nob, indicating that any connections, interactions or contributions of groundwater with lake Alice is highly unlikely. As such, any changes in the groundwater level due to Noble Nob Pit dewatering is unlikely to impact Lake Alice.

The Nobles Nob Pit water quality results also indicate that using this water for processing and dust suppression is not expected to cause any environmental harm to the receiving environment. Following processing, contaminated water will be managed and will be prevented from overflowing or leaching into the water table. Use of the extracted water at Nobles Nob is therefore not expected to impact surface or groundwater quality.

The result of the analytical model indicates that the impacts of the proposed water extraction for the Nobles Nob Pit dewatering could be changes in groundwater level. However, any such changes are expected to be constrained within the 2.763 km radius of the Nobles Nob Pit, and is unlikely to deplete the aquifer or impact water supply of Nobles Nob township. Once mining at Nobles Nob has ceased, dewatering of the pit will stop, resulting in groundwater level recovery.

Furthermore, the predictions of the analytical model and the radius of influence are highly conservative as it assumes isotropic conditions surrounding the pit, with hydraulic connection in every direction. In reality, it is possible that drawdown impacts may reach a hydraulic boundary and cease to propagate out from the Nobles Nob site. This could be due to a boundary, that may be present due to fractured rock conditions of the aquifer(s) and their deformed and faulted structure, including sub-vertical lithological contacts.

5.2 Monitoring and Management of Potential Impacts

As mentioned above, the dewatering of the Nobles Nob pit is most likely going to impact the groundwater levels around the site within the radius of influence. As such, monitoring of groundwater levels will continue to be undertaken to understand the changes in groundwater levels associated with pit dewatering. Currently, groundwater level and quality are being monitored on a monthly frequency (quarterly for some bores) at Nobles Nob. This monitoring will continue for the project's life, which will help further understanding of the groundwater system and natural seasonal variations, and changes in levels associated with dewatering activities.

The collected monitoring data will be regularly reviewed to identify any potential impacts to aquifer recharge rates or water quality against the relevant site-specific and ANZG (2018) guideline values. Any harmful impacts identified that are attributable to dewatering or operation activities will be reported, and management measures will be implemented as appropriate.

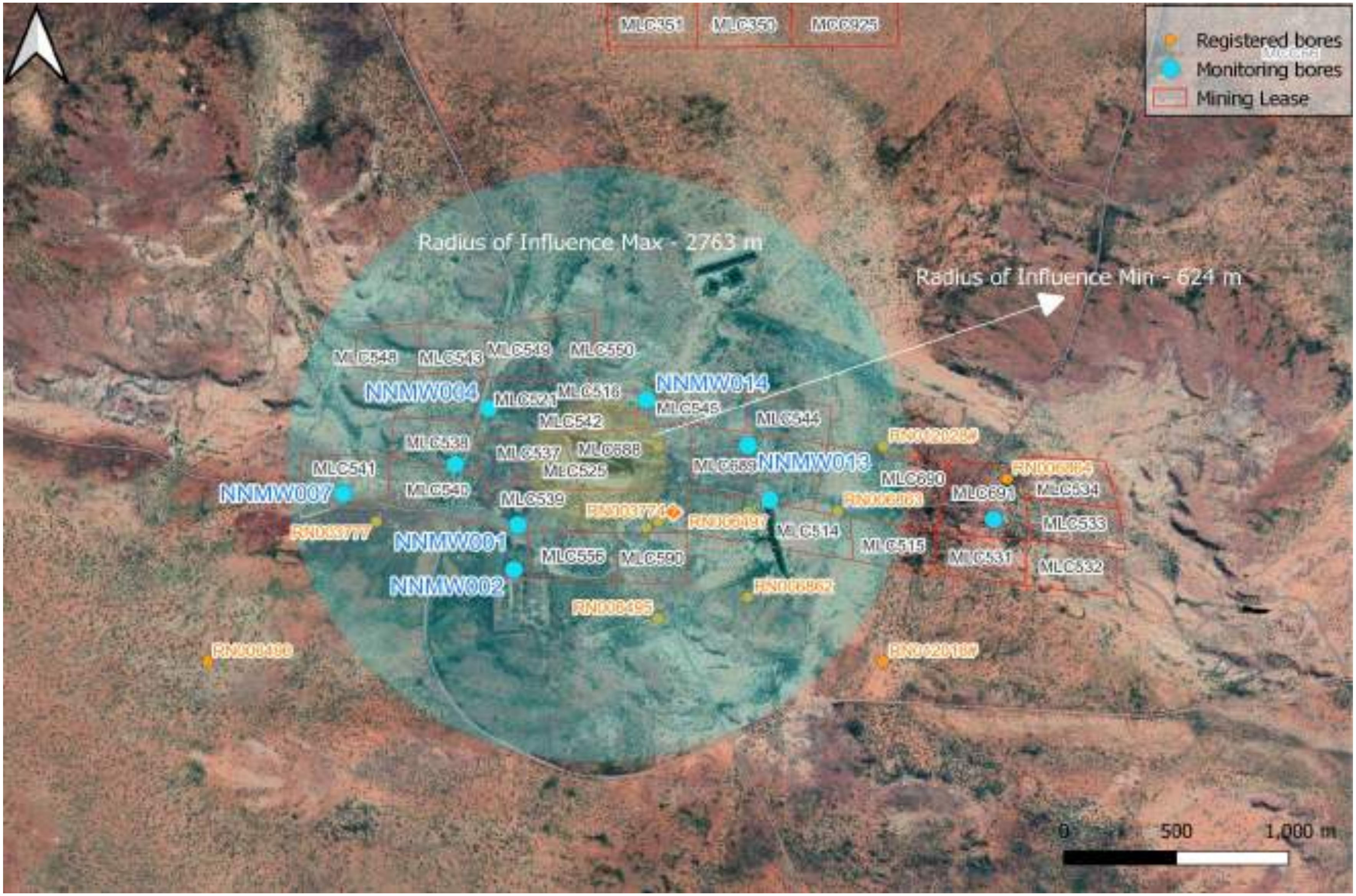


Figure 9 Predicted Radius of Influence from Analytical Model

6.0 Conclusion

An analytical model was developed to predict the mine inflows and the amount of drawdown in response to the Nobles Nob Pit dewatering, and to assess the risks associated with it. Based on the analytical model, the radius of influence for the proposed dewatering was calculated. The radius of influence is the radius, outside of which, there are no impacts on groundwater levels due to pit dewatering. The results indicate that the radius of the influence or the immediate affected area ranges from 624 m to 2.763 km, depending on the K values and recharge rates used to approximate the hydraulic conditions of the site. Taking a conservative approach, the maximum radius of influence observed in the model has been considered to assess the impacts.

The results indicate that the proposed dewatering of Nobles Nob Pit is expected to have no adverse impacts on the groundwater system at Nobles Nob, except changes in groundwater level. Any such impacts will be constraints within the 2.763 km radius. As such, the proposed pit dewatering is unlikely to deplete the aquifer or impact the water supply of Nobles Nob township.

There are no known groundwater users or GDEs within this area, likely due to the depth of the water table. Lake Alice, [redacted] located approximately 500 m southwest of the pit, is within the radius of influence. However, the water quality comparison suggests that the water type and ionic composition of water in Lake Alice are very different from the groundwater at Nobles Nob, indicating unlikely connections and interactions.

7.0 References

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Appendix A. Groundwater Extraction And Storage Point

Mining Lease
MLC516
MLC545
MLC521
MLC517
MLC542
MLC688
MLC689
MLC537
MLC525
Extraction Point
Water Storage Tank
MLC540
MLC539
MLC512
MLC513
MLC589
MLC556
MLC590
0
500
1,000 m

Appendix B. Groundwater Assessment Report Nobles Nob

Type text here

This report is included in Appendix B of this MMP.

APPENDIX G WASTE ROCK AND ORE CHARACTERISATION BLACK SNAKE PROJECT

TENNANT MINING

Waste Rock and Ore Characterisation

Black Snake Project

Tennant Consolidated Mining Group Pty Ltd

Version 1.0

March 2023

Acknowledgement of Country

Tennant Mining acknowledges the Traditional Owners of the lands on which we work. We pay our respects to elders, past, present, and emerging.

Disclaimer

Document Control

Version	Personnel	Date
Version 0.1	Dr Ashish Mishra prepared the document	27-03-2023
Version 0.2	Steve M. and Yemaya SMG reviewed the document	29-03-2023
Version 1.0	Dr Ashish Mishra finalised the document as V1.0	30-03-2023

Table of Contents

Figures

Tables

1.0 Introduction

The Black Snake gold deposit (Black Snake) is part of a joint venture (JV) between Emmerson Resources (Emmerson) and Tennant Consolidated Mining Group (TCMG). The deposit is located approximately 15 km to the East of the town of Tennant Creek, and about 5 km northeast of Nobles Nob Gold Project (Nobles Nob) (**Figure 1**).

Anecdotal evidence suggests that Black Snake was mined in late 1940 to 1950s. It is understood that mining titles MLC32 and MLC53 were granted in 2002, with Emmerson as the operator, and an exploration mining management plan (MMP) was approved. It is also understood that an application for more detailed MMP for mining activities was in process, and as part of this application for more detailed MMP, several studies were undertaken by Emmerson, including waste rock characterisation of Black Snake waste and ores and a review of hydrogeological conditions surrounding Black Snake Hill.

TCMG is currently undertaking advanced studies to prepare an MMP for the eventual mining of this Black Snake gold deposit. As part of this, TCMG reviewed the laboratory results from the previous waste rock and ore samples and assessed the potential of acidic and/or metalliferous drainage from these samples. These results are attached as **Appendix A**. The work included assessment and reporting on the geochemical characteristics of the samples, which were collected and analysed in 2017 as part of a detailed MMP application (EcOz, 2017). This report presents the findings of the geochemical assessment.

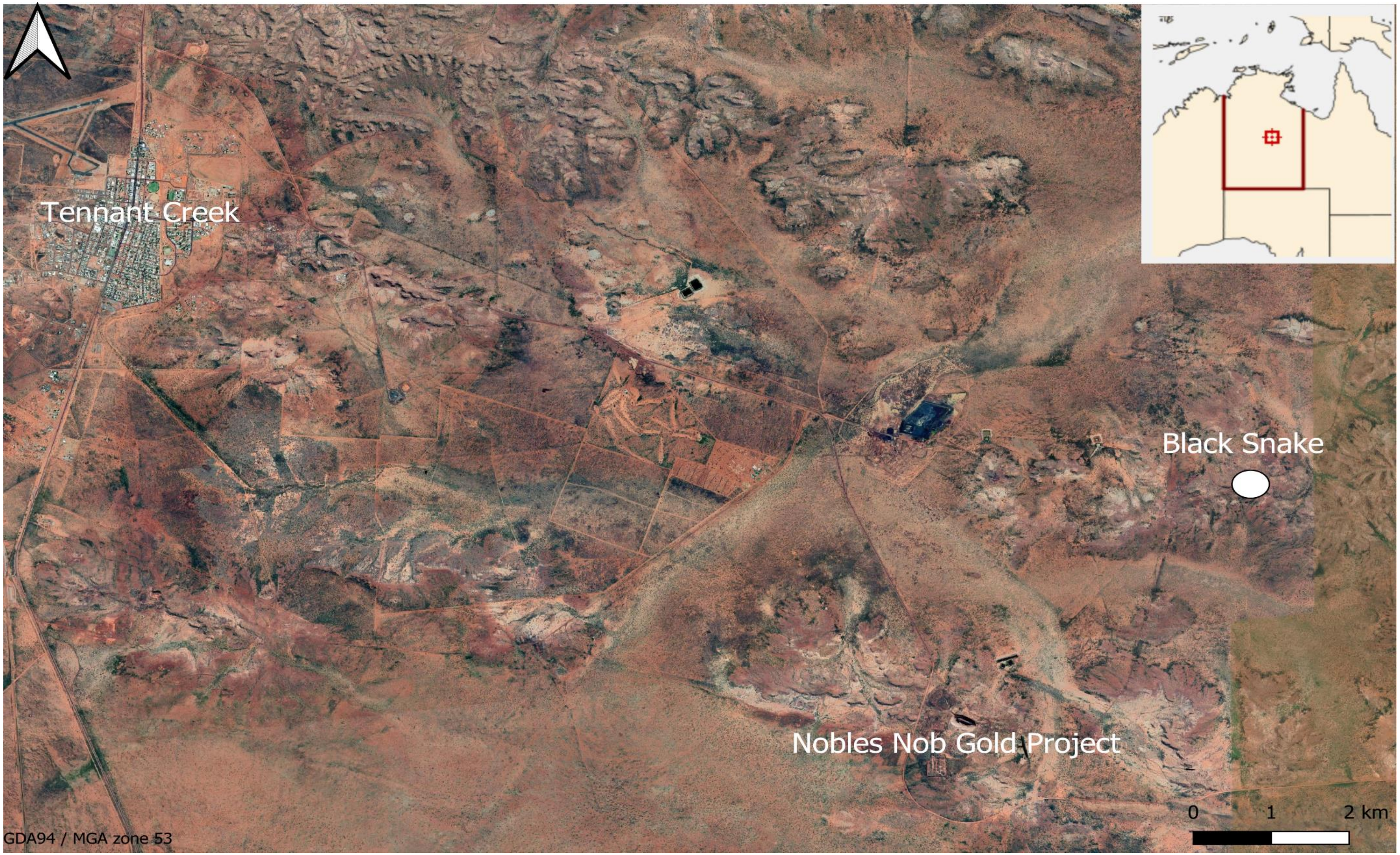

Figure 1 Location of Black Snake Project

1.1 Proposed Activities

The proposed activities at Black Snake include an open pit to mine the gold mineralisation. The proposed open pit footprint is spread over 0.853 hectares (ha), with a maximum depth of 30 meters below ground level, reaching depths of RL 360 mAHD. In addition to an open pit, a waste rock dump, and a run-of-mine pad is also proposed at Black Snake. The conceptual cross-section of the proposed open pit and other proposed activities is presented in **Figure 2**, **Figure 3**, and **Figure 4** below. No processing will occur at Black Snake, and the ore will be hauled to the nearby Nobles Nob processing plant for processing.

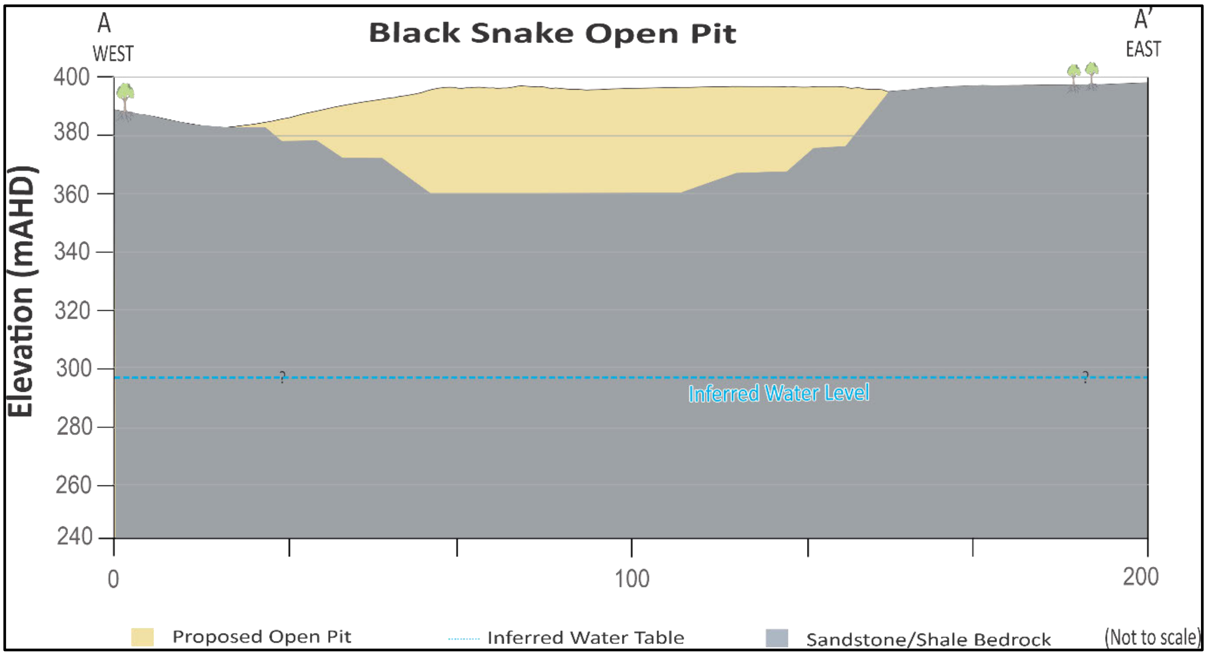

Figure 2 Conceptual Model for Black Snake Open Pit (Looking North)

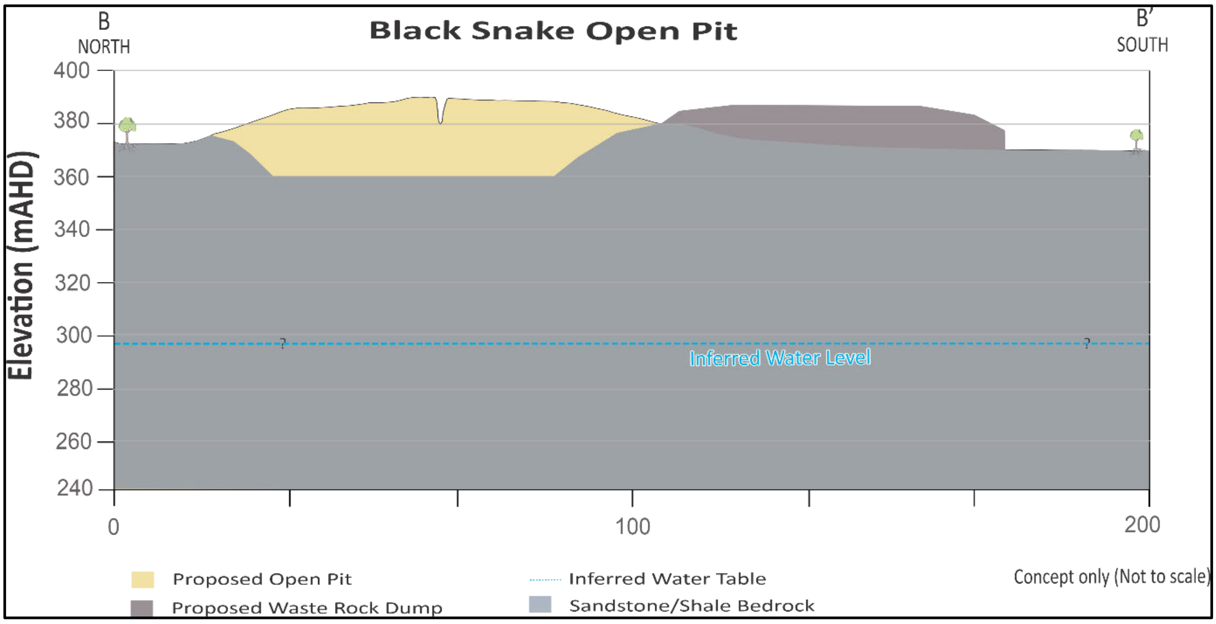

Figure 3 Conceptual Model of Black Snake Pit (Looking East)

Figure 4 Proposed Activities at Black Snake along with AA' and BB' cross-section lines

2.0 Site Characteristics

2.1 Land Use

The Black Snake Project area is located on Aboriginal Freehold Land held by the Warramungu Aboriginal Land Trust (Emmerson, 2017). This site has no private or public infrastructure apart from various access tracks. Historical mining, exploration mining activities, and cattle grazing have been the primary use of the land.

2.2 Geology

The Black Snake deposit is located within the Proterozoic Tennant Creek Inlier, which comprises a turbiditic flysch sedimentary sequence abutting various volcanic rocks. In the Tennant Creek region, these rocks are typified by the Warramunga Group, which commonly strikes east-west with variable dips. Deformation and mineralisation occurred during regional tectonic and magmatic activity, referred to as the Tennant Event, around 1850 million years ago (Ma).

Like the other deposits in the Tennant Creek region, the Black Snake also lies within the Warramunga Group, and mineralisation occurs within hematite shale and ironstone veining. The Black Snake mineralisation is interpreted to strike East-North-East with a vertical dipping lode structure. The lode dimensions are projected 43 meters along strike, a maximum depth of 30m below the surface and a true thickness ranging up to 6 meters (Emmerson, 2017).

2.3 Climate

The area is characterised by a hot arid climate, with evapotranspiration exceeding rainfall throughout the year. The mean monthly temperature data was retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), located approximately 15 km from the site, presented in **Table 1**. The mean monthly maximum temperature ranges from 24.6°C during the winter (June) to 37.3°C in the summer (December) (BoM, 2022).

Table 1 Mean Monthly Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (˚C)	36.8	35.9	34.7	32	27.7	24.6	24.8	27.6	31.8	35	36.7	37.3
Mean minimum temperature (˚C)	25	24.5	23.4	20.6	16.4	13	12.3	14.4	18.5	21.9	23.9	25

Mean has been calculated using monthly data from Jan 1969 to Jan 2023

Rainfall data has been retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), and the publicly available Scientific Information for Landowners (SILO) station at Tennant Creek Airport (Latitude -19.64, Longitude 134.18). The monthly average rainfall and evapotranspiration data for the last 20 years have been presented in **Table 2** below.

The SILO database generally provides a complete long-term dataset and is, therefore, helpful in assessing long-term rainfall trends in the vicinity of the site. This dataset is interpolated from quality-checked observational time-series data collected by the Bureau of Meteorology at nearby stations. Based on the SILO dataset, the average annual rainfall over 100 years is 383.9 mm and over the last

20 years, it is 474 mm, with evaporation exceeding rainfall during each month (**Table 2** and **Figure 5**). The BoM station data suggests that the mean annual precipitation for the last 20 years is 492 mm.

Table 2 Monthly Average of Rainfall and Evapotranspiration (SILO)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
BOM Rainfall*	147.2	101.4	41.3	12.3	7.0	6.6	4.8	4.0	6.8	18.7	43.6	90.0	492.2
SILO Rainfall	97.7	89.4	49.9	11.7	10.3	6.7	5.0	2.1	5.4	15.6	30.4	59.7	383.9
SILO ET#	348.1	288.7	320.1	286.0	231.3	185.8	198.2	249.1	305.7	359.6	369.1	370.2	3511.9
SILO fao56 ET#	213.1	181.3	191.5	167.7	138.4	115.2	126.2	156.1	185.0	217.0	220.4	224.0	2135.9

All values are in millimetres (mm)
*BoM average is of last 20 years (2002 to 2022)
#ET – Evapotranspiration

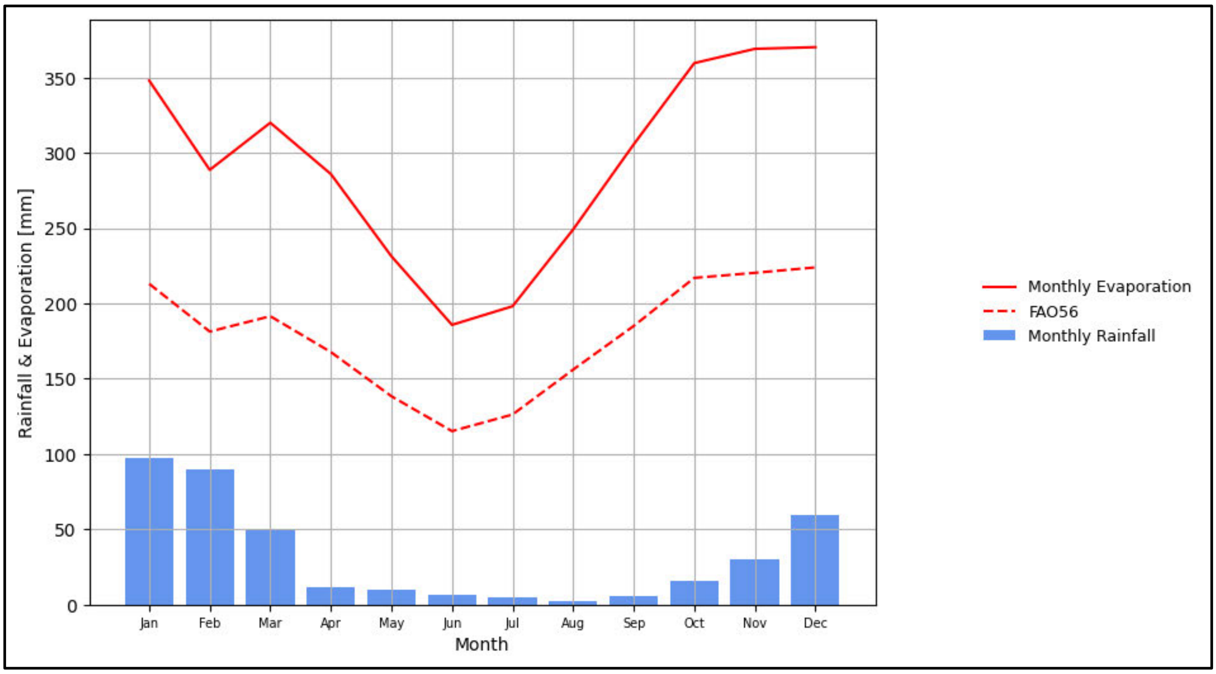

Figure 5 Graph Showing Monthly Average Rainfall and Evapotranspiration

3.0 Acid Drainage Potential

In order to assess the acidic drainage potential of the samples, the combination of net acid production potential (NAPP) and net acid generation (NAG) classification schemes is commonly used in Australia, as per the AMIRA (2002) guideline. The AMIRA (2002) guideline outlines various tests and assessment methods to characterise the acid-forming potential of materials.

The NAPP is the difference between maximum potential acidity (MPA) and acid neutralising capacity (ANC) and represents the net acid producing capacity of the sample. Along with the NAPP determination, samples also undergo NAG testing. In the NAG test, a sample is treated with hydrogen peroxide to rapidly oxidise any sulfide minerals contained within a sample (AMIRA, 2002). The result represents the net amount of acid generated by the sample, and is commonly referred to as the NAG capacity, which is expressed in kilogram of sulfuric acid per tonne (kg H_2SO_4/t).

NAG and NAPP help in the classification of samples into the following categories (AMIRA, 2002):

- Non-acid Forming (NAF): suggests that the material cannot generate acid.
- Potentially acid-forming (PAF): indicates that the material can potentially generate acid.
- Uncertain (UC): the test is not certain about the material's potential to generate acid.

None of the Black Snake samples recorded positive NAPP, ranging from 0 kg H_2SO_4/t to -2 kg H_2SO_4/t. The negative NAPP indicates that the acid neutralising capacity (ANC) of the samples is higher than the maximum potential of acid production. Classification of the samples using the NAG pH and NAPP suggests that all samples are non-acid forming (NAF). The classification plot for the samples is represented in **Figure 6**. This further implies that the potential for any acidic drainage from these samples is unlikely. The samples collected from other projects in the proximity, such as Mauretania and Nobles Nob, have also indicated non-acid producing characteristics.

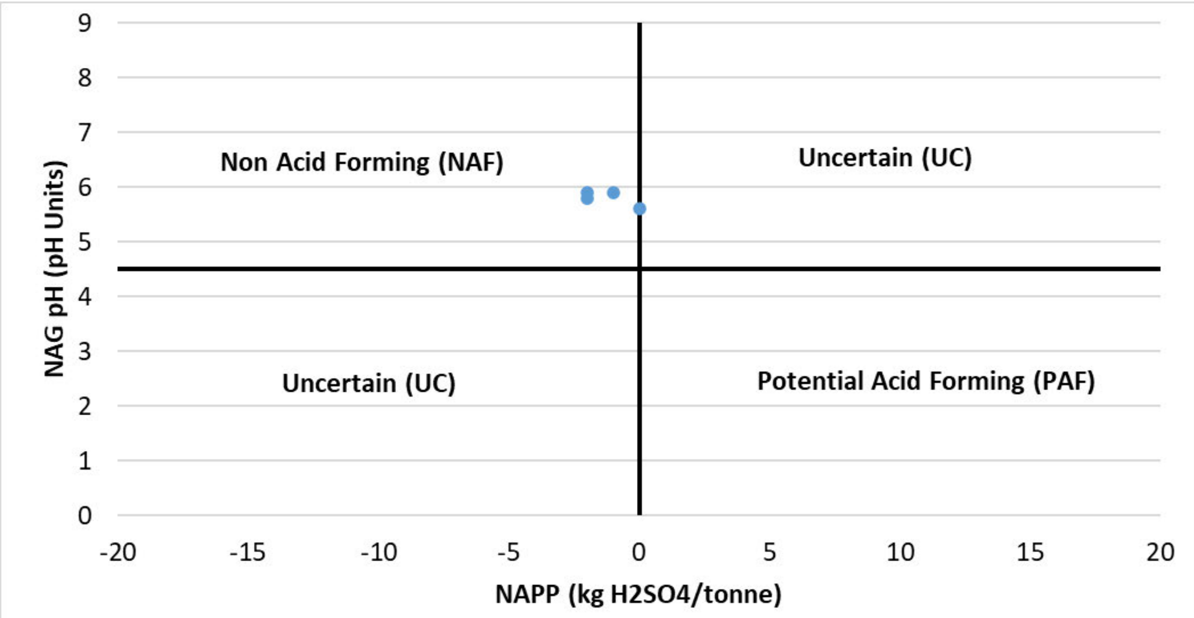

Figure 6 Geochemical Classification Plot

4.0 Metalliferrous Drainage Potential

To measure the metal concentration, the samples underwent multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Tubes. The metal concentrations were analysed by Inductively Coupled Plasma Mass Spectrometry (ICPMS). The metal concentrations in the samples are crucial in identifying enriched metals that can pose a risk of possible metalliferous drainage. Test of enrichment was undertaken by calculating the geochemical abundance index (GAI).

4.1 Geochemical Abundance Index (GAI)

The geochemical abundance index (GAI) can be used to estimate the enrichment of metals in the samples relative to average crustal concentrations. The GAI is expressed on a log 2 scale. The GAI was developed by Förstner et al., (1993) and is defined as follows:

$$GAI = log_2\left(\frac{C}{(1.5 * B)}\right)$$

Where, *C* is the measured concentration in the sample, and *B* is the average crustal abundance/concentration. The enrichment ranges of metal, based on the GAI values, are interpreted as follows:

GAI=0 indicates <3 times average crustal abundance.

GAI=1 indicates 3 to 6 times the average crustal abundance.

GAI=2 indicates 6 to 12 times the average crustal abundance.

GAI=3 indicates 12 to 24 times the average crustal abundance.

GAI=4 indicates 24 to 48 times the average crustal abundance.

GAI=5 indicates 48 to 96 times the average crustal abundance.

GAI=6 indicates more than 96 times the average crustal abundance.

As a general guide, GAI value of 3 or above is considered a significant concentration and might indicate the potential of metalliferous drainage from that sample. The average crustal abundances used to compare results against the GAI are provided in **Table 3**.

Table 3 Average Crustal Concentration of Metals (Haynes, 2016)

Element	Symbol	Average Crustal concentration (mg/Kg)
Aluminium	Al	82,300 (8.23%)
Arsenic	As	1.8 (0.00018%)
Barium	Ba	425 (0.0425%)
Cobalt	Co	25 (0.0025%)
Chromium	Cr	102 (0.0102%)
Copper	Cu	60 (0.006%)
Iron	Fe	56,300 (5.63%)
Manganese	Mn	950 (0.095%)
Molybdenum	Mo	1.2 (0.00012%)
Nickel	Ni	84 (0.0084%)
Lead	Pb	14 (0.0014%)
Zinc	Zn	70 (0.007%)

4.2 GAI Result

The GAI assessment of the Black Snake samples suggests that one of the samples recorded a GAI value of 4 for Molybdenum, indicating a concentration of Molybdenum to be 24 to 48 times the average crustal abundance. Out of the remaining samples, one sample recorded a GAI value of 2, while others recorded a GAI value of 0 for Molybdenum. The GAI values for all other metals in all samples was <3. These results are similar to the characteristics of the waste rock from nearby Nobles Nob, where few waste rock samples also recorded GAI values equal to or greater than 3 for Molybdenum (Umwelt, 2021).

The most commonly occurring Molybdenum-bearing mineral is the sulfide molybdenite. Molybdenite often occurs with other sulfide minerals, including pyrite and chalcopyrite (Frascoli and Hudson-Edwards, 2018). Oxidation of the molybdenum-bearing sulfides can result in the liberation of Molybdenum and its oxidation to molybdate (Frascoli and Hudson-Edwards, 2018). Molybdate is stable over a wide range of pH conditions, from neutral down to pH value of 3-4 (Frascoli and Hudson-Edwards, 2018; Smedley and Kinniburgh, 2017). In an acidic environment (i.e., pH value below 3), the molybdate is protonated to form $HMoO_4^-$ or H_2MoO_4 (Smedley and Kinniburgh, 2017). Also, under moderately acidic pH conditions (pH 5-6), molybdate can be sorbed onto the secondary iron (III) minerals, such as jarosite, schwertmannite, ferrihydrite (Goldberg et al., 1996; Xu et al., 2006). These secondary iron (III) phases can decompose in acidic pH waters (e.g., from acidic drainage), releasing their sorbed molybdate (Frascoli and Hudson-Edwards, 2018; Smedley and Kinniburgh, 2017; Xu et al., 2006; Goldberg et al., 1996). In highly alkaline conditions (i.e., pH above 9), mobility of Molybdenum also increases due to the reduced binding properties of the molybdate (Frascoli and Hudson-Edwards, 2018; Goldberg et al., 1996).

Thus, Molybdenum enriched drainage might occur only in extremely acidic or alkaline drainages. However, the water extracted using a sample:water ratio of 1:5 recorded pH ranging from 6.3 to 7.3, with an average of 6.75 pH unit. The NAG test also recorded a pH greater than 5 in all samples. The pH values recorded in both tests were neither acidic nor alkaline enough to mobilise Molybdenum. As such, enriched molybdenum drainage is unlikely from these samples.

5.0 Conclusion

TCMG undertook a review of the laboratory results of the previous waste rock and ore samples which were collected and analysed in 2017 by Emmerson as part of a detailed MMP application. These laboratory results are attached as **Appendix A**. The laboratory results were assessed for the potential of acidic and/or metalliferous drainage from these samples.

The results state that the water extracted using a sample:water ratio of 1:5 recorded a pH ranging from 6.3 to 7.3, with the mean aged pH being 6.75. None of the samples recorded pH (1:5) <6 pH units or positive NAPP, and the classification of the samples using the NAG pH and NAPP indicates that all samples are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is unlikely.

The GAI assessment of the samples suggests that one sample is significantly enriched (GAI >= 3) with Molybdenum (Mo). The other samples recorded GAI values <3 for Molybdenum. Molybdenum enriched drainage occurs in extremely acidic or alkaline drainage. As suggested by the pH (1:5) and NAG test, the drainage from these samples is likely to be near neutral and not highly acidic or alkaline. As such, chances of Molybdenum enriched drainage from these samples is unlikely.

6.0 Reference

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Appendix A

Intertek GENALYSIS LABORATORY SERVICES

ANALYTICAL REPORT

EMMERSON RESOURCES LIMITED
PO Box 1244
TENNANT CREEK, N.T. 0861
AUSTRALIA

JOB INFORMATION

JOB CODE	:	1443.0/1708354
No. of SAMPLES	:	5
No. of ELEMENTS	:	62
CLIENT O/N	:	303698 (Job 1 of 1)
SAMPLE SUBMISSION No.	:	303698
PROJECT	:	TENNANT CREEK
STATE	:	RC Chip
DATE RECEIVED	:	20/06/2017
DATE COMPLETED	:	07/07/2017
DATE PRINTED	:	07/07/2017
ANALYSING LABORATORY	:	Alice Springs Laboratory
	:	Intertek Genalysis Perth

LEGEND

X	= Less than Detection Limit
N/R	= Sample Not Received
*	= Result Checked
( )	= Result still to come
I/S	= Insufficient Sample for Analysis
E6	= Result X 1,000,000
UA	= Unable to Assay
>	= Value beyond Limit of Method
OV	= Value over-range for Package

MAIN OFFICE AND LABORATORY NATA: 3244 3273

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PO Box 144, Gosnells 6990, Western Australia
Tel: +61 8 9251 8100 Fax: +61 8 9251 8110
Email: genalysis@intertek.com
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KALGOORLIE SAMPLE PREPARATION DIVISION

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Tel: +61 8 9021 6057 Fax: +61 8 9021 3476

ADELAIDE LABORATORY NATA: 3244 18645

11 Senna Road, Wingfield, 5013, South Australia
Tel: +61 8 8162 9714 Fax: +61 8 8349 7444

JOHANNESBURG LABORATORY

43 Malcolm Moodie Crescent,
Jet Park, Gauteng, South Africa 1459
Tel: +27 11 552 8149 Fax: +27 11 552 8248

TOWNSVILLE LABORATORY NATA: 3244 20462

9-23 Kelli Street, Mt St John, Bohle, Queensland, Australia 4818
Tel: +61 7 4774 3655 Fax: +61 7 4774 4692

SAMPLE DETAILS

DISCLAIMER

Intertek Genalysis wishes to make the following disclaimer pertaining to the accompanying analytical results.

All work is performed in accordance with the Intertek Minerals Standard Terms and Conditions of work http://www.intertek.com/terms/

This report relates specifically to the sample(s) that were drawn and/or provided by the client or their nominated third party. The reported result(s) provide no warranty or verification on the sample(s) representing any specific goods and/or shipment and only relate to the sample(s) as received and tested. This report was prepared solely for the use of the client named in this report. Intertek accepts no responsibility for any loss, damage or liability suffered by a third party as a result of any reliance upon or use of this report.

The results provided are not intended for commercial settlement purposes.

SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

Intertek Genalysis accepts no responsibility whatsoever for any interpretation by any party of any data where more than two or three significant figures have been reported.

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $4.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $150.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

ANALYSIS

ELEMENTS	Au	Au-Rp1	Ag	Al	ANC	As
UNITS	ppm	ppm	ppm	ppm	kgH2SO4/t	ppm
DETECTION LIMIT	0.005	0.005	0.05	50	1	0.5
DIGEST	FA25/	FA25/	4A/	4A/	ANCx/	4A/
ANALYTICAL FINISH	OE	OE	MS	MS	VOL	MS
SAMPLE NUMBERS						
0001 168904	0.010		X	5.15%	2	1.2
0002 168905	16.692	11.224	0.15	5.57%	1	5.5
0003 168906	7.331		0.09	4.14%	2	3.8
0004 168907	0.187		0.12	7.36%	2	2.2
0005 168908	I/S		X	1412	-1	0.8
CHECKS						
0001 168904	0.013		0.05	5.22%	2	1.3
STANDARDS						
0001 AMIS0082			4.50	4.66%		111.3
0002 OREAS 45d						
0003 ST638	5.252					
0004 ANC-2	X		X	X	110	X
BLANKS						
0001 Control Blank	X		X	X	0	X

ANALYSIS

ELEMENTS	Ba	Be	Bi	C	Ca	Cd
UNITS	ppm	ppm	ppm	%	ppm	ppm
DETECTION LIMIT	0.1	0.05	0.01	0.01	50	0.02
DIGEST	4A/	4A/	4A/		4A/	4A/
ANALYTICAL FINISH	MS	MS	MS	/CSA	MS	MS
SAMPLE NUMBERS						
0001 168904	311.6	1.28	2.42	0.03	157	X
0002 168905	149.9	1.25	50.17	0.09	181	0.05
0003 168906	182.7	0.77	5.48	0.05	134	X
0004 168907	154.3	1.13	97.96	0.02	218	X
0005 168908	6.4	0.09	0.14	0.03	83	X
CHECKS						
0001 168904	315.3	1.21	2.44	0.03	156	0.02
STANDARDS						
0001 AMIS0082	644.2	1.32	0.17		8296	27.29
0002 OREAS 45d				1.06		
0003 ST638						
0004 ANC-2	X	X	0.02	X	X	X
BLANKS						
0001 Control Blank	0.2	X	X	X	X	X

ANALYSIS

ELEMENTS	Ce	Co	ColourChange	Cr	Cs	Cu
UNITS	ppm	ppm	NONE	ppm	ppm	ppm
DETECTION LIMIT	0.01	0.1	0	1	0.05	0.5
DIGEST	4A/	4A/	ANCx/	4A/	4A/	4A/
ANALYTICAL FINISH	MS	MS	QUAL	MS	MS	MS
SAMPLE NUMBERS						
0001 168904	58.53	2.5	No	43	2.44	6.2
0002 168905	73.52	9.3	No	65	1.10	36.5
0003 168906	37.16	20.5	No	34	1.09	10.3
0004 168907	65.83	15.5	No	37	1.65	71.1
0005 168908	2.59	0.9	No	17	0.11	9.5
CHECKS						
0001 168904	57.36	2.4	No	44	2.49	6.7
STANDARDS						
0001 AMIS0082	64.25	14.2		582	1.92	129.2
0002 OREAS 45d						
0003 ST638						
0004 ANC-2	0.02	X		1	X	X
BLANKS						
0001 Control Blank	0.01	X		X	X	0.7

ANALYSIS

ELEMENTS	EC	Fe	Final-pH	Fizz-Rate	Ga	Ge
UNITS	uS/cm	%	NONE	NONE	ppm	ppm
DETECTION LIMIT	10	0.01	0.1	1	0.05	0.1
DIGEST	Ws/	4A/	ANCx/	ANCx/	4A/	4A/
ANALYTICAL FINISH	MTR	MS	MTR	QUAL	MS	MS
SAMPLE NUMBERS						
0001 168904	107	3.98	1.5	X	13.49	1.2
0002 168905	287	11.68	1.5	X	18.01	1.3
0003 168906	174	7.16	1.5	X	13.27	1.3
0004 168907	331	16.69	1.6	X	24.47	2.0
0005 168908	27	0.46	1.4	X	0.25	0.8
CHECKS						
0001 168904	107	4.01	1.5	X	13.16	1.1
STANDARDS						
0001 AMIS0082		2.25			11.62	2.1
0002 OREAS 45d						
0003 ST638						
0004 ANC-2	X	X			X	X
BLANKS						
0001 Control Blank	X	X			X	X

ANALYSIS

ELEMENTS	Hf	In	K	La	Li	Mg
UNITS	ppm	ppm	ppm	ppm	ppm	ppm
DETECTION LIMIT	0.05	0.01	20	0.01	0.1	20
DIGEST	4A/	4A/	4A/	4A/	4A/	4A/
ANALYTICAL FINISH	MS	MS	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 168904	5.68	0.13	2.08%	30.01	2.2	1667
0002 168905	5.22	0.13	7703	45.62	4.4	816
0003 168906	3.64	0.09	8181	17.24	4.3	750
0004 168907	6.69	0.12	9963	37.54	11.1	938
0005 168908	0.25	X	92	1.28	12.7	78
CHECKS						
0001 168904	5.76	0.11	2.05%	29.49	2.2	1708
STANDARDS						
0001 AMIS0082	2.48	0.05	2.83%	32.11	15.3	8396
0002 OREAS 45d						
0003 ST638						
0004 ANC-2	X	X	X	X	X	X
BLANKS						
0001 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Mn	Mo	MPA	Na	NAG	NAGpH
UNITS	ppm	ppm	kgH2SO4/t	ppm	kgH2SO4/t	NONE
DETECTION LIMIT	1	0.1	1	20	1	0.1
DIGEST	4A/	4A/		4A/	NAGx/	NAGx/
ANALYTICAL FINISH	MS	MS	/CALC	MS	VOL	MTR
SAMPLE NUMBERS						
0001 168904	33	1.4	X	476	4	5.9
0002 168905	151	13.9	X	426	2	5.6
0003 168906	128	1.8	X	360	3	5.8
0004 168907	438	37.6	X	639	2	5.9
0005 168908	99	2.5	X	63	2	4.6
CHECKS						
0001 168904	34	1.6	X	481	4	5.9
STANDARDS						
0001 AMIS0082	382	2.7		9944		
0002 OREAS 45d						
0003 ST638						
0004 ANC-2	X	X	X	X		
BLANKS						
0001 Control Blank	X	X	X	X	5	4.3

ANALYSIS

ELEMENTS	NAG(4.5)	NAPP	Nb	Ni	P	Pb
UNITS	kgH2SO4/t	kgH2SO4/t	ppm	ppm	ppm	ppm
DETECTION LIMIT	1	1	0.05	0.5	50	0.5
DIGEST	NAGx/		4A/	4A/	4A/	4A/
ANALYTICAL FINISH	VOL	/CALC	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 168904	0	-2	8.26	7.7	253	2.7
0002 168905	0	-0	6.38	18.7	782	10.6
0003 168906	0	-2	6.04	20.9	382	3.3
0004 168907	0	-1	7.43	58.0	524	5.7
0005 168908	0	1	1.02	5.0	X	1.2
CHECKS						
0001 168904	0	-2	8.37	8.0	276	2.9
STANDARDS						
0001 AMIS0082			8.64	34.5	431	3108.5
0002 OREAS 45d						
0003 ST638						
0004 ANC-2		-110	X	0.6	X	X
BLANKS						
0001 Control Blank	0	0	X	X	X	X

ANALYSIS

ELEMENTS	pH	pH Drop	Rb	Re	S	S
UNITS	NONE	NONE	ppm	ppm	%	%
DETECTION LIMIT	0.1	0.1	0.05	0.002	0.05	0.01
DIGEST	Ws/	ANCx/	4A/	4A/	4A/	
ANALYTICAL FINISH	MTR	MTR	MS	MS	MS	/CSA
SAMPLE NUMBERS						
0001 168904	7.3	X	121.98	X	X	0.01
0002 168905	6.3	X	45.92	X	X	0.02
0003 168906	6.8	X	46.95	X	X	0.01
0004 168907	6.6	X	59.61	X	X	0.02
0005 168908	6.4	X	0.62	X	X	0.01
CHECKS						
0001 168904	7.3	X	121.12	X	X	X
STANDARDS						
0001 AMIS0082			102.19	X	1.12	
0002 OREAS 45d						0.05
0003 ST638						
0004 ANC-2	5.7	X	X	X	X	0.01
BLANKS						
0001 Control Blank	5.7	X	X	X	X	0.01

ANALYSIS

ELEMENTS	Sb	Sc	Se	Sn	Sr	Ta
UNITS	ppm	ppm	ppm	ppm	ppm	ppm
DETECTION LIMIT	0.05	0.1	0.5	0.1	0.05	0.01
DIGEST	4A/	4A/	4A/	4A/	4A/	4A/
ANALYTICAL FINISH	MS	MS	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 168904	0.88	9.5	X	2.6	6.80	0.76
0002 168905	1.18	9.5	4.6	3.2	10.07	0.57
0003 168906	0.95	7.1	1.2	2.5	5.15	0.52
0004 168907	0.66	9.9	10.0	5.4	77.93	0.55
0005 168908	0.22	0.3	X	0.6	1.37	0.07
CHECKS						
0001 168904	0.94	9.2	X	2.5	6.81	0.75
STANDARDS						
0001 AMIS0082	11.10	5.7	X	2.2	70.00	0.68
0002 OREAS 45d						
0003 ST638						
0004 ANC-2	X	X	X	X	X	X
BLANKS						
0001 Control Blank	0.06	X	X	X	X	X

ANALYSIS

ELEMENTS	Te	Th	Ti	Tl	U	V
UNITS	ppm	ppm	ppm	ppm	ppm	ppm
DETECTION LIMIT	0.2	0.01	5	0.02	0.01	1
DIGEST	4A/	4A/	4A/	4A/	4A/	4A/
ANALYTICAL FINISH	MS	MS	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 168904	X	14.89	2427	0.50	3.33	42
0002 168905	X	15.58	1334	0.21	5.42	41
0003 168906	0.9	11.22	1304	0.19	2.82	31
0004 168907	0.2	18.06	1152	0.25	4.60	45
0005 168908	X	0.74	273	X	0.16	4
CHECKS						
0001 168904	X	15.33	2410	0.50	3.38	41
STANDARDS						
0001 AMIS0082	X	8.88	2338	0.82	2.70	49
0002 OREAS 45d						
0003 ST638						
0004 ANC-2	X	X	X	X	X	X
BLANKS						
0001 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	W	Y	Zn	Zr
UNITS	ppm	ppm	ppm	ppm
DETECTION LIMIT	0.1	0.05	1	0.1
DIGEST	4A/	4A/	4A/	4A/
ANALYTICAL FINISH	MS	MS	MS	MS
SAMPLE NUMBERS				
0001 168904	6.8	15.30	15	213.8
0002 168905	15.2	15.64	54	198.8
0003 168906	9.9	12.54	26	132.2
0004 168907	57.5	21.39	70	249.8
0005 168908	0.3	0.70	11	8.6
CHECKS				
0001 168904	7.2	15.58	16	215.7
STANDARDS				
0001 AMIS0082	1.0	11.74	7563	90.1
0002 OREAS 45d				
0003 ST638				
0004 ANC-2	X	X	3	0.1
BLANKS				
0001 Control Blank	X	X	3	X

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory NATA Laboratory Accreditation	NATA Scope of Accreditation
/CALC	Intertek Genalysis Perth **3244 3237**	

No digestion or other pre-treatment undertaken. Results Determined by calculation from other reported data.

/CSA	Intertek Genalysis Perth **3244 3237**	**MPL_W043, CSA : MPL_W043**

Induction Furnace Analysed by Infrared Spectrometry

4A/MS	Intertek Genalysis Perth **3244 3237**	**4A/ : MPL_W002, MS : ICP_W003**

Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Tubes. Analysed by Inductively Coupled Plasma Mass Spectrometry.

ANCx/MTR	Intertek Genalysis Perth **3244 3237**	

Acid Neutralizing Capacity Digestion Procedure. Analysed with Electronic Meter Measurement

ANCx/QUAL	Intertek Genalysis Perth **3244 3237**	

Acid Neutralizing Capacity Digestion Procedure. Analysed by Qualitative Inspection

ANCx/VOL	Intertek Genalysis Perth **3244 3237**	

Acid Neutralizing Capacity Digestion Procedure. Analysed by Volumetric Technique.

FA25/OE	Intertek Genalysis Perth **3244 3237**	**FA25/ : FA_W001, OE : ICP_W004**

25g Lead collection fire assay. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

NAGx/MTR	Intertek Genalysis Perth **3244 3237**	

Net Acid Generation Extraction of samples with H2O2 Analysed with Electronic Meter Measurement

NAGx/VOL	Intertek Genalysis Perth **3244 3237**	

Net Acid Generation Extraction of samples with H2O2 Analysed by Volumetric Technique.

Ws/MTR	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed with Electronic Meter Measurement

APPENDIX H WASTE ROCK CHARACTERISATION RISING SUN

Waste Rock Characterisation

Rising Sun

Tennant Consolidated Mining Group Pty Ltd

Version 2.0

September 2023

Acknowledgement of Country

Tennant Mining acknowledges the Traditional Owners of the lands on which we work. We pay our respects to elders, past, present, and emerging.

Disclaimer

Document Control

Version	Personnel	Date
Version 0.1	Dr Ashish Mishra prepared the document	11-05-2023
Version 0.1	Steve Murdoch reviewed the document	11-05-2023
Version 1.0	Dr Ashish Finalised the document for release	12-05-2023
Version 1.0	Dr Ashish Finalised the document V2.0 for release	29-09-2023

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Figures

Tables

1.0 Introduction

The Rising Sun gold deposit (Rising Sun) is part of the Nobles Nob Gold project owned by Tennant Consolidated Mining Group (TCMG), and includes the historical Nobles Nob Gold Mine (Nobles Nob) in Northern Territory. The Rising Sun deposit is located roughly 15 km southeast of Tennant Creek, and approximately 1.6 km east of Nobles Nob pit (**Figure 1**). The proposed Rising Sun pit and waste rock dump are located within MLC515, MLC531, and MLC691, which is held by TCMG as part of the Nobles Nob tenement (**Figure 1**).

TCMG has the approval to recommence operations at Nobles Nob, including mining and reprocessing of the crown pillar stockpile, extension of the Nobles Nob Pit, and exploration activities. A Mining Management Plan (MMP) for Nobles Nob was submitted and approved as per the Northern Territory *Mining Management Act 2001*, with mining authorisation (1123-01) granted on 15 August 2022.

TCMG is currently undertaking advanced studies to prepare an amendment to the current Nobles Nob MMP. As part of this, pulps from the exploration drill holes around the proposed Rising Sun pit were sampled to characterise the waste rocks and assess the potential of acidic, metalliferous, or saline drainage from these samples. The samples were collected by TCMG and sent to the National Association of Testing Authorities (NATA) accredited laboratory SGS in Perth for analysis. The results are attached as **Appendix A**.

1.1 Proposed Activities

The proposed activities at Rising Sun include an open pit to mine the gold mineralisation. The proposed open pit footprint is spread over 2.8 hectares (ha), with a maximum depth of 50 meters below ground level, reaching depths slightly above RL 300 mAHD. In addition to an open pit, a waste rock dump, and a run-of-mine pad is also proposed at Rising Sun (**Figure 2** below). No processing will occur at Rising Sun, and the ore will be hauled to the nearby Nobles Nob processing plant.

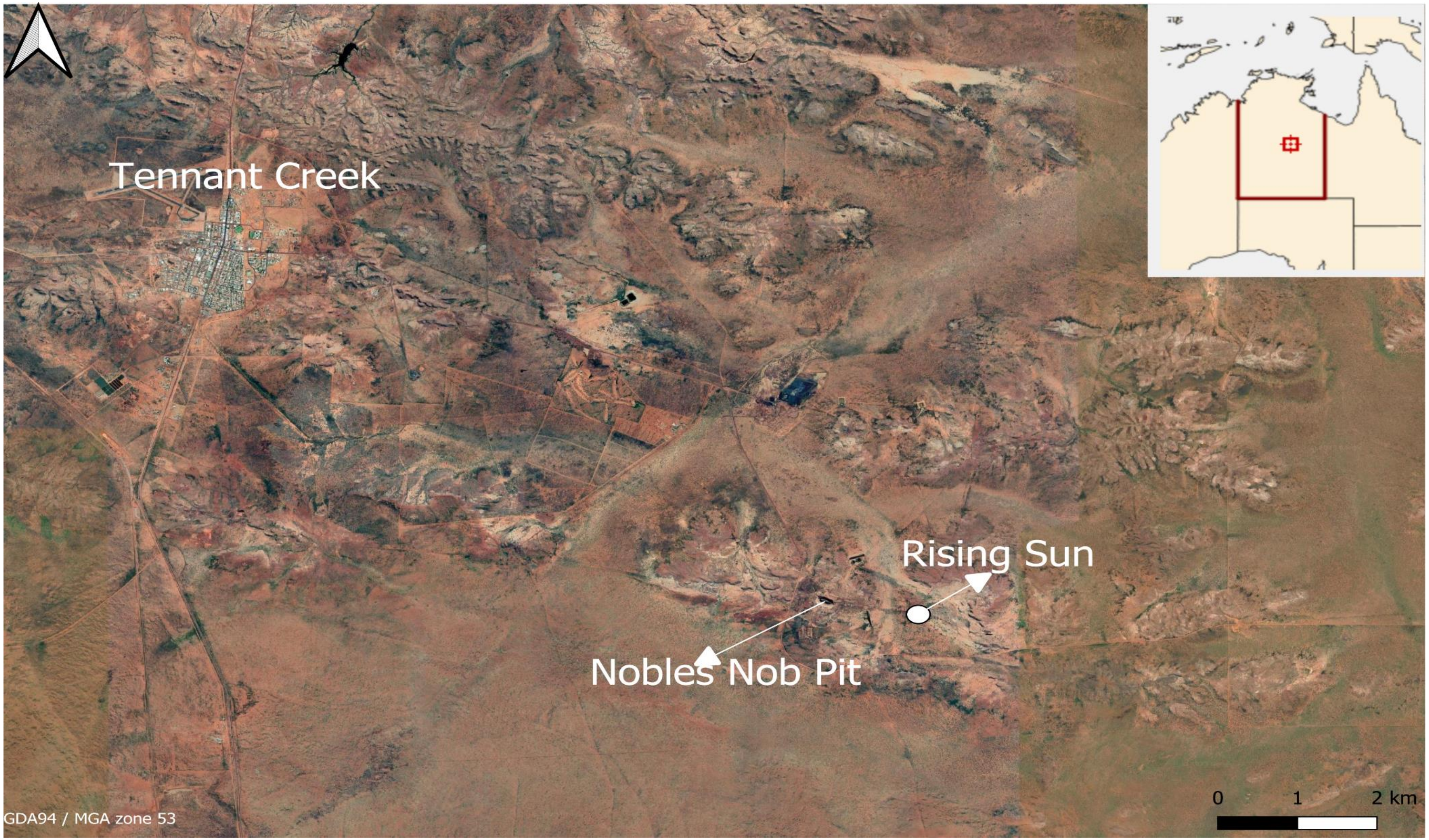

Figure 1 Location of Rising Sun

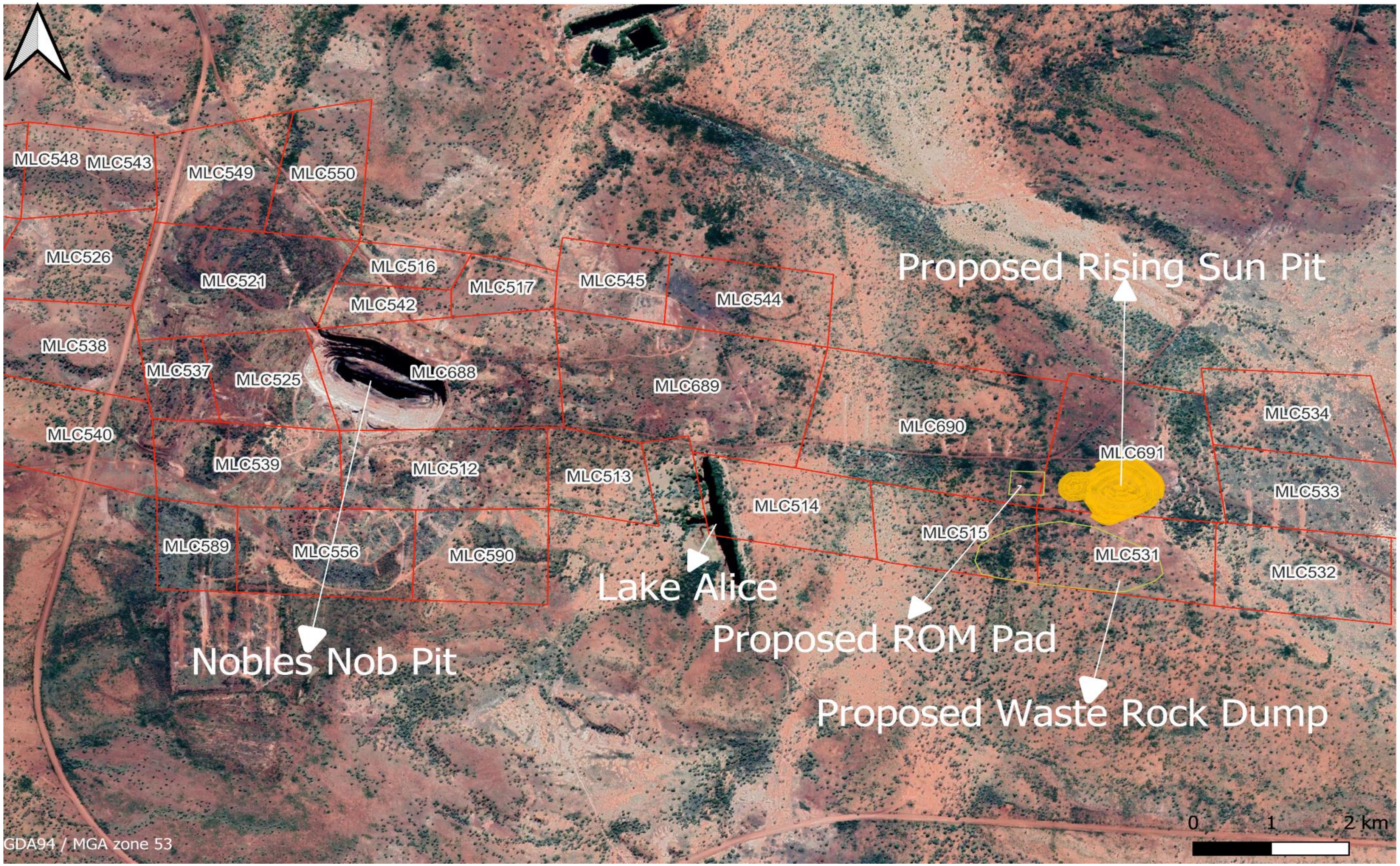

Figure 2 Proposed Infrastructure at Rising Sun

2.0 Site Characteristics

2.1 Land Use

The Rising Sun is located within the Nobles Nob Project area, where historical mining, exploration mining activities, and cattle grazing have been the primary use of the land.

2.2 Geology

The Rising Sun is an iron-oxide gold deposit of the Tennant Creek style, with mineralisation sitting in an east-west striking body. Like the other Tennant Creek region deposits and Nobles Nob deposit, the Rising Sun also lies within the Warramunga Group, and mineralisation occurs within hematite shale and ironstone veining. The mineralisation has been defined with a strike length of about 180 m at Rising Sun, and averages 2-5 metres in width.

2.3 Climate

The area is characterised by a hot arid climate, with evapotranspiration exceeding rainfall throughout the year. The mean monthly temperature data was retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), located approximately 15 km from the site, presented in **Table 1**. The mean monthly maximum temperature ranges from 24.6°C during the winter (June) to 37.3°C in the summer (December) (BoM, 2022).

Table 1 Mean Monthly Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (˚C)	36.8	35.9	34.7	32	27.7	24.6	24.8	27.6	31.8	35	36.7	37.3
Mean minimum temperature (˚C)	25	24.5	23.4	20.6	16.4	13	12.3	14.4	18.5	21.9	23.9	25

Mean has been calculated using monthly data from Jan 1969 to Jan 2023

Rainfall data has been retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), and the publicly available Scientific Information for Landowners (SILO) station at Tennant Creek Airport (Latitude -19.64, Longitude 134.18). The monthly average rainfall and evapotranspiration data for the last 20 years have been presented in **Table 2** below.

The SILO database generally provides a complete long-term dataset and is, therefore, helpful in assessing long-term rainfall trends in the vicinity of the site. This dataset is interpolated from quality-checked observational time-series data collected by the Bureau of Meteorology at nearby stations. Based on the SILO dataset, the average annual rainfall over 100 years is 383.9 mm and over the last 20 years, it is 474 mm, with evaporation exceeding rainfall during each month (**Table 2** and **Figure 3**). The BoM station data suggests that the mean annual precipitation for the last 20 years is 492 mm.

Table 2 Monthly Average of Rainfall and Evapotranspiration (SILO)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
BOM Rainfall*	147.2	101.4	41.3	12.3	7.0	6.6	4.8	4.0	6.8	18.7	43.6	90.0	492.2
SILO Rainfall	97.7	89.4	49.9	11.7	10.3	6.7	5.0	2.1	5.4	15.6	30.4	59.7	383.9
SILO ET#	348.1	288.7	320.1	286.0	231.3	185.8	198.2	249.1	305.7	359.6	369.1	370.2	3511.9

SILO fao56 ET#	213.1	181.3	191.5	167.7	138.4	115.2	126.2	156.1	185.0	217.0	220.4	224.0	2135.9

All values are in millimetres (mm)
*BoM average is of last 20 years (2002 to 2022)
#ET – Evapotranspiration

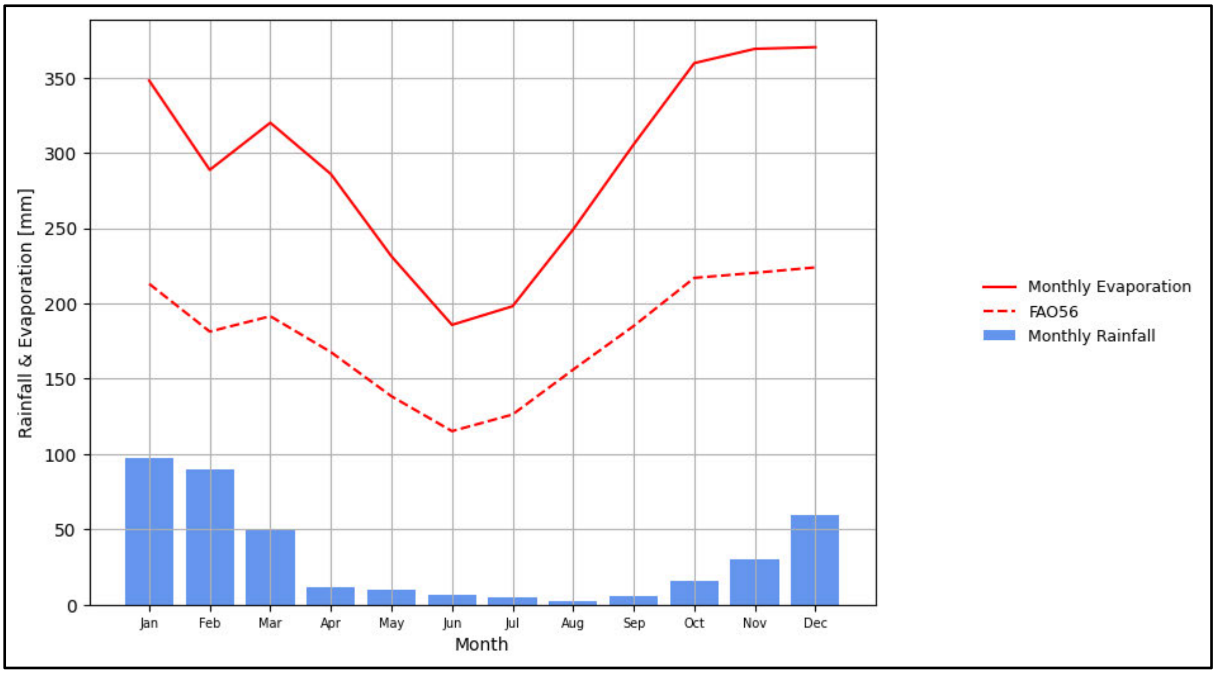

Figure 3 Graph Showing Monthly Average Rainfall and Evapotranspiration

3.0 Acid Drainage Potential

In order to assess the acidic drainage potential of the samples, the combination of net acid production potential (NAPP) and net acid generation (NAG) classification schemes is commonly used in Australia, as per the AMIRA (2002) guideline. The AMIRA (2002) guideline outlines various tests and assessment methods to characterise the acid-forming potential of materials. In addition to that, aged pH (1:2) is also used to assess the acidic drainage potential of the samples. The aged pH (1:2) of a sample is determined by equilibrating the sample in deionised water for 12 to 16 hours (or overnight), at a solid to water ratio of 1:2 (w/w) (AMIRA, 2002). This gives an indication of the inherent acidity of the samples when initially exposed in a waste emplacement area.

The aged pH (1:2) of the samples ranged from a 6.5 to 8.5 pH unit (**Figure 4**). The median aged pH is 6.7 pH units. The highest aged pH was recorded in sample collected from hole TMRS005, and the lowest aged pH was recorded in the sample from drill hole TMRS006. The aged pH of the samples did not show any significant correlation with the spatial distribution or depth from which they were collected. Of the 15 samples, none recorded aged pH <6.5 pH units, suggesting the potential for any acidic drainage is unlikely.

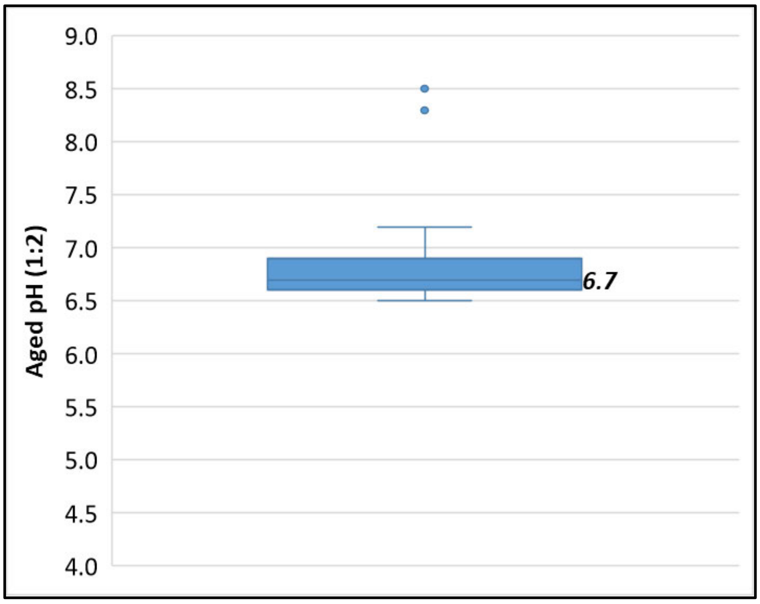

Figure 4 Boxplot showing pH (1:2)

The Maximum Potential Acidity (MPA) is often determined from the sulphur content of the sample. The formula that is used is as follows:

MPA (kg H_2SO_4/t) = (Total %S) * 30.6

The capacity of the material to neutralise the acid formed from pyrite oxidation due to the presence of acid neutralising minerals contained within the sample, is called acid neutralising capacity (ANC). The NAPP is the difference between maximum potential acidity (MPA) and acid neutralising capacity (ANC) and represents the net acid-producing capacity of the sample.

Along with the NAPP determination, samples also undergo NAG test. In the NAG test, a sample is treated with hydrogen peroxide to rapidly oxidise any sulfide minerals contained within a sample (AMIRA, 2002). The result represents the net amount of acid generated by the sample, and is commonly referred to as the NAG capacity, which is expressed in kilogram of sulfuric acid per tonne (kg H_2SO_4/t).

NAG and NAPP help in the classification of waste rocks into the following categories (AMIRA, 2002):

- Non-acid Forming (NAF): suggests that the material cannot generate acid.
- Potentially acid-forming (PAF): indicates that the material can potentially generate acid.
- Uncertain (UC): the test is not certain about the material's potential to generate acid.

The Rising Sun samples recorded NAPP ranging from -5.727 kg H_2SO_4/t to 0.234 kg H_2SO_4/t. Out of the 15 samples, 12 samples recorded negative NAPP, which indicates that the acid neutralising capacity (ANC) of these samples is higher than the maximum potential of acid production. Classification of the samples using the NAG pH and NAPP suggests 12 out of the 15 samples are non-acid forming (NAF). The classification plot for the samples is represented in **Figure 5**. The remaining three samples recorded slightly positive NAPP, but the NAG pH was above 4.5. These samples were characterised as uncertain (UC), likely due to the non-acid forming sulfur, iron-carbonates, and/or insufficient hydrogen peroxide. However, the low NAPP and high Nag pH further imply that the potential for any acidic drainage from these samples is highly unlikely. The waste rock samples collected from other projects in the proximity, such as Black Snake and Nobles Nob, have also indicated non-acid-producing characteristics.

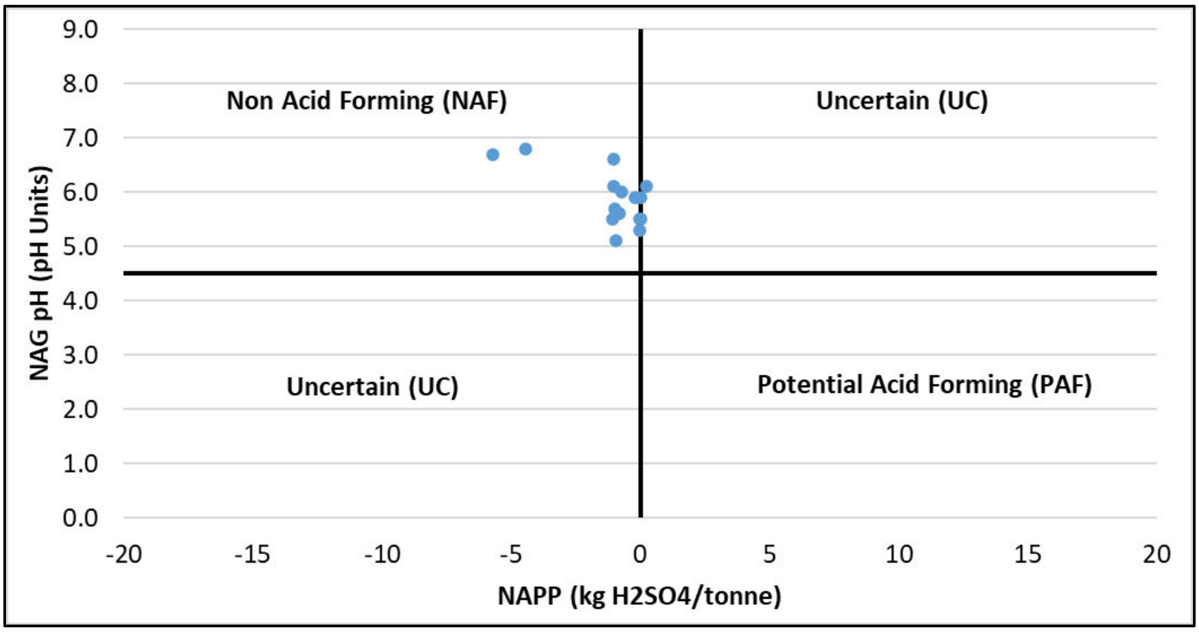

Figure 5 Geochemical Classification Plot

4.0 Metalliferous Drainage Potential

The metal concentrations were analysed by inductively coupled plasma optical emission spectrometry (ICPOES). The metal concentrations in the samples are crucial in identifying enriched metals that can pose a risk of possible metalliferous drainage. Enrichment was assessed by calculating the geochemical abundance index (GAI).

4.1 Geochemical Abundance Index (GAI)

The geochemical abundance index (GAI) can be used to estimate the enrichment of metals in the samples relative to average crustal concentrations. The GAI is expressed on a log 2 scale. The GAI was developed by Förstner et al., (1993) and is defined as follows:

$$GAI = log_2\left(\frac{C}{(1.5 * B)}\right)$$

Where, C is the measured concentration in the sample, and B is the average crustal abundance/concentration. The enrichment ranges of metal, based on the GAI values, are interpreted as follows:

- GAI=0 indicates <3 times average crustal abundance.
- GAI=1 indicates 3 to 6 times the average crustal abundance.
- GAI=2 indicates 6 to 12 times the average crustal abundance.
- GAI=3 indicates 12 to 24 times the average crustal abundance.
- GAI=4 indicates 24 to 48 times the average crustal abundance.
- GAI=5 indicates 48 to 96 times the average crustal abundance.
- GAI=6 indicates more than 96 times the average crustal abundance.

As a general guide, GAI value of 3 or above is considered a significant concentration and might indicate the potential of metalliferous drainage from that sample. The average crustal abundances used to compare results against the GAI are provided in **Table 3**.

Table 3 Average Crustal Concentration of Metals (Haynes, 2016)

Element	Symbol	Average Crustal concentration (mg/Kg)
Aluminium	Al	82,300 (8.23%)
Arsenic	As	1.8 (0.00018%)
Barium	Ba	425 (0.0425%)
Cobalt	Co	25 (0.0025%)
Cadmium	Cd	0.15 (0.000015%)
Chromium	Cr	102 (0.0102%)
Copper	Cu	60 (0.006%)
Iron	Fe	56,300 (5.63%)
Manganese	Mn	950 (0.095%)
Molybdenum	Mo	1.2 (0.00012%)
Mercury	Hg	0.085 (0.0000085%)
Nickel	Ni	84 (0.0084%)
Lead	Pb	14 (0.0014%)
Selenium	Se	0.05 (000005%)
Zinc	Zn	70 (0.007%)

The GAI values for all metals, except selenium, was below 3 in all samples (**Table 4**). For selenium, all samples recorded GAI value of 4, whereas one sample recorded GAI value of 5. Notably, 10 out of the 15 samples recorded a concentration of selenium below the limit of reporting (LOR). The high GAI value is due to the LOR being high (LOR for selenium 2mg/Kg) compared to the average crustal abundance of selenium (0.05 mg/Kg). Despite the higher GAI values, acidic conditions are required to liberate and mobilise selenium. As acidic drainage from the waste rocks is highly unlikely, selenium-enriched drainage is also unlikely.

These results are similar to the characteristics of the waste rock from nearby Black Snake and Nobles Nob, which also recorded GAI values <3 for most of the elements.

4.2 Australian Standards Leaching Procedure (ASLP)

The Geochemical Abundance Index (GAI) assessment might be an over-conservative indicator for understanding the potential of metalliferous drainage (Jones et al., 2016). Therefore, other methods, such as leaching procedures, are also incorporated into assessing metalliferous drainages. The Australian Standards Leaching Procedure (ASLP) was undertaken on all 15 samples.

The ASLP is based on the Toxicity Characteristic Leaching Procedure (TCLP) developed by the United States Environmental Protection Agency (US EPA, 1992). The main objective of this procedure is to simulate the leaching of wastes from the waste rock into the receiving environment under acidic conditions. Deionised water is generally used as a leaching agent in test procedures for assessing waste rocks' leaching potential at mine sites.

The ASLP test results of the Rising Sun samples indicated that leachate from the samples recorded above the detection limit only for barium, manganese, and molybdenum. The number of samples that recorded concentration above the detection limit for each element are as follows:

- Barium – 9 out of 15 samples recorded the barium concentration in the leachate above the detection limit (**Table 5**). The barium concentration in these samples ranged from 2 µg/L to 71 µg/L. Barium is likely associated with the geology and mineralisation at Rising Sun. Generally, barium shows limited mobility because of the formation of water-insoluble salts (Aziz et al., 2017; WHO, 1990). The dissolution of common barium minerals, such as barite ($BaSO_4$) or witherite ($BaCO_3$), can occur if exposed to acidic conditions (Aziz et al., 2017; WHO, 1990). As outlined above, the potential of acidic drainage occurring from these samples is highly unlikely. As such, barium-enriched drainage is also unlikely. Additionally, the maximum concentration recorded in the leachate was 71 µg/L, significantly lower than the drinking water guideline value for barium (2000 µg/L), indicating no risk to the receiving environment.
- Manganese – 4 out of 15 samples recorded manganese concentration in the leachates above the detection limit (**Table 5**). The concentration of manganese in the leachate of these samples ranged from 1 to 9 µg/L, significantly lower than the ANZG (2018) default guidelines values (DGVs) for 95% level of species protection, which is 1900 µg/L. The chances of drainage from the waste rocks enriched in manganese are highly unlikely, given that only 4 out of 15 samples recorded concentrations of manganese higher than the detection limit, and the concentrations are lower than the ANZG (2018) DGV. Furthermore, manganese drainage occurs in acidic conditions only, which is unlikely to occur in these samples.
- Molybdenum – only 1 sample out of 15 samples recorded a concentration of molybdenum which was above the detection limit (**Table 5**). The concentration recorded by this one sample is equal to the detection limit (1 µg/L), and is significantly lower than the ANZG (2018) (DGV)(34 µg/L). The chances of drainage from the waste rocks enriched in molybdenum is

highly unlikely, given that only 1 out of 15 samples recorded a concentration of molybdenum higher than the detection limit, and none of the samples were enriched with molybdenum.

The ASLP results for all the remaining elements, including selenium, were below the detection limit (**Table 5**). This further illustrates that metalliferous drainage from these waste rock samples is highly unlikely.

Table 4 GAI Values of Elements in Samples

SAMPLE ID	As	Ba	Cd	Co	Cr	Cu	Mn	Mo	Ni	Pb	Se	Zn	Hg
TMRS005_0_6	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS005_15_21	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS009_3_9	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS009_18_24	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS010_12_18	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS007_3_9	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS007_24_30	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS008_3_9	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS001_12_18	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS003_9_15	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS002_3_9	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS002_15_21	0	0	0	0	0	0	0	0	0	0	5	0	0
TMRS004_12_18	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS011_15_21	0	0	0	0	0	0	0	0	0	0	4	0	0
TMRS006_6_12	0	0	0	0	0	0	0	0	0	0	4	0	0

Cells highlighted in orange recorded a GAI value of 3 or above.

Table 5 ASLP Test Results In Rising Sun Samples

SAMPLE ID	As	Ba	Cd	Co	Cr	Cu	Mn	Mo	Ni	Pb	Se	Zn	Hg
TMRS005_0_6	<1	71	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS005_15_21	<1	22	<0.1	<1	<1	<1	9	<1	<1	<1	<2	<5	<0.0005
TMRS009_3_9	<1	26	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS009_18_24	<1	4	<0.1	<1	<1	<1	6	<1	<1	<1	<2	<5	<0.0005
TMRS010_12_18	<1	5	<0.1	<1	<1	<1	1	<1	<1	<1	<2	<5	<0.0005
TMRS007_3_9	<1	5	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS007_24_30	<1	<1	<0.1	<1	<1	<1	3	1	<1	<1	<2	<5	<0.0005
TMRS008_3_9	<1	11	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS001_12_18	<1	<1	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS003_9_15	<1	<1	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS002_3_9	<1	7	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS002_15_21	<1	<1	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS004_12_18	<1	<1	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS011_15_21	<1	<1	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005
TMRS006_6_12	<1	2	<0.1	<1	<1	<1	<1	<1	<1	<1	<2	<5	<0.0005

All values are in µg/L, except Mercury (Hg), which is in mg/L.
Cells highlighted in orange are above the detection limit.

5.0 Saline Drainage Potential

There are no standard methods to assess saline drainage in the AMIRA (2002) guidelines. However, many technical guidelines (such as Jones et al., 2016) outline an indicative criterion to assess the potential for saline drainage using electrical conductivity (EC). The potential for saline drainage has been assessed using aged EC of a 1:2 (sample:water) suspension.

Electrical conductivity (EC) measures the capacity of a solution to conduct electricity. It is often used as a proxy for salinity and is expressed as µS/cm. All 15 samples underwent aged EC (1:2) measurement. The aged EC recorded by the samples ranged from 460 µS/cm to 1900 µS/cm, with an average of 1,009 µS/cm and a median of 1000 µS/cm. More than half of the samples (~60%) record aged EC greater than 900 µS/cm (**Table 6**), indicating the potential of saline drainage from these samples is likely. Out of the remaining samples, ~40% of the samples recorded aged EC between 450 - 900 µS/cm and none of the samples recorded aged EC below 450 µS/cm (**Table 6**).

The comparison of the aged EC with the depth and spatial location of the samples shows no correlation, suggesting that the saline drainage characteristics of the waste rocks at Rising Sun are homogenous.

Table 6 Sample Distribution based on Classification of Aged EC

	Very Low	Low	Moderate	High	TOTAL
	<150µS/cm	150-450µS/cm	450-900µS/cm	>900µS/cm	
Aged EC (1:2)	0	0	6	9	**15**

6.0 Conclusion

TCMG sampled pulps from the exploration drill holes around the proposed Rising Sun pit to characterise the waste rocks, and assess the potential of acidic, metalliferous, and/or saline drainage from these samples. The samples were sent to the National Association of Testing Authorities (NATA) accredited laboratory SGS (Perth) for analysis. The laboratory results are attached as **Appendix A**.

The results state that a sample:water ratio of 1:2 recorded a pH ranging from 6.5 to 8.5, with a median pH of 6.7. The samples recorded NAPP ranging from -5.727 kg H_2SO_4/t to 0.234 kg H_2SO_4/t. None of the samples recorded pH (1:2) <6.5 pH units. Furthermore, all samples recorded negative or low NAPP values (i.e., <1 kg H_2SO_4/t), and the classification of the samples using the NAG pH and NAPP indicates that most samples are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is highly unlikely.

The GAI assessment of the samples suggests that all samples recorded GAI value of greater than 3 for selenium. However, most samples also recorded selenium concentrations below the limit of reporting, indicating a low risk of selenium-enriched drainage. Furthermore, selenium-enriched drainage occurs in acidic conditions, which is not the case for these samples, as suggested by the pH (1:2) and NAG test. As such, chances of selenium-enriched drainage from these samples are unlikely. The ASLP test results of the Rising Sun samples indicated concentration of selenium in all samples was below the detection limit, further confirming that selenium-enriched drainage is not likely. The ASLP test results also stated that leachate from the samples recorded a concentration of barium, manganese, and molybdenum above the detection limit. Drainage enriched with these elements only occurs in acidic conditions. As acidic drainage is not likely to occur from these samples, metalliferous drainage enriched in barium, manganese or molybdenum from these samples is also unlikely.

The aged EC (1:2) recorded by the samples ranged from 460 µS/cm to 1900 µS/cm, with more than half of the samples (~60%) recording EC greater than 900 µS/cm. This indicates that the potential of saline drainage from these samples is likely.

7.0 Reference

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Appendix A

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Ashish Mishra	Manager	Merene Hwang
Client	TENNANT MINING	Laboratory	SGS Perth Environmental
Address	PO BOX 37 WEST PERTH WA 6005	Address	28 Reid Rd Perth Airport WA 6105
Telephone	0451 786 490	Telephone	(08) 9373 3500
Facsimile	(Not specified)	Facsimile	(08) 9373 3556
Email	amishra@tennantmining.com.au	Email	au.environmental.perth@sgs.com
Project	**Soil Analysis**	SGS Reference	**PE167394 R1**
Order Number	**PO0106**	Date Received	31 Mar 2023
Samples	15	Date Reported	05 May 2023

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(898/20210).

Total Recoverable Metals: Mn: Spike recovery failed due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
Total Recoverable Metals: As:Mo & Se: Spike recovery and MSD RPD failed due to sample matrix interference. Confirmed by re-analysis

CRS , SHCL, TS, TOS Tot S-SO4, Acid base Accounting, ANC and NAG subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146, CE165932
This report cancels and supersedes the report No. PE167394 dated 19.4.2023 issued by SGS Environment, Health and Safety due to the inclusion of ANC data.

SIGNATORIES

Hue Thanh LY
Metals Team Leader

Loan HA
Laboratory Technician

Melissa WHITE
Laboratory Technician

Ohmar DAVID
Metals Chemist

Parameter	Units	LOR	PE167394.001 Soil TMRS005_0_6	PE167394.002 Soil TMRS005_15_21	PE167394.003 Soil TMRS009_3_9	PE167394.004 Soil TMRS009_18_24
Sample Number / Sample Matrix / Sample Name			PE167394.001 / Soil / TMRS005_0_6	PE167394.002 / Soil / TMRS005_15_21	PE167394.003 / Soil / TMRS009_3_9	PE167394.004 / Soil / TMRS009_18_24
pH in soil (1:2) Method: AN101 Tested: 14/4/2023						
pH (1:2) aged	pH Units	0.1	8.5	6.5	8.3	6.6
Conductivity (1:2) in soil Method: AN106 Tested: 14/4/2023						
Conductivity (1:2) aged @ 25C*	µS/cm	2	1100	1900	1500	1600
Moisture Content Method: AN002 Tested: 6/4/2023						
% Moisture	%w/w	0.5	0.8	1.5	1.0	1.3
Total Sulfur Method: AN012/AN320 Tested: 19/4/2023						
Total Sulfur	%w/w	0.005	0.025	0.024	0.022	0.017
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 19/4/2023						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	0.023	0.022	0.023	0.017
Mercury in Soil Method: AN312 Tested: 5/4/2023						
Mercury	mg/kg	0.05	<0.05	0.10	<0.05	<0.05

Parameter	Units	LOR	Sample Number: PE167394.001 Sample Matrix: Soil Sample Name: TMRS005_0_6	PE167394.002 Soil TMRS005_15_21	PE167394.003 Soil TMRS009_3_9	PE167394.004 Soil TMRS009_18_24

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 14/4/2023

Parameter	Units	LOR	PE167394.001	PE167394.002	PE167394.003	PE167394.004
pHox (NAG pH)	No unit	-	**6.8**	**6.1**	**6.7**	**5.9**

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 11/4/2023

Parameter	Units	LOR	PE167394.001	PE167394.002	PE167394.003	PE167394.004
Mass of test sample for extraction	g	-	**5**	**5**	**5**	**5**
Mass of leaching solution used	g	-	**100**	**100**	**100**	**100**
Leaching solution used*	No unit	-	DI Water	DI Water	DI Water	DI Water
pH of solids leachate	pH Units	-	**9.3**	**7.2**	**9.4**	**9.3**
Mass of liquid expelled	g	-	-	-	-	-
pH of liquid expelled	pH Units	-	-	-	-	-
Conductivity @25C	µS/cm	1	**180**	**250**	**240**	**200**
Percentage Solids*	%	-	-	-	-	-

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.001	PE167394.002	PE167394.003	PE167394.004
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**71**	**22**	**26**	**4**
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	<1	<1	<1
Cobalt, Co	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	<1	<1	<1	<1
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	<1	**9**	<1	**6**
Molybdenum, Mo	µg/L	1	<1	<1	<1	<1
Nickel, Ni	µg/L	1	<1	<1	<1	<1
Selenium, Se	µg/L	2	<2	<2	<2	<2
Zinc, Zn	µg/L	5	<5	<5	<5	<5

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.001	PE167394.002	PE167394.003	PE167394.004
Mercury	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Chromium Reducible Sulfur (CRS) Method: AN217 Tested: 19/4/2023

Parameter	Units	LOR	PE167394.001	PE167394.002	PE167394.003	PE167394.004
Chromium Reducible Sulfur (Scr)	%	0.005	<0.005	<0.005	<0.005	<0.005
Chromium Reducible Sulfur (Scr)	moles H+/T	5	<5	<5	<5	<5

Chromium Suite Net Acidity Calculations Method: AN220 Tested: 19/4/2023

Parameter	Units	LOR	PE167394.001	PE167394.002	PE167394.003	PE167394.004
s-Net Acidity	%w/w S	0.005	<0.005	<0.005	<0.005	**0.012**
s-Net Acidity without ANC	%w/w S	0.005	<0.005	**0.006**	<0.005	**0.012**
a-Net Acidity	moles H+/T	5	<5	<5	<5	**7**
Liming Rate*	kg CaCO3/T	0.1	<0.1	<0.1	<0.1	N/A
Verification s-Net Acidity*	%w/w S	-20	**-0.11**	**0.00**	**-0.14**	**0.00**
a-Net Acidity without ANCBT*	moles H+/T	5	<5	<5	<5	**7**
Liming Rate without ANCBT*	kg CaCO3/T	0.1	<0.1	<0.1	<0.1	N/A

Parameter	Units	LOR	Sample Number PE167394.001 Sample Matrix Soil Sample Name TMRS005_0_6	PE167394.002 Soil TMRS005_15_21	PE167394.003 Soil TMRS009_3_9	PE167394.004 Soil TMRS009_18_24
Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 13/4/2023						
Aluminium, Al	mg/L	0.02	**0.30**	<0.02	**0.15**	<0.02
Antimony, Sb	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Arsenic, As	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Barium, Ba	mg/L	0.005	**0.076**	**0.023**	**0.027**	<0.005
Beryllium, Be	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Bismuth, Bi*	mg/L	0.05	-	-	-	-
Boron, B	mg/L	0.05	<0.05	**0.07**	<0.05	**0.07**
Cadmium, Cd	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Calcium, Ca	mg/L	0.2	**6.0**	**1.8**	**5.3**	**1.2**
Chromium, Cr	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Cobalt, Co	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Copper, Cu	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Iron, Fe	mg/L	0.02	**0.17**	<0.02	**0.04**	<0.02
Lead, Pb	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Lithium, Li	mg/L	0.005	-	-	-	-
Magnesium, Mg	mg/L	0.1	**2.4**	**2.4**	**2.2**	**1.7**
Manganese, Mn	mg/L	0.005	<0.005	**0.011**	<0.005	**0.007**
Molybdenum, Mo	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Nickel, Ni	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Phosphorus, P	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Potassium, K	mg/L	0.1	**9.2**	**3.8**	**8.1**	**3.5**
Selenium, Se	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Silicon, Si	mg/L	0.05	**2.9**	**2.5**	**2.5**	**2.6**
Silver, Ag	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Sodium, Na	mg/L	0.5	**17**	**34**	**30**	**28**
Soluble Silicon as Silica, SiO2	mg/L	0.1	**6.2**	**5.3**	**5.4**	**5.6**
Strontium, Sr	mg/L	0.005	**0.066**	**0.032**	**0.043**	**0.020**
Sulfur as Sulfate, SO4	mg/L	0.3	**20**	**24**	**27**	**19**
Sulfur, S	mg/L	0.1	**6.7**	**7.9**	**9.0**	**6.3**
Tin, Sn	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Thallium, Tl*	mg/L	0.05	-	-	-	-
Titanium, Ti*	mg/L	0.005	**0.006**	<0.005	<0.005	<0.005
Vanadium, V	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Zinc, Zn	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Zirconium, Zn	mg/L	0.005	-	-	-	-
Total Hardness by Calculation as CaCO3*	mg CaCO3/L	1	**25**	**14**	**22**	**10**
Total Recoverable Elements in Soil by ICPOES Method: AN045/AN320 Tested: 5/4/2023						
Arsenic, As	mg/kg	1	<1	<1	<1	<1
Barium, Ba	mg/kg	0.5	**410**	**170**	**200**	**69**
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.5	**2.8**	**14**	**2.7**	**8.7**
Chromium, Cr	mg/kg	0.5	**9.5**	**36**	**9.7**	**30**
Copper, Cu	mg/kg	0.5	**3.3**	**29**	**5.0**	**25**
Manganese, Mn	mg/kg	1	**13**	**460**	**21**	**430**
Molybdenum, Mo	mg/kg	1	<1	<1	<1	**1**
Nickel, Ni	mg/kg	0.5	**3.8**	**10**	**2.9**	**9.4**
Lead, Pb	mg/kg	1	<1	<1	<1	<1
Selenium, Se	mg/kg	2	<2	**2**	<2	<2
Zinc, Zn	mg/kg	2	**8**	**23**	**12**	**24**
Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 5/5/2023						
ANC as % $CaCO_3$	% CaCO3	0.05	**0.50**	<0.05	**0.70**	<0.05
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	0.5	**0.5**	<0.5	**0.7**	<0.5
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	0.5	**5.2**	<0.5	**6.4**	<0.5

Parameter	Units	LOR	PE167394.005 Soil TMRS010_12_18	PE167394.006 Soil TMRS007_3_9	PE167394.007 Soil TMRS007_24_30	PE167394.008 Soil TMRS008_3_9
pH in soil (1:2) Method: AN101 Tested: 14/4/2023						
pH (1:2) aged	pH Units	0.1	6.7	6.7	6.9	6.9
Conductivity (1:2) in soil Method: AN106 Tested: 14/4/2023						
Conductivity (1:2) aged @ 25C*	µS/cm	2	900	1200	520	460
Moisture Content Method: AN002 Tested: 6/4/2023						
% Moisture	%w/w	0.5	<0.5	0.8	<0.5	0.7
Total Sulfur Method: AN012/AN320 Tested: 19/4/2023						
Total Sulfur	%w/w	0.005	0.015	0.017	0.008	0.009
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 19/4/2023						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	0.014	0.016	0.008	0.010
Mercury in Soil Method: AN312 Tested: 5/4/2023						
Mercury	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
Sample Number			PE167394.005	PE167394.006	PE167394.007	PE167394.008
Sample Matrix			Soil	Soil	Soil	Soil
Sample Name			TMRS010_12_18	TMRS007_3_9	TMRS007_24_30	TMRS008_3_9

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 14/4/2023

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
pHox (NAG pH)	No unit	-	5.5	5.5	6.6	6.1

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 11/4/2023

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
Mass of test sample for extraction	g	-	5	5	5	5
Mass of leaching solution used	g	-	100	100	100	100
Leaching solution used*	No unit	-	DI Water	DI Water	DI Water	DI Water
pH of solids leachate	pH Units	-	7.2	7.6	7.2	7.8
Mass of liquid expelled	g	-	-	-	-	-
pH of liquid expelled	pH Units	-	-	-	-	-
Conductivity @25C	µS/cm	1	110	150	64	63
Percentage Solids*	%	-	-	-	-	-

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	5	5	<1	11
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	<1	<1	<1
Cobalt, Co	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	<1	<1	<1	<1
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	1	<1	3	<1
Molybdenum, Mo	µg/L	1	<1	<1	1	<1
Nickel, Ni	µg/L	1	<1	<1	<1	<1
Selenium, Se	µg/L	2	<2	<2	<2	<2
Zinc, Zn	µg/L	5	<5	<5	<5	<5

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
Mercury	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Chromium Reducible Sulfur (CRS) Method: AN217 Tested: 19/4/2023

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
Chromium Reducible Sulfur (Scr)	%	0.005	<0.005	<0.005	<0.005	<0.005
Chromium Reducible Sulfur (Scr)	moles H+/T	5	<5	<5	<5	<5

Chromium Suite Net Acidity Calculations Method: AN220 Tested: 19/4/2023

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
s-Net Acidity	%w/w S	0.005	<0.005	<0.005	<0.005	<0.005
s-Net Acidity without ANC	%w/w S	0.005	<0.005	<0.005	<0.005	<0.005
a-Net Acidity	moles H+/T	5	<5	<5	<5	<5
Liming Rate*	kg CaCO3/T	0.1	<0.1	<0.1	<0.1	<0.1
Verification s-Net Acidity*	%w/w S	-20	0.00	0.00	0.00	0.00
a-Net Acidity without ANCBT*	moles H+/T	5	<5	<5	<5	<5
Liming Rate without ANCBT*	kg CaCO3/T	0.1	<0.1	<0.1	<0.1	<0.1

Parameter	Units	LOR	PE167394.005 Soil TMRS010_12_18	PE167394.006 Soil TMRS007_3_9	PE167394.007 Soil TMRS007_24_30	PE167394.008 Soil TMRS008_3_9

Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
Aluminium, Al	mg/L	0.02	<0.02	**0.21**	<0.02	**0.29**
Antimony, Sb	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Arsenic, As	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Barium, Ba	mg/L	0.005	**0.005**	**0.006**	<0.005	**0.012**
Beryllium, Be	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Bismuth, Bi*	mg/L	0.05	-	-	-	-
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Cadmium, Cd	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Calcium, Ca	mg/L	0.2	**0.5**	<0.2	<0.2	<0.2
Chromium, Cr	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Cobalt, Co	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Copper, Cu	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Iron, Fe	mg/L	0.02	<0.02	**0.15**	<0.02	**0.36**
Lead, Pb	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Lithium, Li	mg/L	0.005	-	-	-	-
Magnesium, Mg	mg/L	0.1	**0.9**	**0.1**	**0.3**	**0.2**
Manganese, Mn	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum, Mo	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Nickel, Ni	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Phosphorus, P	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Potassium, K	mg/L	0.1	**7.4**	**4.2**	**6.5**	**5.1**
Selenium, Se	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Silicon, Si	mg/L	0.05	**1.1**	**1.7**	**0.90**	**2.1**
Silver, Ag	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Sodium, Na	mg/L	0.5	**12**	**22**	**6.4**	**7.5**
Soluble Silicon as Silica, SiO2	mg/L	0.1	**2.3**	**3.6**	**1.9**	**4.5**
Strontium, Sr	mg/L	0.005	**0.009**	<0.005	<0.005	<0.005
Sulfur as Sulfate, SO4	mg/L	0.3	**12**	**17**	**5.6**	**6.8**
Sulfur, S	mg/L	0.1	**3.9**	**5.8**	**1.9**	**2.3**
Tin, Sn	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Thallium, Tl*	mg/L	0.05	-	-	-	-
Titanium, Ti*	mg/L	0.005	<0.005	**0.010**	<0.005	**0.008**
Vanadium, V	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Zinc, Zn	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Zirconium, Zn	mg/L	0.005	-	-	-	-
Total Hardness by Calculation as CaCO3*	mg CaCO3/L	1	**5**	<1	**1**	**1**

Total Recoverable Elements in Soil by ICPOES Method: AN045/AN320 Tested: 5/4/2023

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
Arsenic, As	mg/kg	1	<1	<1	**2**	<1
Barium, Ba	mg/kg	0.5	**86**	**150**	**140**	**150**
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.5	**5.3**	**1.8**	**16**	**2.0**
Chromium, Cr	mg/kg	0.5	**14**	**8.4**	**8.8**	**17**
Copper, Cu	mg/kg	0.5	**23**	**2.8**	**64**	**4.7**
Manganese, Mn	mg/kg	1	**160**	**13**	**2000**	**12**
Molybdenum, Mo	mg/kg	1	<1	<1	**2**	<1
Nickel, Ni	mg/kg	0.5	**5.7**	**2.2**	**6.9**	**4.3**
Lead, Pb	mg/kg	1	<1	<1	<1	<1
Selenium, Se	mg/kg	2	<2	<2	**2**	<2
Zinc, Zn	mg/kg	2	**13**	**8**	**21**	**8**

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 5/5/2023

Parameter	Units	LOR	PE167394.005	PE167394.006	PE167394.007	PE167394.008
ANC as % $CaCO_3$	% CaCO3	0.05	<0.05	<0.05	**0.13**	**0.13**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	0.5	<0.5	<0.5	**1.3**	**1.3**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	0.5	<0.5	<0.5	**1.3**	**1.3**

Parameter	Units	LOR	PE167394.009 Soil TMRS001_12_18	PE167394.010 Soil TMRS003_9_15	PE167394.011 Soil TMRS002_3_9	PE167394.012 Soil TMRS002_15_21
pH in soil (1:2) Method: AN101 Tested: 14/4/2023						
pH (1:2) aged	pH Units	0.1	6.6	6.7	7.2	6.7
Conductivity (1:2) in soil Method: AN106 Tested: 14/4/2023						
Conductivity (1:2) aged @ 25C*	µS/cm	2	520	1200	1000	490
Moisture Content Method: AN002 Tested: 6/4/2023						
% Moisture	%w/w	0.5	0.5	<0.5	0.6	<0.5
Total Sulfur Method: AN012/AN320 Tested: 19/4/2023						
Total Sulfur	%w/w	0.005	0.010	0.016	0.019	0.007
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 19/4/2023						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	0.011	0.016	0.020	0.008
Mercury in Soil Method: AN312 Tested: 5/4/2023						
Mercury	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
Sample Number			PE167394.009	PE167394.010	PE167394.011	PE167394.012
Sample Matrix			Soil	Soil	Soil	Soil
Sample Name			TMRS001_12_18	TMRS003_9_15	TMRS002_3_9	TMRS002_15_21

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 14/4/2023

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
pHox (NAG pH)	No unit	-	**5.7**	**5.6**	**6.0**	**5.5**

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 11/4/2023

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
Mass of test sample for extraction	g	-	**5**	**5**	**5**	**5**
Mass of leaching solution used	g	-	**100**	**100**	**100**	**100**
Leaching solution used*	No unit	-	DI Water	DI Water	DI Water	DI Water
pH of solids leachate	pH Units	-	**7.3**	**7.1**	**7.9**	**7.5**
Mass of liquid expelled	g	-	-	-	-	-
pH of liquid expelled	pH Units	-	-	-	-	-
Conductivity @25C	µS/cm	1	**110**	**140**	**130**	**65**
Percentage Solids*	%	-	-	-	-	-

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	<1	<1	**7**	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	<1	<1	<1
Cobalt, Co	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	<1	<1	<1	<1
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	<1	<1	<1	<1
Molybdenum, Mo	µg/L	1	<1	<1	<1	<1
Nickel, Ni	µg/L	1	<1	<1	<1	<1
Selenium, Se	µg/L	2	<2	<2	<2	<2
Zinc, Zn	µg/L	5	<5	<5	<5	<5

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
Mercury	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Chromium Reducible Sulfur (CRS) Method: AN217 Tested: 19/4/2023

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
Chromium Reducible Sulfur (Scr)	%	0.005	<0.005	<0.005	<0.005	<0.005
Chromium Reducible Sulfur (Scr)	moles H+/T	5	<5	<5	<5	<5

Chromium Suite Net Acidity Calculations Method: AN220 Tested: 19/4/2023

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
s-Net Acidity	%w/w S	0.005	<0.005	<0.005	<0.005	<0.005
s-Net Acidity without ANC	%w/w S	0.005	<0.005	<0.005	<0.005	<0.005
a-Net Acidity	moles H+/T	5	<5	<5	<5	<5
Liming Rate*	kg CaCO3/T	0.1	<0.1	<0.1	<0.1	<0.1
Verification s-Net Acidity*	%w/w S	-20	**0.00**	**0.00**	**-0.03**	**0.00**
a-Net Acidity without ANCBT*	moles H+/T	5	<5	<5	<5	<5
Liming Rate without ANCBT*	kg CaCO3/T	0.1	<0.1	<0.1	<0.1	<0.1

Parameter	Units	LOR	Sample Number: PE167394.009 / Sample Matrix: Soil / Sample Name: TMRS001_12_18	PE167394.010 / Soil / TMRS003_9_15	PE167394.011 / Soil / TMRS002_3_9	PE167394.012 / Soil / TMRS002_15_21

Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
Aluminium, Al	mg/L	0.02	<0.02	<0.02	**0.03**	<0.02
Antimony, Sb	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Arsenic, As	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Barium, Ba	mg/L	0.005	<0.005	<0.005	**0.008**	<0.005
Beryllium, Be	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Bismuth, Bi*	mg/L	0.05	-	-	-	-
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Cadmium, Cd	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Calcium, Ca	mg/L	0.2	**0.3**	**0.6**	**0.5**	<0.2
Chromium, Cr	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Cobalt, Co	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Copper, Cu	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Iron, Fe	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Lead, Pb	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Lithium, Li	mg/L	0.005	-	-	-	-
Magnesium, Mg	mg/L	0.1	**0.5**	**1.1**	**0.6**	**0.2**
Manganese, Mn	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum, Mo	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Nickel, Ni	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Phosphorus, P	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Potassium, K	mg/L	0.1	**9.1**	**9.5**	**7.0**	**6.4**
Selenium, Se	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Silicon, Si	mg/L	0.05	**1.1**	**0.96**	**1.1**	**1.1**
Silver, Ag	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Sodium, Na	mg/L	0.5	**12**	**16**	**16**	**7.1**
Soluble Silicon as Silica, SiO2	mg/L	0.1	**2.4**	**2.1**	**2.4**	**2.3**
Strontium, Sr	mg/L	0.005	<0.005	**0.009**	**0.011**	<0.005
Sulfur as Sulfate, SO4	mg/L	0.3	**10**	**15**	**15**	**5.7**
Sulfur, S	mg/L	0.1	**3.4**	**5.0**	**4.9**	**1.9**
Tin, Sn	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Thallium, Tl*	mg/L	0.05	-	-	-	-
Titanium, Ti*	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Vanadium, V	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Zinc, Zn	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Zirconium, Zn	mg/L	0.005	-	-	-	-
Total Hardness by Calculation as CaCO3*	mg CaCO3/L	1	**3**	**6**	**4**	**1**

Total Recoverable Elements in Soil by ICPOES Method: AN045/AN320 Tested: 5/4/2023

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
Arsenic, As	mg/kg	1	<1	**2**	<1	**1**
Barium, Ba	mg/kg	0.5	**34**	**36**	**160**	**36**
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.5	**2.4**	**2.5**	**2.9**	**3.4**
Chromium, Cr	mg/kg	0.5	**14**	**11**	**9.0**	**15**
Copper, Cu	mg/kg	0.5	**25**	**29**	**15**	**30**
Manganese, Mn	mg/kg	1	**40**	**32**	**25**	**94**
Molybdenum, Mo	mg/kg	1	**1**	**2**	<1	<1
Nickel, Ni	mg/kg	0.5	**5.2**	**4.2**	**3.2**	**6.1**
Lead, Pb	mg/kg	1	<1	<1	<1	<1
Selenium, Se	mg/kg	2	<2	<2	<2	**3**
Zinc, Zn	mg/kg	2	**12**	**10**	**9**	**17**

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 5/5/2023

Parameter	Units	LOR	PE167394.009	PE167394.010	PE167394.011	PE167394.012
ANC as % $CaCO_3$	% CaCO3	0.05	**0.13**	**0.13**	**0.10**	**0.13**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	0.5	**1.3**	**1.3**	<0.5	**1.3**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	0.5	**1.3**	**1.3**	**1.3**	**1.3**

Parameter	Units	LOR	Sample Number PE167394.013 Sample Matrix Soil Sample Name TMRS004_12_18	PE167394.014 Soil TMRS011_15_21	PE167394.015 Soil TMRS006_6_12
pH in soil (1:2) Method: AN101 Tested: 14/4/2023					
pH (1:2) aged	pH Units	0.1	6.6	6.6	6.5
Conductivity (1:2) in soil Method: AN106 Tested: 14/4/2023					
Conductivity (1:2) aged @ 25C*	µS/cm	2	1000	790	960
Moisture Content Method: AN002 Tested: 6/4/2023					
% Moisture	%w/w	0.5	<0.5	<0.5	0.7
Total Sulfur Method: AN012/AN320 Tested: 19/4/2023					
Total Sulfur	%w/w	0.005	0.012	0.010	0.016
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 19/4/2023					
Acid Soluble Sulfur (SHCl)	%w/w	0.005	0.013	0.011	0.018
Mercury in Soil Method: AN312 Tested: 5/4/2023					
Mercury	mg/kg	0.05	<0.05	<0.05	<0.05

Parameter	Units	LOR	Sample Number Sample Matrix Sample Name	PE167394.013 Soil TMRS004_12_18	PE167394.014 Soil TMRS011_15_21	PE167394.015 Soil TMRS006_6_12

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 14/4/2023

Parameter	Units	LOR	PE167394.013	PE167394.014	PE167394.015
pHox (NAG pH)	No unit	-	5.1	5.9	5.3

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 11/4/2023

Parameter	Units	LOR	PE167394.013	PE167394.014	PE167394.015
Mass of test sample for extraction	g	-	5	5	5
Mass of leaching solution used	g	-	100	100	100
Leaching solution used*	No unit	-	DI Water	DI Water	DI Water
pH of solids leachate	pH Units	-	7.2	7.3	7.2
Mass of liquid expelled	g	-	-	-	-
pH of liquid expelled	pH Units	-	-	-	-
Conductivity @25C	µS/cm	1	110	95	120
Percentage Solids*	%	-	-	-	-

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.013	PE167394.014	PE167394.015
Arsenic, As	µg/L	1	<1	<1	<1
Barium, Ba	µg/L	1	<1	<1	2
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	<1	<1
Cobalt, Co	µg/L	1	<1	<1	<1
Copper, Cu	µg/L	1	<1	<1	<1
Lead, Pb	µg/L	1	<1	<1	<1
Manganese, Mn	µg/L	1	<1	<1	<1
Molybdenum, Mo	µg/L	1	<1	<1	<1
Nickel, Ni	µg/L	1	<1	<1	<1
Selenium, Se	µg/L	2	<2	<2	<2
Zinc, Zn	µg/L	5	<5	<5	<5

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.013	PE167394.014	PE167394.015
Mercury	mg/L	0.0005	<0.0005	<0.0005	<0.0005

Chromium Reducible Sulfur (CRS) Method: AN217 Tested: 19/4/2023

Parameter	Units	LOR	PE167394.013	PE167394.014	PE167394.015
Chromium Reducible Sulfur (Scr)	%	0.005	<0.005	<0.005	<0.005
Chromium Reducible Sulfur (Scr)	moles H+/T	5	<5	<5	<5

Chromium Suite Net Acidity Calculations Method: AN220 Tested: 19/4/2023

Parameter	Units	LOR	PE167394.013	PE167394.014	PE167394.015
s-Net Acidity	%w/w S	0.005	<0.005	<0.005	<0.005
s-Net Acidity without ANC	%w/w S	0.005	<0.005	<0.005	<0.005
a-Net Acidity	moles H+/T	5	<5	<5	<5
Liming Rate*	kg CaCO3/T	0.1	<0.1	<0.1	<0.1
Verification s-Net Acidity*	%w/w S	-20	0.00	0.00	0.00
a-Net Acidity without ANCBT*	moles H+/T	5	<5	<5	<5
Liming Rate without ANCBT*	kg CaCO3/T	0.1	<0.1	<0.1	<0.1

	Sample Number	PE167394.013	PE167394.014	PE167394.015
	Sample Matrix	Soil	Soil	Soil
	Sample Name	TMRS004_12_18	TMRS011_15_21	TMRS006_6_12

Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 13/4/2023

Parameter	Units	LOR	PE167394.013	PE167394.014	PE167394.015
Aluminium, Al	mg/L	0.02	<0.02	<0.02	<0.02
Antimony, Sb	mg/L	0.05	<0.05	<0.05	<0.05
Arsenic, As	mg/L	0.02	<0.02	<0.02	<0.02
Barium, Ba	mg/L	0.005	<0.005	<0.005	<0.005
Beryllium, Be	mg/L	0.005	<0.005	<0.005	<0.005
Bismuth, Bi*	mg/L	0.05	-	-	-
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05
Cadmium, Cd	mg/L	0.001	<0.001	<0.001	<0.001
Calcium, Ca	mg/L	0.2	**0.5**	<0.2	**0.3**
Chromium, Cr	mg/L	0.005	<0.005	<0.005	<0.005
Cobalt, Co	mg/L	0.01	<0.01	<0.01	<0.01
Copper, Cu	mg/L	0.005	<0.005	<0.005	<0.005
Iron, Fe	mg/L	0.02	<0.02	<0.02	<0.02
Lead, Pb	mg/L	0.02	<0.02	<0.02	<0.02
Lithium, Li	mg/L	0.005	-	-	-
Magnesium, Mg	mg/L	0.1	**0.7**	**0.3**	**0.4**
Manganese, Mn	mg/L	0.005	<0.005	<0.005	<0.005
Molybdenum, Mo	mg/L	0.01	<0.01	<0.01	<0.01
Nickel, Ni	mg/L	0.005	<0.005	<0.005	<0.005
Phosphorus, P	mg/L	0.05	<0.05	<0.05	<0.05
Potassium, K	mg/L	0.1	**7.4**	**10**	**6.5**
Selenium, Se	mg/L	0.05	<0.05	<0.05	<0.05
Silicon, Si	mg/L	0.05	**1.0**	**0.99**	**1.3**
Silver, Ag	mg/L	0.005	<0.005	<0.005	<0.005
Sodium, Na	mg/L	0.5	**13**	**9.1**	**15**
Soluble Silicon as Silica, SiO2	mg/L	0.1	**2.2**	**2.1**	**2.8**
Strontium, Sr	mg/L	0.005	**0.006**	<0.005	**0.006**
Sulfur as Sulfate, SO4	mg/L	0.3	**12**	**8.8**	**13**
Sulfur, S	mg/L	0.1	**4.1**	**2.9**	**4.3**
Tin, Sn	mg/L	0.05	<0.05	<0.05	<0.05
Thallium, Tl*	mg/L	0.05	-	-	-
Titanium, Ti*	mg/L	0.005	<0.005	<0.005	<0.005
Vanadium, V	mg/L	0.01	<0.01	<0.01	<0.01
Zinc, Zn	mg/L	0.01	<0.01	<0.01	<0.01
Zirconium, Zn	mg/L	0.005	-	-	-
Total Hardness by Calculation as CaCO3*	mg CaCO3/L	1	**4**	**2**	**3**

Total Recoverable Elements in Soil by ICPOES Method: AN045/AN320 Tested: 5/4/2023

Parameter	Units	LOR	PE167394.013	PE167394.014	PE167394.015
Arsenic, As	mg/kg	1	<1	**2**	<1
Barium, Ba	mg/kg	0.5	**26**	**49**	**55**
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3
Cobalt, Co	mg/kg	0.5	**3.2**	**2.6**	**2.5**
Chromium, Cr	mg/kg	0.5	**14**	**13**	**17**
Copper, Cu	mg/kg	0.5	**19**	**6.5**	**13**
Manganese, Mn	mg/kg	1	**30**	**180**	**21**
Molybdenum, Mo	mg/kg	1	<1	<1	<1
Nickel, Ni	mg/kg	0.5	**4.9**	**6.9**	**3.7**
Lead, Pb	mg/kg	1	<1	**1**	<1
Selenium, Se	mg/kg	2	**2**	<2	**2**
Zinc, Zn	mg/kg	2	**11**	**20**	**9**

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 5/5/2023

Parameter	Units	LOR	PE167394.013	PE167394.014	PE167394.015
ANC as % $CaCO_3$	% CaCO3	0.05	**0.13**	<0.05	<0.05
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	0.5	**1.3**	<0.5	<0.5
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	0.5	**1.3**	<0.5	<0.5

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

ASLP (Australian Standard Leaching Procedure) DI Water   Method: ME-(AU)-[ENV]AN007/AS4439.3

Parameter	QC Reference	Units	LOR	MB
Mass of test sample for extraction	LB205538	g	-	5
Mass of leaching solution used	LB205538	g	-	100
Leaching solution used*	LB205538	No unit	-	DI Water
pH of solids leachate	LB205538	pH Units	-	6.3
Conductivity @25C	LB205538	µS/cm	1	<1

Conductivity (1:2) in soil   Method: ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity (1:2) aged @ 25C*	LB205668	µS/cm	2	<2	1 - 5%	101%

Mercury in ASLP DI Water Extract   Method: ME-(AU)-[ENV]AN311(Perth) /AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD
Mercury	LB205619	mg/L	0.0005	<0.0001	0%

Mercury in Soil   Method: ME-(AU)-[ENV]AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Mercury	LB205421	mg/kg	0.05	<0.05	0%	86%	82%	9%

Metals in ASLP DI Extract by ICPOES   Method: ME-(AU)-[ENV]AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD
Aluminium, Al	LB205626	mg/L	0.02	<0.02	0%
Antimony, Sb	LB205626	mg/L	0.05	<0.05	0%
Arsenic, As	LB205626	mg/L	0.02	<0.02	0%
Barium, Ba	LB205626	mg/L	0.005	<0.005	0%
Beryllium, Be	LB205626	mg/L	0.005	<0.005	0%
Boron, B	LB205626	mg/L	0.05	<0.05	0%
Cadmium, Cd	LB205626	mg/L	0.001	<0.001	0%
Calcium, Ca	LB205626	mg/L	0.2	<0.2	3 - 9%
Chromium, Cr	LB205626	mg/L	0.005	<0.005	0%
Cobalt, Co	LB205626	mg/L	0.01	<0.01	0%
Copper, Cu	LB205626	mg/L	0.005	<0.005	0%
Iron, Fe	LB205626	mg/L	0.02	<0.02	0%
Lead, Pb	LB205626	mg/L	0.02	<0.02	0%
Magnesium, Mg	LB205626	mg/L	0.1	<0.1	1 - 7%
Manganese, Mn	LB205626	mg/L	0.005	<0.005	0%
Molybdenum, Mo	LB205626	mg/L	0.01	<0.01	0%
Nickel, Ni	LB205626	mg/L	0.005	<0.005	0%
Phosphorus, P	LB205626	mg/L	0.05	<0.05	0%
Potassium, K	LB205626	mg/L	0.1	<0.1	1%
Selenium, Se	LB205626	mg/L	0.05	<0.05	0%
Silicon, Si	LB205626	mg/L	0.05	<0.05	1 - 3%
Silver, Ag	LB205626	mg/L	0.005	<0.005	0%
Sodium, Na	LB205626	mg/L	0.5	<0.5	0 - 4%
Soluble Silicon as Silica, SiO2	LB205626	mg/L	0.1	<0.1	
Strontium, Sr	LB205626	mg/L	0.005	<0.005	1 - 8%
Sulfur as Sulfate, SO4	LB205626	mg/L	0.3	<0.3	1 - 4%
Sulfur, S	LB205626	mg/L	0.1	<0.1	1 - 4%
Tin, Sn	LB205626	mg/L	0.05	<0.05	0%
Titanium, Ti*	LB205626	mg/L	0.005	<0.005	0%
Vanadium, V	LB205626	mg/L	0.01	<0.01	0%
Zinc, Zn	LB205626	mg/L	0.01	<0.01	0%
Total Hardness by Calculation as CaCO3*	LB205626	mg CaCO3/L	1	<1	2 - 8%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Moisture Content Method: ME-(AU)-[ENV]AN002

Parameter	QC Reference	Units	LOR	DUP %RPD
% Moisture	LB205453	%w/w	0.5	0%

pH in soil (1:2) Method: ME-(AU)-[ENV]AN101

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH (1:2) aged	LB205667	pH Units	0.1	6.0	0 - 1%	106%

Total Recoverable Elements in Soil by ICPOES Method: ME-(AU)-[ENV]AN045/AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Arsenic, As	LB205421	mg/kg	1	<1	0%	101%	49%	7%
Barium, Ba	LB205421	mg/kg	0.5	<0.5	5 - 15%	103%	120%	28%
Cadmium, Cd	LB205421	mg/kg	0.3	<0.3	0%	100%	97%	1%
Cobalt, Co	LB205421	mg/kg	0.5	<0.5	2 - 8%	99%	97%	3%
Chromium, Cr	LB205421	mg/kg	0.5	<0.5	1 - 3%	100%	98%	10%
Copper, Cu	LB205421	mg/kg	0.5	<0.5	1 - 7%	101%	102%	8%
Manganese, Mn	LB205421	mg/kg	1	<1	2 - 5%	100%	57%	88%
Molybdenum, Mo	LB205421	mg/kg	1	<1	0%	108%	60%	2%
Nickel, Ni	LB205421	mg/kg	0.5	<0.5	1%	106%	105%	1%
Lead, Pb	LB205421	mg/kg	1	<1	0%	99%	96%	0%
Selenium, Se	LB205421	mg/kg	2	<2	0%	90%	17%	36%
Zinc, Zn	LB205421	mg/kg	2	<2	3 - 8%	96%	100%	4%

Trace Metals in ASLP DI Extract by ICPMS Method: ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	DUP %RPD
Arsenic, As	LB205620	µg/L	1	<1	0%
Barium, Ba	LB205620	µg/L	1	<1	6 - 18%
Cadmium, Cd	LB205620	µg/L	0.1	<0.1	0%
Chromium, Cr	LB205620	µg/L	1	<1	0%
Cobalt, Co	LB205620	µg/L	1	<1	0%
Copper, Cu	LB205620	µg/L	1	<1	0%
Lead, Pb	LB205620	µg/L	1	<1	0%
Manganese, Mn	LB205620	µg/L	1	<1	0%
Molybdenum, Mo	LB205620	µg/L	1	<1	0%
Nickel, Ni	LB205620	µg/L	1	<1	0%
Selenium, Se	LB205620	µg/L	2	<2	0%
Zinc, Zn	LB205620	µg/L	5	<5	0%

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN007/AS4439.3	Contaminants of interest in a waste material are leached out of the waste with a selected leaching solution under controlled conditions. The ratio of sample to extraction fluid is 100 g to 2 L (1 to 20 by mass). The concentration of each contaminant of interest is determined in the leachate by appropriate methods after separation from the sample by filtering. Based on AS4439.3.
AN012/AN320	Dried prepared soil is digested by oxidation with nitric acid and bromine followed by analysis of the digest by ICP OES.
AN014	This method is for the determination of soluble sulfate (SO4-S) by extraction with hydrochloric acid. Sulphides should not react and would normally be expelled. Sulfate as Sulfur is determined by ICP.
AN045	A portion of sample is digested with Nitric acid and Hydrogen Peroxide over time and then with Hydrochloric acid through several heating and cooling cycles. It provides a strong oxidising medium for bringing metal analytes into solution according to USEPA3050, after filtration the solution is presented for analysis on AAS or ICP .
AN045/AN320	Solid sample is digested with HNO3 and H2O2 and completed with addition of HCl based on USEPA Method 3050. Digest is then analysed by ICP-OES. Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference USEPA3050, USEPA6010C and APHA 3120 B.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:2 and the pH determined and reported on the extract after 1 hour extraction (pH 1:2) or after 1 hour extraction and overnight aging (pH (1:2) aged). Reference APHA 4500-H+.
AN106	Conductivity : Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract of as received sample with water is made at a ratio of 1:2 and the EC determined and reported on the extract basis after the 1 hour extraction (EC(1:2)) or after the 1 hour extraction and overnight aging (EC(1:2) aged). Reference APHA 2510 B.
AN106	Resistivity of the extract is reported on the extract basis and is the reciprocal of conductivity. Salinity and TDS can be calculated from the extract conductivity and is reported back to the soil basis.
AN212	Samples are initially evaluated to determine the strength of reagents needed using a `'fizz ' test. Samples are then subjected to an excess of hydrochloric acid followed by alkaline back titration to pH 7. Results are expressed in kg H2SO4/tonne or Kg CaCO3/tonne after correction for moisture content if applicable.
AN216	Pulverised sub-sample of a waste rock or an as received sample of filter cake, soil or sludge is subjected to an oxidising digest with 15% hydrogen peroxide adjusted to pH 4.5. The pH and EC of the NAG suspension is recorded at various stages in the digest. The acid produced (if any) is titrated using standardised NaOH to pH 7.0. NAG results are reported to 0.5 kg H2SO4/tonne.
AN217	Dried pulped sample is mixed with acid and chromium metal in a rapid distillation unit to produce hydrogen sulfide (H2S) which is collected and titrated with iodine (I2(aq)) to measure SCR.

METHOD	METHODOLOGY SUMMARY
AN220	Chromium Suite: Scheme for the calculation of net acidities and liming rates using a Fineness Factor of 1.5.
AN311(Perth) /AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500
AN318	Determination of elements at trace level in waters by ICP-MS technique, referenced to USEPA 6020B and USEPA 200.8 (5.4).
AN320	Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components .
AN320	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
***	Indicates that both * and ** apply.	NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

APPENDIX I JUNO LICENCE TO TAKE GROUNDWATER

NORTHERN TERRITORY OF AUSTRALIA
LICENCE TO TAKE GROUNDWATER
Pursuant to section 60 of the *Water Act 1992*

Licence No: L10012

Licence Holder:	Tennant Consolidated Mining Group Pty Ltd (ABN 72 645 263 547)		
Address:	PO Box 37 West Perth, WA, 6872		
Commencement Date:	1 February 2023		
Expiry Date:	31 January 2033		
Water Control District:	Tennant Creek		
Groundwater Resource:	Local Aquifer		
Management Zone:	Not Applicable		
Water Allocation Plan:	Not Applicable		
Bore(s):	Juno underground mine workings -19.7026865, 134.2403897 (GDA 94)		
Property(s) on which water is used:	NT Portion 3735 (935 Peko Rd, Warumungu)		
Beneficial Use(s) of Water Entitlement	**Maximum Water Entitlement ML/yr**	**Security Level**	**Licence Trading Allowed?**
Mining activity	339	Not Specified	N/A
Total Maximum Water Entitlement:	**339 ML/yr**		

Terms and Conditions

1 General Conditions

1.1 The licence holder can surrender or apply for modification of this licence at any time.

2 Water Extraction Conditions

2.1 The licence holder must extract no more than the stated Total Maximum Water Entitlement from the listed groundwater resource.

2.2 The licence holder must ensure that total extraction from the listed groundwater resource over the Periods specified below does not exceed the following Entitlements:

Period	Entitlement
1 February 2023 – 30 June 2023	141.25
1 July 2023 – 30 June 2024	339
1 July 2024 – 30 June 2025	339
1 July 2025 – 30 June 2026	339
1 July 2026 – 30 June 2027	339
1 July 2027 – 30 June 2028	339

1 July 2028– 30 June 2029	339
1 July 2029 – 30 June 2030	339
1 July 2030 – 30 June 2031	339
1 July 2031 – 30 June 2032	339
1 July 2032 – 31 January 2033	197.75

2.3 The Maximum Water Entitlement for each listed beneficial use must be used for no purpose other than that beneficial use without the prior written approval of the Controller.

2.4 The licence holder may only extract water under this licence from a bore listed on this licence.

2.5 The licence holder must maintain the bores used for extracting water under this licence in accordance with the National Uniform Drillers Licensing Committee 'Minimum Construction Requirement for Water Bores in Australia' as amended.

2.6 The licence holder may only use water extracted under this licence on a property listed on this licence.

2.7 Extraction under this licence must be recorded by a meter or meters supplied, installed and maintained by the licence holder in accordance with the Northern Territory Non-Urban Water Metering Code of Practice for Water Extraction Licences, as amended from time to time.

2.8 Within two (2) weeks following the end of each quarter, the licence holder must supply the Controller with a record of total extraction from each of the listed bore(s) during that month.

3 Special Conditions

3.1 The licence holder must have in place an authorised mining management plan, in accordance with the *Mining Management Act 2001*, throughout the term of the licence. If the mining authorisation is revoked the licence holder must notify the Controller within 7 days. The notification must be via email to water.regulation@nt.gov.au

3.2 The licence holder must notify the Department, via email to water.regulation@nt.gov.au, within 48 hours of becoming aware of non-compliance (or suspected non-compliance) with any condition of this licence. A notification under this condition must:

(a) contain the particulars of the non-compliance, including the identified or potential impacts associated with the non-compliance;

(b) identify steps that have or will be taken to minimise the impacts of the non-compliance; and

(c) identify the steps that have or will be taken to prevent the re-occurrence or minimise the risk of further non-compliance.

Joanne Townsend   Controller of Water Resources   19 January 2023

Definitions

"Act" means the *Water Act 1992* (NT).

"Controller" means the Controller of Water Resources.

"Department" means the Northern Territory Government department with the responsibility for administering the Water Act 1992

"Entitlement" means the amount(s) specified in Condition 2.2.

"Period" means a period of time specified in Condition 2.2.

"Quarter" means a period of 3 months ending on 30 June, 30 September, 31 December and 31 March during the Term (or part of such a quarter occurring at the beginning or end of the Term).

"Regulations" means the Water Regulations 1992 (NT).

APPENDIX J RISK ASSESSMENT

Theme	Environmental Factor/Value	Hazard/Aspect	Incident/event	Possible impact	L*	C*	IR*		Mitigation measures	L*	C*	RR*	
LAND	**Terrestrial Environmental Quality**	Erosion	Exposed soils	Soil erosion due to increased runoff from cleared areas.	**C**	**3**	**High Risk (13)**	**13**	Development and implementation of an Erosion and Sediment Control Plan (ESCP) This plan will be developed in accordance with the *International Erosion Control Association Australasia (2008) - Best Practice Erosion and Sediment Control (BPESC)* .	**B**	**3**	**Moderate Risk (9)**	**9**
LAND	**Terrestrial Environmental Quality**	Clearing vegetation / ground disturbance	Clearing vegetation for solar field	Reduction of vegetation type. Reduction of habitat availability for fauna.	**D**	**3**	**High Risk (17)**	**17**	Revegetation at end of project with local seed stock to restore vegetation cover and habitat value.	**D**	**2**	**Moderate Risk (12)**	**12**
LAND	**Terrestrial Environmental Quality**	Traffic	Fauna strike	Native fauna death or injury due to vehicle interaction	**C**	**2**	**Moderate Risk (8)**	**8**	Enforce speed limits on site access roads. Incident report to be completed for all fauna injuries or death. Little or no habitat on site	**B**	**2**	**Low Risk (5)**	**5**
LAND	**Terrestrial Environmental Quality**	Contaminated soil	Unexpected find of contaminated material	Contamination is spread from disturbance during activities	**C**	**3**	**High Risk (13)**	**13**	In the event that any unexpected material that has the potential of being a contaminant (e.g. dumped waste, stained soil, asbestos), is identified or uncovered during operations the following procedure will be implemented: •Stop work in the area where potential contaminated material is identified • Specialists will be engaged as necessary to advise and/or oversee the removal of the unexpected find. • The removal of the material will be conducted in accordance with relevant legislation (depending on what material is identified e.g. a licenced asbestos removal contractor) •If the material is identified as a listed waste, the waste will be removed and transported by a licenced waste contractor and disposed of at a licenced waste facility specific to the contaminated material. **If Asbestos is identified** - In the event that asbestos is found, an Asbestos Management Plan will be developed and implemented. Removal, transportation, disposal and remediation will be in accordance with the *Work Health and Safety (National Uniform Legislation) Regulations 2011, the Public and Environmental Health Act, the Waste Management and Pollution Control Act* and *Regulations 1998* , and other relevant guidelines/industry standards.	**B**	**3**	**Moderate Risk (9)**	**9**
LAND	**Terrestrial Environmental Quality**	Storage and handling of hazardous materials	Leaks and spills from fuel storage areas entering surface or groundwater	Contamination of soil from hazardous materials	**D**	**2**	**Moderate Risk (12)**	**12**	Storage and handling of hazardous materials will be developed as part of the site EMP. Fuel and flammable chemicals will be stored and handled in accordance with *AS 1940-2004* . Fit for purpose spill kits to be positioned at refuelling and storage areas. All personnel on site will be trained in use of spill kits, in the event of an spill.	**B**	**2**	**Low Risk (5)**	**5**
LAND	**Terrestrial Ecosystems**	Weeds	Weed introduction and spread	Reduced habitat quality on and off-site due to competition with native plant species	**E**	**3**	**High Risk (20)**	**20**	Weed mitigation measures will be incorporated in the sites EMP. Mitigation measures will include the following: o All machinery and equipment to be certified weed free by a suitably qualified person prior to arrival at site. o Control of declared weeds on-site as per the NT *Weeds Management Act*. o All weeds removed will be and disposed of appropriately to ensure no further spread of weeds. o Identification of any declared weed will be reported to the Weeds Branch in accordance with the NT *Weeds Management Act* .	**B**	**3**	**Moderate Risk (9)**	**9**
LAND	**Terrestrial Ecosystems**	Pests	Introduction of pest animals (i.e. fire ants) by machinery and equipment	Reduced habitat quality and competition with native species	**D**	**2**	**Moderate Risk (12)**	**12**	Visual inspection of machinery and equipment will be undertaken prior to arrival and departure from site.	**B**	**2**	**Low Risk (5)**	**5**
LAND	**Terrestrial Ecosystems**	Pests	Increase of pest species such as rats, cats and dogs at site during operations	Reduced habitat quality and competition with native species	**D**	**2**	**Moderate Risk (12)**	**12**	Putrescible waste will be correctly managed under the EMP and stored onsite in skip bins between each removal during construction and once the proposal area is used for residential purposes.	**B**	**2**	**Low Risk (5)**	**5**
LAND	**Terrestrial Ecosystems**	Noise	Noise emissions from machinery and equipment	Reduced habitat quality for fauna due to noise disturbance.	**B**	**2**	**Low Risk (5)**	**5**	No sensitive habitats in proximity to site (i.e. wetlands, roost sites), no mitigation required.	**B**	**2**	**Low Risk (5)**	**5**
LAND	**Terrestrial Ecosystems**	Dust	Dust emissions caused by operation of machinery and equipment	Reduced habitat quality due to smothering of plants	**B**	**2**	**Low Risk (5)**	**5**	No sensitive habitats in proximity to site (i.e. wetlands, roost sites), no mitigation required.	**B**	**2**	**Low Risk (5)**	**5**
LAND	**Terrestrial Ecosystems**	Bushfire	Uncontrolled bushfire caused by operation of equipment, lighting fires, discarded cigarette.	Change of vegetation community due to changes in fire frequency.	**C**	**3**	**High Risk (13)**	**13**	No fires allowed on site. Hot works such as welding not to be undertaken on days of total fire ban or high winds. Smokers appropriate disposal of cigarettes, vehicles maintained.	**B**	**3**	**Moderate Risk (9)**	**9**
LAND	**Terrestrial Environmental Quality**	Contaminated soil	AMD/NMD from ROM/Ore stockpiles	Stockpiles left in-situ leach contaminants to surrounding land/soils	**C**	**2**	**Moderate Risk (8)**	**8**	Ore stockpiled on ROM short-term Samples from the mineralised waste rock dump and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely. Possible elevated levels of metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) - these will be monitored for in the WQMP. On-going operational waste characterisation to confirm material characteristics.	**B**	**2**	**Low Risk (5)**	**5**
LAND	**Terrestrial Environmental Quality**	Contaminated soil	AMD/NMD from WRD	Contamination to surrounding environment	**C**	**2**	**Moderate Risk (8)**	**8**	The assessment of the waste rock samples of Nobles Nob indicated that the likelihood of acidic or saline drainage from these waste rocks is unlikely. However, there is a potential for metalliferous drainage enriched in aluminium and zinc from waste rocks from Nobles Nob. The samples from Rising Sun indicated that acidic or metalliferous drainage is unlikely, but there are higher chances of saline drainage from these samples.	**B**	**2**	**Low Risk (5)**	**5**
LAND	**Terrestrial Environmental Quality**	Contaminated soil	Failure of Dry Stack Landforms of Tailings	Contamination to surrounding environment	**B**	**3**	**Moderate Risk (9)**	**9**	TCMG are going with dry stacking option. Dry Stacking is a tailings management technique that offers several advantages over traditional tailings dams. The risk is negligible, as dry stacks of tailings will be a non-flowable landform with negligible risk of liquefaction. Stacking will be done as per engineering design to maintain stability.	**A**	**3**	**Low Risk (6)**	**6**
WATER	**Hydrological processes**	Hydrology	Extraction of groundwater	Decreased quantity of groundwater in underlying aquifer system	**B**	**2**	**Low Risk (5)**	**5**	Groundwater is proposed to be used if necessary, however, the Project will rely heavily on recycling of the in-process water stream.	**B**	**2**	**Low Risk (5)**	**5**
WATER	**Hydrological processes**	Hydrology	Extraction of surface water	Decreased quantity of surface water in nearby surface water systems	**B**	**2**	**Low Risk (5)**	**5**	There is no intended use of any surface water for any Project activities.	**B**	**2**	**Low Risk (5)**	**5**
WATER	**Inland Water Environmental Quality**	Storage and handling of hazardous materials	Leaks and spills from fuel storage areas entering surface or groundwater	Hydrocarbon contamination of downstream surface waterways or groundwater.	**B**	**3**	**Moderate Risk (9)**	**9**	Storage and use of fuel will be included in the site specific EMP. Fuel storage and handling in designated areas and accordance with AS1940 and WHS Regulations Fit for purpose spill kits located on site in re fuelling areas and areas where hazardous substances are stored. All workers to be trained in use of spill kits.	**A**	**2**	**Low Risk (3)**	**3**
WATER	**Inland Water Environmental Quality**	Erosion	Erosion of site due to disturbance and exposure of ground surface.	Increased turbidity and sediment loads in ephemeral watercourses	**B**	**3**	**Moderate Risk (9)**	**9**	Development and implementation of an Erosion and Sediment Control Plan (ESCP) This plan will be developed in accordance with the *International Erosion Control Association Australasia (2008) - Best Practice Erosion and Sediment Control (BPESC)* .	**A**	**3**	**Low Risk (6)**	**6**
WATER	**Aquatic ecosystems**	Contaminated water (surface and groundwater)	Increased nutrients in surface water and groundwater from sedimentation discharge from site	Decrease in aquatic ecosystems health downstream of site	**B**	**3**	**Moderate Risk (9)**	**9**	Development and implementation of an Erosion and Sediment Control Plan (ESCP) This plan will be developed in accordance with the *International Erosion Control Association Australasia (2008) - Best Practice Erosion and Sediment Control (BPESC)* .	**A**	**3**	**Low Risk (6)**	**6**
WATER	**Inland water environmental quality**	Contaminated water (surface and groundwater)	Leaks from septic system/wastewater treatment system into groundwater or surface water	Bacterial contamination of groundwater or surface water affects environmental values and/or other users	**B**	**2**	**Low Risk (5)**	**5**	Spill response procedures in EMP Waste water system to be installed and maintained as per manufacturers specifications. On-site waste water system will be installed by a licensed plumber in accordance with NT Code of Practice for onsite wastewater management. Approval for wastewater treatment system under the Building Act prior to installation	**B**	**2**	**Low Risk (5)**	**5**
WATER	**Inland water environmental quality**	Contaminated water (surface and groundwater)	AMD/NMD from ROM/Ore stockpiles	Stockpiles left in-situ leach contaminants to surrounding environment	**C**	**2**	**Moderate Risk (8)**	**8**	Ore stockpiled on ROM short-term Samples from the mineralised waste rock dump and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely. Possible elevated levels of metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) - these will be monitored for in the WQMP. On-going operational waste characterisation to confirm material characteristics.	**B**	**2**	**Low Risk (5)**	**5**
WATER	**Inland water environmental quality**	Contaminated water (surface and groundwater)	AMD/NMD from WRD	Contamination to surrounding environment	**C**	**2**	**Moderate Risk (8)**	**8**	The assessment of the waste rock samples of Nobles Nob indicated that the likelihood of acidic or saline drainage from these waste rocks is unlikely. However, there is a potential for metalliferous drainage enriched in aluminium and zinc from waste rocks from Nobles Nob. The samples from Rising Sun indicated that acidic or metalliferous drainage is unlikely, but there are higher chances of saline drainage from these samples.	**B**	**2**	**Low Risk (5)**	**5**
WATER	**Inland water environmental quality**	Contaminated water (surface and groundwater)	AMD/NMD from WRD	Contamination to surrounding environment	**C**	**2**	**Moderate Risk (8)**	**8**	Samples from the mineralised waste rock dump and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely. Possible elevated levels of metals and metalloids - Molybdenum (Mo), Mercury (Hg), aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) - these will be monitored for in the WQMP. On-going operational waste characterisation to confirm material characteristics.	**B**	**2**	**Low Risk (5)**	**5**
WATER	**Inland water environmental quality**	Contaminated water (surface and groundwater)	Failure of Dry Stack Landforms of Tailings	Contamination to surrounding environment	**B**	**3**	**Moderate Risk (9)**	**9**	TCMG is going with dry stacking option. Dry Stacking is a tailings management technique that offers several advantages over traditional tailings dams. The risk is negligible, as dry stacks of tailings will be a non-flowable landform with negligible risk of liquefaction. Stacking will be done as per engineering design to maintain stability.	**A**	**3**	**Low Risk (6)**	**6**
AIR	**Air Quality**	Dust	Dust emissions from cleared/disturbed ground and movement of vehicles and material	Increase in air particulates exceeding guidelines values for environmental values	**C**	**2**	**Moderate Risk (8)**	**8**	Dust levels will be visually monitored on site during operations, if dust becomes an issue, water carts will be used to wet down the areas of concern.	**B**	**2**	**Low Risk (5)**	**5**
AIR	**Air Quality**	Bushfire	Smoke emissions from uncontrolled bushfire caused from operation of equipment, lighting fires or discarding cigarette	Increase in air particulates exceeding guidelines values for environmental values (Potential implications include - suffocation of sensitive vegetation - increased fire potential)	**C**	**2**	**Moderate Risk (8)**	**8**	The bushfires will be managed in accordance with the *Bushfires Management Act 2016* and will be incorporated into the EMP. The EMP will include: No fires allowed on site. Hot works such as welding not to be undertaken on days of total fire ban or high winds. Smokers appropriate disposal of cigarettes, vehicles maintained. Cleared material will not be burnt on site, it will be mulched and use for erosion control or removed from site. Water cart on standby during periods of high fire danger.	**B**	**2**	**Low Risk (5)**	**5**
AIR	**Atmospheric processes**	Greenhouse Gas emissions	GHG emissions from use of diesel powered vehicles and generators	Increase in GHG	**B**	**2**	**Low Risk (5)**	**5**	Greenhouse gas emission from that activity will be on par with any small, short-term construction project. Vehicles and machinery will be kept in good running order i.e. not producing plumes of black smoke and not operating efficently.	**B**	**2**	**Low Risk (5)**	**5**
PEOPLE	**Communities and economy**	Noise	Noise emissions	Noise nuisance to surrounding land users	**C**	**2**	**Moderate Risk (8)**	**8**	Machinery maintained to manufacturers specifications . All vehicles and machinery will be fitted with noise attenuating reverse alarms. Noise complaint register to be established pre-construction. Records of noise complaints to be kept and investigation actions undertaken after a complaint is made.	**B**	**2**	**Low Risk (5)**	**5**
PEOPLE	**Communities and economy**	Dust	Dust emissions result in exceedance of air quality (particulates) guidelines	Dust nuisance on people accessing areas around proposal area.	**D**	**2**	**Moderate Risk (12)**	**12**	Dust will be managed through the Site EMP. Mitigaiton measures include: Dust suppression using water carts where necessary. Stockpiles will be covered and kept to heights <3m. Maintain a complaints register. A Erosion and Sediment Control Plan (ESCP) will be developed in accordance with the International Erosion Control Association Australasia (2008) - *Best Practice Erosion and Sediment Control (BPESC).*	**B**	**2**	**Low Risk (5)**	**5**
PEOPLE	**Culture and Heritage**	Clearing vegetation / ground disturbance	Disturbance of ground	Damage, desecration or destruction of Aboriginal sacred sites	**C**	**3**	**High Risk (13)**	**13**	A stop works will be implemented if artefacts are located during activities on site. The **PM** will be notified immediately, who will then liaise with the NT Heritage Branch, for further instructions.	**A**	**3**	**Low Risk (6)**	**6**
PEOPLE	**Culture and Heritage**	Clearing vegetation / ground disturbance	Clearing of vegetation for solar field	Damage, desecration or destruction of Aboriginal sacred sites	**C**	**3**	**High Risk (13)**	**13**	A stop works will be implemented if artefacts are located during activities on site. The **PM** will be notified immediately, who will then liaise with the NT Heritage Branch, for further instructions.	**A**	**3**	**Low Risk (6)**	**6**

Qualitative measures of likelihood categories		
A	Rare	Highly unlikely, will only occur in exceptional circumstances. Has never occurred in association with an development in the region.
B	Unlikely	Could occur at some time but unlikely. Has only occasionally occurred in association with an development in the region.
C	Moderate	Might occur at some time. Has previously occurred in similar developments.
D	Likely	Known to occur or will probably occur. Has occurred several times in association with recent developments.
E	Almost certain	Common or repeating occurrence. Is expected to occur several times over the duration of an development in the region.

Consequence categories		
1	Insignificant	No measurable impact on the environment or social values
2	Minor	Some, minor, temporary environmental and/or social impact
3	Moderate	Contained temporary, or permanent minor, localised environmental damage or social impact
4	Major	Severe environmental and/or social impacts
5	Catastrophic	Environmental disaster

Risk Matrix

Likelihood	Consequence: 1	2	3	4	5
A	1	3	6	10	15
B	2	5	9	14	19
C	4	8	13	18	22
D	7	12	17	21	24
E	11	16	20	23	25

Red	Extreme risk	Intolerable
Orange	High risk	Intolerable or tolerable
Yellow	Moderate risk	Tolerable or acceptable
Green	Low risk	Acceptable

Risk Assessment Criteria & Descriptions

Consequence	Score		Terrestrial Flora and Fauna	Terrestrial Environmental Quality	Inland Water Environmental Quality	Hydrological processes	Social, Economic and Cultural Surrounds	Community Health and Safety
Severe **Permanent =** Impact is felt during operations and indefinitely post-closure **Regional =** Impact occurs over a large area beyond the proposal area **Irreversible**	**5**		Impacts to terrestrial flora and fauna that permanently alter biodiversity and/or ecological integrity over a large area beyond the proposal area.	Soil disturbance, erosion or contamination that is irreversible and extends over a larger area beyond the proposal area.	Permanent major exceedance of pre-development water quality criteria and/or criteria for ecosystem protection and/or criteria for beneficial uses downstream of the proposal area.	Significant reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges leading to permanent irreversible impact to ecological health, land-uses and/or amenity downstream of the proposal area.	Irreversible detrimental impact to stakeholder and/or community values. Long-term disruption to way of life that is felt by the majority of the regional population. Unauthorised destruction of Aboriginal Sacred Site and/or sites of heritage signficance. Damage is irreversible.	One or more fatalities. More than 1 people injured with permanent disbilities.
Major **Long-term** = Impact that is felt during construction and for some years post-construction **Regional** = Impact occurs over a larger area than the proposal area **Reversible** in the medium-long term with significant remedial works	**4**		Impacts to terrestrial flora and fauna that lead to long-term alteration of biodiversity and/or ecological integrity and/or extend over a large area beyond the proposal area.	Soil disturbance, erosion or contamination that occurs over a long period of time and/or extends over a larger area than the proposal area. Significant remedial works required to reverse damage.	Long-term and/or major exceedance of pre-development water quality criteria and/or criteria for ecosystem protection and/or criteria for beneficial uses downstream of the proposal area. Significant remedial works required over an extended period to return to acceptable water quality.	Reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges leading to long-term impact to ecological health, land-uses and/or amenity downstream of the proposal area. Significant remedial works required over an extended period to re-instate hydrological regimes.	Long-term detrimental impact to stakeholder and/or community values. Long-term disruption to way of life that is felt by some of the regional population. Unauthorised damage to Aboriginal Sacred Sites and/or sites of heritage signficance that can be remediated.	No fatalities. One injury with permanent disability. More than 10 injuries requiring hospitalisation.
Moderate **Medium to long-term =** Impact that is felt during operations and for some months to years post-closure **Localised =** Impact occurs within the disturbance footprint or immediate surrounds within the proposal area or in the ephemeral watercourse downstream of dams **Reversible** with a moderate level of remedial works	**3**		Medium-long term impacts to flora and fauna that are confined to the disturbance footprint and immediate surrounds with no measurable impact to biodiversity and/or ecological integrity	Localised soil disturbance, erosion or contamination that continues for months to years post-closure. Damage is reversible with a moderate level of remedial works.	On-going minor exceedances of pre-development water quality criteria and/or criteria for ecosystem protection and/or criteria for beneficial uses. Exceedances will cease within months to a few years following site rehabilitation works.	Medium to long-term reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges that impacts ecological health, land-uses and/or amenity within the disturbance footprint and immediate surrounds.	Medium to long-term detrimental impact to stakeholder and/or community value. Medium-long term disruption to way of life that is felt by a small number of people. Unauthorised damage to Aboriginal Sacred Sites and/or sites of heritage signficance that can be remediated.	No fatalities. No permanent disability. 5-10 injuries requiring hospitalisation.
Minor **Short-term** = Impact that is felt during the construction phase only **Localised** = Impact occurs within the proposal area. **Reversible** without significant remedial works	**2**		Short-term impact to flora and fauna with no measurable impact to biodiversity and/or ecological integrity outside of the disturbance footprint.	Short-term and/or localised soil disturbance, erosion or contamination that is reversible without significant remedial works.	Minor temporary exceedances of pre-development water quality criteria and/or criteria for ecosystem protection and/or criteria for beneficial uses. Exceedances will cease following mine closure without significant remedial works.	Short-term reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges that impacts ecological health, land-uses and/or amenity only within the disturbance footprint and immediate surrounds. Natural hydrological regimes will return in a short period of time post-closure without significant remedial works.	Short-term detrimental impact to stakeholder and/or community values. Short-term disruption/ nuisance that is felt by a small number of people. Minor damage to Aboriginal Sacred Sites and/or heritage sites that does not require remedial works.	No fatalities. No permanent disability. Less than 5 injuries requiring hospitalisation.
Insignificant No measurable impact outside of the immediate proposal area.	**1**		No measureable impact to terrestrial flora and fauna outside of the immediate disturbance footprint.	No measurable soil disturbance, erosion or contamination outside of the immediate disturbance footprint.	No measurable exceedance of pre-development water quality conditions attributable to project activities.	No measurable change to hydrological regimes outside of the immediate disturbance footprint.	No noticeable impact to stakeholder and/or community values. No impact to Aboriginal Sacred Sites and/or heritage sites.	No fatalities. No permanent disability. No injuries requiring hospitalisation.

Theme	NT EPA Factors	Indicative environmental values and sensitivities
Land	Landforms	Distinctive features in the landscape, either geological or anthropogenic Subterranean karstic terrain and faults Craters, gorges, ranges, saves, massifs, escarpments, plateaus Monuments Culturally important features Tourism related landforms
	Terrestrial Environmental Quality	Characteristics of soils, including chemical, physical, biological and aesthetic qualities
	Terrestrial Ecosystems	Sensitive or significant' vegetation Vegetation that provides an important ecological function Listed threatened species and their habitat (NT and Commonwealth) Listed migratory species and their habitat (Commonwealth) Locally endemic species or species with restricted habitat 'iconic' or culturally important animals, plants and vegetation
Water	Hydrological processes	The supply and quantity of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines. The supply and quality of water in groundwater features including aquifers, aquitards and water tables declared beneficial uses present and future uses and users of water current or potential water supplies, including regional scale aquifers culturally important water features
	Inland water environmental quality	The quality of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines. The quality of water in groundwater features including aquifers and water tables declared beneficial uses present and future uses and users of water current or potential water supplies, including regional scale aquifers culturally important water features RAMSAR wetlands
	Aquatic ecosystems	The health of the biota in inland waterways the habitats that support the lifecycle of aquatic biota Groundwater dependent ecosystems
Sea	Coastal processes	Processes that support coastal benthic communities and habitats such as coral reefs, mangroves, salt marshes, seagrass meadows and sponge gardens. Conservation significant low lying areas including tidal creeks, deltas and river mouths Unique coastal landforms Significant cultural and aesthetic values Active or passive recreation
	Marine environmental quality	Quality of the water, sediment and biota Ecosystem health condition Fishing and aquaculture Recreation and aesthetics Industrial water supply Cultural and spiritual value
	Marine ecosystems	Conservation significant marine and coastal fauna and critical habitat such as nesting, breeding or foraging habitat Conservation significant marine and coastal flora and vegetation Groups of species (species richness and assemblages of species) Ecological functions and processes Species of social, cultural and/or economic significance. Integrity of marine ecosystems and the ecological services they supply Biological diversity Functional diversity Provision of refuge Food supply
Air	Air Quality	The chemical, physical and biological characteristics of air The biological processes that depend on the air quality
	Atmospheric Processes	A contribution to the NT's greenhouse gas emissions Adaptation to a changing climate
People	Society and economy	Communities, towns, private properties and dwellings where people reside Aesthetics and recreation Resources including water supply and food sources Jobs and businesses Agriculture, fisheries and industry
	Culture and heritage	Bush foods Totemic flora and fauna Important or significant country
	Human health	Drinking water Recreational water Air quality Bush tucker Radiological limits

	Hazard/Aspect
1	Clearing vegetation / ground disturbance
2	Erosion
3	Weeds
4	Pests
5	Noise
6	Dust
7	Greenhouse Gas emissions
8	Bushfire
9	Contaminated soil
10	Traffic
11	Contaminated water (surface and groundwater)
12	Biting insects
13	Power and water supply
14	Storage and handling of hazardous materials
15	Waste
16	Visual
17	Dredging
18	Hydrology

APPENDIX K WASTE ROCK CHARACTERISATION NOBLES NOB MINE

Environmental & Social Consultants

WASTE ROCK CHARACTERISATION

Nobles Nob Mine

FINAL

October 2021

WASTE ROCK CHARACTERISATION

Nobles Nob Mine

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tennant Mining Consolidated Group

Project Director:	Claire Stephenson
Project Manager:	Ashish Mishra
Report No.	21728/R01
Date:	October 2021

umwelt
Environmental & Social Consultants

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Claire Stephenson	28/10/2021	Claire Stephenson	28/10/2021

Executive Summary

Umwelt Australia Pty Ltd (Umwelt) was engaged by Tennant Mining Consolidated Group (TCMG) to characterise the samples from the historical southern waste rock dump of the Nobles Nob Project in the Northern Territory, Australia. TCMG collected a total of 25 composite samples from drill holes drilled on the southern waste rock dump and one within the historical ROM pad. These samples were sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis. The results were assessed to observe the potential of acidic, metalliferous, or saline drainage from these samples.

***Potential of Acidic* Drainage**

The results suggest that the aged pH of the samples ranged from a 5.9 to 8.6 pH unit, with the mean aged pH being 7, whereas the median aged pH being 6.9. Only one sample out of the total 26 samples recorded aged pH <6 pH units. The classification of the samples suggests that all 25 samples from the mineralised waste rock dump and one ROM pad sample are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely.

Potential of Metalliferous Drainage

The geochemical abundance index (GAI) assessment of the 25 samples collected from the southern waste rock dump and one sample from the ROM pad at Nobles Nob suggest that the samples are significantly enriched (GAI >= 3) with the following metals:

- Molybdenum (Mo) – 5 out of 26 samples recorded GAI value equal to or greater than 3.
- Mercury (Hg) – only the sample from the ROM pad recorded GAI value equal to 3.

The Australian Standard Leachate Procedure (ASLP) tests for all 26 samples from the southern waste rock dump at Nobles Nob are summarised, and the 80th percentile value was compared with the ANZG (2018) DGV for 90% species protection. The results indicate that leachate from the samples recorded 80th percentile concentration of aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) higher than the ANZG (2018) DGVs for 90% species protection. Out of these elements, none were found to be in significant abundance (i.e., GAI >=3) in the samples in GAI assessment.

The combined assessment of GAI and ASLP results suggests a potential of metalliferous drainage from a few samples enriched in aluminium, zinc, and mercury (possibility of mercury enriched drainage is only from 1 sample 143512). It is recommended that drainage from these samples be restrained, and the receiving environment should be monitored for these analytes.

***Potential of Saline* Drainage**

Electrical conductivity (EC) has been used as a proxy for salinity in this assessment. All 26 samples underwent aged EC (1:2) and ASLP EC measurement. The average aged EC recorded by the samples is 313.8 µS/cm, whereas the average ASLP EC is 55.1 µS/cm. Most samples (~73%) recorded aged EC between 150 and 450 µS/cm, whereas 100% samples recorded ASLP EC below 150 µS/cm. None of the samples recorded aged EC or ASLP EC higher than 900 µS/cm, indicating that the potential of saline drainage from these samples is less likely.

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1.0 Introduction

The Nobles Nob Mine is located within the Tennant Creek Goldfield, approximately 10 km southeast of Tennant Creek. Tennant Creek is approximately 500 km north of Alice Springs and 978 km south of Darwin.

Nobles Nob Mine ranked amongst Australia's richest gold mine, yielding almost 1.1 million ounces (34 tonnes) of gold during its 45 years of operation. Gold mining at Nobles Nob commenced in 1934 when the first shaft was sunk to the depth of 50 feet (~15 meters). In 1968, following the collapse of the crown pillar, the mine was modified into an open pit with a new mill on site. Production at Nobles Nob continued until September 1992 when it was put into care and maintenance. The mine is now owned by Tennant Consolidated Mining Group (TCMG). TCMG are conducting field studies to support a mine management plan (MMP) to re-commence operations at the site. This included collection of 25 samples by TCMG from reverse circulation (RC) drill holes drilled on the southern waste rock dump at Nobles Nob and one sample from the historical Run-of-Mine (ROM) pad (refer **Figure 1.1)**. The samples were submitted to National Association of Testing Authorities (NATA) accredited laboratory SGS for analysis. It is understood from the information provided by TCMG, that materials from the historical waste rock dump and historical ROM pad will be processed at the proposed processing facilities at Nobles Nob.

Umwelt Australia Pty Ltd (Umwelt) was engaged by TCMG to review the laboratory results from the waste rock samples and assess the potential of acidic, metalliferous, or saline drainage from the samples. This report presents the findings from the geochemical assessment.

1.1 Geology

The Nobles Nob area is located within the Proterozoic Tennant Creek Inlier, which comprises a turbiditic flysch sedimentary sequence abutting various volcanic rocks. In the Tennant Creek region, these rocks are typified by the Warramunga Group, which commonly strikes east-west with variable dip. These rocks have been intruded by various granites and deformed by the Tennant Event of 1850 Ma.

The Nobles Nob ore body lies within the Warramunga Group, comprising sediments, volcanic lavas and volcaniclastic sediments. Gold-copper-bismuth mineralisation in the area has been found to be hosted by fine-grained haematitic mudstones and shaley siltstones. The mineralisation at Tennant Creek is generally small but of high grade and is hosted by fine-grained haematitic mudstones and shaley siltstones (Excalibur 2012). The mineralisation occurs within lenticular, ellipsoidal or pipelike bodies rich in magnetite and/or hematite. These are replacement bodies that cut across sedimentary structures and have been referred to as "ironstones" by previous workers on site. These zones of rich gold mineralisation are characterised by strong magnetite alteration below the base of oxidation. Above the base of oxidation, the magnetite is chemically weathered to haematite. Gold is generally very fine-grained in fresh deposits but very coarse and nuggety in the oxidised deposits (Excalibur 2012).

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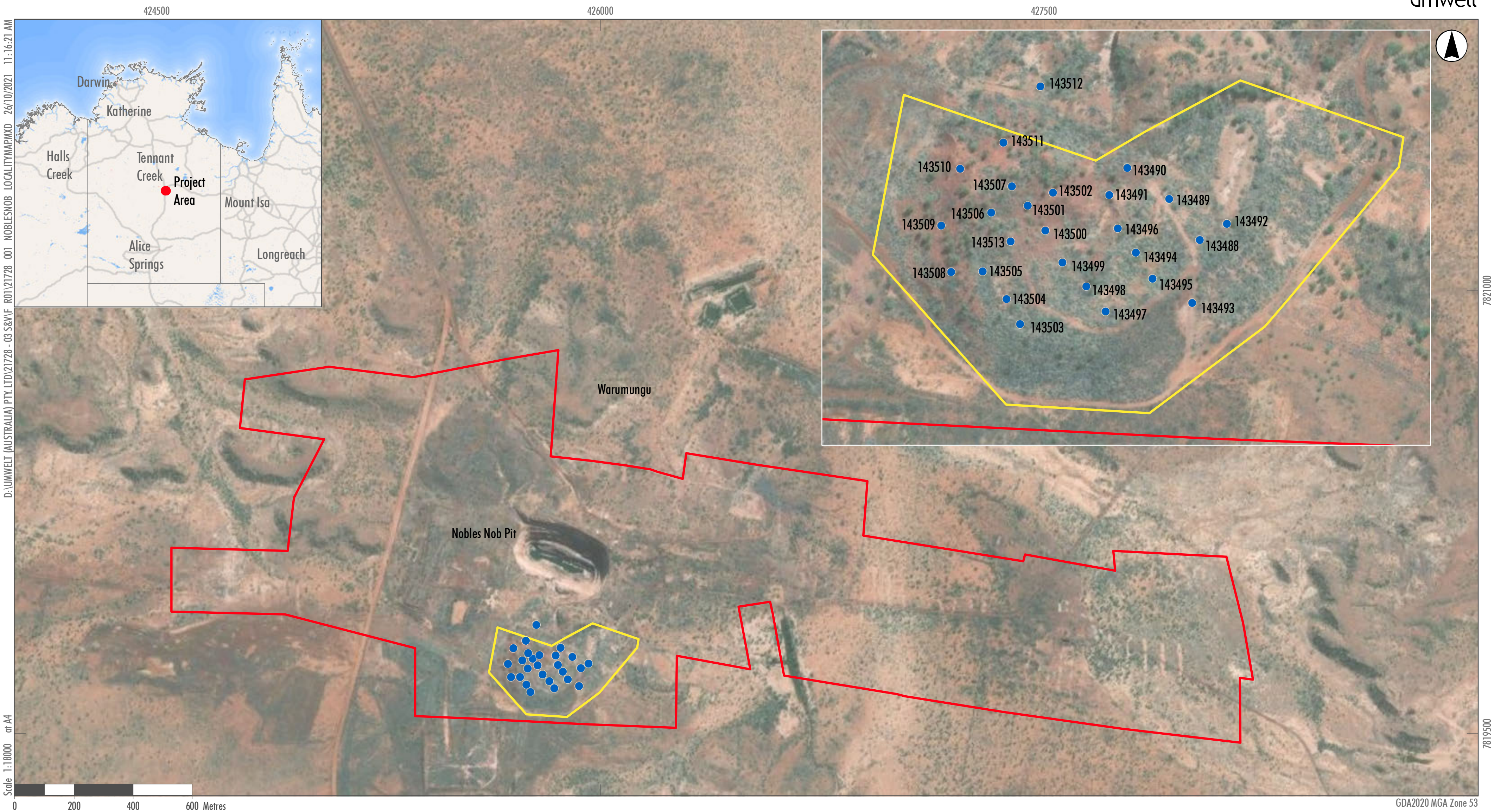

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Scale 1:18000 at A4

Legend

- Extent of Mine
- Historical Mineralised Waste Rock Dump
- Sample Locations

FIGURE 1.1

Site Layout and Sample Locations

Image Source: ESRI Basemap (2021) Data source: Umwelt 2021

1.2 Climate

The area is characterised by a hot arid climate, with evapotranspiration exceeding rainfall throughout the year. The mean monthly temperature data was retrieved from the nearest Bureau of Meteorology (BoM) weather station Tennant Creek Airport (Station number 15135), presented in **Table 1.1**. Mean monthly maximum temperature ranges from 24.6°C during the winter (June) to 37.2°C in the summer (December). The maximum temperature recorded at this station was 45.6°C in January 2014, and the minimum of 8°C was in June 2007 (BoM, 2021).

Table 1.1 Mean Monthly Temperature in Degree Celsius from 1969 to 2021

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature	36.8	35.9	34.6	31.9	27.7	24.6	24.8	27.6	31.8	35	36.7	37.2
Mean minimum temperature	25	24.5	23.4	20.5	16.4	13	12.4	14.4	18.5	21.8	23.9	24.9

All Values are in degree Celsius. Mean has been calculated using monthly data from 1969 to 2021

Rainfall data has been retrieved from the publicly available Scientific Information for Landowners (SILO) database. The monthly average rainfall and evapotranspiration data has been retrieved from the nearest SILO station Tennant Creek Airport (Latitude -19.64, Longitude 134.18), from 01/01/1900 to 01/10/2021.

The SILO database generally provides a complete long-term dataset and is, therefore, helpful in assessing long term rainfall trends in the vicinity of the site. This dataset is interpolated from quality checked observational time-series data collected at nearby stations by the Bureau of Meteorology. Based on the SILO dataset, the average annual rainfall is 383 mm, which shows a rainfall deficit with evapotransiration (fao56) of 2137 mm/year (**Table 1.2** and **Figure 1.2**).

Table 1.2 Monthly Average of Rainfall and Evapotranspiration at Tennant Creek Airport

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SILO Rainfall	96.74	91.08	50.18	11.81	10.36	6.56	5.03	2.00	5.36	14.95	30.23	58.14	382.45
SILO ET	350.17	291.84	321.21	287.54	232.83	186.81	198.92	250.05	307.12	358.69	371.79	371.63	3528.60
SILO fao56 ET	213.65	182.77	191.34	167.69	138.37	115.27	126.32	156.08	185.14	215.50	220.75	224.11	2136.98

Note: ET – Evapotranspiration. All values are in mm.

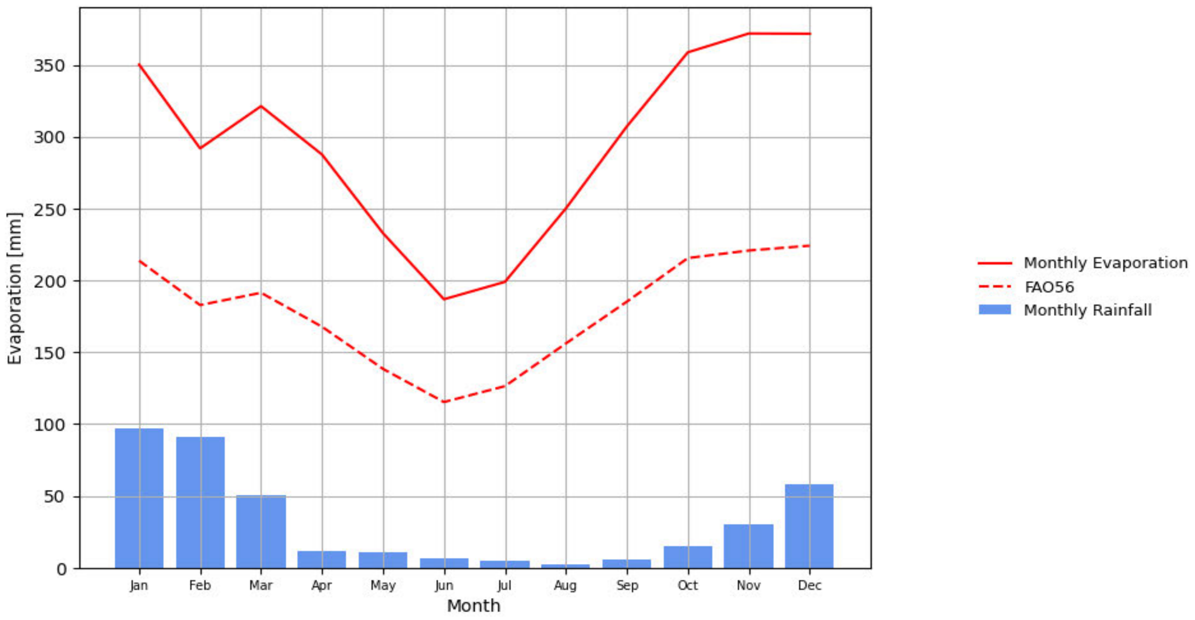

Figure 1.2 Graph showing Monthly Average Rainfall and Evaporation

The SILO dataset was used to calculate the cumulative rainfall deviation (CRD). The CRD is a summation of the monthly departure of rainfall from the long-term average monthly rainfall and provides a historical record of relatively wet and dry periods. A rising trend in slope in the CRD plot indicates periods of above-average rainfall, whilst a declining slope indicates periods when rainfall is below average.

The CRD in **Figure 1.3** indicates that the area has experienced a period of above-average rainfall from around 2000 to 2016, and below-average rainfall since 2016. Due to the importance of large, episodic rainfall events for groundwater recharge, and in order to address temporal data gaps in the record, rainfall station data from across the area were combined. The figure also shows that there is strong seasonality in rainfall, with majority of rainfall occurring over the wet season, between November and March.

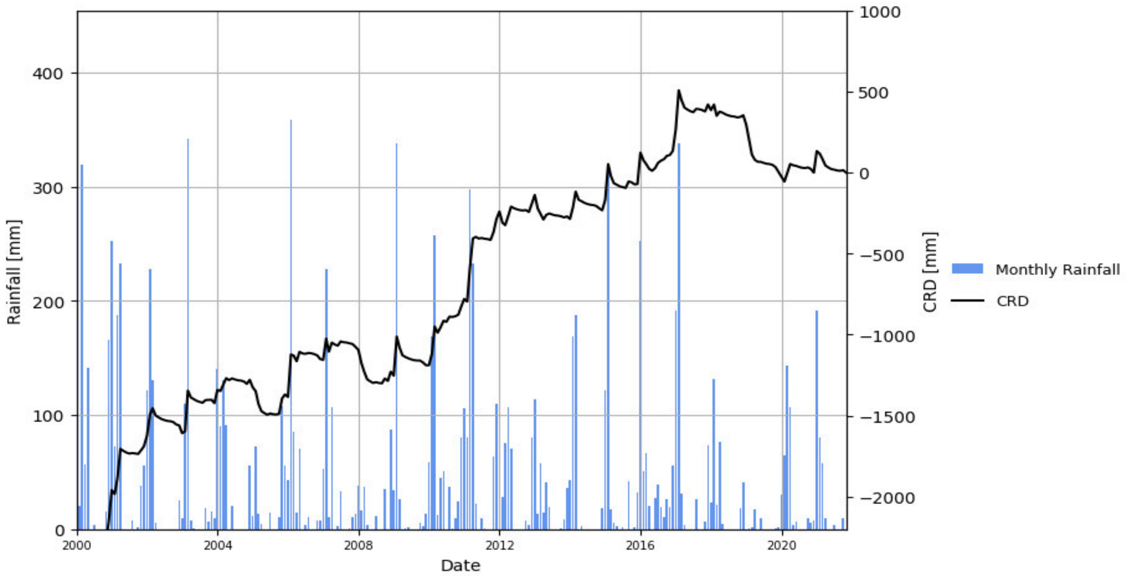

Figure 1.3 Monthly Rainfall and CRD (2000-2021)

2.0 Methodology

2.1 Sample Selection

A total of 25 composite samples were collected by TCMG from the reverse circulation (RC) drill holes drilled on the southern waste rock dump. Plus, one sample (143512) collected from the historical ROM pad.

Composite samples were collected by combining drill chips from various depth interval. The details of the samples including drill holes collected from, and the depth interval that were combined to form a composite sample is presented in **Table 2.1**. The sample locations are shown in **Figure 1.1.**

Table 2.1 Details and Locations of the Samples

Hole ID	Easting	Northing	Collar RL	Dip(◦)	Depth From (m)	Depth To (m)	Sample ID
TNNDU002	425935.43	7819721.5	375.73	-90	0	16	143488
TNNDU003	425890.25	7819684.7	374.13	-90	0	9	143495
TNNDU004	425845.46	7819653.3	373.36	-90	0	9	143497
TNNDU006	425874.54	7819709.5	371.77	-90	0	13	143494
TNNDU007	425827.35	7819677.2	371.68	-90	0	7	143498
TNNDU009	425906.34	7819760.6	373.15	-90	0	9	143489
TNNDU010	425857.27	7819732.8	370.97	-90	0	13	143496
TNNDU011	425804.55	7819700.3	370.77	-90	0	12	143499
TNNDU013	425866.06	7819790.2	370.01	-90	0	11	143490
TNNDU014	425849.03	7819764.5	369.72	-90	0	14	143491
TNNDU015	425788	7819730.7	371.31	-90	0	11	143500
TNNDU016	425771.48	7819754.3	374.93	-90	0	17	143501
TNNDU017	425756.13	7819772.6	376.72	-90	0	17	143507
TNNDU018	425764.11	7819641.4	374.54	-90	0	11	143503
TNNDU019	425751.04	7819665.4	374.91	-90	0	12	143504
TNNDU020	425728.42	7819691.3	375.6	-90	0	15	143505
TNNDU021	425736.5	7819747.6	376.54	-90	0	13	143506
TNNDU023	425795.18	7819766.7	374.54	-90	0	18	143502
TNNDU024	425755.16	7819720.2	374.8	-90	0	14	143513
TNNDU031	425783.31	7819868.2	363.35	-90	0	7	143512*
TNNDU036	425748.18	7819814.3	370.25	-90	0	13	143511
TNNDU041	425706.84	7819789.4	369.67	-90	0	15	143510
TNNDU042	425688.63	7819735.4	368.74	-90	0	11	143509
TNNDU043	425698.41	7819690.9	371.28	-90	0	10	143508
TNNDU044	425961.06	7819736.9	372.57	-90	0	13	143492
TNNDU045	425928.3	7819661.3	372.38	-90	0	14	143493

Coordinates are in GDA 2020. Collar RL is in mAHD.
*Sample 143512 from hole ID TNNDU031 is located on the historical ROM pad.

2.2 Laboratory Assessment

TCM sent the samples for analysis to SGS, which is a NATA accredited laboratory. Sub-sample preparation at the laboratory involved crushing, splitting and pulverising rock chip samples. All 26 samples were subjected to initial acid-base account (ABA) geochemical testing.

The characteristics that were assessed included:

- Aged pH (1:2) and Aged Electrical Conductivity (1:2) - The aged pH and aged electrical conductivity (EC) is the measured pH and EC of a mixture of sample and water at a ratio of 1:2, after leaving it overnight (~>16 hours).
- Total sulfur (wt%)
- Australian standard leaching procedure (ASLP)
- Acid neutralising capacity (ANC)
- Net acid producing potential (NAPP)
- Net acid generation (NAG)

In addition, a full metal suite analysed by inductively coupled plasma optical emission spectroscopy methods (ICP-OES) was conducted for the following metals:

- Arsenic (As)
- Aluminium (Al)
- Barium (Ba)
- Cadmium (Cd)
- Cobalt (Co)
- Chromium (Cr)
- Copper (Cu)
- Iron (Fe)
- Manganese (Mn)
- Mercury (Hg)
- Molybdenum (Mo)
- Nickel (Ni)
- Lead (Pb)
- Zinc (Zn)

2.3 Acidic Drainage Potential

In order to assess the acidic drainage potential of the samples, the combination of net acid production potential (NAPP) and net acid generation (NAG) classification scheme is commonly used in Australia, as per the AMIRA (2002) guideline. AMIRA (2002) is a guideline that outlines various tests and assessment methods to characterise acid forming potential of materials.

The NAPP is the difference between maximum potential acidity (MPA) and acid neutralising capacity (ANC) and represents the net acid producing capacity of the sample. In the NAG test, a sample is treated with hydrogen peroxide to rapidly oxidise any sulfide minerals contained within a sample (AMIRA, 2002). The result represents the net amount of acid generated by the sample, and is commonly referred to as the NAG capacity and is expressed in kg H_2SO_4/t.

NAG and NAPP help in classification of waste rocks into following categories (AMIRA, 2002):

- Non-acid Forming (NAF): suggests that the material cannot generate acid.
- Potentially acid forming (PAF): suggests that the material can potentially generate acid.
- Uncertain (UC): the test is not certain about the material's potential to generate acid.

2.4 Metalliferous Drainage Potential

Metal concentrations in the samples were analysed by inductively coupled plasma optical emission spectroscopy methods (ICP-OES). These results are important to characterise the overall metal concentrations in the samples and to identify enriched metals that can pose a risk of possible metalliferous drainage. Test of enrichment was undertaken using the geochemical abundance index (GAI).

2.4.1 Geochemical Abundance Index (GAI)

The geochemical abundance index (GAI) can be used to estimate the enrichment of metals in the samples relative to median crustal concentrations. The GAI is expressed on a log 2 scale. The GAI was developed by Förstner et al., (1993) and is defined as follows:

$$GAI = log_2(\frac{C}{(1.5*B)})$$

Where,

C= measured concentration in sample,

B= median crustal abundance/concentration.

The enrichment ranges of a metal based on the GAI values are interpreted as follow:

- GAI=0 indicates <3 times median crustal abundance.
- GAI=1 indicates 3 to 6 times median crustal abundance.
- GAI=2 indicates 6 to 12 times median crustal abundance.
- GAI=3 indicates 12 to 24 times median crustal abundance.
- GAI=4 indicates 24 to 48 times median crustal abundance.
- GAI=5 indicates 48 to 96 times median crustal abundance.
- GAI=6 indicates more than 96 times median crustal abundance.

As a general guide, GAI value of 3 or above is considered significant concentration and might indicate potential of metalliferous drainage from that particular sample. The median crustal abundances used to compare results against the GAI are provided in **Table 2.2**.

Table 2.2 Median Crustal Abundance for Metals (Berkman and Ryall, 1976; Bowen, 1979)

Name	Symbol	Median Crustal Abundance (mg/kg)
Arsenic	As	6
Aluminium	Al	71000
Barium	B	500
Cadmium	Cd	0.35
Cobalt	Co	8
Chromium	Cr	70
Copper	Cu	30
Iron	Fe	40000
Manganese	Mn	1000
Molybdenum	Mo	2
Nickel	Ni	50
Lead	Pb	35
Zinc	Zn	90
Mercury	Hg	0.06

2.4.2 Australian Standards Leaching Procedure (ASLP)

The use of the GAI alone to understand the potential of metalliferous drainage may provide an over-conservative indicator (Jones et al., 2016). Therefore, other methods to assess the potential of metalliferous drainages, such as leaching procedures, is also undertaken. As such, the Australian Standards Leaching Procedure (ASLP) was undertaken on all 26 samples.

The ASLP is originally based on the Toxicity Characteristic Leaching Procedure (TCLP) developed by the United States Environmental Protection Agency (US EPA, 1992). The main objective of this procedure is to simulate the leaching of wastes from the waste rock into the receiving environment under acidic conditions. Deionised water is generally used as a leaching agent in test procedures that are utilised for assessing the leaching potential of waste rocks at mine sites.

Taking a conservative approach, the ASLP test results were compared to ANZG (2018) default guideline values (DGVs) for freshwater aquatic ecosystems, to understand impacts to receiving environment from drainage from these samples. The reason for selecting ANZG (2018) DGVs for comparison is because these DGVs are conservative, and lack of any site-specific trigger levels for metals and metalloids in water. As the site was operational until 1992, the site was considered highly disturbed, and the 90% species protection DGVs for aquatic ecosystem were used for comparison.

2.5 Saline Drainage Potential

There are no standard methods to assess saline drainage in the AMIRA (2002) guidelines. However, many technical guidelines (such as DME,1995 and Jones et al., 2016) outline an indicative criterion to assess the potential for saline drainage using electrical conductivity (EC). The potential for saline drainage has been assessed using aged EC of a 1:2 (sample:water) suspension. EC in the leachate test has also been measured for the samples and have been utilised to determine the potential for saline drainage.

3.0 Results

3.1 Acid Drainage Potential

3.1.1 Aged pH

The aged pH of the samples ranged from a 5.9 to 8.6 pH unit (**Figure 3.1**). The mean aged pH recorded by the samples is 7, whereas the median aged pH is recorded 6.9. The highest aged pH was recorded in sample ID 143512 collected from the drill hole TNNDU031 within the historical ROM pad (**Figure 1.1**). The lowest aged pH was recorded in sample 143489 collected from the drill hole TNNDU009 located on the eastern side of the mineralised waste rock dump. Only one sample (143489) out of the total 26 samples recorded aged pH <6 pH units, thereby suggesting that the potential for any acidic drainage from these samples is less likely.

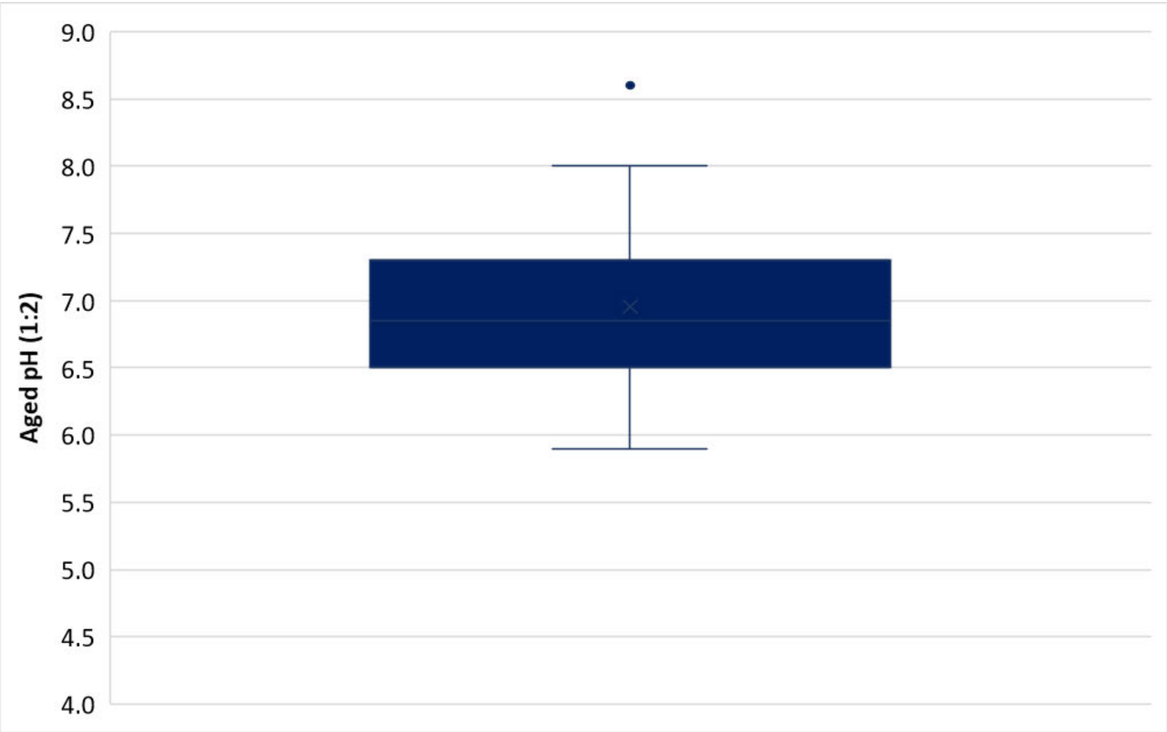

Figure 3.1 **Boxplot showing range of aged pH (1:2) in samples**

3.1.2 Acid-Base Classification

All 26 samples recorded negative NAPP, ranging from -35 kg H_2SO_4/t to -3 kg H_2SO_4/t. Classification of the samples using the NAG pH and NAPP suggests that all 25 samples from the mineralised waste rock dump and the sample from the ROM pad are non-acid forming (NAF). The classification plot for the samples is represented in **Figure 3.2**. Like aged pH, no correlation was found between NAPP and the spatial location of the sample.

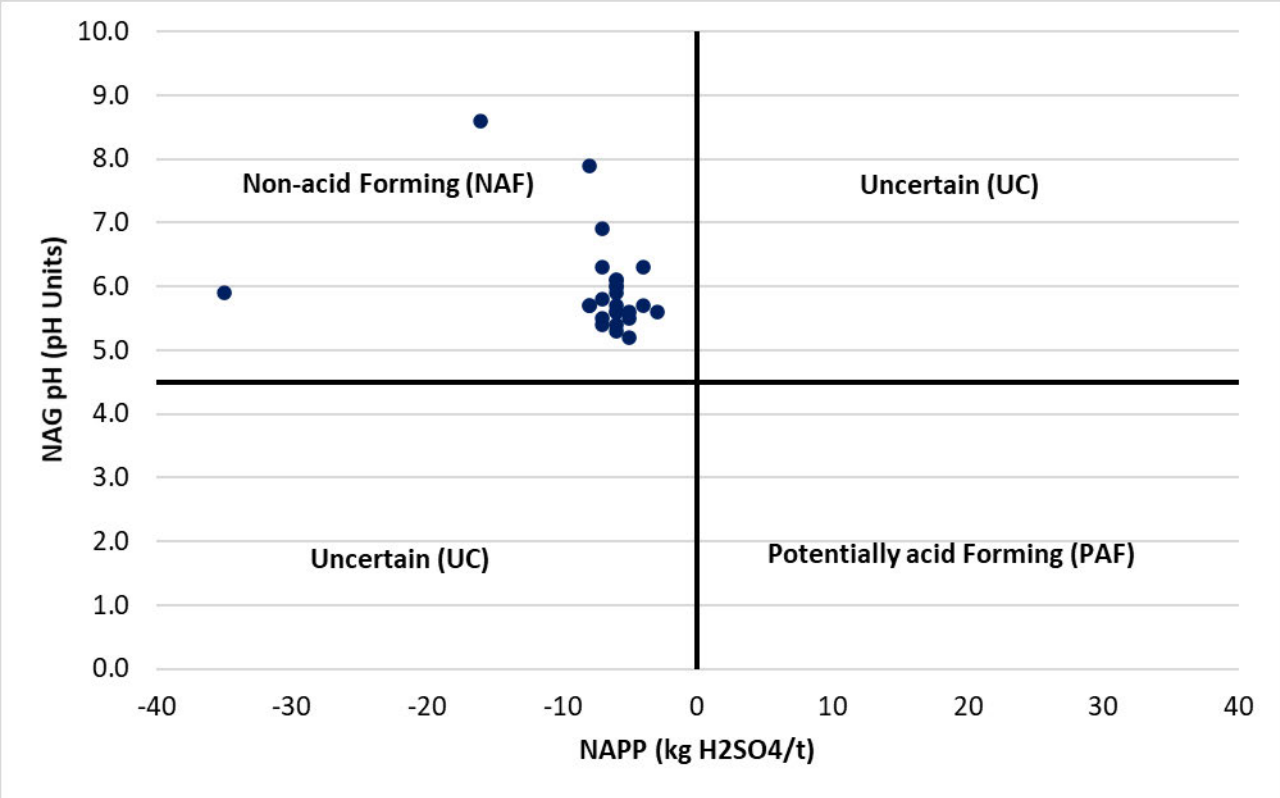

Figure 3.2 Geochemical Classification Plot

3.2 Metalliferous Drainage Potential

The mobilisation of metals from waste rock samples in drainage is called metalliferous drainage. Typically, pH controls the mobility of metals in aqueous systems (Smith, 1999), and the potential for metalliferous drainage is significantly reduced in non-acidic conditions. However, the mobility of metals also depends on geochemical changes and the characteristics of the metals themselves. Therefore, determining the abundances of specific metals via the geochemical abundance index (GAI) is a good indicator of the potential for metalliferous drainage potential in waste rocks.

3.2.1 Geochemical Abundance Index (GAI)

The GAI assessment of the 25 samples collected from the southern waste rock dump and one sample from the ROM pad at Nobles Nob suggests that some samples recorded GAI value of equal to or greater than 3 for the following metals:

- Molybdenum (Mo) – five out of 26 samples recorded GAI values equal to or greater than 3 (**Table 3.1**). Highest GAI recorded was 4, signifying 24 to 48 times median crustal concentrations. Among the remaining samples, 16 recorded GAI values greater than 1 but less than 3, and 5 samples recorded GAI values equal to 0.

- Mercury (Hg) – only the sample collected from the ROM pad (143512) recorded GAI value equal to 3 (**Table 3.1**). Out of the remaining 25 samples, one sample recorded GAI value of 1, while all the others recorded GAI values of 0 for mercury. In addition to the above, two samples for copper and 1 sample for cobalt recorded GAI value of 1 (**Table 3.1**).

Table 3.1 GAI values of Elements in the Samples

Sample	GAI (Al)	GAI (As)	GAI(Ba)	GAI (Cd)	GAI (Co)	GAI (Cr)	GAI (Cu)	GAI (Fe)	GAI (Mn)	GAI (Mo)	GAI (Ni)	GAI (pb)	GAI (Zn)	GAI (Hg)
143488	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143489	0	0	0	0	0	0	0	0	0	2	0	0	0	0
143490	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143491	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143492	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143493	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143494	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143495	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143496	0	0	0	0	0	0	0	0	0	3	0	0	0	0
143497	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143498	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143499	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143500	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143501	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143502	0	0	0	0	0	0	0	0	0	3	0	0	0	0
143503	0	0	0	0	0	0	0	0	0	3	0	0	0	0
143504	0	0	0	0	0	0	0	0	0	4	0	0	0	0
143505	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143506	0	0	0	0	1	0	0	0	0	3	0	0	0	0
143507	0	0	0	0	0	0	1	0	0	2	0	0	0	0
143508	0	0	0	0	0	0	0	0	0	2	0	0	0	0
143509	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143510	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143511	0	0	0	0	0	0	0	0	0	1	0	0	0	0
143512	0	0	0	0	0	0	0	0	0	0	0	0	0	3
143513	0	0	0	0	0	0	1	0	0	2	0	0	0	1

Cells highlighted in pink denotes GAI value of 3 or above. Cells highlighted in orange denotes GAI value of >0 but <3.
Median crustal abundance for metals were retrieved from Berkman and Ryall (1976) and Bowen (1979).

3.2.2 Australian Standards Leaching Procedure (ASLP)

The results of the ASLP tests for all 25 samples from the southern waste rock dump and one sample from the ROM pad at Nobles Nob are summarised, and the 80th percentile value was compared with the ANZG (2018) default guideline values (DGVs). As the site was operational until 1992, the site was considered highly disturbed, and the 90% species protection DGVs were used for comparison. The comparison has been summarised in Table 3.2.

The ASLP results indicate that leachate from the samples recorded 80th percentile concentration of aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) higher than the ANZG (2018) DGVs for 90% species protection (**Table 3.2**). Out of these elements, none were found to be in significant abundance (i.e., GAI >=3) in the samples in GAI assessment. The GAI value of copper was recorded to be 1, signifying 3 to 6 times median crustal abundance in 2 samples (143507 and 143513); however, the ASLP results from both these samples recorded concentration of copper below the limit of reporting (LOR).

Table 3.2 Statistical Summary of ASLP Test Results in Samples

Analytes	Units	ANZG (2018) DGVs*	Number	non-detect (%)	Min	5th %ile	20th %ile	Median	80th %ile	95th %ile	Max
ASLP pH	pH units	-	26	0	5.2	5.325	5.6	6.1	6.9	7.825	8.5
ASLP EC	µS/cm	-	26	0	18	23.25	31	50.5	76	104.75	130
Aluminium	mg/L	0.08	26	7.7	0.01	0.02	0.09	0.585	13	18.5	26
Boron	mg/L	0.68	26	100	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Mercury	mg/L	0.0019	26	96.2	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	0.0015
Arsenic	µg/L	42	26	100	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Barium	µg/L	-	26	0	1	3.25	8	28.5	90	167.5	200
Beryllium	µg/L	-	26	100	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium	µg/L	0.4	26	100	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Chromium	µg/L	1.8	26	53.8	0.5	0.5	0.5	0.5	2	2	3
Cobalt^	µg/L	14	26	73.1	0.5	0.5	0.5	0.5	2	2	5
Copper	µg/L	1.8	26	46.2	0.5	0.5	0.5	1	6	9.75	27
Manganese	µg/L	2500	26	7.7	0.5	0.625	3	12.5	27	50.5	54
Molybdenum**	µg/L	34	26	73.1	0.5	0.5	0.5	0.5	1	4.75	8
Nickel	µg/L	13	26	73.1	0.5	0.5	0.5	0.5	1	2	2
Lead	µg/L	5.6	26	84.6	0.5	0.5	0.5	0.5	0.5	9	12
Zinc	µg/L	15	26	3.8	0.5	1	2	11	36	68.5	87

*DGV used here is ANZG (2018) DGVs for 90% species protection for freshwater aquatic ecosystem. Cells highlighted in orange exceed ANZG (2018) DGVs for 90% species protection. **level of species protection for molybdenum's DGV is not specified in ANZG (2018).

^ level of species protection for cobalt in freshwater is not specified in ANZG (2018). Hence, DGV in marine water has been used in this assessment.

3.2.3 Potential of Metalliferous Drainage

The metals that have the potential to cause metalliferous drainage from these samples, based on the GAI assessment and ASLP results, are discussed below.

3.2.3.1 Aluminium

None of the samples were found to be significantly enriched with aluminium (i.e., GAI >=3). However, the ASLP results indicated that the leachate from 21 out of 26 samples recorded aluminium concentration higher than the ANZG (2018) DGV (0.08 mg/L).

Under most environmental conditions, the mobility of aluminium is low (Shiller and Frilot, 1996). However, aluminium mobility can increase if the pH drops below 5.5, or in the anionic form under strongly alkaline conditions at pH values above 8 (Shiller and Frilot, 1996).

In this case, the average aged pH of the samples is recorded to be 7, which is not acidic or alkaline enough to mobilise aluminium. In addition, none of the samples were found to be enriched with aluminium in GAI assessment. Some samples, such as 143493 and 143512, recorded high aged pH values of 8 and 8.6, respectively. Aluminium enriched drainage might occur from these two samples. Overall, it is less likely that aluminium enriched drainage will occur from all the other samples.

3.2.3.2 Chromium

None of the samples were found to be significantly enriched with chromium in the GAI assessment in **section 3.2.1** above. However, the ASLP results indicated that the leachate from six out of 26 samples recorded a chromium concentration above the ANZG (2018) DGV (1.8 µg/L). The 80th percentile concentration of chromium for all samples was recorded 2 µg/L, also higher than the ANZG (2018) DGV (1.8 µg/L) (**Table 3.2**).

Chromium is generally not very mobile, especially if the conditions are moderately oxidising or moderately reducing (Kabata-Pendias, 2001). At near-neutral pH values, the mobility of chromium is limited (Kabata-Pendias, 2001). The main dominant species in reducing environments between pH 5 and pH 9 are $CrOH^{2+}$ and $Cr(OH)_2^+$ (Kabata-Pendias, 2001). Chromium, especially the trivalent form, readily substitutes for iron (III) (Fe^{3+}) in minerals, and coprecipitates with Fe^{3+} as insoluble $Cr(OH)_3$, at high pH values (i.e., above pH 9). It is possible that chromium might get liberated along with iron at higher pH values. However, the average aged pH of the samples is 7, implying near-neutral pH value, where chromium is less mobile. Therefore, the likelihood of chromium enriched drainage is low from these samples.

3.2.3.3 Copper

None of the samples were found to be significantly enriched with copper (i.e., GAI >=3). The ASLP test results for the samples indicated that the 80th percentile concentration of copper was above the ANZG (2018) DGV (1.8 µg/L). Out of the 26 samples, 12 recorded concentrations of copper in ASLP test above the ANZG (2018) DGV.

Copper is mobile under oxidising, acidic conditions, especially at pH values in the range of 5 to 6 (Rashid, 1974; Rippey, 1982). This is because of the more oxidised Cu^{2+} species, that predominates in such conditions. Co-precipitation of Copper (and zinc) can occur in the presence of iron hydrous oxides (Lottermoser et al., 1999), which can be discharged in an acidic environment. None of the samples recorded aged pH <6, and the average aged pH of all the samples is 7, which is not acidic enough to cause copper enriched drainage. Additionally, the GAI of copper for 24 samples was 0, implying no enrichment of copper in these samples. The two samples that recorded GAI values of 1 for copper – 143507 and 143513, recorded the concentration of copper in ASLP test below LOR, implying that copper enriched drainage from these samples is less likely.

3.2.3.4 Lead

None of the 26 samples were found to be significantly enriched with lead. However, the ASLP results indicated that leachate from samples recorded the 95th percentile concentration of lead higher than the ANZG (2018) DGV (5.6 µg/L). This was because two samples (143491 and 143512) out of 26 samples recorded a concentration of lead above the ANZG (2018) DGV in ASLP test. One of these sample locations (143512) was collected from the old ROM pad.

Lead can mobilise in acidic environments, as it is present in the aqueous environment as Pb^{2+} when the pH is below 6 (Nelson et al., 1995). None of the samples recorded aged pH <6, and the average aged pH recorded by the samples is 7. The two samples that recorded the concentration of lead above the DGV in the ASLP test, also recorded a high aged pH value of 7.9 (143491) and 8.6 (143512). Therefore, lead enriched drainage from these samples is unlikely.

3.2.3.5 Molybdenum

Five samples out of the 26 samples recorded GAI value of 3 and above for molybdenum. However, the ASLP test result stated that leachate from all the samples recorded a concentration of molybdenum below the ANZG (2018) DGV (0.0034 mg/L).

The most commonly occurring molybdenum-bearing mineral is the sulfide molybdenite. Molybdenite often occurs with other sulfide minerals, including pyrite and chalcopyrite (Frascoli and Hudson-Edwards, 2018). Minor chalcopyrite was associated with the gold ore at Nobles Nob (ADL, 1970). Oxidation of the molybdenum-bearing sulfides can result in the liberation of molybdenum and its oxidation to molybdate (Frascoli and Hudson-Edwards, 2018). Molybdate is stable over a wide range of pH conditions, from neutral down to pH value of 3-4 (Frascoli and Hudson-Edwards, 2018; Smedley and Kinniburgh, 2017). In an acidic environment (i.e., pH value below 3), the molybdate is protonated to form $HMoO_4^-$ or H_2MoO_4 (Smedley and Kinniburgh, 2017). Also, under moderately acidic pH conditions (pH 5-6), molybdate can be sorbed onto the secondary iron (III) minerals, such as jarosite, schwertmannite, ferrihydrite (Goldberg et al., 1996; Xu et al., 2006). These secondary iron (III) phases can decompose in acidic pH waters (e.g., from acidic drainage), releasing their sorbed molybdate (Frascoli and Hudson-Edwards, 2018; Smedley and Kinniburgh, 2017; Xu et al., 2006; Goldberg et al., 1996). In highly alkaline conditions (i.e., pH above 9), mobility of molybdenum also increases due to the reduced binding properties of the molybdate (Frascoli and Hudson-Edwards, 2018; Goldberg et al., 1996).

Thus, molybdenum enriched drainage might occur in extremely acidic or alkaline drainages. However, the average aged pH for the samples is 7 pH unit, which is neither acidic enough nor alkaline enough to mobilise molybdenum. Furthermore, none of the samples recorded aged pH <6 or greater than 9. Two samples that recorded aged pH equal to or above 8 are 143493 (aged pH 8) and 143512 from the ROM pad (aged pH 8.6), and both were not significantly enriched in molybdenum (i.e., recorded GAI<3). As such, enriched molybdenum drainage is less likely from these samples.

3.2.3.6 Mercury

Only one sample (143512) out of the 26 samples recorded GAI value of 3 for mercury (**Table 3.1**). This sample was collected from the ROM pad (143512) and is the only sample that recorded concentrations of mercury above the LOR. The concentration recorded at sample 143512 is 0.0015 mg/L, which is below ANZG (2018) DGV for 90% species protection (0.0019 mg/L) but is above the ANZG (2018) GDV for 95% species protection (0.0006 mg/L). To account for the bioaccumulating nature of mercury, the comparison has been made with the 95% species protection level DGV.

The behaviour of mercury is highly dependent on the presence of sorption materials such as organic complexes or clay. In acidic environments, mercury bound to organic matter may be leached (Kabata-Pendias 2001). At pH >5.5, sorption of mercury occurs to iron oxides (Barringer et al., 2013; Connor et al., 2019; Yang et al.,2007). In an acidic environment, sorbed mercury can mobilise with iron oxide particles (Barringer et al., 2013). The mobility of mercury decreases at pH<3 and at pH>12, due to the extremely high buffering capacity of humus in both acidic and alkaline environments (Kabata-Pendias 2001).

As the aged pH recorded at the enriched sample 143512 is 8.6, it is possible that mercury enriched drainage might occur for that sample from the ROM pad. And as the ASLP test results suggest, mercury enriched drainage from the waste rock is unlikely.

3.2.3.7 Zinc

None of the samples were found to be significantly enriched with zinc (i.e., GAI >=3). All samples recorded GAI value of 0. The ASLP test results for the samples indicated that the 80th percentile concentration of zinc is above the ANZG (2018) DGV (15 µg/L). The concentration of zinc in the ASLP test of 11 out of 26 samples exceeded the DGV.

The mobility of zinc is more dependent on adsorption on clay minerals, hydroxides of iron/manganese/aluminium, and organic matter than its solubility (Mihaljevic, 1999). The mobility of zinc in the environment is greatest under oxidising, acidic conditions and more restricted under reducing conditions. Below pH 7.5 - 8.0, zinc occurs predominantly in the Zn^{2+} form (Brookins, 1988). At higher pH values, it forms low solubility complexes with carbonate and hydroxyl ions (Brookins, 1988). Since the average aged pH of all samples is 7, which is below 7.5, it is likely that zinc enriched drainage might occur from these samples.

3.2.4 Limitations of ASLP

It is noteworthy that the ASLP test and the assessment of drainage potential have certain limitations. The ASLP test is not indicative of actual drainage quality, because ASLP tests only provide representative leaching data for the pH values under which the tests are carried out. The ASLP test also does not provide any information on the long-term leaching behaviour of the materials under a range of varied conditions (van der Sloot, 1996).

Additionally, the ASLP tests are slightly biased for acidic conditions, resulting in conservative values of leaching potential for these samples. Also, no consideration is given to the variation in concentration of enrichment of metals with changes in the water to rock ratio (van der Sloot, 1996).

The assessment of enriched drainage potential is mainly based on the pH of the runoff from these samples. However, none of the pH (e.g. aged pH, NAG pH, and ASLP pH) is an authoritative indicator of potential drainage pH. Additionally, the drainage due to rainfall usually dilutes the concentration of the metals much more compared to ASLP results.

3.3 Saline Drainage Potential

Electrical conductivity (EC) measures the capacity of a solution to conduct electricity. It is often used as a proxy for salinity and is expressed as µS/cm. All 26 samples underwent aged EC (1:2) measurement. In addition, the ASLP extracts were also measured for EC to assess saline drainage potential. The results are discussed in the subsections below.

3.3.1 Aged and ASLP EC

The aged EC recorded by the samples ranged from 90 µS/cm (at 143489) to 670 µS/cm (at 143493). The average aged EC recorded by the samples is 313.8 µS/cm, whereas the average ASLP EC is 55.1 µS/cm. Most samples (~73%) recorded EC between 150 and 450 µS/cm, and 100% of samples recorded ASLP EC below 150 µS/cm. None of the samples recorded aged EC or ASLP EC higher than 900 µS/cm, indicating that the potential of saline drainage from these samples is less likely. The sample distribution is presented in **Table 3.3** and **Figure 3.3**.

Table 3.3 Sample Distribution based on classification of aged and ASLP EC

	Very Low <150µS/cm	Low 150-450µS/cm	Moderate 450-900µS/cm	High >900µS/cm	TOTAL
Aged EC	2	19	5	0	26
ASLP EC	26	0	0	0	26

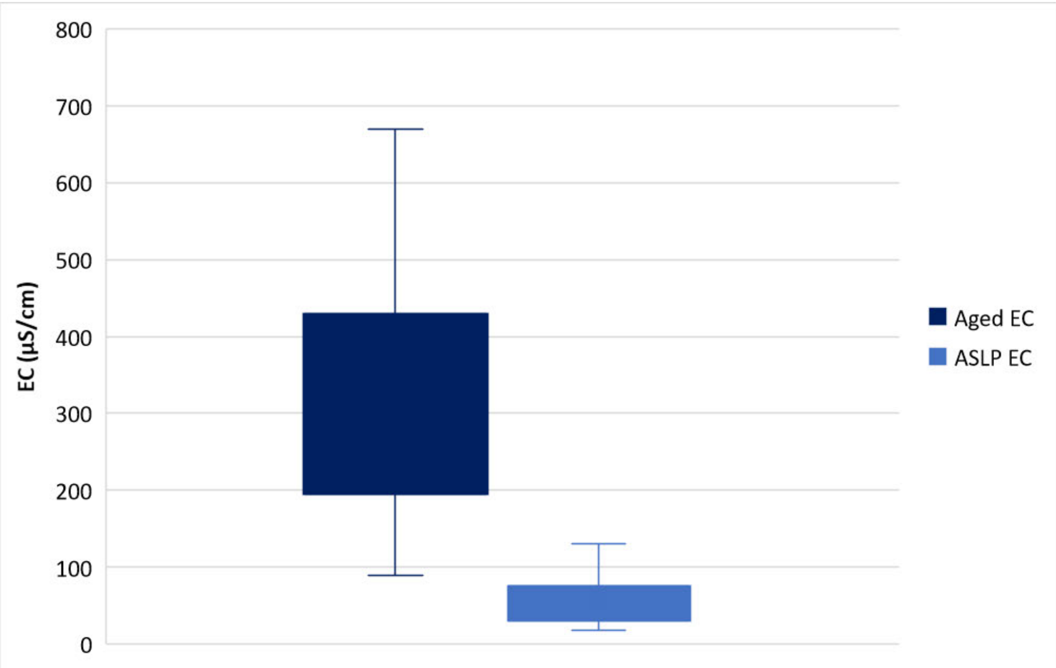

Figure 3.3 Boxplot showing range of Aged EC and ASLP EC (in µS/cm)

4.0 Conclusion and Recommendations

Umwelt was engaged by TCMG to characterise the samples from the historical southern waste rock dump of the Nobles Nob Project in the Northern Territory. One sample 143512 collected from the drill hole located on the historical ROM pad containing ore stockpiles, close to the mill.

TCMG collected a total of 26 composite samples from the RC drill holes drilled on the southern waste rock dump. Composite samples were collected by combining drill chips from various depth intervals. These samples were sent to a NATA accredited laboratory for analyses. The results were assessed to observe potential of acidic, metalliferous, or saline drainage from these samples.

The results suggest that the aged pH of the samples ranged from a 5.9 to 8.6 pH unit, with the mean aged pH being 7, whereas the median aged pH being 6.9. Only one sample out of the total 26 samples recorded aged pH <6 pH units. All 26 samples recorded negative NAPP, and the classification of the samples using the NAG pH and NAPP suggests that all 26 samples from the mineralised waste rock dump are non-acid forming (NAF), thereby suggesting that the potential for any acidic drainage from these samples is less likely.

The GAI assessment of the 26 samples collected from the southern waste rock dump at Nobles Nob suggests that the samples are significantly enriched (GAI >= 3) with the following metals:

- Molybdenum (Mo) – 5 out of 26 samples recorded GAI value equal to or greater than 3.
- Mercury (Hg) – only the sample from the ROM pad recorded GAI value equal to 3.

The results of the ASLP tests for all 25 samples from the southern waste rock dump and one sample from the ROM pad at Nobles Nob are summarised, and the 80th percentile value was compared with the ANZG (2018) DGV for 90% species protection. The results indicate that leachate from the samples recorded 80th percentile concentration of aluminium (Al), chromium (Cr), copper (Cu) and zinc (Zn) higher than the ANZG (2018) DGVs for 90% species protection. Out of these elements, none were found to be in significant abundance (i.e., GAI >=3) in the samples in GAI assessment. The combined assessment of GAI and ASLP results of the samples from waste rock dump suggests a potential of metalliferous drainage from a few samples, enriched in aluminium, and zinc. Sample 143512, collected from the ROM pad, outside the historical waste rock dump, recorded highest aged pH value (pH 8.6). Additionally, it also recorded highest concentration of aluminium, chromium, copper, mercury, and zinc in ASLP test. The assessment also indicated that aluminium, molybdenum, and mercury enriched drainage might occur from this sample.

Electrical conductivity (EC) is used as a proxy for salinity in this assessment. All 26 samples underwent aged EC (1:2) and ASLP EC measurement. The average aged EC recorded by the samples is 313.8 µS/cm, whereas the average ASLP EC is 55.1 µS/cm. Most samples (~73%) recorded aged EC between 150 and 450 µS/cm, whereas 100% samples recorded ASLP EC below 150 µS/cm. None of the samples recorded aged EC or ASLP EC higher than 900 µS/cm, indicating that the potential of saline drainage from these samples is less likely.

5.0 References

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APPENDIX A

Certificate of Analysis of Laboratory Results

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Matt Golovanoff	Manager	Anthony Nilsson
Client	TENNANT MINING	Laboratory	SGS Cairns Environmental
Address	PO BOX 37 WEST PERTH WA 6005	Address	Unit 2, 58 Comport St Portsmith QLD 4870
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Facsimile	(Not specified)	Facsimile	+61 07 4035 5122
Email	matt@tennantmining.com.au	Email	AU.Environmental.Cairns@sgs.com
Project	**Nobles Nob Southern Waste Dump**	SGS Reference	**CE154939A R0**
Order Number	(Not specified)	Date Received	07 Oct 2021
Samples	26	Date Reported	12 Oct 2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(3146/19038)

SIGNATORIES

Anthony NILSSON	Jon DICKER	Mitsuko BALDWIN
Operations Manager	Manager Northern QLD	Metals Team Leader

Parameter	Units	LOR	CE154939A.001	CE154939A.002	CE154939A.003	CE154939A.004
Sample Matrix			Soil	Soil	Soil	Soil
Sample Name			143488	143489	143490	143491

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.001	CE154939A.002	CE154939A.003	CE154939A.004
Aluminium, Al	mg/kg	50	**3600**	**3900**	**4100**	**2600**
Arsenic, As	mg/kg	0.5	**1.1**	**1.1**	**1.2**	**1.1**
Barium, Ba	mg/kg	0.5	**62**	**83**	**160**	**95**
Cadmium, Cd	mg/kg	0.1	**0.2**	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	**1.6**	**3.2**	**2.6**	**1.1**
Chromium, Cr	mg/kg	0.5	**15**	**14**	**18**	**13**
Copper, Cu	mg/kg	0.5	**27**	**47**	**24**	**14**
Iron, Fe	mg/kg	50	**45000**	**70000**	**61000**	**39000**
Manganese, Mn	mg/kg	2	**90**	**110**	**72**	**60**
Molybdenum, Mo	mg/kg	1	**4**	**12**	**7**	**6**
Nickel, Ni	mg/kg	0.5	**4.6**	**5.1**	**5.8**	**4.2**
Lead, Pb	mg/kg	0.5	<0.5	<0.5	**0.5**	<0.5
Zinc, Zn	mg/kg	0.5	**20**	**31**	**32**	**53**

Mercury in Soil Method: AN312 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.001	CE154939A.002	CE154939A.003	CE154939A.004
Mercury	mg/kg	0.01	<0.01	**0.06**	**0.04**	**0.05**

Parameter	Units	LOR	CE154939A.005	CE154939A.006	CE154939A.007	CE154939A.008
Sample Matrix			Soil	Soil	Soil	Soil
Sample Name			143492	143493	143494	143495

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.005	CE154939A.006	CE154939A.007	CE154939A.008
Aluminium, Al	mg/kg	50	3800	3900	4200	3800
Arsenic, As	mg/kg	0.5	1.3	1.6	1.3	1.8
Barium, Ba	mg/kg	0.5	76	88	110	60
Cadmium, Cd	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	4.7	4.5	3.8	2.8
Chromium, Cr	mg/kg	0.5	18	15	21	16
Copper, Cu	mg/kg	0.5	46	40	43	46
Iron, Fe	mg/kg	50	74000	40000	62000	62000
Manganese, Mn	mg/kg	2	170	130	150	120
Molybdenum, Mo	mg/kg	1	10	9	4	8
Nickel, Ni	mg/kg	0.5	5.2	6.6	5.2	4.6
Lead, Pb	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Zinc, Zn	mg/kg	0.5	31	32	41	36

Mercury in Soil Method: AN312 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.005	CE154939A.006	CE154939A.007	CE154939A.008
Mercury	mg/kg	0.01	<0.01	<0.01	0.01	0.02

Parameter	Units	LOR	CE154939A.009	CE154939A.010	CE154939A.011	CE154939A.012
		Sample Matrix	Soil	Soil	Soil	Soil
		Sample Name	143496	143497	143498	143499

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.009	CE154939A.010	CE154939A.011	CE154939A.012
Aluminium, Al	mg/kg	50	2500	4300	4500	4300
Arsenic, As	mg/kg	0.5	1.4	1.4	3.0	1.3
Barium, Ba	mg/kg	0.5	73	440	62	69
Cadmium, Cd	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	1.1	4.0	5.2	1.6
Chromium, Cr	mg/kg	0.5	19	20	22	20
Copper, Cu	mg/kg	0.5	26	41	70	33
Iron, Fe	mg/kg	50	77000	68000	85000	52000
Manganese, Mn	mg/kg	2	77	140	270	82
Molybdenum, Mo	mg/kg	1	30	9	10	4
Nickel, Ni	mg/kg	0.5	2.8	5.0	5.0	4.3
Lead, Pb	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Zinc, Zn	mg/kg	0.5	17	29	25	22

Mercury in Soil Method: AN312 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.009	CE154939A.010	CE154939A.011	CE154939A.012
Mercury	mg/kg	0.01	<0.01	0.04	<0.01	<0.01

Parameter	Units	LOR	CE154939A.013 (Soil, 143500)	CE154939A.014 (Soil, 143501)	CE154939A.015 (Soil, 143502)	CE154939A.016 (Soil, 143503)
Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021						
Aluminium, Al	mg/kg	50	**3500**	**3900**	**4100**	**4400**
Arsenic, As	mg/kg	0.5	**0.9**	**1.9**	**1.3**	**1.3**
Barium, Ba	mg/kg	0.5	**77**	**160**	**110**	**150**
Cadmium, Cd	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	**1.8**	**5.9**	**3.0**	**8.0**
Chromium, Cr	mg/kg	0.5	**18**	**20**	**18**	**16**
Copper, Cu	mg/kg	0.5	**30**	**69**	**26**	**47**
Iron, Fe	mg/kg	50	**64000**	**76000**	**80000**	**60000**
Manganese, Mn	mg/kg	2	**100**	**160**	**87**	**140**
Molybdenum, Mo	mg/kg	1	**7**	**5**	**31**	**37**
Nickel, Ni	mg/kg	0.5	**4.3**	**5.8**	**5.3**	**6.2**
Lead, Pb	mg/kg	0.5	<0.5	<0.5	**1.0**	<0.5
Zinc, Zn	mg/kg	0.5	**32**	**41**	**43**	**47**
Mercury in Soil Method: AN312 Tested: 11/10/2021						
Mercury	mg/kg	0.01	<0.01	**0.05**	**0.08**	**0.01**

Parameter	Units	LOR	CE154939A.017	CE154939A.018	CE154939A.019	CE154939A.020
Sample Matrix			Soil	Soil	Soil	Soil
Sample Name			143504	143505	143506	143507

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.017	CE154939A.018	CE154939A.019	CE154939A.020
Aluminium, Al	mg/kg	50	3600	4400	4400	4500
Arsenic, As	mg/kg	0.5	1.2	1.2	1.3	2.0
Barium, Ba	mg/kg	0.5	180	130	76	47
Cadmium, Cd	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	3.3	6.3	38	7.6
Chromium, Cr	mg/kg	0.5	16	20	20	19
Copper, Cu	mg/kg	0.5	35	53	86	100
Iron, Fe	mg/kg	50	69000	68000	92000	72000
Manganese, Mn	mg/kg	2	85	200	710	230
Molybdenum, Mo	mg/kg	1	51	10	24	12
Nickel, Ni	mg/kg	0.5	3.9	5.6	11	9.0
Lead, Pb	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Zinc, Zn	mg/kg	0.5	41	22	41	110

Mercury in Soil Method: AN312 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.017	CE154939A.018	CE154939A.019	CE154939A.020
Mercury	mg/kg	0.01	0.01	<0.01	0.01	0.03

Parameter	Units	LOR	CE154939A.021	CE154939A.022	CE154939A.023	CE154939A.024
Sample Matrix			Soil	Soil	Soil	Soil
Sample Name			143508	143509	143510	143511

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.021	CE154939A.022	CE154939A.023	CE154939A.024
Aluminium, Al	mg/kg	50	3800	3700	3400	3700
Arsenic, As	mg/kg	0.5	2.1	1.5	1.1	0.8
Barium, Ba	mg/kg	0.5	35	69	94	100
Cadmium, Cd	mg/kg	0.1	0.2	<0.1	<0.1	<0.1
Cobalt, Co	mg/kg	0.5	3.0	5.6	1.7	1.5
Chromium, Cr	mg/kg	0.5	26	19	14	17
Copper, Cu	mg/kg	0.5	53	79	32	17
Iron, Fe	mg/kg	50	56000	79000	45000	63000
Manganese, Mn	mg/kg	2	100	170	69	88
Molybdenum, Mo	mg/kg	1	13	11	8	6
Nickel, Ni	mg/kg	0.5	4.8	6.2	4.5	4.0
Lead, Pb	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Zinc, Zn	mg/kg	0.5	63	41	47	38

Mercury in Soil Method: AN312 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.021	CE154939A.022	CE154939A.023	CE154939A.024
Mercury	mg/kg	0.01	<0.01	<0.01	<0.01	0.05

Parameter	Units	LOR	CE154939A.025	CE154939A.026
Sample Matrix			Soil	Soil
Sample Name			143512	143513

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES Method: AN040/AN320 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.025	CE154939A.026
Aluminium, Al	mg/kg	50	**3400**	**6000**
Arsenic, As	mg/kg	0.5	**1.1**	**1.8**
Barium, Ba	mg/kg	0.5	**130**	**89**
Cadmium, Cd	mg/kg	0.1	<0.1	**0.1**
Cobalt, Co	mg/kg	0.5	**1.7**	**14**
Chromium, Cr	mg/kg	0.5	**12**	**24**
Copper, Cu	mg/kg	0.5	**23**	**100**
Iron, Fe	mg/kg	50	**26000**	**99000**
Manganese, Mn	mg/kg	2	**36**	**280**
Molybdenum, Mo	mg/kg	1	**1**	**12**
Nickel, Ni	mg/kg	0.5	**4.8**	**12**
Lead, Pb	mg/kg	0.5	**4.1**	<0.5
Zinc, Zn	mg/kg	0.5	**53**	**160**

Mercury in Soil Method: AN312 Tested: 11/10/2021

Parameter	Units	LOR	CE154939A.025	CE154939A.026
Mercury	mg/kg	0.01	**1.0**	**0.34**

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Mercury in Soil **Method: ME-(AU)-[ENV]AN312**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Mercury	LB094887	mg/kg	0.01	<0.01	0%	99 - 100%	104%

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES **Method: ME-(AU)-[ENV]AN040/AN320**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Aluminium, Al	LB094889	mg/kg	50	<50	6 - 7%	109 - 114%	
Arsenic, As	LB094889	mg/kg	0.5	<0.5	9 - 10%	98 - 102%	
Barium, Ba	LB094889	mg/kg	0.5	<0.5	1 - 6%	96 - 101%	
Cadmium, Cd	LB094889	mg/kg	0.1	<0.1	0%	95 - 99%	92%
Cobalt, Co	LB094889	mg/kg	0.5	<0.5	6 - 23%	89 - 95%	84%
Chromium, Cr	LB094889	mg/kg	0.5	<0.5	4 - 6%	101 - 105%	97%
Copper, Cu	LB094889	mg/kg	0.5	<0.5	7 - 9%	105 - 109%	103%
Iron, Fe	LB094889	mg/kg	50	<50	3 - 5%	106 - 110%	
Manganese, Mn	LB094889	mg/kg	2	<2	4 - 6%	96 - 101%	93%
Molybdenum, Mo	LB094889	mg/kg	1	<1	9 - 19%	102 - 106%	
Nickel, Ni	LB094889	mg/kg	0.5	<0.5	9 - 10%	86 - 92%	82%
Lead, Pb	LB094889	mg/kg	0.5	<0.5	0%	101 - 105%	97%
Zinc, Zn	LB094889	mg/kg	0.5	<0.5	1 - 8%	85 - 90%	78%

METHOD	METHODOLOGY SUMMARY
AN040/AN320	A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.
AN312	Mercury by Cold Vapour AAS in Soils: After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
***	Indicates that both * and ** apply.	NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Matt Golovanoff	Manager	Anthony Nilsson
Client	TENNANT MINING	Laboratory	SGS Cairns Environmental
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Email	matt@tennantmining.com.au	Email	AU.Environmental.Cairns@sgs.com
Project	**Nobles Nob Southern Waste Dump**	SGS Reference	**CE154939 R0**
Order Number	(Not specified)	Date Received	17 Sep 2021
Samples	26	Date Reported	07 Oct 2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(3146/19038)

SIGNATORIES

Anthony NILSSON	Jon DICKER	Maristela GANZAN
Operations Manager	Manager Northern QLD	Quality Coordinator

Parameter	Units	LOR	CE154939.001 Soil 01 Sep 2021 143488	CE154939.002 Soil 01 Sep 2021 143489	CE154939.003 Soil 01 Sep 2021 143490	CE154939.004 Soil 01 Sep 2021 143491
		Sample Number / Sample Matrix / Sample Date / Sample Name				

Moisture Content Method: AN002 Tested: 20/9/2021

Parameter	Units	LOR	.001	.002	.003	.004
% Moisture	%w/w	0.5	**0.6**	**0.5**	**0.9**	**0.8**

pH in soil (1:2) Method: AN101 Tested: 22/9/2021

Parameter	Units	LOR	.001	.002	.003	.004
pH (1:2) aged	pH Units	-	**6.5**	**5.9**	**7.3**	**7.9**

Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021

Parameter	Units	LOR	.001	.002	.003	.004
Conductivity (1:2) aged @ 25C	µS/cm	1	**120**	**90**	**380**	**330**

Total Sulfur Method: AN012/AN320 Tested: 5/10/2021

Parameter	Units	LOR	.001	.002	.003	.004
Total Sulfur	%w/w	0.005	**0.007**	**0.013**	**0.015**	**0.007**

HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021

Parameter	Units	LOR	.001	.002	.003	.004
Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.006**	**0.006**	**0.010**	**0.006**

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021

Parameter	Units	LOR	.001	.002	.003	.004
ANC as % $CaCO_3$	% CaCO3	0.1	**0.6**	**0.5**	**0.5**	**1.6**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**6.3**	**5.0**	**5.0**	**16**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**6.1**	**4.9**	**4.9**	**16**

Parameter	Units	LOR	Sample Number: CE154939.001 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143488	CE154939.002 Soil 01 Sep 2021 143489	CE154939.003 Soil 01 Sep 2021 143490	CE154939.004 Soil 01 Sep 2021 143491

Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021

Parameter	Units	LOR	CE154939.001	CE154939.002	CE154939.003	CE154939.004
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-6**	**-5**	**-4**	**-16**

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.001	CE154939.002	CE154939.003	CE154939.004
ECox (NAG Conductivity)	µS/cm	1	**37**	**40**	**46**	**90**
pHox (NAG pH)	No unit	-	**5.3**	**5.2**	**6.3**	**8.6**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**1.3**	**1.2**	<0.5	<0.5
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	**1.3**	**1.2**	<1.0	<1.0

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.001	CE154939.002	CE154939.003	CE154939.004
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.7**	**5.3**	**6.9**	**7.9**
Conductivity @25C	µS/cm	1	**22**	**18**	**67**	**87**

Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021

Parameter	Units	LOR	CE154939.001	CE154939.002	CE154939.003	CE154939.004
Aluminium, Al	mg/L	0.02	**0.11**	**0.05**	**0.41**	**0.44**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021

Parameter	Units	LOR	CE154939.001	CE154939.002	CE154939.003	CE154939.004
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**1**	**4**	**77**	**43**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	<1	<1	<1
Cobalt, Co	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	<1	<1	**1**	<1
Lead, Pb	µg/L	1	<1	<1	<1	**12**
Manganese, Mn	µg/L	1	<1	**3**	**2**	<1
Molybdenum, Mo	µg/L	1	<1	<1	**5**	**4**
Nickel, Ni	µg/L	1	<1	<1	<1	<1
Zinc, Zn	µg/L	1	<1	**2**	**2**	**1**

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021

Parameter	Units	LOR	CE154939.001	CE154939.002	CE154939.003	CE154939.004
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	CE154939.005	CE154939.006	CE154939.007	CE154939.008
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			01 Sep 2021	01 Sep 2021	01 Sep 2021	01 Sep 2021
Sample Name			143492	143493	143494	143495

Moisture Content Method: AN002 Tested: 20/9/2021

% Moisture	%w/w	0.5	**0.7**	**0.8**	**0.8**	**0.8**

pH in soil (1:2) Method: AN101 Tested: 22/9/2021

pH (1:2) aged	pH Units	-	**7.1**	**8.0**	**7.3**	**7.1**

Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021

Conductivity (1:2) aged @ 25C	µS/cm	1	**370**	**670**	**160**	**200**

Total Sulfur Method: AN012/AN320 Tested: 5/10/2021

Total Sulfur	%w/w	0.005	**0.008**	**0.012**	**0.005**	<0.005

HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021

Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.006**	**0.010**	**0.006**	<0.005

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021

ANC as % $CaCO_3$	% CaCO3	0.1	**0.9**	**0.8**	**3.6**	**0.6**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**8.8**	**7.5**	**36**	**6.3**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**8.6**	**7.4**	**36**	**6.1**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	CE154939.005 Soil 01 Sep 2021 143492	CE154939.006 Soil 01 Sep 2021 143493	CE154939.007 Soil 01 Sep 2021 143494	CE154939.008 Soil 01 Sep 2021 143495

Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021

Parameter	Units	LOR	CE154939.005	CE154939.006	CE154939.007	CE154939.008
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-8**	**-7**	**-35**	**-6**

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.005	CE154939.006	CE154939.007	CE154939.008
ECox (NAG Conductivity)	µS/cm	1	**43**	**54**	**41**	**39**
pHox (NAG pH)	No unit	-	**5.7**	**6.9**	**5.9**	**5.7**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**0.9**	<0.5	**0.6**	<0.5
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.005	CE154939.006	CE154939.007	CE154939.008
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.7**	**7.6**	**6.2**	**6.4**
Conductivity @25C	µS/cm	1	**52**	**130**	**31**	**32**

Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021

Parameter	Units	LOR	CE154939.005	CE154939.006	CE154939.007	CE154939.008
Aluminium, Al	mg/L	0.02	<0.02	**15**	**13**	**7.6**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021

Parameter	Units	LOR	CE154939.005	CE154939.006	CE154939.007	CE154939.008
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**11**	**79**	**79**	**25**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	**2**	**2**	**1**
Cobalt, Co	µg/L	1	<1	**2**	**1**	<1
Copper, Cu	µg/L	1	<1	**8**	**8**	**5**
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	**8**	**51**	**43**	**12**
Molybdenum, Mo	µg/L	1	<1	<1	<1	<1
Nickel, Ni	µg/L	1	<1	**2**	**1**	<1
Zinc, Zn	µg/L	1	**5**	**25**	**39**	**10**

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021

Parameter	Units	LOR	CE154939.005	CE154939.006	CE154939.007	CE154939.008
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	CE154939.009 Soil 01 Sep 2021 143496	CE154939.010 Soil 01 Sep 2021 143497	CE154939.011 Soil 01 Sep 2021 143498	CE154939.012 Soil 01 Sep 2021 143499
Moisture Content Method: AN002 Tested: 20/9/2021						
% Moisture	%w/w	0.5	**0.5**	**0.6**	**0.6**	<0.5
pH in soil (1:2) Method: AN101 Tested: 22/9/2021						
pH (1:2) aged	pH Units	-	**6.3**	**6.3**	**6.2**	**6.9**
Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021						
Conductivity (1:2) aged @ 25C	µS/cm	1	**200**	**340**	**450**	**180**
Total Sulfur Method: AN012/AN320 Tested: 5/10/2021						
Total Sulfur	%w/w	0.005	**0.008**	**0.016**	**0.012**	<0.005
HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021						
Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.006**	**0.016**	**0.013**	<0.005
Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021						
ANC as % $CaCO_3$	% CaCO3	0.1	**0.8**	**0.6**	**0.5**	**0.4**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**7.5**	**6.3**	**5.0**	**3.8**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**7.4**	**6.1**	**4.9**	**3.7**

Parameter	Units	LOR	Sample Number: CE154939.009 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143496	CE154939.010 Soil 01 Sep 2021 143497	CE154939.011 Soil 01 Sep 2021 143498	CE154939.012 Soil 01 Sep 2021 143499

Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021

Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	-7	-6	-5	-4

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021

ECox (NAG Conductivity)	µS/cm	1	42	48	49	39
pHox (NAG pH)	No unit	-	5.4	5.6	5.5	5.7
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	0.7	0.6	0.7	0.6
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021

Mass of test sample for extraction	g	-	20	20	20	20
Mass of leaching solution used	g	-	400	400	400	400
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	5.4	5.7	5.2	6.3
Conductivity @25C	µS/cm	1	31	61	76	27

Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021

Aluminium, Al	mg/L	0.02	0.09	2.8	0.24	17
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021

Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	6	160	16	49
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	1	<1	2
Cobalt, Co	µg/L	1	<1	2	<1	<1
Copper, Cu	µg/L	1	<1	3	<1	5
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	1	54	49	10
Molybdenum, Mo	µg/L	1	<1	<1	<1	<1
Nickel, Ni	µg/L	1	<1	<1	<1	1
Zinc, Zn	µg/L	1	1	10	4	14

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021

Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	Sample Number: CE154939.013 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143500	CE154939.014 Soil 01 Sep 2021 143501	CE154939.015 Soil 01 Sep 2021 143502	CE154939.016 Soil 01 Sep 2021 143503

Moisture Content Method: AN002 Tested: 20/9/2021

% Moisture	%w/w	0.5	<0.5	0.5	<0.5	<0.5

pH in soil (1:2) Method: AN101 Tested: 22/9/2021

pH (1:2) aged	pH Units	-	6.4	7.5	7.3	6.8

Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021

Conductivity (1:2) aged @ 25C	µS/cm	1	490	480	200	260

Total Sulfur Method: AN012/AN320 Tested: 5/10/2021

Total Sulfur	%w/w	0.005	0.017	0.010	0.011	0.014

HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021

Acid Soluble Sulfur (SHCl)	%w/w	0.005	0.019	0.011	0.005	0.008

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021

ANC as % $CaCO_3$	% CaCO3	0.1	0.6	0.8	0.6	0.6
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	6.3	7.5	6.3	6.3
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	6.1	7.4	6.1	6.1

Parameter	Units	LOR	CE154939.013	CE154939.014	CE154939.015	CE154939.016
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			01 Sep 2021	01 Sep 2021	01 Sep 2021	01 Sep 2021
Sample Name			143500	143501	143502	143503

Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021

Parameter	Units	LOR	CE154939.013	CE154939.014	CE154939.015	CE154939.016
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-6**	**-7**	**-6**	**-6**

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.013	CE154939.014	CE154939.015	CE154939.016
ECox (NAG Conductivity)	µS/cm	1	**49**	**48**	**40**	**40**
pHox (NAG pH)	No unit	-	**5.4**	**6.3**	**5.6**	**6.1**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**0.7**	<0.5	**0.9**	**0.8**
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.013	CE154939.014	CE154939.015	CE154939.016
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.8**	**7.0**	**6.3**	**5.5**
Conductivity @25C	µS/cm	1	**75**	**89**	**32**	**41**

Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021

Parameter	Units	LOR	CE154939.013	CE154939.014	CE154939.015	CE154939.016
Aluminium, Al	mg/L	0.02	**6.5**	**19**	**15**	**3.8**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021

Parameter	Units	LOR	CE154939.013	CE154939.014	CE154939.015	CE154939.016
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**24**	**150**	**170**	**90**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	**1**	**2**	**2**	**1**
Cobalt, Co	µg/L	1	<1	**2**	**2**	<1
Copper, Cu	µg/L	1	**3**	**10**	**9**	**4**
Lead, Pb	µg/L	1	<1	**1**	**3**	<1
Manganese, Mn	µg/L	1	**20**	**26**	**27**	**39**
Molybdenum, Mo	µg/L	1	<1	<1	<1	<1
Nickel, Ni	µg/L	1	<1	**2**	**2**	**1**
Zinc, Zn	µg/L	1	**17**	**36**	**76**	**46**

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021

Parameter	Units	LOR	CE154939.013	CE154939.014	CE154939.015	CE154939.016
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	CE154939.017	CE154939.018	CE154939.019	CE154939.020
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			01 Sep 2021	01 Sep 2021	01 Sep 2021	01 Sep 2021
Sample Name			143504	143505	143506	143507

Moisture Content Method: AN002 Tested: 20/9/2021

% Moisture	%w/w	0.5	<0.5	<0.5	<0.5	<0.5

pH in soil (1:2) Method: AN101 Tested: 22/9/2021

pH (1:2) aged	pH Units	-	**6.5**	**6.7**	**6.9**	**6.7**

Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021

Conductivity (1:2) aged @ 25C	µS/cm	1	**280**	**430**	**210**	**370**

Total Sulfur Method: AN012/AN320 Tested: 5/10/2021

Total Sulfur	%w/w	0.005	**0.015**	**0.009**	<0.005	**0.006**

HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021

Acid Soluble Sulfur (SHCl)	%w/w	0.005	**0.010**	**0.010**	<0.005	**0.006**

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021

ANC as % $CaCO_3$	% CaCO3	0.1	**0.6**	**0.9**	**0.5**	**0.8**
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	**6.3**	**8.8**	**5.0**	**7.5**
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	**6.1**	**8.6**	**4.9**	**7.4**

Parameter	Units	LOR	CE154939.017	CE154939.018	CE154939.019	CE154939.020
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			01 Sep 2021	01 Sep 2021	01 Sep 2021	01 Sep 2021
Sample Name			143504	143505	143506	143507

Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021

Parameter	Units	LOR	CE154939.017	CE154939.018	CE154939.019	CE154939.020
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-6**	**-8**	**-5**	**-7**

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.017	CE154939.018	CE154939.019	CE154939.020
ECox (NAG Conductivity)	µS/cm	1	**45**	**51**	**41**	**43**
pHox (NAG pH)	No unit	-	**5.9**	**5.7**	**5.6**	**5.8**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**1.2**	<0.5	**1.0**	**0.8**
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	**1.2**	<1.0	**1.0**	<1.0

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.017	CE154939.018	CE154939.019	CE154939.020
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.6**	**6.0**	**6.3**	**6.0**
Conductivity @25C	µS/cm	1	**49**	**69**	**32**	**54**

Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021

Parameter	Units	LOR	CE154939.017	CE154939.018	CE154939.019	CE154939.020
Aluminium, Al	mg/L	0.02	**0.70**	**0.26**	**0.15**	**0.06**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021

Parameter	Units	LOR	CE154939.017	CE154939.018	CE154939.019	CE154939.020
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**120**	**22**	**6**	**8**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	<1	<1	<1
Cobalt, Co	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	**1**	<1	<1	<1
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	**23**	**11**	**11**	**13**
Molybdenum, Mo	µg/L	1	<1	<1	**1**	**2**
Nickel, Ni	µg/L	1	<1	<1	<1	<1
Zinc, Zn	µg/L	1	**34**	**1**	**2**	**23**

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021

Parameter	Units	LOR	CE154939.017	CE154939.018	CE154939.019	CE154939.020
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	CE154939.021 Soil 01 Sep 2021 143508	CE154939.022 Soil 01 Sep 2021 143509	CE154939.023 Soil 01 Sep 2021 143510	CE154939.024 Soil 01 Sep 2021 143511
Sample Number / Sample Matrix / Sample Date / Sample Name						

Moisture Content Method: AN002 Tested: 20/9/2021

% Moisture	%w/w	0.5	<0.5	<0.5	<0.5	<0.5

pH in soil (1:2) Method: AN101 Tested: 22/9/2021

pH (1:2) aged	pH Units	-	6.6	6.9	6.6	6.8

Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021

Conductivity (1:2) aged @ 25C	µS/cm	1	430	170	180	250

Total Sulfur Method: AN012/AN320 Tested: 5/10/2021

Total Sulfur	%w/w	0.005	0.008	0.007	0.007	0.011

HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021

Acid Soluble Sulfur (SHCl)	%w/w	0.005	0.005	<0.005	0.006	0.008

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021

ANC as % $CaCO_3$	% CaCO3	0.1	0.4	0.6	0.8	0.6
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	3.8	6.3	7.5	6.3
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	3.7	6.1	7.4	6.1

Parameter	Units	LOR	Sample Number: CE154939.021 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143508	CE154939.022 Soil 01 Sep 2021 143509	CE154939.023 Soil 01 Sep 2021 143510	CE154939.024 Soil 01 Sep 2021 143511

Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021

Parameter	Units	LOR	CE154939.021	CE154939.022	CE154939.023	CE154939.024
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-3**	**-6**	**-7**	**-6**

Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.021	CE154939.022	CE154939.023	CE154939.024
ECox (NAG Conductivity)	µS/cm	1	**49**	**38**	**35**	**38**
pHox (NAG pH)	No unit	-	**5.6**	**6.0**	**5.5**	**6.0**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	**1.1**	**0.6**	**1.1**	**0.6**
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	**1.1**	<1.0	**1.1**	<1.0

ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021

Parameter	Units	LOR	CE154939.021	CE154939.022	CE154939.023	CE154939.024
Mass of test sample for extraction	g	-	**20**	**20**	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**5.5**	**6.5**	**5.8**	**6.5**
Conductivity @25C	µS/cm	1	**64**	**28**	**30**	**42**

Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021

Parameter	Units	LOR	CE154939.021	CE154939.022	CE154939.023	CE154939.024
Aluminium, Al	mg/L	0.02	<0.02	**4.5**	**6.6**	**0.47**
Boron, B	mg/L	0.05	<0.05	<0.05	<0.05	<0.05

Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021

Parameter	Units	LOR	CE154939.021	CE154939.022	CE154939.023	CE154939.024
Arsenic, As	µg/L	1	<1	<1	<1	<1
Barium, Ba	µg/L	1	**3**	**29**	**52**	**28**
Beryllium, Be	µg/L	1	<1	<1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	<1	**1**	**1**	<1
Cobalt, Co	µg/L	1	<1	<1	<1	<1
Copper, Cu	µg/L	1	<1	**6**	**3**	<1
Lead, Pb	µg/L	1	<1	<1	<1	<1
Manganese, Mn	µg/L	1	**18**	**17**	**8**	**2**
Molybdenum, Mo	µg/L	1	<1	**2**	<1	**1**
Nickel, Ni	µg/L	1	<1	<1	<1	<1
Zinc, Zn	µg/L	1	**37**	**11**	**33**	**3**

Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021

Parameter	Units	LOR	CE154939.021	CE154939.022	CE154939.023	CE154939.024
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	Units	LOR	CE154939.025	CE154939.026
Sample Number			CE154939.025	CE154939.026
Sample Matrix			Soil	Soil
Sample Date			01 Sep 2021	01 Sep 2021
Sample Name			143512	143513

Moisture Content Method: AN002 Tested: 20/9/2021

Parameter	Units	LOR	CE154939.025	CE154939.026
% Moisture	%w/w	0.5	<0.5	<0.5

pH in soil (1:2) Method: AN101 Tested: 22/9/2021

Parameter	Units	LOR	CE154939.025	CE154939.026
pH (1:2) aged	pH Units	-	8.6	7.7

Conductivity (1:2) in soil Method: AN106 Tested: 28/9/2021

Parameter	Units	LOR	CE154939.025	CE154939.026
Conductivity (1:2) aged @ 25C	µS/cm	1	490	430

Total Sulfur Method: AN012/AN320 Tested: 5/10/2021

Parameter	Units	LOR	CE154939.025	CE154939.026
Total Sulfur	%w/w	0.005	0.015	0.010

HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 5/10/2021

Parameter	Units	LOR	CE154939.025	CE154939.026
Acid Soluble Sulfur (SHCl)	%w/w	0.005	0.012	0.009

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: AN212 Tested: 22/9/2021

Parameter	Units	LOR	CE154939.025	CE154939.026
ANC as % $CaCO_3$	% CaCO3	0.1	0.9	0.6
Acid Neutralisation Capacity/Neutralisation Potential	kg CaCO3/T	1	8.8	6.3
Acid Neutralisation Capacity/Neutralisation Potential kg	kg H2SO4/T	1	8.6	6.1

Parameter	Units	LOR	Sample Number: CE154939.025 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143512	Sample Number: CE154939.026 Sample Matrix: Soil Sample Date: 01 Sep 2021 Sample Name: 143513
Net Acid Generation Potential (NAGP) Method: AN215 Tested: 5/10/2021				
Net Acid Production Potential (Tot S and ANC only)	kg H2SO4/T	-1,000	**-8**	**-6**
Single Addition Net Acid Generation (NAG) Method: AN216 Tested: 23/9/2021				
ECox (NAG Conductivity)	µS/cm	1	**74**	**47**
pHox (NAG pH)	No unit	-	**7.9**	**6.1**
NAG as kg H_2SO_4/tonne to pH 4.5	kg H2SO4/T	0.5	<0.5	<0.5
NAG as kg H_2SO_4/tonne to pH 7	kg H2SO4/T	0.5	<0.5	**0.6**
NAG as kg CaCO3/tonne to pH 4.5	kg CaCO3/T	1	<1.0	<1.0
NAG as kg CaCO3/tonne to pH 7	kg CaCO3/T	1	<1.0	<1.0
ASLP (Australian Standard Leaching Procedure) DI Water Method: AN007/AS4439.3 Tested: 23/9/2021				
Mass of test sample for extraction	g	-	**20**	**20**
Mass of leaching solution used	g	-	**400**	**400**
Leaching solution used*	No unit	-	DiH2O	DiH2O
pH of solids leachate	pH Units	-	**8.5**	**6.9**
Conductivity @25C	µS/cm	1	**110**	**83**
Metals in ASLP DI Extract by ICPOES Method: AN320 Tested: 7/10/2021				
Aluminium, Al	mg/L	0.02	**26**	**0.08**
Boron, B	mg/L	0.05	<0.05	<0.05
Trace Metals in ASLP DI Extract by ICPMS Method: AN318 Tested: 20/9/2021				
Arsenic, As	µg/L	1	<1	<1
Barium, Ba	µg/L	1	**200**	**27**
Beryllium, Be	µg/L	1	<1	<1
Cadmium, Cd	µg/L	0.1	<0.1	<0.1
Chromium, Cr	µg/L	1	**3**	<1
Cobalt, Co	µg/L	1	**2**	**5**
Copper, Cu	µg/L	1	**27**	<1
Lead, Pb	µg/L	1	**11**	<1
Manganese, Mn	µg/L	1	**20**	**5**
Molybdenum, Mo	µg/L	1	<1	**8**
Nickel, Ni	µg/L	1	**2**	<1
Zinc, Zn	µg/L	1	**87**	**11**

Parameter	Units	LOR	CE154939.025	CE154939.026
Sample Number			CE154939.025	CE154939.026
Sample Matrix			Soil	Soil
Sample Date			01 Sep 2021	01 Sep 2021
Sample Name			143512	143513
Mercury in ASLP DI Water Extract Method: AN311(Perth) /AN312 Tested: 27/9/2021				
Mercury	mg/L	0.0001	**0.0015**	<0.0001

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Acid Neutralising Capacity or Neutralisation Potential(ANC/NP) Method: ME-(AU)-[ENV]AN212

Parameter	QC Reference	Units	LOR	DUP %RPD
Acid Neutralisation Capacity/Neutralisation Potential	LB094328	kg CaCO3/T	1	0 - 29%
Acid Neutralisation Capacity/Neutralisation Potential kg H_2SO_4/t	LB094328	kg H2SO4/T	1	0 - 29%

Conductivity (1:2) in soil Method: ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	DUP %RPD
Conductivity (1:2) aged @ 25C	LB094536	µS/cm	1	1 - 3%

Mercury in ASLP DI Water Extract Method: ME-(AU)-[ENV]AN311(Perth) /AN312

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Mercury	LB094475	mg/L	0.0001	<0.0001	0 - 8%	103 - 104%

Metals in ASLP DI Extract by ICPOES Method: ME-(AU)-[ENV]AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Aluminium, Al	LB094779	mg/L	0.02	<0.02	0 - 3%	98%
Boron, B	LB094779	mg/L	0.05	<0.05	0%	NA

pH in soil (1:2) Method: ME-(AU)-[ENV]AN101

Parameter	QC Reference	Units	LOR	DUP %RPD
pH (1:2) aged	LB094327	pH Units	-	1 - 2%

Single Addition Net Acid Generation (NAG) Method: ME-(AU)-[ENV]AN216

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
ECox (NAG Conductivity)	LB094377	µS/cm	1	40	0 - 7%	97%
pHox (NAG pH)	LB094377	No unit	-	5.1	0 - 3%	96%
NAG as kg H_2SO_4/tonne to pH 4.5	LB094377	kg H2SO4/T	0.5	<0.5	0%	105%
NAG as kg H_2SO_4/tonne to pH 7	LB094377	kg H2SO4/T	0.5	<0.5	0 - 27%	112%
NAG as kg CaCO3/tonne to pH 4.5	LB094377	kg CaCO3/T	1	<1.0	0%	105%
NAG as kg CaCO3/tonne to pH 7	LB094377	kg CaCO3/T	1	<1.0	0 - 27%	112%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Trace Metals in ASLP DI Extract by ICPMS Method: ME-(AU)-[ENV]AN318

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Arsenic, As	LB094234	µg/L	1	<1	0%	NA
Barium, Ba	LB094234	µg/L	1	<1	4 - 8%	NA
Beryllium, Be	LB094234	µg/L	1	<1	0%	NA
Cadmium, Cd	LB094234	µg/L	0.1	<0.1	0%	NA
Chromium, Cr	LB094234	µg/L	1	<1	0%	NA
Cobalt, Co	LB094234	µg/L	1	<1	0%	NA
Copper, Cu	LB094234	µg/L	1	<1	0%	NA
Lead, Pb	LB094234	µg/L	1	<1	0%	NA
Manganese, Mn	LB094234	µg/L	1	<1	0 - 6%	NA
Molybdenum, Mo	LB094234	µg/L	1	<1	0%	NA
Nickel, Ni	LB094234	µg/L	1	<1	0%	NA
Zinc, Zn	LB094234	µg/L	1	<1	0 - 2%	NA

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN007/AS4439.3	Contaminants of interest in a waste material are leached out of the waste with a selected leaching solution under controlled conditions. The ratio of sample to extraction fluid is 100 g to 2 L (1 to 20 by mass). The concentration of each contaminant of interest is determined in the leachate by appropriate methods after separation from the sample by filtering. Based on AS4439.3.
AN012/AN320	Dried prepared soil is digested by oxidation with nitric acid and bromine followed by analysis of the digest by ICP OES.
AN014	This method is for the determination of soluble sulfate (SO4-S) by extraction with hydrochloric acid. Sulphides should not react and would normally be expelled. Sulfate as Sulfur is determined by ICP.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:2 and the pH determined and reported on the extract after 1 hour extraction (pH 1:2) or after 1 hour extraction and overnight aging (pH (1:2) aged). Reference APHA 4500-H+.
AN106	Conductivity : Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract of as received sample with water is made at a ratio of 1:2 and the EC determined and reported on the extract basis after the 1 hour extraction (EC(1:2)) or after the 1 hour extraction and overnight aging (EC(1:2) aged). Reference APHA 2510 B.
AN106	Resistivity of the extract is reported on the extract basis and is the reciprocal of conductivity. Salinity and TDS can be calculated from the extract conductivity and is reported back to the soil basis.
AN212	Samples are initially evaluated to determine the strength of reagents needed using a `'fizz ' test. Samples are then subjected to an excess of hydrochloric acid followed by alkaline back titration to pH 7. Results are expressed in kg H2SO4/tonne or Kg CaCO3/tonne after correction for moisture content if applicable.
AN215	This is purely a calculation based on results obtained from Total Sulphur , Sulfate Method, and Acid Neutralisation Capacity Method (ME-AU-ENV-AN212). The negative value included as the LOR allows negative NAPP data to be reported in the LIMS, it is not the numerical LOR which would theoretically be 1kg H2SO4/tonne. The range of results is theoretically -980 to 1640kg H2SO4/ Tonne.
AN216	Pulverised sub-sample of a waste rock or an as received sample of filter cake, soil or sludge is subjected to an oxidising digest with 15% hydrogen peroxide adjusted to pH 4.5. The pH and EC of the NAG suspension is recorded at various stages in the digest. The acid produced (if any) is titrated using standardised NaOH to pH 7.0. NAG results are reported to 0.5 kg H2SO4/tonne.
AN311(Perth) /AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN318	Determination of elements at trace level in waters by ICP-MS technique, referenced to USEPA 6020B and USEPA 200.8 (5.4).

METHOD	METHODOLOGY SUMMARY
AN320	Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components .
AN320	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
***	Indicates that both * and ** apply.	NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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APPENDIX L NOBLES NOB GROUNDWATER IMPACT ASSESSMENT

Nobles Nob Groundwater Impact Assessment

Nobles Nob Gold Project

Tennant Consolidated Mining Group Pty Ltd

Version 2.0

September 2023

Acknowledgement of Country

Tennant Mining acknowledges the Traditional Owners of the lands on which we work. We pay our respects to elders, past, present, and emerging.

Disclaimer

Document Control

Version	**Personnel**	**Date**
Version 0.1	Dr Ashish Mishra prepared the document	22-05-2023
Version 0.1	Steve Murdoch reviewed and approved the document	23-05-2023
Version 1.0	Dr Ashish Mishra finalised the document for issue.	23-05-2023
Version 2.0	Dr Ashish Mishra finalised v2.0, and approved for issue	29-09-2023

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1.0 Introduction

1.1 Background

The Nobles Nob Gold Project (Nobels Nob) is located approximately 13 kilometres (km) southeast of Tennant Creek township, in the Northern Territory (NT). Gold was initially extracted at Nobles Nob from underground operations in the early 1930s and then through open-pit methods from the 1960s. Open-pit mining at Nobles Nob concluded in 1985, although gold production at Nobles Nob continued until 1992.

Tennant Consolidated Mining Group (TCMG) have obtained the approval to recommence operations at Nobles Nob, which currently includes mining and processing of the crown pillar stockpile (CPS), a small extension of the Nobles Nob Pit (goodbye cut), and exploration activities. A Mining Management Plan (MMP) for Nobles Nob was submitted and approved as per the Northern Territory *Mining Management Act 2001*, with mining authorisation (1123-01) granted on 15 August 2022. A Water Extraction Licence was granted to TCMG by the Northern Territory Government's Department of Environment, Parks and Water Security (DEPWS) for the Nobles Nob Gold Project on 19 January 2023 (Licence No: L10012).

TCMG is currently planning an amendment to the current approved MMP to add more mining-related activities on-site. These include expansion of Nobles Nob Pit, processing of ores from satellite deposits (such as Black Snake), reprocessing of historical tailings from the northern tailings area, and storage of tailings produced from processing gold as dry stacks instead of Geotubes. The proposed activities are outlined in more detail in the section below. This impact assessment presents the hydrogeological understanding of the Nobles Nob based on available information and outlines potential impacts that may occur as a result of the proposed mining activities. The report also recommends appropriate management and mitigation measures, where required.

1.2 Relevant Legislation and Guidelines

The relevant legislation and guidelines that were used in the preparation of this assessment are as follows:

- The *Mining Management Act 2001* (Northern Territory) - Exploration and mining operations in NT must be authorised under the *Mining Management Act 2001* (MMA). Under the MMA, a Mining Management Plan (MMP) must be submitted to the Department of Tourism, Industry and Trade (DITT) for authorisation. TCMG received the mining authorisation under this act on 15 August 2022.
- The *Water Act 1992* (Northern Territory) - the *Water Act 1992* outlines the legal framework for allocations, entitlements, and water planning for most water resources in the NT. The investigation, allocation, use, control, protection, management, and administration of surface water and groundwater resources are also covered by the *Water Act*. The Tennant Creek Water Control District, which is a recognised water management region under the *Water Act 1992*, includes the Nobles Nob tenement. The Tennant Creek Water Control District currently lacks a water allocation strategy.
- The *Environmental Protection Act 2019* (Northern Territory) – the *Environmental Protection Act 2019* (EP Act) came into effect on 29 June 2020 and intends to build a framework for evaluating the potential environmental impacts of development projects in order to protect the Northern Territory's environment and promote ecologically sustainable development. As outlined in Part 4 of the EP Act, an impact assessment is required where a proposed action

has the potential to have a significant impact on the environment or meets referral criteria. Although the Nobles Nob project has not been referred, this assessment has been undertaken proactively by TCMG to understand the impacts, if any, from the proposed activities.

- *Waste Management and Pollution Control Act 1998* (Northern Territory) – this act provides the framework for the protection of the environment from waste and pollution, by incorporating effective waste management, pollution prevention and control practices.
- *Environment Protection and Biodiversity Conversation Act 1999* (Cth) (EPBC Act) – The EPBC Act provides a framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and other matters, defined in the EPBC Act as matters of national environmental significance (MNES). A search of desktop tools states there are no MNES identified in the vicinity of the Nobles Nob.

1.3 Data Availability

This assessment was undertaken based on available site data and field data collected from Nobles Nob for various previous studies. This includes the following:

- Nobles Nob water quality management plan (TCMG, 2022) – Attached as **Appendix A**
- Nobles Nob Pit dewatering assessment report (TCMG, 2023a) – Attached as **Appendix B**
- Nobles Nob waste rock analysis report (Umwelt, 2021a)
- Nobles Nob Mine groundwater slug test report (Umwelt, 2021b)
- Nobles Nob Mine groundwater assessment report (Umwelt, 2021c)
- Nobles Nob groundwater monitoring bore installation and construction details
- Black Snake waste rock characterisation report (TCMG, 2023b)
- Rising Sun waste rock characterisation report (TCMG, 2023c)
- Water quality results from October 2021 to March 2023

1.4 Proposed Activities

TCMG is proposing amendments to its existing MMP to include the proposed activities mentioned in the sections below.

1.4.1 Expansion of Nobles Nob Pit

TCMG plans to expand the footprints of existing Nobles Nob Pit to mine gold mineralisation (**Figure 1**). The existing Nobles Nob Pit is spread over an area of 6.4 hectares (ha), whereas the proposed expansion of the Nobles Nob Pit will cover approximately an area of 15.9 ha, and the maximum depth will be 266 mAHD, which is 20 m below the existing pit floor at 286 mAHD. The expansion will require dewatering of the pit and will require lowering the groundwater levels 20 m below the pit floor. The impacts of the pit dewatering were assessed in the Nobles Nob Pit dewatering assessment (TCMG, 2023a). The assessment concluded that the proposed dewatering of Nobles Nob Pit is expected to have no adverse impacts on the groundwater system at Nobles Nob, except for changes in groundwater level. Any such impacts will be constraints within the 2.763 km radius. As such, the proposed pit dewatering is unlikely to deplete the aquifer or impact the water supply of Tennant Creek township. The waste rock produced from the expansion will be stored in the northern waste rock dump (northern WRD), which was historically used for storing waste rock from historical operations at Nobles Nob.

1.4.2 Reprocessing of Northern Tailings Area

The historical tailings stored in the northern tailings area will be extracted and reprocessed. Before initiating the reprocessing of historical gold mine tailings, a thorough assessment of the existing tailings storage facility (TSF) and tailings will be undertaken. This will include the geochemical characterisation of the tailings. Extraction will be undertaken by utilising high-pressure water jets to create a slurry, which will be transported to the processing plant for processing, where gold contained within the tailings will be extracted using the cyanide leach process. This method reduces the need for traditional excavation and hauling, resulting in a smaller environmental footprint.

1.4.3 Changing Tailings Storage from Geotubes to Dry Stacking

As part of the currently approved MMP, it was proposed that Geotubes dewatering technology will be used to treat and store the tailings produced from operations at Nobles Nob. However, as part of the project optimisation and to further minimise the environmental impacts, TCMG now plans to use dry stacking of the tailings as the method to store tailings at Nobles Nob. Dry stacking is a tailings management technique that offers several advantages over traditional storage methods, such as Tailings dams or Geotubes. Few of the benefits of dry stacking are as follows:

- **Reduced Environmental Impact** – Dry stacking of tailings can significantly reduce the environmental impact of mining operations. Since the tailings are stacked in a dry and stable form, the potential for water contamination or leaching of contaminants is negligible.
- **Reduced Footprint** – Dry stacking of tailings can also significantly reduce the land footprint required for tailings storage. The stacking process creates a compact and stable tailings stack that requires less land area compared to traditional impoundments or Geotubes.
- **Improved Stability and Safety** – Dry stacking of tailings results in a stable and non-porous stack of tailings that eliminates the risk of dam failures and associated environmental disasters. Unlike impoundments or Geotubes, dry stacked tailings do not rely on water retention to maintain structural stability. This feature reduces the risk of liquefaction, a common issue with saturated tailings. Additionally, dry stacking eliminates the need for tailings dams, which can be potential sources of instability and safety hazards.
- **Reduced Water Consumption** – Dry stacking of tailings involves dewatering the tailings slurry to a moisture content that enables stacking into a dry and stable state. This method significantly reduces water consumption for processing, compared to traditional storage methods that rely on the retention of large volumes of water, making dry stacking a more sustainable option.

Dry stacking of the tailings is proposed to occur in a staged approach in the southern tailings area (southern TSF), northern tailings area (northern TSF), which is already approved for Geotubes in the current authorisation, and eventually in the southern waste rock dump. Dry stacking will occur once the historical tailings at northern TSF and waste rocks in the southern waste rock dumps have been reprocessed. More information on the process of dry stacking is outlined in the section below.

1.4.3.1 Dry Stacking of Tailings

Dry stacking of tailings is a tailings management technique that involves dewatering the tailings to a moisture content suitable for stacking into a dry and stable form. This process significantly reduces the environmental impact and risks associated with traditional tailings storage methods. Below is a step-by-step explanation of the dry stacking process for better understanding.

1. **Tailings Processing** – After the tailings have undergone the necessary processing steps for gold extraction, the resulting tailings slurry contains a mixture of water and fine particles. At this stage, the tailings are approximately 40%(w/w) thick.
2. **Thickening** – In the first stage of the dry stacking process, the tailings slurry will be treated in thickeners, making the 40%(w/w) thickened up to 60%(w/w). Thickeners enable the separation of water from the solid particles, reducing the water content of the slurry.

3. **Dewatering** – Following thickening, the partially dewatered tailings slurry will undergo further dewatering processes to achieve the desired moisture content for dry stacking. Filter presses will be used as the dewatering method. Mechanical dewatering in a filter press will reduce the moisture content in the tailings to less than 20%.
4. **Discharging and Spreading** – Once the filter press sufficiently dewaters the tailings slurry, it will be discharged onto a specially prepared stacking area. The dewatered tailings will then be spread and distributed evenly across the stacking area. A wheeled loader or a dozer will be used to spread the dry tailings and provide sufficient compaction for the trafficability of the conveyor and stacker as needed. Additional compaction will be conducted in specified areas to limit the possibility of dynamic (earthquake) liquefaction of the tailings, which may cause instability of the stack. The stacking will be undertaken in accordance with ANCOLD guidelines, to maintain the factor of safety (FOS) of 1.5.
5. **Layering and Compaction** – To ensure stability and optimise space utilisation, the dewatered dry tailings will be layered and compacted. Each layer will be typically compacted using wheeled loaders or dozers and heavy machinery to increase the density and reduce the air voids within the stack. Compaction helps to create a stable and self-supporting structure. The aim will be to achieve high compaction percentage for dry stacks for the project, typically up to 95% of the maximum achievable density. The compaction percentage refers to the ratio of the final compacted density to the maximum achievable density of the tailings material. It is usually expressed as a percentage. Achieving this high compaction percentage will help in reducing the presence of voids within the stack, making it impermeable to water infiltration.
6. **Terracing and Contouring**: As the dry stack grows, a terrace or contour will be created by cutting into the slope of the stack at predetermined intervals. These terraces provide additional stability, allowing for better water runoff management and erosion control. Surface water, including rainfall, will be effectively managed to prevent erosion and maintain the stability of the stack. Diversion channels, drainage ditches, and erosion control measures will be implemented to guide and control water flow.
7. **Final Cover** Once the dry stack reaches its designed height, a final cover will be applied to minimise potential environmental impacts. This cover layer will provide further protection against erosion, dust generation, and infiltration, and will consider aspects such as soil types, climatic conditions, and long-term stability. The final cover design will also consider the post-closure land use objectives and will be in compliance with the relevant legislation and adhere to best practices to achieve successful and sustainable mine site rehabilitation.

1.4.4 Processing of Ores from Satellite Deposit

TCMG will also be processing ores from nearby satellite deposits (such as Black Snake, Rising Sun, and Weabers Find), that share similarities in ore types and geological characteristics with the Nobles Nob project area, in the Warramunga region. These satellite deposits are located within the same geological province, indicating a high likelihood of similar mineralisation and ore quality. By leveraging the proximity of these satellite deposits, the mining operation can optimise its resource utilisation and operational efficiency. The similar ore types imply that the processing plant can utilise existing infrastructure, equipment, and processing techniques already in place. This streamlines the processing operations and reduces the need for significant modifications or additional investments. Additionally, processing ore from satellite deposits within the same geological province can enhance the understanding of the overall mineralisation patterns and geology in the region. It provides an opportunity to gain valuable insights into the deposit genesis, geological controls, and potential extensions of the ore bodies. This knowledge can be utilised for future exploration efforts and resource estimation in the area.

2.0 Site Characteristics

2.1 Location and History

The Nobles Nob Mine is located within the Tennant Creek Goldfield, approximately 13 km southeast of Tennant Creek in Northern Territory, Australia. Tennant Creek is approximately 504 km north of Alice Springs and 978 km south of Darwin (**Figure 1**). The Nobles Nob area encompasses 355 hectares (ha), with 253 ha within Nobles Nob mining tenements and 102 ha within Juno tenements.

Previous disturbances at Nobles Nob occurred during historical mining activities. Nobles Nob was historically mined over 50 years from the late 1930s to the 1980s. Mining commenced in 1939 with underground operations. The collapse of the crown pillar in 1968 led to the construction of a new plant, followed by open-pit operations in 1969. Some of the material from the collapsed crown pillar was recovered, while most of the material was stockpiled in the existing mineralised southern waste rock dump (southern WRD), located to the south of the Nobles Nob pit.

Open-pit mining continued at Nobles Nob from 1969 through to 1985 with a total production of 1.6Mt of ore at a grade of ~7g/t gold yielding 342,000 ounces of gold. In total, since the 1930s, the Nobles Nob mine produced 2.1Mt of ore at a grade of 17.0 g/t with a total yield of 1.17M ounces of gold and was considered Australia's richest gold mine for many of those years.

2.2 Topography and Drainage

Land surface elevation, informed by LiDAR data, shows that the area around Nobles Nob comprises plains and low hills associated with the McDougall Ranges (Umwelt, 2021c). Elevation throughout the site ranges from approximately 296 mAHD to 380 mAHD. The rest of the region towards the west of Nobles Nob appears to be dominated by level to undulating plains, associated mainly with dune fields and sand plains of the Tanami Desert (Umwelt, 2021c).

Two permanent surface water bodies exist around Nobles Nob (TCMG, 2022; Tennant Gold Resource, 2018), including the Nobles Nob Pit and Lake Alice, [redacted] located approximately 500 m southwest of the pit. Some surface drainage occurs on-site briefly during the wet season. Surface flows across the mine site would predominately be conveyed as sheet flow before channelising and forming local flow paths (ATCW, 2022). Refer to **Figure 2**, which illustrates the existing watercourses and surface drainages in the area.

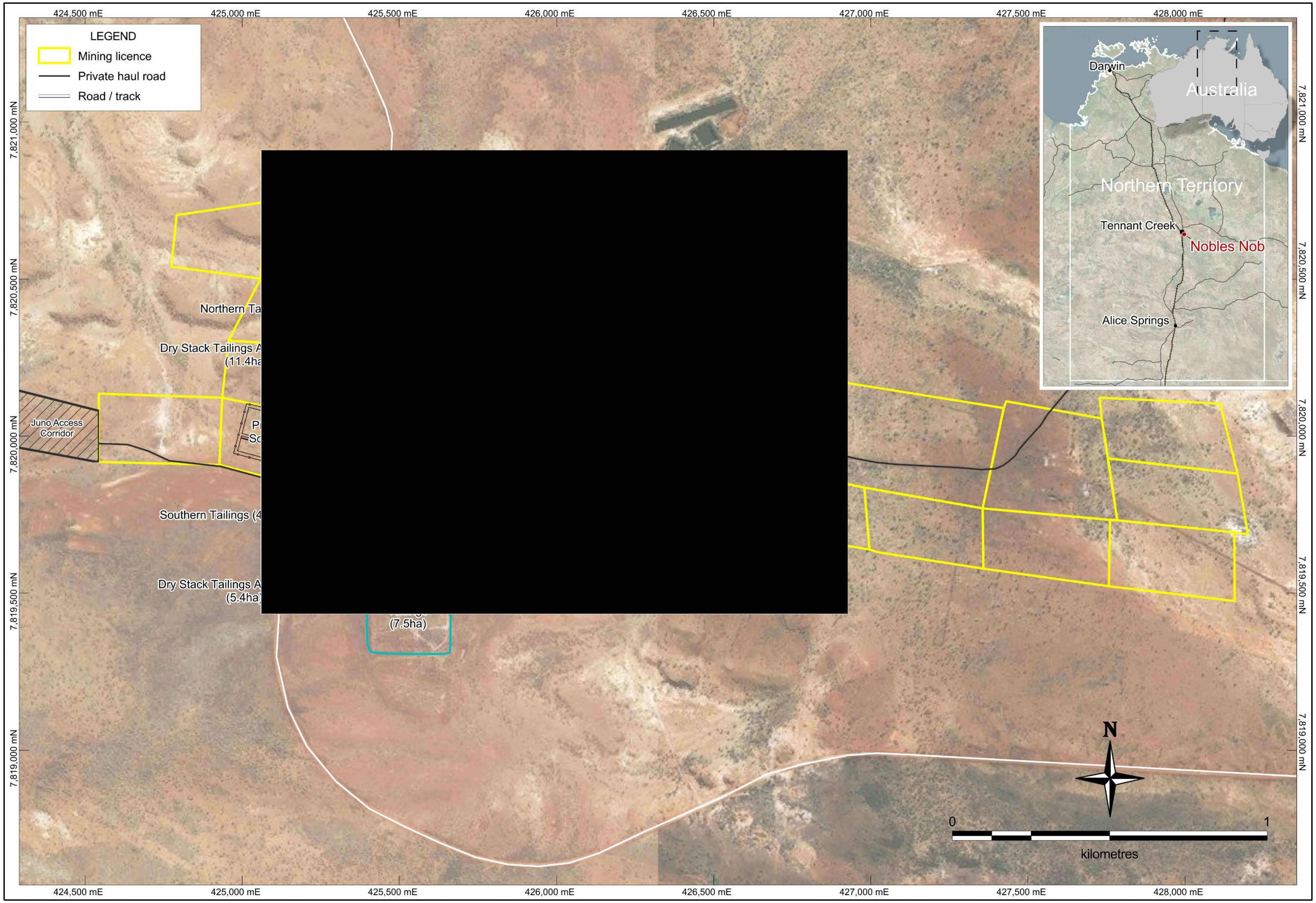

Figure 1 Site Location and Proposed Infrastructure

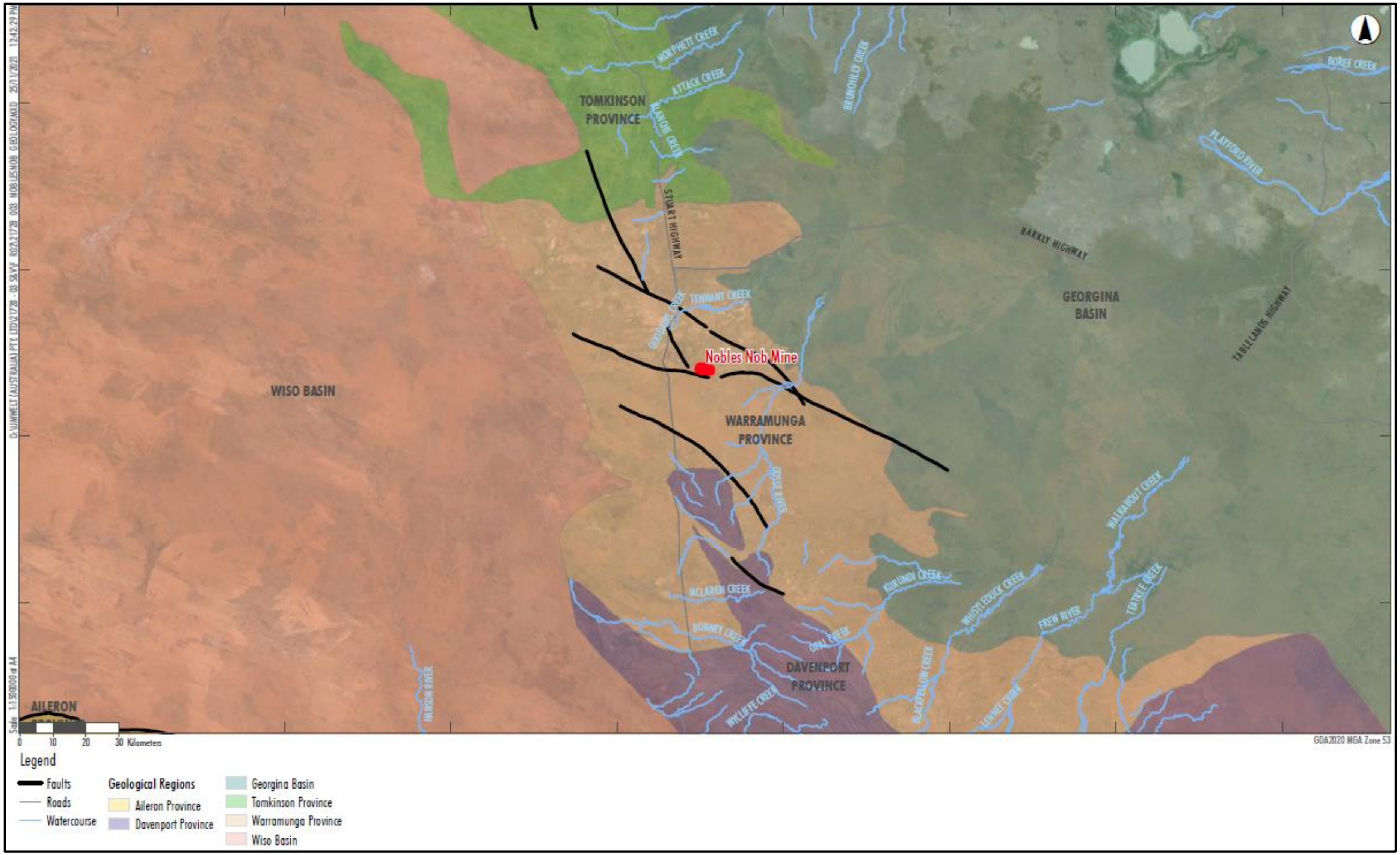

Figure 2 Existing Catchments and Flow Directions (Source: Umwelt, 2021c)

2.3 Climate

The area is characterised by a hot arid climate, with evapotranspiration exceeding rainfall throughout the year. The mean monthly temperature data was retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), presented in **Table 1**. The mean monthly maximum temperature ranges from 24.6°C during the winter (June) to 37.3°C in the summer (December) (BoM, 2022).

Table 1 Mean Monthly Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (˚C)	36.8	35.9	34.7	32	27.7	24.6	24.8	27.6	31.8	35	36.7	37.3
Mean minimum temperature (˚C)	25	24.5	23.4	20.6	16.4	13	12.3	14.4	18.5	21.9	23.9	25

Mean has been calculated using monthly data from Jan 1969 to Jan 2023

Rainfall data has been retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), and from the publicly available Scientific Information for Landowners (SILO) station at Tennant Creek Airport (Latitude -19.64, Longitude 134.18). The monthly average rainfall and evapotranspiration data for the last 20 years have been presented in **Table 2** below.

The SILO database generally provides a complete long-term dataset and is, therefore, helpful in assessing long-term rainfall trends in the vicinity of the site. This dataset is interpolated from quality-checked observational time-series data collected at nearby stations by the Bureau of Meteorology. Based on the SILO dataset, the average annual rainfall over 100 years is 383.9 mm, with evaporation exceeding rainfall during each month of the year (**Table 2** and **Figure 3**). On the other hand, the BoM station data suggests that the mean annual precipitation for the last 20 years is 492 mm.

Table 2 Monthly Average of Rainfall and Evapotranspiration (SILO)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
BOM Rainfall*	147.2	101.4	41.3	12.3	7.0	6.6	4.8	4.0	6.8	18.7	43.6	90.0	492.2
SILO Rainfall	97.7	89.4	49.9	11.7	10.3	6.7	5.0	2.1	5.4	15.6	30.4	59.7	383.9
SILO ET#	348.1	288.7	320.1	286.0	231.3	185.8	198.2	249.1	305.7	359.6	369.1	370.2	3511.9
SILO fao56 ET#	213.1	181.3	191.5	167.7	138.4	115.2	126.2	156.1	185.0	217.0	220.4	224.0	2135.9

All values are in millimetres (mm)
*BoM average is of last 20 years
#ET – Evapotranspiration

The SILO dataset was used to calculate the cumulative rainfall deviation (CRD). The CRD is a summation of the monthly departure of rainfall from the long-term average monthly rainfall. A rising trend in slope in the CRD plot indicates periods of above-average rainfall, whilst a declining slope indicates periods when rainfall is below average. The CRD in **Figure 4** below has been calculated based on the long-term average monthly rainfall from 1900 to 2022. The CRD indicates that the Nobles Nob area has experienced a period of above-average rainfall from 2010 to 2016, and below-average rainfall from 2016 until 2022. In 2022, the average rainfall experience at Nobles Nob was higher than average (**Figure 4**).

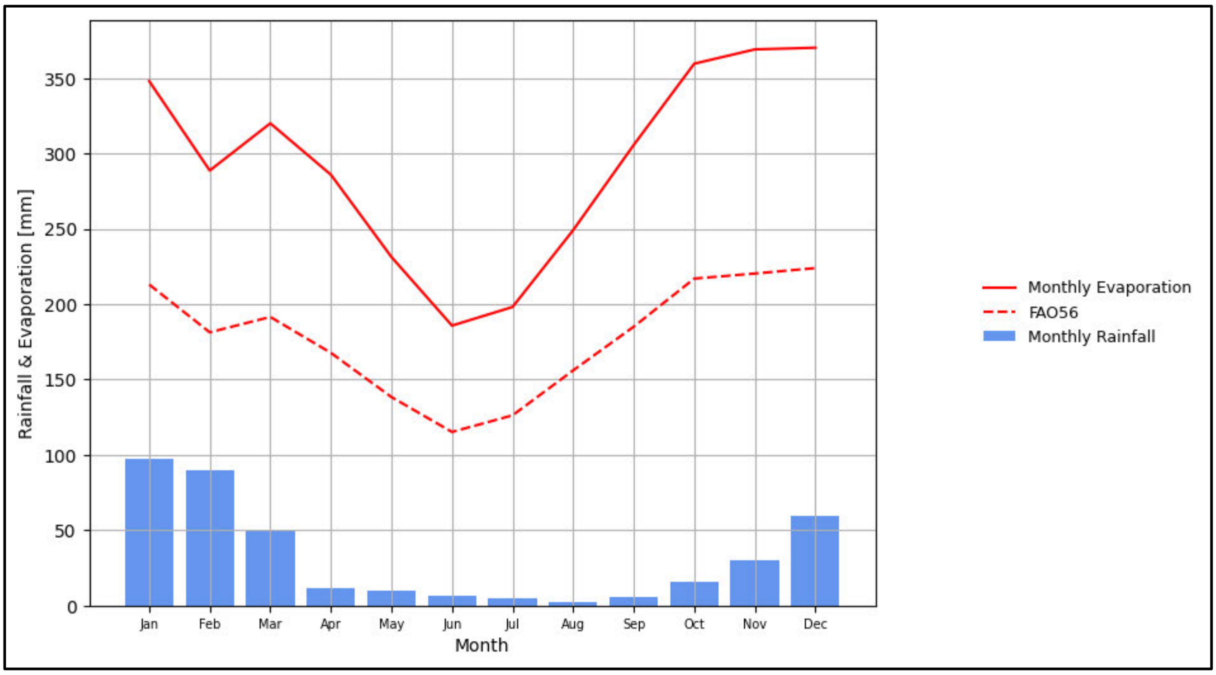

Figure 3 Graph Showing Monthly Average Rainfall and Evapotranspiration

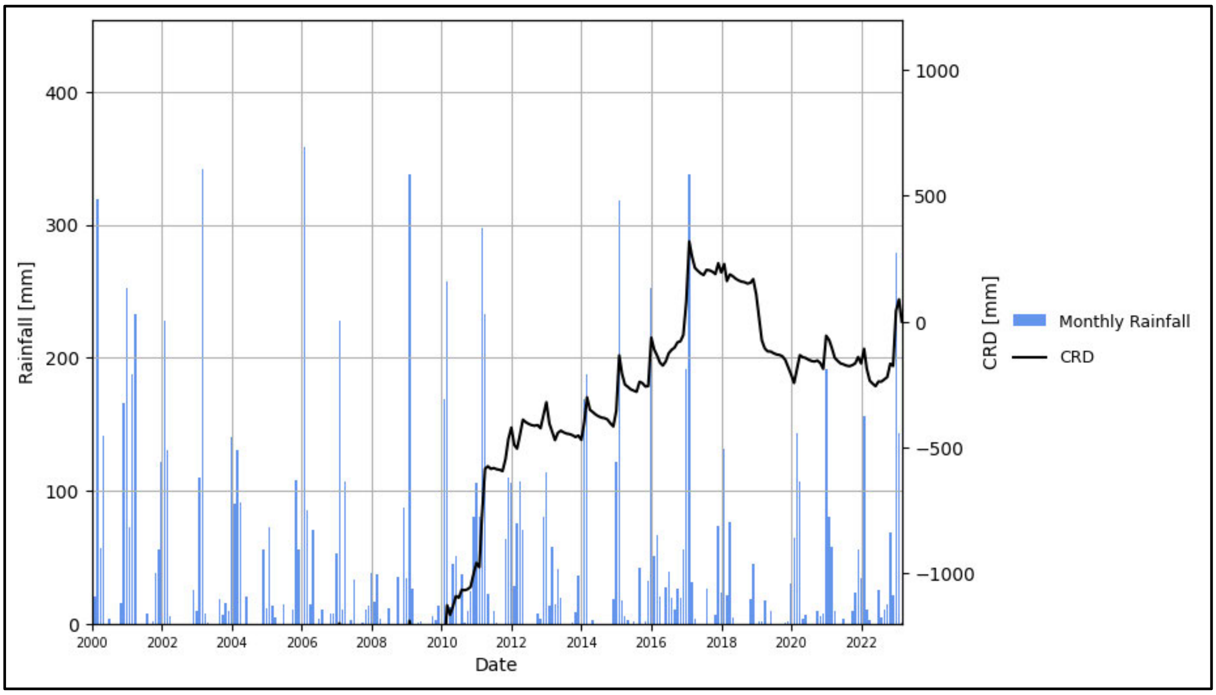

Figure 4 Monthly Rainfall (2000-2022) and CRD at Nobles Nob

2.4 Land System and Soils

Nobles Nob is situated within the Tennant Creek Land System, dominated by sandstone plains and rises characteristic of the Ashburton Range subregion. It is part of the greater Davenport Murchison Ranges bioregion, characterised by plateaux, plains and rises on sandstone, claystone and limestone, and outcrops with shallow stony soils.

According to the Australian Soil Classification, the dominant soils at Nobles Nob are Kandosol, Rudosol and Tenosol.

- Kandosols are often referred to as red, yellow and brown earth. Kandosols are essential for agricultural and horticultural production. They occur throughout the Northern Territory and are widespread across the Top End, Sturt plateau, Tennant Creek and Central Australian regions.
- Rudosols are very shallow soils with minimal soil development. Rudosols include very shallow rocky and gravelly soils across rugged terrain and pure sand soils in deserts.
- Tenosols are weakly developed or sandy soils which are essential for horticulture. These soils show some degree of development (minor colour or soil texture increase in subsoil) down the profile.

2.6 Vegetation

Previous surveys identified the vegetation at Nobles Nob as predominantly eucalypt low open woodland and acacia-sparse shrubland over hummock grassland. The rises on-site host a community of open woodland dominated by snappy gum (*Eucalyptus leucophloia* subsp. *euroa*) over gummy spinifex (*Triodia pungens*) grassland. Plains and drainage communities have a mosaic of *E. pruinosa* and *E. aparrerinja* woodlands (Tennant Gold, 2018). No vegetation communities or ecological communities of listed conservation significance have been recorded within 50 km of Nobles Nob. A search of the NT Flora Atlas identified 22 records of 13 species of listed conservation significance, three of which are considered 'Near Threatened' under the *TPWC Act*: *Lythrum wilsonii, Trianthema glossostigmum,* and *Trianthema. oxycalyptra* var. *oxycalyptra.*

3.0 Hydrogeology

3.1 Existing Groundwater Bores at Nobles Nob

A total of 10 monitoring bores were installed by TCMG in May/June 2021 to monitor the water level and quality of groundwater at Nobles Nob. The details of the bores are presented in **Table 3** below, and the locations are shown in **Figure 5** below.

The hydrogeological assessment at Nobles Nob was undertaken in 2021 (Umwelt, 2021c), in which a review of registered bores within 2.5 km of the Nobles Nob pit was also undertaken using the NR Maps desktop tool (https://nrmaps.nt.gov.au/nrmaps.html). Details of the registered bores are also presented in **Table 3** below. The review of registered bores identified 16 registered bores within 2.5 km of Nobles Nob (Umwelt, 2021c). Of these 16 bores, most were installed for historical mine water production; however, most of them did not encounter any water (Umwelt, 2021c). The NR Maps assessment suggests that none of the 16 registered bores are being used for stock water supply.

Table 3 Groundwater Bores around Nobles Nob

Bore ID	Date completed	Easting*	Northing*	Depth	Screen Interval	Water Bearing Unit	Yield (L/s)
Monitoring Bores							
NNMW001	6/06/2021	425505	7819803	102	90 - 102	Sandstone	0.01
NNMW002	9/06/2021	425488	7819596	77.9	65.9 - 77.9	Sandstone	0.05
NNMW004	4/06/2021	425374.9	7820346	75	63 - 75	Sandstone	0.11
NNMW005	3/06/2021	425228.6	7820086	70	58 - 70	Sandstone	0.53
NNMW007	2/06/2021	424730.8	7819950	95.8	83.8 - 95.8	Sandstone	0.13
NNMW011	29/05/2021	426621.8	7819922	66	54 - 66	Sandstone	1
NNMW012	31/05/2021	427616.9	7819830	76.6	64.4 - 76.4	Sandstone	0.2
NNMW013	7/06/2021	426527.3	7820174	78	66 - 78	Sandstone/ Siltstone	0.2
NNMW014	30/05/2021	426075.9	7820387	69.6	57.6 - 69.6	Hematite Shale	0.2
NNMW018	1/06/2021	427151.5	7819926	78	66 - 78	Sandstone	1.9
Registered Bores							
RN006863	26/11/1969	426927	7819869	100.6	NA	Slate	1
RN006864	28/11/1969	427677	7820019	152.4	NA	Siltstone	0.1
RN007139	11/05/1970	427677	7820019	131.1	NA	No Water Encountered	0
RN007140	19/05/1970	427677	7820019	112.8	NA	No Water Encountered	0
RN006496	5/05/1969	424127	7819169	91.4	NA	No Water Encountered	0
RN006862	24/11/1969	426527	7819469	123.4	NA	Siltstone	0.9
RN006495	6/05/1969	426127	7819369	99.1	NA	No Water Encountered	0
RN003777	11/06/1963	424877	7819819	112.8	NA	Greywacke (sandstone)	0.5
RN012016#	6/10/1978	427127	7819169	106.8	NA	Greywacke (sandstone)	0.1
RN003776†	14/05/1963	426127	7819819	32	NA	No Water Encountered	0
RN012015#	5/02/1990	426076	7819792	97.6	NA	Siltstone	2

RN003775†	16/06/1963	426127	7819819	25.9	NA	No Water Encountered	0
RN006497	7/05/1969	426527	7819869	100.6	NA	Siltstone	1
RN011760#	18/11/1977	426127	7820169	110	NA	Siltstone	3.2
RN003774†	10/03/1963	426127	7819819	23.2	NA	No Water Encountered	0
RN012028#	25/11/1978	427127	7820169	91	NA	Siltstone	2

*Coordinates in GDA2020 MGA Zone 53.

abandoned/backfilled. † Stope holes located at the same location. NA - Not Available

Figure 5 Monitoring and Registered Groundwater Bores at Nobles Nob

3.2 Hydrogeological Units

Based on the analysis of aquifer yields, bore logs and lithology, the primary hydrogeological unit at Nobles Nob is within the local scale fractured sandstone/siltstone of the Warramunga Group (Umwelt, 2021c). The information provided in the drilling records and water level readings post-installation of the groundwater bores at Nobles Nob were also reviewed and suggested the same. Groundwater in this aquifer is generally first encountered between approximately 70 to 80 meters below ground level (Umwelt, 2021c). The drilling records from the monitoring and registered bores generally suggest that no groundwater was encountered at shallow depths. Registered bores drilled at shallow depths (<32m) also did not encounter any groundwater. Measurements of airlift yields recorded during drilling of monitoring bores and registered bores are generally less than 1 L/s (only 2 out of 10 bores recorded a yield of > 1 L/s), suggesting that the permeability in the area is low.

Previous studies around the Tennant Creek area also found groundwater within Warramunga Group siltstones, schists and granites, and Gum Ridge Formation limestone and chert (Verhoeven, 1976; Verhoeven & Knott, 1980). These studies also found that the permeability of these aquifers is low, and the quality is unsuitable for human consumption (Rockwater, 1989; Verhoeven & Knott, 1980).

3.3 Hydraulic Parameters

Slug tests were undertaken at 10 monitoring bores at Nobles Nob in October 2021, to estimate the hydraulic parameters of the groundwater system (Umwelt, 2021b). The values of hydraulic conductivity ranged from 0.0105 m/day at bore NNMW002 to 0.681 m/day at bore NNMW018 (see **Table 4**). Bores NNMW011 and NNMW012, located towards the east of the Nobles Nob Pit, recorded hydraulic conductivity values of 0.387 m/day and 0.355 m/day, respectively. This range is consistent with previous studies into the Warramunga Formation (e.g., Rockwater, 1989; Verhoeven & Knott, 1980), which suggested that the permeability in the area is low.

Table 4 Hydraulic Conductivity of Groundwater Bores at Nobles Nob

Bores	Hydraulic Conductivity (m/day)	Method	Screen Length (m)	Transmissivity (m^2/day)
NNMW001	0.0162	Hvorslev	12	0.194
NNMW002	0.0105	Bouwer & Rice	12	0.126
NNMW004	0.321	Hvorslev	12	3.852
NNMW005	0.559	Hvorslev	12	6.708
NNMW007	0.0591	Hvorslev	12	0.709
NNMW011	0.387	Bouwer & Rice	12	4.644
NNMW012	0.355	Hvorslev	12	4.260
NNMW013	0.411	Hvorslev	12	4.932
NNMW014	0.11	Hvorslev	12	1.320
NNMW018	0.681	Hvorslev	12	8.172
Average (All)	***0.291***			***3.492***

3.4 Groundwater Levels and Flow Direction

The groundwater level has been measured at groundwater bores monthly (and quarterly at some bores) since October 2021. The results of the groundwater level from October 2021 to January 2023 are presented in **Figure 6**. The elevation of groundwater ranges from approximately 293 mAHD at

NNMW007 to approximately 296 mAHD at NNMW011, NNMW012 and NNMW018. There is no water level reading available for the Nobles Nob Pit. A LiDAR reading from May 2021 indicated water level at around 296 mAHD (Umwelt, 2021c). The data available for the groundwater bores indicates that the groundwater gradient is relatively flat in the area. The average groundwater level in the bores east of the Nobles Nob pit (i.e., bores NNMW011, NNMW012, NNMW013, NNMW014, and NNMW018) is 295.85 mAHD, which is higher compared to the average groundwater level of 294.61 mAHD recorded in the bores located towards west of Nobles Nob pit (i.e., NNMW001, NNMW002, NNMW004, NNMW005, and NNMW005).

The groundwater levels at Nobles Nob further suggest that the overall flow is from the east towards the west-northwest, mirroring the regional groundwater flow direction and overall surface topography. This is in agreement with the other studies that suggested that the regional groundwater flow is from the southeast to the northwest, in line with regional surface topography (McPherson et al., 2021).

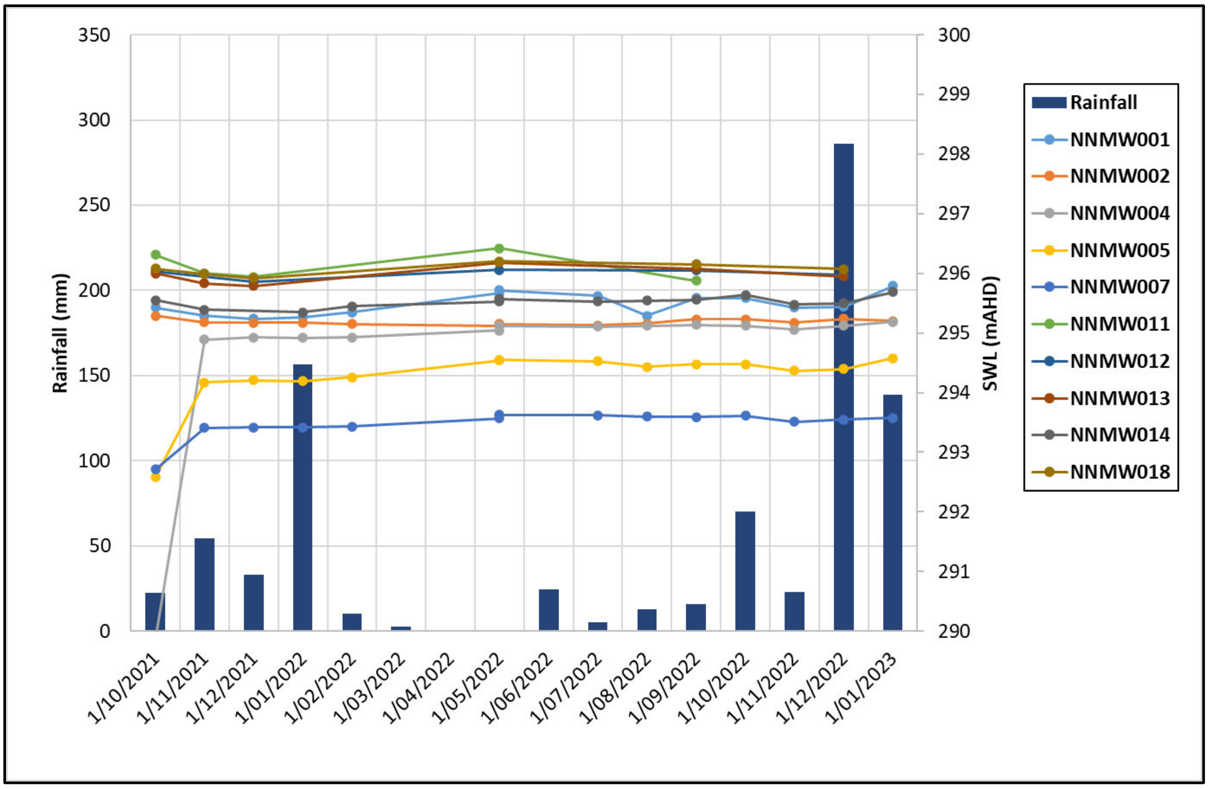

Figure 6 Groundwater Levels and Rainfall at Nobles Nob

3.5 Groundwater Quality

The groundwater quality has been measured at groundwater bores monthly (and quarterly) in accordance with the Nobles Nob water quality management plan (TCMG, 2022), since October 2021. The results of the groundwater quality are discussed below. In addition to the groundwater bores, one round of water quality samples from Nobles Nob Pit was also collected in 2018, and the results are also discussed in the sections below.

3.5.1 Physicochemical and Major Ions

The pH values observed in the groundwater bores ranged from 6.6 at NNMW002 to 8 pH units at NNMW007 (**Table 5**). The electrical conductivity (EC) values ranged from 4,400 µS/cm at NNMW002 to 15,000 µS/cm at NNMW005. The total dissolved solids (TDS) concentrations were also high in the groundwater bores, ranging from 2,700 mg/L to 11,000 mg/L. This is consistent with the previous studies that also found that water quality in the Warramunga Group is highly saline and unsuitable for human consumption (Umwelt, 2021c, Rockwater, 1989; Verhoeven & Knott, 1980).

Compared to the groundwater bores, the water in the Nobles Nob pit collected in 2018 and the water from Lake Alice since October 2021 recorded very low EC (42 to 99 µS/cm at Lake Alice and 140 µS/cm at Nobles Nob Pit) and TDS (30 to 120 mg/L at Lake Alice and 84 mg/L at Nobles Nob Pit). The low EC in the Nobles Nob Pit might be due to the fact that the samples were collected from near-surface, and higher EC/TDS values could be expected further down the water profile as saline water often sinks to the bottom. It could also be possible that water in the pit and Lake Alice could represent fresh rainfall runoff just before sampling. Gradient sampling of pit water will be undertaken during pit dewatering to understand the water composition and stratification.

Major ion concentrations were also monitored for all 10 groundwater bores. Amongst the cations, the sodium concentration was recorded the highest at all bores, ranging from 450 mg/L at NNMW002 to 3,100 mg/L at NNMW005. Amongst the anions, the chloride concentration was the highest ranging from 1,200 mg/L at NNMW002 to 4,600 mg/L at NNMW005, followed by sulfate ranging from 210 mg/L at NNMW002 to 1,600 mg/L at NNMW011. Carbonate concentrations were below the limit of reporting at all bores, while bicarbonate results ranged from 96 mg/L at NNMW002 to 520 mg/L at NNMW007. The major ion data suggests that the water type of all groundwater bores is sodium chloride type (**Figure 7**). Sodium chloride (Na-Cl) dominated water in the groundwater bores reflect low recharge and influence of evaporative processes.

Compared to the groundwater bores, the water in the Nobles Nob Pit collected in 2018 and the surface water from Lake Alice (SWLA) since October 2021 record a different proportion of major ions. The dominant cation in Nobles Nob Pit is potassium (13 mg/L), followed by calcium (7.3 mg/L). The dominant anion in Nobles Nob Pit water is bicarbonate (52 mg/L). The Piper diagram of Nobles Nob Pit suggests the water type is Ca-HCO3+CO3 (**Figure 7**). The dominant cation in Lake Alice is sodium, followed by calcium, and the dominant anion is bicarbonate (HCO3), followed by chloride. The water type of Lake Alice, plotted in the Piper diagram, is very different from the composition of groundwater at Nobles Nob, indicating that any connection or interaction between Lake Alice and the groundwater is highly unlikely (**Figure 7**).

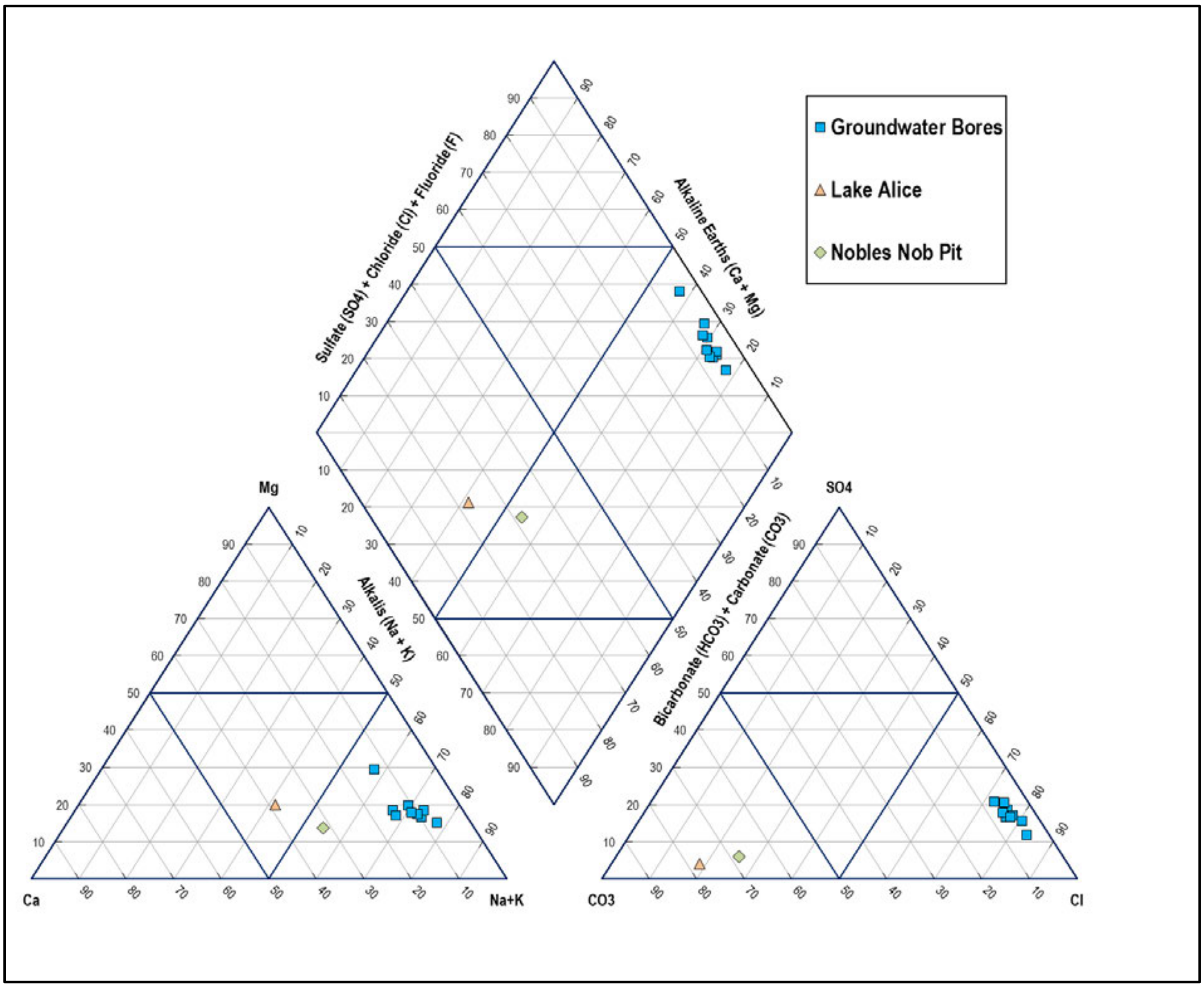

Figure 7 Piper Diagram of Groundwater Bores at Nobles Nob

3.5.2. Metals and Metalloids

Results for dissolved and total metals from samples collected since October 2021 are presented in **Table 5** and summarised below.

The concentration of many metals was below the limit of reporting (LOR) in all bores. These include dissolved and total concentrations of arsenic, beryllium, mercury, silver, and vanadium (**Table 5**). All bores, except bores NNMW001, NNMW004, and NNMW005, recorded free and total cyanide concentrations below the LOR in most of the monitoring events (**Table 5**). The concentration of free and total cyanide was highest at bore NNMW005. The presence of cyanide at the bores NNMW001, NNMW004, and NNMW005 might be attributed to the fact that these bores are located very close to the historical tailings deposits. Cyanide concentrations were not available for the Nobles Nob Pit.

Table 5 Summary of Groundwater Quality at Nobles Nob

Parameters	Unit	Groundwater Bores				Nobles Nob Pit**
		Non-detect (%)	Min	Median	Max	
Lab EC	µS/cm	0	4400	9850	15000	140
Lab pH	pH unit	0	6.6	7.4	8	6.9
Sulfur as Sulfate SO4	mg/L	0	210	845	1600	4
Total Dissolved Solids	mg/L	0	2700	6600	11000	84
Aluminium	mg/L	0	0.012	0.025	0.06	<0.01

Arsenic	mg/L	98.3	5.00E-04	0.0015	0.0045	<0.001
Cadmium	mg/L	74.1	0.00005	0.00015	7.00E-04	<0.0001
Chromium	mg/L	78.4	0.00025	0.001	0.007	<0.001
Cobalt	mg/L	6.0	0.0005	0.011	0.29	<0.001
Copper	mg/L	58.6	0.0005	0.0015	0.017	0.001
Iron	mg/L	63.2	0.0025	0.01	2.5	0.003
Lead	mg/L	84.5	5.00E-04	0.0005	0.006	<0.001
Manganese	mg/L	1.7	0.0025	0.41	8.1	<0.005
Mercury	mg/L	93.1	2.50E-05	2.50E-05	1.50E-04	-
Nickel	mg/L	37.1	0.0005	0.002	0.013	<0.001
Selenium	mg/L	14.7	0.0005	0.011	0.037	<0.001
Silver	mg/L	89.6	2.50E-05	7.50E-05	0.004	-
Vanadium	mg/L	83.8	0.0005	0.0005	0.005	-
Zinc	mg/L	22.0	0.0025	0.008	0.063	<0.01
Total Aluminium	mg/L	0.0	0.03	0.155	3.3	4.6
Total Arsenic	mg/L	96.6	5.00E-04	0.0015	0.0045	0.002
Total Cadmium	mg/L	70.7	0.00005	1.50E-04	1.70E-03	<0.0001
Total Chromium	mg/L	70.7	0.00025	0.0015	0.008	0.009
Total Cobalt	mg/L	2.6	0.0005	0.015	0.32	0.004
Total Copper	mg/L	31.0	0.0005	0.002	0.035	0.011
Total Iron	mg/L	1.5	0.01	0.315	3.9	13
Total Lead	mg/L	58.6	0.0005	0.001	0.011	0.011
Total Manganese	mg/L	0.0	0.006	0.44	8.1	0.23
Total Mercury	mg/L	90.5	2.50E-05	2.50E-05	1.60E-04	-
Total Nickel	mg/L	26.7	0.0005	0.003	0.014	0.003
Total Selenium	mg/L	13.2	0.0005	0.011	0.049	<0.001
Total Silver	mg/L	87.0	2.50E-05	7.50E-05	0.0025	-
Total Vanadium	mg/L	48.5	0.0005	0.001	0.008	-
Total Zinc	mg/L	15.4	0.0025	0.01	0.07	0.017
Free Cyanide	mg/L	86.2	0.002	0.002	0.024	-
Total Cyanide	mg/L	57.8	0.002	0.002	0.15	-

** Nobles Nob Pit was sampled in 2018. < denotes below Limit of Reporting

3.6 Water Quality Assessment

To assess the water quality monitoring results at Nobles Nob, guideline values were derived that will provide an early warning for any potential impacts. Due to the lack of sufficient available baseline water quality data at Nobles Nob, interim guideline values have been developed in accordance with ANZECC & ARMCANZ (2000) guideline values for livestock drinking water, and Australian drinking water guidelines (NHMRC, NRMMC, 2011). These guideline values include interim triggers and limits, and are outlined in the Nobles Nob water quality management plan (WQMP)(TCMG, 2022).

The water quality at Nobles Nob was assessed against these interim triggers and limits. The bores that exceeded these guideline values are presented in **Table 6** below. Most exceedances that occurred were for electrical conductivity (EC), sulfate, and total dissolved solids (TDS). This is not surprising as previous studies also found that water quality in the Warramunga Group is highly saline and has high TDS, and is therefore unsuitable for human consumption (Umwelt, 2021c, Rockwater, 1989; Verhoeven & Knott, 1980). The exceedances of some metals, such as iron, managanese, and selenium, are also attributed to the natural occurrence of these metals in the geology and groundwater. It is also evident that the existing interim triggers and limits might not be suitable, and will require revision once sufficient baseline data is available. TCMG plans to revise the WQMP annually, and will incorporate suitable triggers in the next review of the WQMP.

Some bores recorded concentrations of free and total cyanide above the limit of reporting in most sampling events. These were bores NNMW001, NNMW004, and NNMW005. These bores are located in the proximity of the historical northern TSF. Bore NNMW005 recorded the highest free and total cyanide concentrations among these bores. The free cyanide concentration in bores NNMW001 and NNMW004 has remained relatively constant over time, whereas in bore NNMW005, it has exhibited significant fluctuations (**Figure 8**). The overall cyanide levels in all three bores initially increased during the first monitoring event, but subsequently showed a gradual decline (**Figure 8** and **Figure 9**). The presence of cyanide in baseline groundwater data, even before any operations have started on site, often indicates historical impacts.

Although the groundwater is deep and there are layers of clay beneath the tailings facility, there remain potential pathways for cyanide to reach the groundwater through hydraulic connections between groundwater and Nobles Nob Pit. However, comparing the free and total cyanide concentration with monthly rainfall does not suggest any correlation between surface runoff (as indicated by rainfall) and cyanide concentration at these specific bores (**Figure 8** and **Figure 9**). It is understood that if surface runoff were indeed contributing to the elevated cyanide concentration, there would be a direct or delayed (lagged)correlation between rainfall and cyanide concentration.

The records also show that the initial spike in cyanide concentration is correlated with the rise in water level at these bores, especially NNMW005 (**Figure 10**). It is possible that the installation of monitoring bores could have caused a disturbance, potentially exposing residual cyanide compounds that had not undergone complete decomposition or degradation over time. Consequently, these compounds may have dissolved and migrated through the subsurface, ultimately reaching the groundwater, thereby increasing the water level and cyanide concentration in the bore.

Table 6 Sample Points that Exceeded Triggers and Limits

Analyte	Exceeded Trigger	Exceeded Interim Limit
EC	All bores (except bore NNMW002 and Lake Alice)	NNMW005, NNMW012, NNMW018
Iron	NNMW001, NNMW004, NNMW018, and Lake Alice	NNMW004, NNMW018, and Lake Alice
Manganese	All bores (except bore NNMW011 and Lake Alice)	NNMW001, NNMW005, NNMW012, NNMW018
Selenium	NNMW001, NNMW04, NNMW005, NNMW013, NNMW014	NNMW001, NNMW014
Sulfate	NNMW001, NNMW005, NNMW011	NNMW001, NNMW005
Total Dissolved Solids	All bores (except bore NNMW002 and Lake Alice)	NNMW001, NNMW005, NNMW012
Total Iron	Lake Alice and All bores (except bore NNMW011)	Lake Alice, NNMW004, NNMW018
Total Manganese	All bores (except bore NNMW011 and Lake Alice)	NNMW001, NNMW005, NNMW012, NNMW018
Total Selenium	NNMW001, NNMW04, NNMW005, NNMW011, NNMW013, NNMW014	NNMW001, NNMW014
Free Cyanide	NNMW005	NNMW005

Total Cyanide	NNMW005	NNMW005

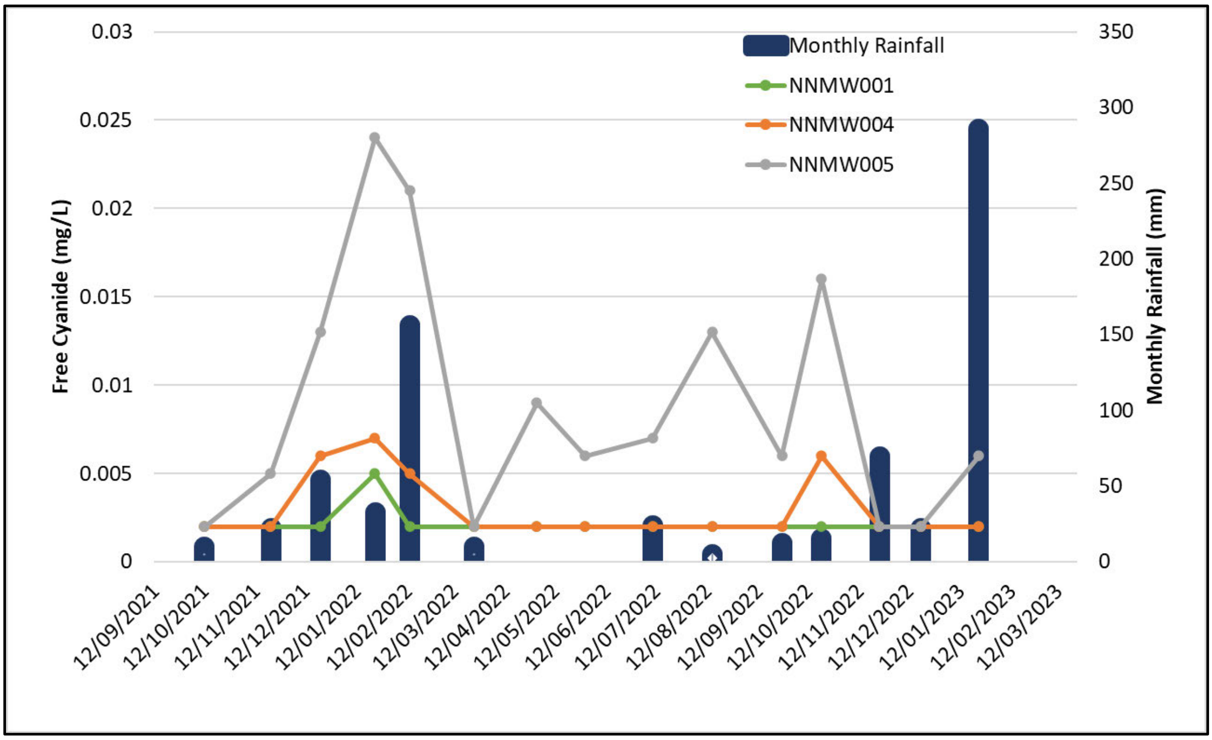

Figure 8 Free Cyanide at NNMW001, NNMW004, NNMW005 and Monthly Rainfall

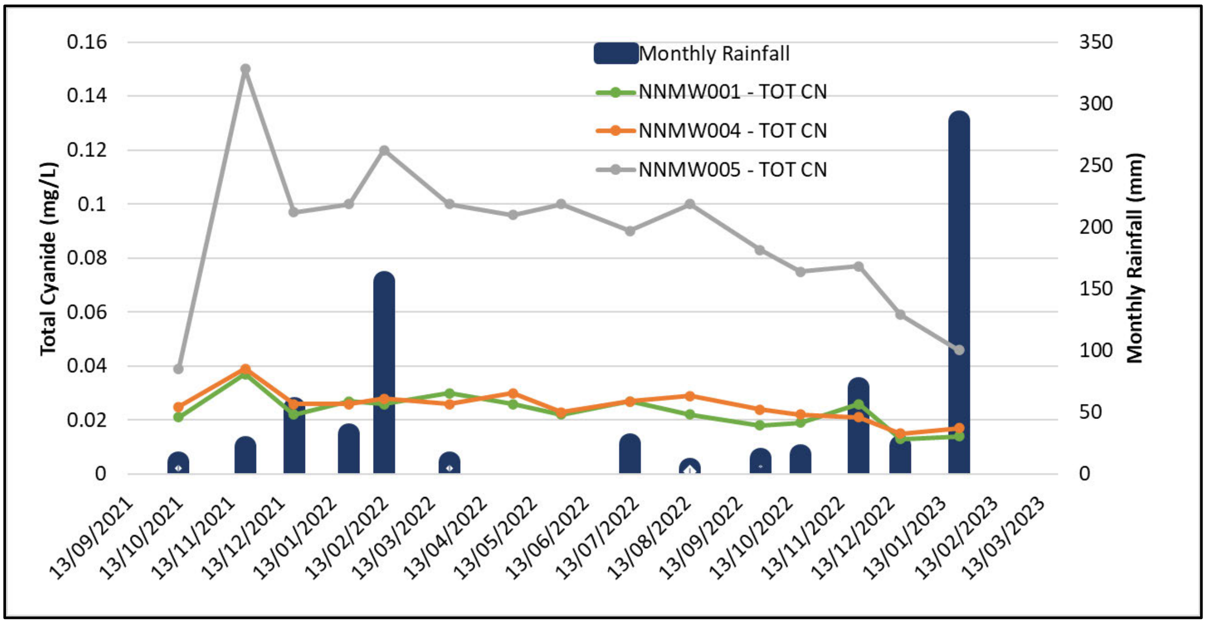

Figure 9 Total Cyanide at NNMW001, NNMW004, NNMW005 and Monthly Rainfall

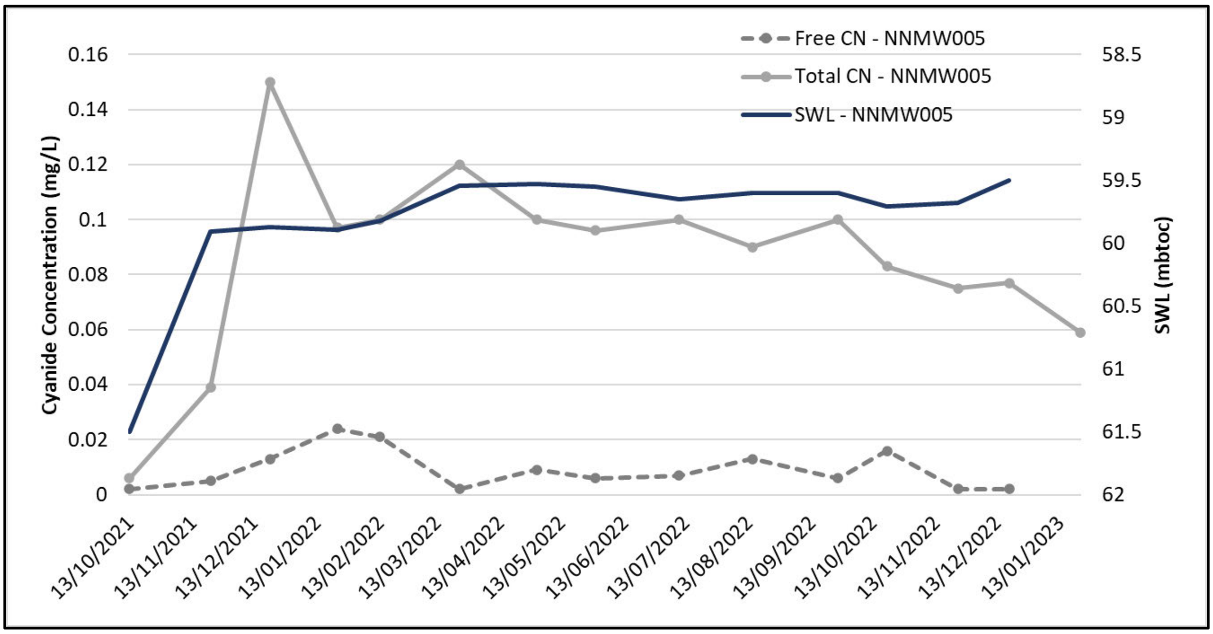

Figure 10 Free and Total Cyanide at NNMW005 and Standing Water Level

3.7 Recharge and Discharge

Recharge to the aquifers around Nobles Nob is primarily from rainfall infiltration through the ground. As rainfall in the Tennant Creek area is episodic and low, and as the evapotranspiration rates are high throughout the year, recharge from rainfall will be during high-intensity rainfall periods. This is further illustrated in **Figure 6**, where the groundwater level responds to rainfall events (e.g., in December 2022). The average groundwater level is approximately 60 metres below ground, so the response is small. In the Nobles Nob area, the discharge is mainly through evapotranspiration.

3.8 Environmental Values and Groundwater Use

A review of the previous studies (e.g., Rockwater, 1989; Rose, 1973; Rose & Willis, 1973; Verhoeven, 1976; Verhoeven & Knott, 1980) suggested that the quality and low permeability of groundwater from the Warramunga Group limits its usage. That is the reason why the water supply for Tennant Creek township is pumped from the Cabbage Gum, and Kelly Well borefields, which are approximately 25 kilometres south of Tennant Creek. All the registered bores within 2.5 km of Nobles Nob Pit are mine related bores, and there are no declared groundwater users in the area. Historical mining and grazing have been the primary use of the land, and therefore the use of groundwater around Nobles Nob is restricted to these activities (Umwelt, 2021c).

The assessment of groundwater-dependent ecosystems (GDEs) and springs through the Atlas of Groundwater Dependent Ecosystems (BOM, 2012) and the NR Maps desktop tool indicated no known GDEs or springs within 10 km of the Nobles Nob pit (Umwelt, 2021c). The GDEs refer to ecosystems that rely on groundwater, either permanently or intermittently. This includes surface expressions of groundwater in the forms of springs and wetlands and below-ground systems, such as caves.

There are no permanent surface water features in the area, except the Nobles Nob Pit and Lake Alice located close to bore NNMW011. The available water quality data from Lake Alice is very different compared to the groundwater quality recorded at the groundwater bores, indicating unlikely groundwater connections, interactions or contributions.

4.0 Potential Impacts of Proposed Activities

4.1 Potential Impacts of Expansion of Nobles Nob Open Pit

As outlined in **Figure 1**, TCMG proposes to expand the footprint of existing Nobles Nob Pit, which would cover an area of 15.9 ha (the existing pit area is 6.4 ha) and will be extended 20 m below the current pit floor. The expansion of Nobles Nob Pit will require dewatering of the groundwater. The impacts of dewatering Nobles Nob Pit have been assessed using an analytical model in Nobles Nob Pit Dewatering Assessment Report (TCMG, 2023a). The radius of influence for the proposed dewatering was calculated based on the analytical model. The radius of influence is the radius, outside of which, there are no impacts on groundwater levels due to pit dewatering. The results indicate that the radius of the influence ranges from 624 m to 2.763 km, depending on the hydraulic conductivity values and recharge rates used to approximate the hydraulic conditions of the site. Taking a conservative approach, the maximum radius of influence observed in the model has been considered to assess the impacts. The results indicate that the proposed dewatering of Nobles Nob Pit is expected to have no adverse impacts on the groundwater system at Nobles Nob, except for changes in groundwater level. Any such impacts will be constraints within the 2.763 km radius. As such, the proposed pit dewatering is unlikely to deplete the aquifer or impact the water supply of Tennant Creek township. There are no known groundwater users or GDEs within this area, likely due to the depth of the water table. Lake Alice, [redacted], located approximately 500 m southwest of the pit, is within the radius of influence. However, the water quality comparison suggests that the water type and ionic composition of water in Lake Alice are very different from the groundwater at Nobles Nob, confirming highly unlikely connections and interactions.

TCMG submitted an application to the Water Resource Division of the Department of Environment, Parks, and Water Security (DEPWS) for a water extraction license, intending to dewater the Nobles Nob Pit. The application included a comprehensive briefing to the Water Assessment Branch of the DEPWS, highlighting the minimal impacts expected from the dewatering process at the Nobles Nob Pit. Consequently, TCMG's application was successfully accepted on May 8, 2023.

4.2 Potential Impacts of Nobles Nob Waste Rocks

TCMG has undertaken extensive characterisation of the waste rocks that will be produced from the gold deposits in Warramunga province, including Nobles Nob (Umwelt, 2021a). The assessment of the waste rock samples of Nobles Nob indicated that the likelihood of acidic or saline drainage from these waste rocks is unlikely (Umwelt, 2021a; TCMG, 2023b; TCMG, 2023c). However, there is a potential for metalliferous drainage enriched in aluminium and zinc (Umwelt, 2021a). Since the groundwater at Nobles Nob is over 50 m below the surface, it is unlikely to be impacted by these metalliferous or saline drainages. It is more likely that the metalliferous or saline drainage from these waste rock dumps will travel at the surface. As such, systems to intercept this surface flow (such as sumps and diversion drains etc.) will be installed to capture any runoff. It is noteworthy that as the Nobles Nob area does not experience much rainfall, the likelihood of these drainages is fairly low, but cannot be completely ruled out.

4.3 Potential Impacts of Dry Stacking of Tailings

Dry stacking of the tailings is proposed to occur in a staged approach in the northern tailings area (northern TSF), the southern tailings area (southern TSF), and eventually in the southern waste rock dump area. As outlined in the method above, dry stacking of the tailings will be a non-flowable landform with negligible risk of liquefaction. This would be achieved through compacting the dry tailings to achieve 90-95% compaction, which would minimise permeability and limit any inflow into the dry stack landform. Any leachate from the dry tailings is extremely unlikely due to the removal of water from the landform and preventing any water from entering the landform.

In the unlikely event that any leachate occurs from the dry stacked tailings, the downward seepage is highly unlikely. This is because the tailings will be dry stacked within the existing footprints of the historical tailings storage facility (Northern TSF and Southern TSF). Drilling of groundwater monitoring bores in 2021 noted a substantial layer of clay in the area. Drilling records of bore NNMW001, located between north and southern TSF, noted 30 meters of clay (from 3 to 33m below ground), and bore NNMW002, which is located close to southern TSF, noted 12 m of clay layer (from 0 to 12 m below ground). Similarly, drilling records of bores NNMW011, NNMW013, and NNMW014, located on different sides of Nobles Nob tenements, also recorded approximately 9 to 15 m of clay below the ground, confirming the presence of clay across the site. This clay layer will likely act as an impermeable layer, preventing any downward seepage to groundwater, which is located more than 50 metres below surface. The clay is overlying fractured sandstone/siltstone of the Warramunga Group, which has low hydraulic conductivity (Umwelt, 2021c) and, therefore, if any leachate seeps through the clay layer, it has a low potential to migrate through the sandstone/siltstones. Before dry stacking commences, the proposed area will be inspected by an engineer to confirm the presence of clay layer, and the suitability for construction of the dry stack ensuring no evidence of any cracks/fissures that could affect the permeability.

Although highly unlikely, it is possible (very low likelihood) that shallow leachate or seepage from the dry stacked tailings associated with recharge events (i.e., rainfall and surface water flow) travel at the surface. Seepage/runoff interception facilities (e.g., sumps and catch drains etc.) will be installed that will enable interception of surface run-off and shallow sub-surface seepage in the down-gradient system. Ongoing monitoring of the surface water diversion systems, and maintenance of the seepage interception system will likely prevent any potential seepage.

In addition, an appropriate and suitable capping system will be installed upon completion of the dry stack landform to limit further moisture ingress. The capping will usually comprise a rock fill capillary breaking layer overlain by a clay fill barrier layer, topped with growth media/top soil. This will limit the risk of liquefaction and will further make the potential of any leachate from dry stacked tailings unlikely.

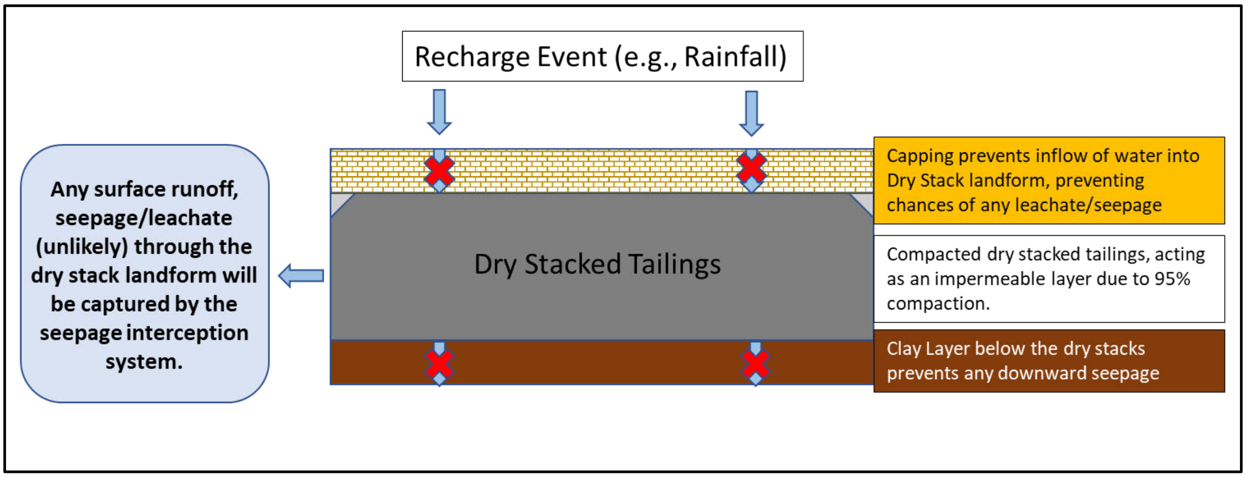

Figure 11 Conceptual Diagram of Dry Stack of Tailings

4.4 Potential Impacts of Processing Ore from Satellite Deposits

As mentioned before, TCMG will also be processing ores from nearby satellite deposits (such as Black Snake and Golden Forty etc.) that share similarities in ore types and geological characteristics with the Nobles Nob project area. These satellite deposits are located within the same geological province, indicating a high likelihood of similar mineralisation and ore quality. Therefore, processing these ores is not expected to result in any additional impacts compared to processing ores from the Nobles Nob deposit.

Although unlikely, it is possible that acidic or metalliferous enriched drainage might occur from these ores when stockpiled on pads before processing. Despite the fact that the timeframe of this storage will be small, there is the potential of leachate running from these ores and waste rocks stockpiles during rainfall events. To ensure that no environmental impacts are caused, proper geochemical characterisation of the ores will be undertaken prior to processing them.

4.5 Potential Impacts of Reprocessing Northern Tailings

The reprocessing of historical gold mine tailings from the northern tailings area has the potential to impact both groundwater and surface water systems. As outlined above, the extraction process will involve the use of water jets to create a slurry, which will be transported to the processing plant for further treatment. There is a risk of cyanide and other contaminants being released into the surrounding systems during the extraction and transportation stages. Therefore, careful management and implementation of appropriate measures, such as robust containment systems, monitoring protocols, and water management processes, will be crucial to mitigate any potential adverse impacts on both groundwater and surface water quality. The slurry will be transported through appropriate HDPE pipelines to the processing plant, to avoid any leakages. The pipeline will be monitored for any leakages and damages. An interception system will be installed around the northern TSF, to capture any runoff or surface seepage from the slurry.

Table 7 Risk Assessment of Proposed Activities

Activity	Mechanism	Potential Impacts On	Pathway	Receptor	Project Risk Level	Risk	Recommended Actions
Nobles Nob Pit Expansion	Dewatering	Groundwater levels	Through dewatering and extraction activities	Groundwater	Low	The results indicate that the proposed dewatering of Nobles Nob Pit is expected to have no adverse impacts on the groundwater system at Nobles Nob, except changes in groundwater level. Any such impacts will be constraints within the 2.763 km radius. As such, the proposed pit dewatering is unlikely to deplete the aquifer or impact the water supply of Tennant Creek township.	Continue monitoring water levels at groundwater monitoring bores at Nobles Nob
Nobles Nob Pit Expansion	Dewatering	Lake Alice	Through dewatering and extraction activities	Lake Alice	Very Low (Highly Unlikely)	1. Lake Alice is most likely a perched lake, likely fed by rainwater. Water quality results (i.e., low EC and TDS) demonstrate this. 2. The water quality comparison suggests that the water type and ionic composition of water in Lake Alice are very different from the groundwater at Nobles Nob, confirming highly unlikely connections and interactions. 3. Groundwater is located approximately 60 m below, confirming no connection.	Continue monitoring water level at groundwater monitoring bores at Nobles Nob. Continue monitoring water quality at Lake Alice.
Waste Rock Dumps	Surface runoff	Water Quality	Through surface	Surface water/receiving environment;	Moderate	The assessment of the waste rock samples of Nobles Nob indicated that the likelihood of acidic or saline drainage from these waste rocks is unlikely. However, there is a potential for metalliferous drainage enriched in aluminium and zinc from waste rocks from Nobles Nob.	Systems to intercept any surface flow (such as sumps, bunds, and diversion drains etc.) will be installed.
Waste Rock Dumps	Subsurface seepage	Water Quality	Through surface and fractured sandstone/siltstone	Groundwater	Low	The assessment of the waste rock samples of Nobles Nob indicated that the likelihood of acidic or saline drainage from these waste rocks is unlikely. However, there is a potential for metalliferous drainage enriched in aluminium and zinc from waste rocks from Nobles Nob.	None

Dry Stacking of Tailings	Downward seepage	Water Quality	Seepage below the dry stack area	Groundwater	Low	1. Dry stacking of the tailings will be a non-flowable landform with negligible risk of liquefaction. This would be achieved through compacting the dry tailings to achieve 90-95% compaction, which would minimise permeability and limit any inflow into the dry stack landform. 2. The drilling records of the monitoring bores at Nobles Nob confirms the presence of more than 10 meters of clay between surface and groundwater, across the site. This clay layer will likely act as an impermeable layer, preventing any downward contaminant laden leachate/seepage to groundwater, which is more than 50 metres below surface. 3. In addition, an appropriate and suitable capping system will be installed upon completion of the dry stack landform to limit further moisture ingress. 4. In an unlikely event, if there is any leachate/seepage associated with recharge events (i.e., rainfall and surface water flow), the low hydraulic conductivity of the Warramunga Province will restrict the movement of the contaminants. Additionally, due to dewatering of Nobles Nob Pit, the groundwater will be flowing towards the pit (the pit will act as a sink).	1. Progressive capping of the dry stacked landform. 2. Continue monitoring of water level and quality at Nobles Nob. 3. Ensure that the dry stacked landform is compacted to achieve dersired permeability. 4. Once the floor of the dry stacking area is exposed, it should be inspected to confirm the presence of clay leyer beneath and suitability for construction of the dry stack.
Dry Stacking of Tailings	Surface/Subsurface seepage and Runoff	Water Quality	Seepage through regolith and surface	Surface water and groundwater	Moderate	Although highly unlikely, it is possible (very low likelihood) that leachate or seepage from the dry stacked tailings associated with recharge events (i.e., rainfall and surface water flow) travel at the surface. Seepage/runoff interception facilities (e.g., sumps and catch drains etc.) will be installed that will enable interception of surface run-off and sub-surface seepage in the down-gradient system.	1. Ongoing monitoring of the surface water diversion systems, and maintenance of the seepage interception system.
Processing ores from Satellite Deposits	Surface runoff, subsurface seepage	Water Quality	Through surface	Surface water and Groundwater	Low	Ores from nearby satellite deposits (such as Black Snake and Golden Forty etc.) are likely to share similarities in characteristics with the Nobles Nob project area and are unlikely to impact groundwater or surface water. Although unlikely, it is possible that acidic or metalliferous enriched drainage might occur from these ores when stockpiled on pads before processing. Despite the fact that the timeframe of this storage will be small, there is the potential of leachate running from these ores and waste rocks stockpiles during rainfall events.	
Reprocessing of Northern Tailings	Runoff, and shallow sub-surface seepage	Water Quality	Through surface	Surface water and Groundwater	low	the extraction process will involve the use of water jets to create a slurry, which will be transported to the processing plant for further treatment. There is a risk of cyanide and other contaminants being released into the surrounding systems during the extraction and transportation stages.	1. Monitoring of the transport pipeline. 2. Maintain a seepage interception system, with the sump designed and equipped to pump out and remove any water intercepted and prevent seepage

5.0 Management Measures and Water Quality Management Plan

As outlined in **Section 4** above, the main potential risks and impacts relevant to groundwater relate to changes in water level and quality. Due to this, the management and mitigation measures are focused on monitoring water level and quality aspects. The water quality management plan (TCMG, 2022) was prepared for Nobles Nob, and was approved by Department of Industry, Tourism, and Trade (DITT) on 9 August 2022. The water quality management plan (WQMP) presents the monitoring network, monitoring frequency and parameters, quality assurance, assessment and reporting protocols. s

The existing monitoring network outlined in the WQMP of Nobles Nob was reviewed and is adequate to capture any potential impacts from the proposed and existing activities. As such, no additional monitoring bores are required. Monitoring of water level and quality at Nobles Nob will be undertaken as per the existing water quality management plan (WQMP). The WQMP will be revised to include additional monitoring locations of the surface flow interception system, and sumps that will be installed to capture any surface runoff. The revised WQMP will be submitted to DITT for approval before the proposed activities commence.

6.0 Conclusion

TCMG is currently planning an amendment to the current approved MMP to add more activities on site. These include expansion of Nobles Nob Pit, processing of ores from satellite deposits (such as Black Snake, Risisng Sun, Weabers Find), reprocessing of historical tailings from the northern tailings area, and storage of tailings produced from processing gold as dry stacks instead of Geotubes.

The proposed expansion of the Nobles Nob Pit includes dewatering, which has been assessed using an analytical model. The radius of influence for the dewatering process ranges from 624 m to 2.763 km, indicating that any impacts on the groundwater system will be constrained locally, and are not expected to adversely affect the groundwater system or water supply of Tennant Creek township. There are no known groundwater users or Groundwater Dependent Ecosystems (GDEs) in the area, and Lake Alice, located within the radius of influence, has different water composition, confirming no connections and interactions with groundwater. Furthermore, TCMG's application for a water extraction license to dewater the Nobles Nob Pit was accepted on 8 May 2023 by the Water Resource Division of Department of Environment, Parks, and Water Security (DEPWS).

Extensive waste rock characterisation suggests slight risks of metalliferous drainage from waste rocks. As such, surface flow interception systems will be implemented to capture runoff and drainages from the proposed waste rock dumps. Overall, the likelihood of significant impacts on groundwater and the surrounding environment is low, considering the depth of the groundwater table.

In addition, the tailings produced from the processing of gold at Nobles Nob will be stored as dry stacks. The proposed dry stacking of tailings at the Nobles Nob site will be carried out in a staged approach in the northern TSF, southern TSF, and southern waste rock dump. The dry stacks will be a non-flowable landform with minimal liquefaction risk. The dry tailings will be compacted to achieve 90-95% compaction, reducing permeability and preventing water ingress. Any potential leachate from the dry stacked tailings is highly unlikely due to water removal and prevention of water entry. The presence of clay layer, ranging from 9 to 30 meters in thickness across the site, has been confirmed through drilling the monitoring bores, and is expected to act as an impermeable barrier, preventing downward seepage to the groundwater, which occurs over 50 meters below the surface. Inspections will be conducted to ensure the suitability of the clay layer and the absence of cracks or fissures. Surface water diversion systems, including sumps and catch drains, will be installed to capture any potential surface runoff or seepage, with ongoing monitoring and maintenance to prevent any environmental harm. Upon completion, a capping system will be placed on the dry stacks to further limit moisture ingress and reduce the risk of liquefaction and leachate from the dry stacked tailings.

Based on the data and review of the available information, it is considered unlikely that the proposed activities at Nobles Nob will create any new impact pathways. The proposed activities will also be undertaken in a manner to minimise potential impacts. Ongoing monitoring and management have been included in the site management plans. Further review will be undertaken where any new information is obtained, or changes made that have the potential to influence the findings presented in this report.

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Appendix A. Nobles Nob Water Quality Management Plan

This report is included in Appendix N of this MMP.

Appendix B. Nobles Nob Pit Dewatering Assessment

This report is included in Appendix F of this MMP.

APPENDIX M EROSION SEDIMENT CONTROL PLAN

Erosion and Sediment Control Plan

Nobles Nob Gold Project

Tennant Consolidated Mining Group Pty Ltd

ER012/Version 3.0

January 2023

Acknowledgement of Country

Tennant Mining acknowledges the Traditional Owners of the lands on which we work. We pay our respects to elders, past, present, and emerging.

Disclaimer

Document Control

Version	Personnel	Date
Version 1.0	Dr Ashish Mishra prepared the document	14-10-2022
Version 1.0	Adele Faraone from EcOz (CPESC) reviewed the document	30-10-2022
Version 1.1	Dr Ashish Mishra revised V1.0 incorporating Adele's comments	07-12-2022
Version 1.1	Steve Murdoch reviewed V1.1	08-12-2022
Version 1.2	Dr Ashish Mishra revised V1.1 incorporating Steve M's comments	08-12-2022
Version 2.0	Dr Ashish Mishra finalised V2.0 for CPESC Adele Faraone	10-12-2022
Version 2.1	CPESC review	19-12-2022
Version 2.2	Dr Ashish Mishra addressing CPESC's comments	19-12-2022
Version 3.0	Dr Ashish Mishra finalised V3.0	09-01-2023

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1.0 Introduction

1.1 Background

This Primary Erosion and Sediment Control Plan (ESCP) has been developed on behalf of Tennant Consolidated Mining Group (TCMG) for the Nobles Nob Gold Project (Nobles Nob). Nobles Nob is located approximately 13 kilometres (km) southeast of Tennant Creek township, in the Northern Territory (NT). Gold was initially extracted at Nobles Nob from underground operations commencing in the early 1930s and then via open-cut methods from the 1960s. Open-cut mining at Nobles Nob concluded in 1985, although gold production continued until 1992.

TCMG is proposing to recommence operations at Nobles Nob, which will include extractive mining and reprocessing of the old rock waste dump, a small extension of the Nobles Nob Pit, and exploration activities. The Northern Territory *Mining Management Act 2001* requires approval of a Mining Management Plan (MMP) for mining authorisation approval, prior to any mining activity (including exploration or operational activities) taking place. An MMP for Nobles Nob has been approved, with mining authorisation (1123-01) granted as of 15 August 2022. This erosion sediment control plan has been prepared to meet Condition 16 of the Mining Authorisation.

1.2 Plan Development and Certification

This Primary ESCP has been prepared by a suitably qualified person, Dr Ashish Mishra. Dr Ashish has a doctorate (PhD) in environmental geochemistry, where his thesis focused on soil erosion and sediment generation. Ashish has been involved in developing erosion and sediment control plans for various mines site in Queensland. Additionally, Ashish has undertaken several specialised contaminant source, cause and extent identification investigations for groundwater and surface water resources, and assessment of potential environmental impacts on water resources.

This Primary ESCP has also been reviewed and certified by a Certified Professional in Erosion and Sediment Control (CPESC) from EcOz Pty Ltd, Adele Faraone (CPESC #11426). A letter of endorsement is provided in **Appendix C**.

1.3 Scope

The scope of this ESCP includes the following:

- Strategies to minimise erosion and sediment discharge at the mine site.
- Maintenance and monitoring program.

This ESCP provides a general overview of the erosion and sediment control measures that will be implemented to minimise the impact of the proposed site activities on the external environment. Recommendations and designs provided within this ESCP are consistent with the International Erosion Control Association (IECA) best practice guideline *Best Practice Erosion and Sediment Control* (IECA, 2008).

Progressive ESCPs for construction and operation will be developed by TCMG prior to the commencement of site construction works, when specific site conditions can be assessed, and appropriate control measures determined. All Progressive ESCP's are to be consistent with the details of this Primary ESCP, with site specific measures implemented in accordance with IECA guidelines, project approvals and associated documentation.

1.4 Objectives

The objective of this ESCP are as follows:

- Minimise and control erosion and sediment generation from disturbed areas during construction and mining activities.
- Ensure adequate drainage control measures are implemented to manage runoff from disturbed site areas.
- Ensure stormwater is managed to protect downstream water quality.
- Ensure sedimentation from the site is reduced, so soil particles greater than 1mm are retained.
- Ensure erosion is prevented, where possible.

1.5 Relevant Legislation and Guidelines

The relevant legislation and guidelines that were used in the preparation of this ESCP are as follows:

- *Water Act 1992* (Northern Territory).
- *Soil Conservation and Land Utilisation Act 1969* (Northern Territory).
- *Waste Management and Pollution Control Act 1998* (Northern Territory).
- Best Practice Erosion and Sediment Control (IECA, 2008).

1.6 Review and Updates

This Primary ESCP will be reviewed annually to assess effectiveness and performance based on the objectives noted in Section 1.4. The ESCP will be updated where necessary to reflect identified changes or modifications from site inspections using site checklists as found in Appendix B

2.0 Project Description

The Nobles Nob Mine is located within the Tennant Creek Goldfield, approximately 13 km southeast of Tennant Creek in Northern Territory, Australia. Tennant Creek is approximately 504 km north of Alice Springs and 978 km south of Darwin (**Figure 1**).

The Nobles Nob project area encompasses 355 hectares (ha), with 253 ha within Nobles Nob mining tenements and 102 ha within Juno tenements. Previous disturbances at Nobles Nob occurred during historical mining activities. Nobles Nob was historically mined over 50 years from the late 1930s to the 1980s. Mining commenced in 1939 with underground operations. The collapse of the crown pillar in 1968 led to the construction of a new plant, followed by open-cut operations in 1969. Some of the material from the collapsed crown pillar was recovered, while most of the material was stockpiled in the existing mineralised southern waste rock dump (Southern WRD), located to the south of the Nobles Nob pit.

Open-cut mining continued at Nobles Nob from 1969 through to 1985 with a total production of 1.6Mt of ore at a grade of ~7g/t gold yielding 342,000 ounces of gold. In total, since the 1930s, the Nobles Nob mine produced 2.1Mt of ore at a grade of 17.0 g/t with a total yield of 1.17M ounces of gold and was considered Australia's richest gold mine for many of those years.

2.1 Proposed Activities

TCMG plans to commence the following activities on site, which includes:

- The excavation of existing waste rock from the Southern WRD for reprocessing. The existing Southern WRD is from historic Nobles Nob pit operations.
- A cut back of the existing Nobles Nob pit.
- Establishment of a processing area that comprises the following:

- Processing Plant – the plant is designed based on an estimated throughput of 700k tonnes per annum Carbon-In Leach (CIL) ore processing plant (COMO, 2021). The processing will include crushing and milling of the ore before processing and discharge of tailings.
- Tailings Storage Area – tailings from the processing plant will be stacked in a tailings storage area, where it will be stored.
- Sump and Water Ponds – The sumps and process water ponds will store water required for processing and the water recovered from tailings storage area.

All infrastructure except the solar field will be placed within the disturbance footprint of previous mining operations and will not require any clearing. The proposed solar field will be placed on the western section of the site and will require clearing a 4 hectares (ha) area of vegetation. This is the only new area, where disturbance is proposed to previously undisturbed land.

Construction at Nobles Nob is scheduled to commence in Late-February/March 2023 for eight months, until November 2023, and will include the following activities:

- Upgrade of the access road, where required.
- Setting up of office/administration and amenities.
- Setting up the processing facility.
- Earthworks to prepare the area for tailings storage.

Mining operations are scheduled to commence in November 2023, on completion of the commissioning of the critical infrastructure.

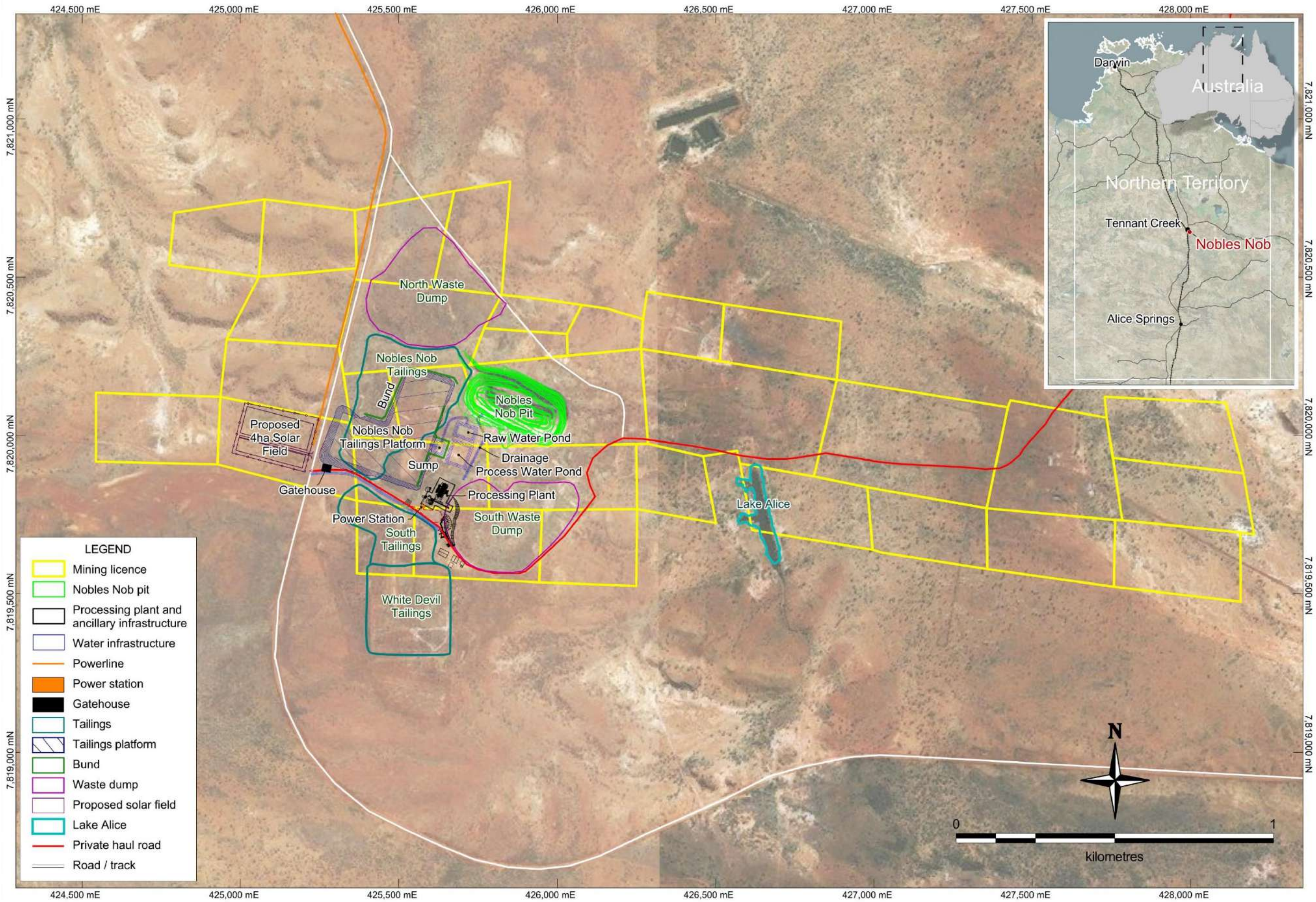

Figure 1 Site Location and Proposed Infrastructure

3.0 Site Characteristics

2.1 Topography and Drainage

Land surface elevation, informed by LiDAR data, shows that the area around Nobles Nob comprises plains and low hills associated with the McDougall Ranges (Umwelt, 2021). Elevation throughout the site ranges from approximately 296 mAHD to 380 mAHD. The rest of the region towards the west of Nobles Nob appears to be dominated by level to undulating plains, associated mainly with dune fields and sand plains of the Tanami Desert (Umwelt, 2021).

Two permanent surface water body exist around Nobles Nob (TCMG, 2022; Tennant Gold Resource, 2018), including the Nobles Nob Pit and Lake Alice, [redacted] located approximately 500 m southwest of the pit. Some surface drainage occurs briefly during the wet season. Surface flows across the mine site would predominately be conveyed as sheet flow before channelising and forming local flow paths (ATCW, 2022). A large extent of site surface areas discharges to the Nobles Nob Pit. The existing catchment draining to the Nobles Nob Pit is approximately 36.9 ha. The southern and western extents of the site discharge to the north/northwest along Peko Road. Refer to **Figure 2**, which illustrates the existing catchment boundaries and flow paths.

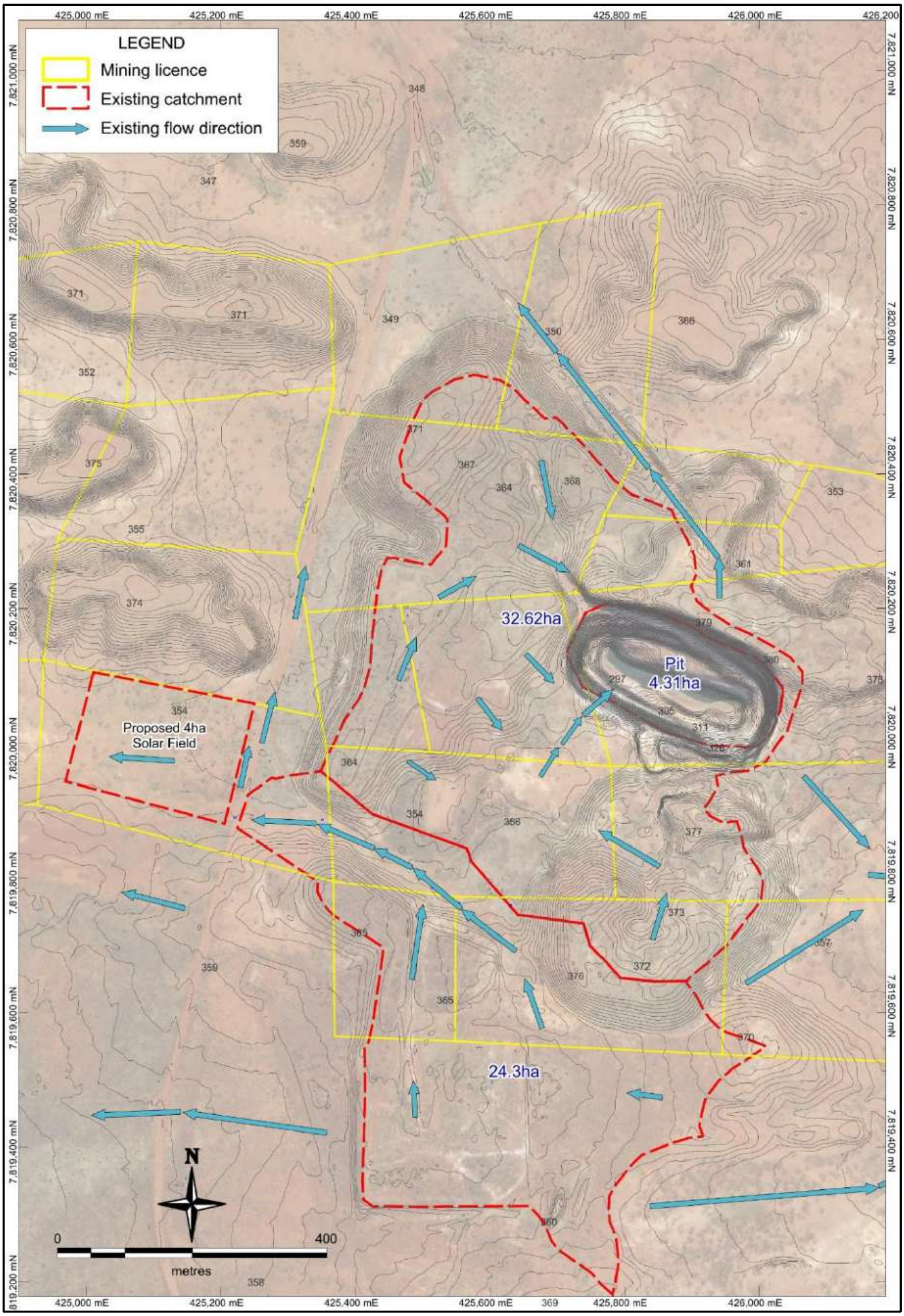

Figure 2 Existing Catchments and Flow Directions (Source: ATCW, 2022)

2.2 Climate

The area is characterised by a hot arid climate, with evapotranspiration exceeding rainfall throughout the year. The mean monthly temperature data was retrieved from the nearest Bureau of Meteorology (BoM) weather station at Tennant Creek Airport (Station number 15135), presented in **Table 1**. The mean monthly maximum temperature ranges from 24.6°C during the winter (June) to 37.3°C in the summer (December) (BoM, 2022).

Table 1 Mean Monthly Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (˚C)	36.8	35.9	34.7	32	27.7	24.6	24.8	27.6	31.8	35	36.7	37.3
Mean minimum temperature (˚C)	25	24.5	23.4	20.6	16.4	13	12.3	14.4	18.5	21.9	23.9	25

Mean has been calculated using monthly data from Jan 1969 to Oct 2022

Rainfall data has been retrieved from the publicly available Scientific Information for Landowners (SILO) database. The monthly average rainfall and evapotranspiration data has been retrieved from the nearest SILO station Tennant Creek Airport (Latitude -19.64, Longitude 134.18), from 01/01/1900 to 01/10/2022.

The SILO database generally provides a complete long-term dataset and is, therefore, helpful in assessing long-term rainfall trends in the vicinity of the site. This dataset is interpolated from quality-checked observational time-series data collected at nearby stations by the Bureau of Meteorology. Based on the SILO dataset, the average annual rainfall is 383 mm, with evaporation exceeding rainfall during each month of the year (**Table 2** and **Figure 3**). As mentioned above, the average annual rainfall at Nobles Nob is less than 500 mm per year and the landscape is arid with almost flat terrain, which minimises potential for runoff and sedimentation.

Table 2 Monthly Average of Rainfall and Evapotranspiration (SILO)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SILO Rainfall	96.7	91.1	50.2	11.8	10.4	6.6	5.0	2.0	5.4	14.9	30.2	58.1	382.5
SILO ET	350.2	291.8	321.2	287.5	232.8	186.8	198.9	250.1	307.2	358.7	371.8	371.6	3528.6
SILO fao56 ET	213.7	182.8	191.3	167.7	138.4	115.3	126.3	156.1	185.1	215.5	220.8	224.1	2137.0

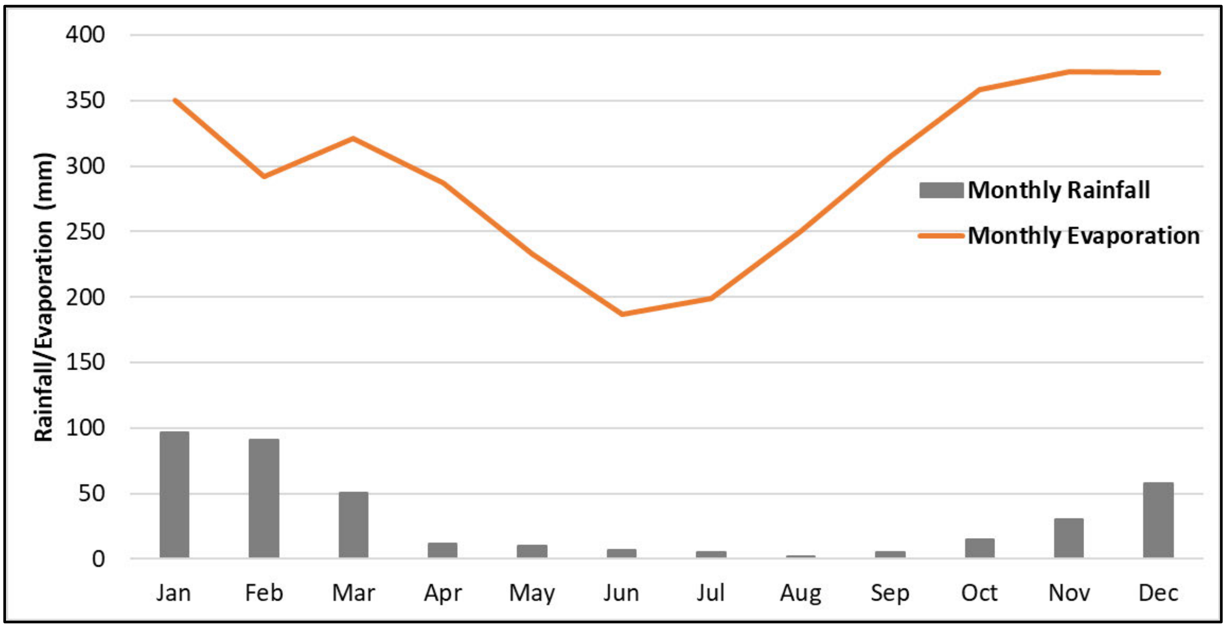

Figure 3 Graph Showing Monthly Average Rainfall and Evapotranspiration

2.5 Land System and Soils

Nobles Nob is situated within the Tennant Creek Land System, dominated by sandstone plains and rises characteristic of the Ashburton Range subregion. It is part of the greater Davenport Murchison Ranges bioregion, characterised by plateaux, plains and rises on sandstone, claystone and limestone, and outcrops with shallow stony soils.

According to the Australian Soil Classification, the dominant soils at Nobles Nob are Kandosol, Rudosol and Tenosol (**Figure 4**).

- Kandosols are often referred to as red, yellow and brown earth. Kandosols are essential for agricultural and horticultural production. They occur throughout the Northern Territory and are widespread across the Top End, Sturt plateau, Tennant Creek and Central Australian regions.
- Rudosols are very shallow soils with minimal soil development. Rudosols include very shallow rocky and gravelly soils across rugged terrain and pure sand soils in deserts.
- Tenosols are weakly developed or sandy soils which are essential for horticulture. These soils show some degree of development (minor colour or soil texture increase in subsoil) down the profile.

The Digital Atlas of Australian Soils (Australian Soil Resource Information System 1991) shows that the soil types at Nobles Nob are primarily: AB31, BA13, and My80 (**Figure 5**). The description of these soil types as per the Digital Atlas of Australian Soils are as follows:

- AB31 – these soils are associated with flat to gently undulating sand plains with some low broad sand rises and small alluvial flats. These soils usually comprise red earthy sands, with some clay pans.
- BA13 – These soils are usually found in areas with flat-topped, gently sloping areas and valleys on sandstones, siltstones, and shales. These soils are usually stony sands and loams.
- My80 – These soils are usually found in gently undulating plains and hills with rock outcrop. These soils are mainly neutral red earths, with a variable content and surface scatter of

ironstone gravels. My80 soils are also often characterised with loamy soils, and some shallow gravelly and stony soils.

Soil from sumps that were dug for the recent drilling program were also examined across the site. the top layer of the soils was found to be brown to red in colour, dry, very fine loam with pebbles and larger rocks throughout. Below the top layer (i.e., approximately 0.5-1 m), the soil encountered was mostly clay with fine loam. The drilling records of the groundwater monitoring bores also recorded that the top layer comprised of approximately 3 metres of red laterite soils, followed by 3 metres of clay layer.

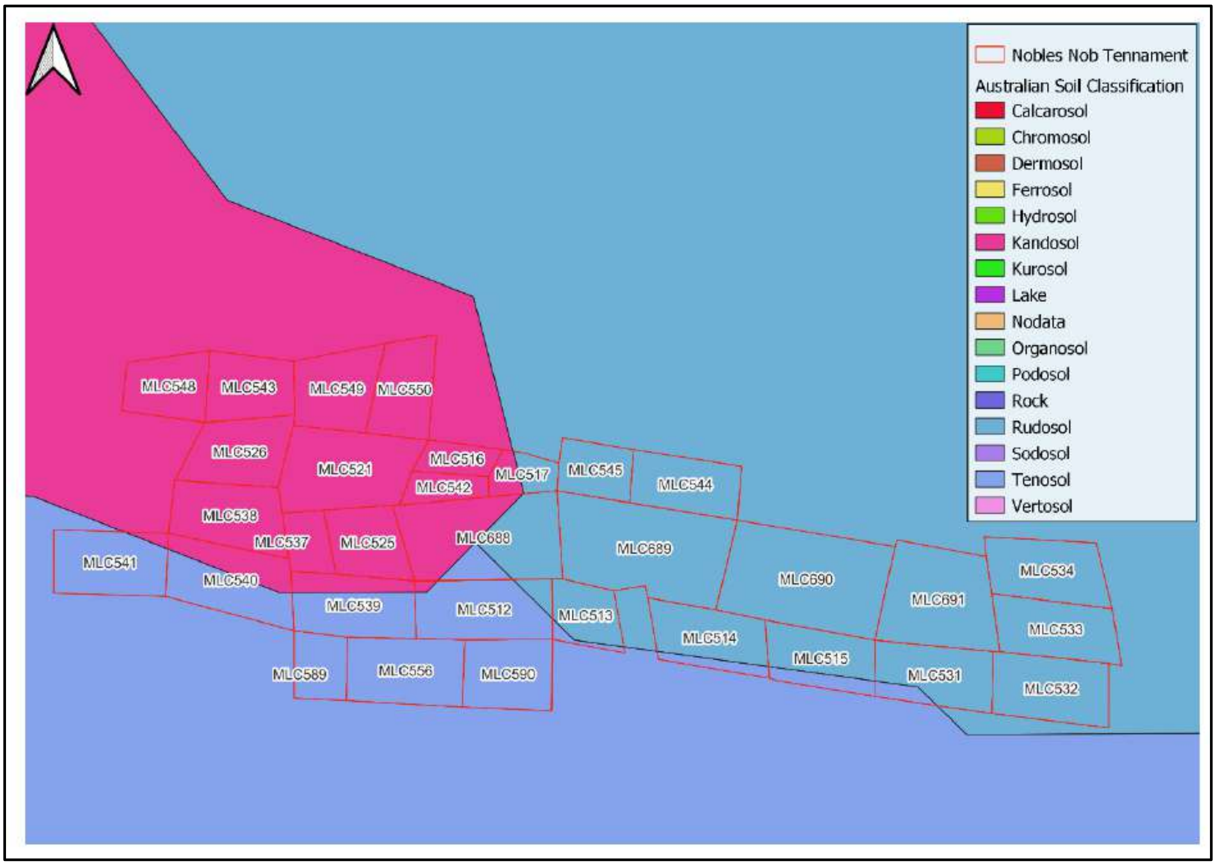

Figure 4 Soil Type from Australian Soil Classification at Nobles Nob

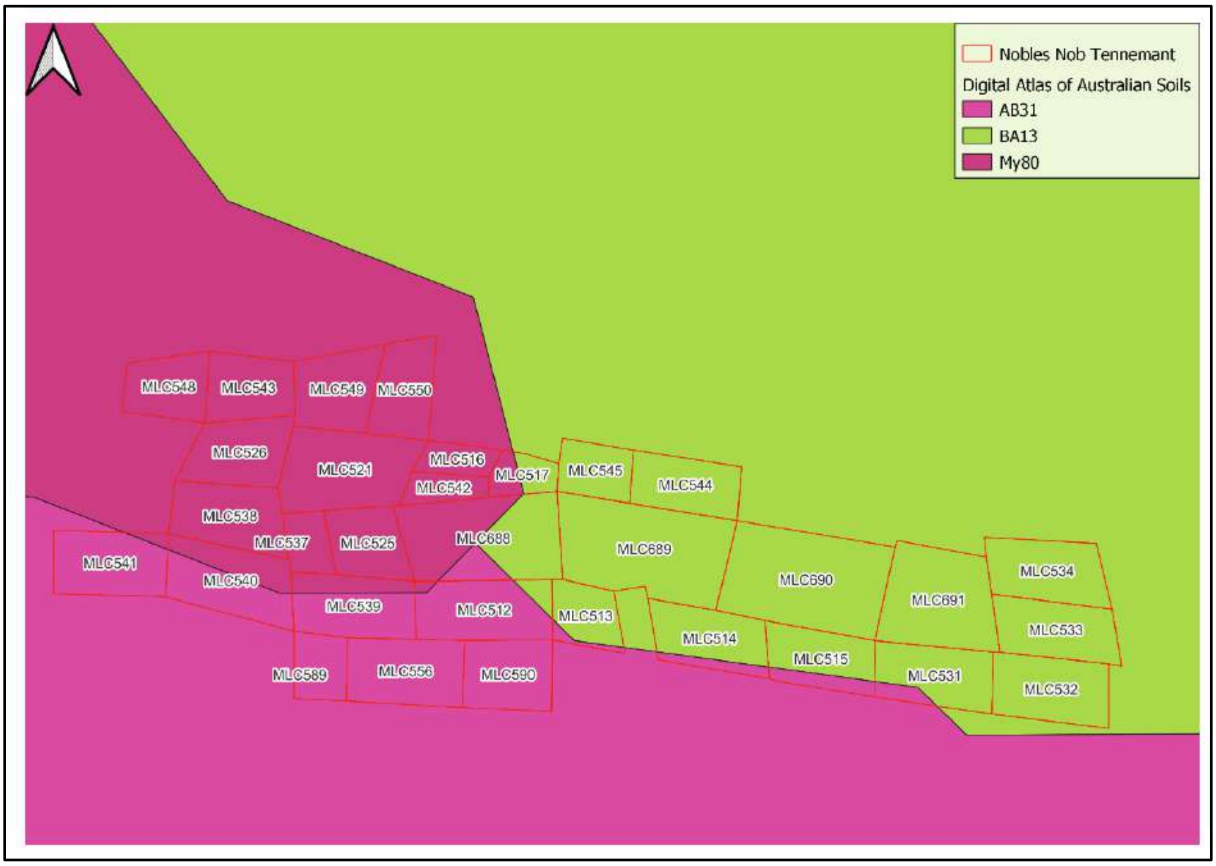

Figure 5 Soil Type from Digital Atlas of Australian Soils at Nobles Nob

2.6 Vegetation

Previous surveys identified the vegetation at Nobles Nob as predominantly eucalypt low open woodland and acacia-sparse shrubland over hummock grassland. Rises host a community of open woodland dominated by snappy gum (*Eucalyptus leucophloia* subsp. *euroa*) over gummy spinifex (*Triodia pungens*) grassland. Plains and drainage communities have a mosaic of *E. pruinosa* and *E. aparrerinja* woodlands (Tennant Gold, 2018). No vegetation communities or ecological communities of listed conservation significance have been recorded within 50 km of Nobles Nob. A search of the NT Flora Atlas identified 22 records of 13 species of listed conservation significance, three of which are considered 'Near Threatened' under the *TPWC Act*: *Lythrum wilsonii, Trianthema glossostigmum,* and *Trianthema. oxycalyptra* var. *oxycalyptra.*

2.7 Disturbances

2.7.1 Previous Disturbances

As mentioned in **Section 2.0**, Nobles Nob was historically mined over 50 years from the late 1930s to the 1980s. Some recent exploration activities were undertaken on-site besides the disturbance caused by historical mining activities. In 2011, 5 reverse circulation (RC) exploration holes were drilled at Nobles Nob. In 2012, 5 holes were drilled, and a full-scale structural geological mapping program and a ground-based gravity survey were undertaken. Work carried out during 2013 consisted of non-invasive ground-based activities using existing tracks. Walking gravity surveys and mapping were also carried out. In 2018, 269 RC holes were drilled in the Nobles Nob Tenements, 63 of which were in the pit and 10 of these holes were in the Southern WRD.

2.7.2 Proposed Disturbances

As outlined in **Section 2.1**, the proposed activities include the following:

- The excavation of existing waste rock from the Southern WRD for reprocessing. The existing Southern WRD is from historic Nobles Nob pit operations.
- A cutback of the existing Nobles Nob pit.
- Establishment of the processing area that comprises the following:
  - Processing Plant
  - Tailings Storage Area
  - Sumps and Water Ponds.

In addition, construction and earthwork activities will be carried out before mining operations commences, and will include the following:

- Upgrade of access road, where required.
- Office/administration and amenities
- Setting up the processing facility.
- Earthworks to prepare the area for tailings storage.

All infrastructure except the solar field will be placed within the disturbance footprint of previous mining operations and will not require clearing any undisturbed areas. The proposed solar field will be placed on the western section of the site and require clearing a 4 ha area of vegetation. This is the only new area of disturbance proposed. **Figure 6** below shows the area with proposed disturbance in previously disturbed areas (in orange) and in previously un-disturbed areas (in brown). The remaining area within the site will be undisturbed (shown in green in **Figure 6).**

Further details of the proposed disturbances have been presented in **Table 3** below.

Table 3 Details of the Proposed Disturbances

Proposed Disturbance Area	Proposed Activities	Area (ha)	Previous Disturbance	Land Clearance
Operational Area	Areas for construction of the processing facility, office/administration and amenities.	3.28	Area is previously disturbed by historical mining activities.	No land clearance required
Tailings Area	Area for construction of tailings storage facility	10	Area is previously disturbed by historical mining activities.	No land clearance required
Solar Farm	Area for construction of a solar farm	4	Area is not previously disturbed.	Land clearance required. Will be done as per NT Land Clearing Guidelines

The erosion risk from proposed disturbances in these areas has been discussed in the sections below. Clearing in the proposed solar farm area and disturbance across the site will be in accordance with the NT Land Clearing Guidelines (DEPWS, 2021).

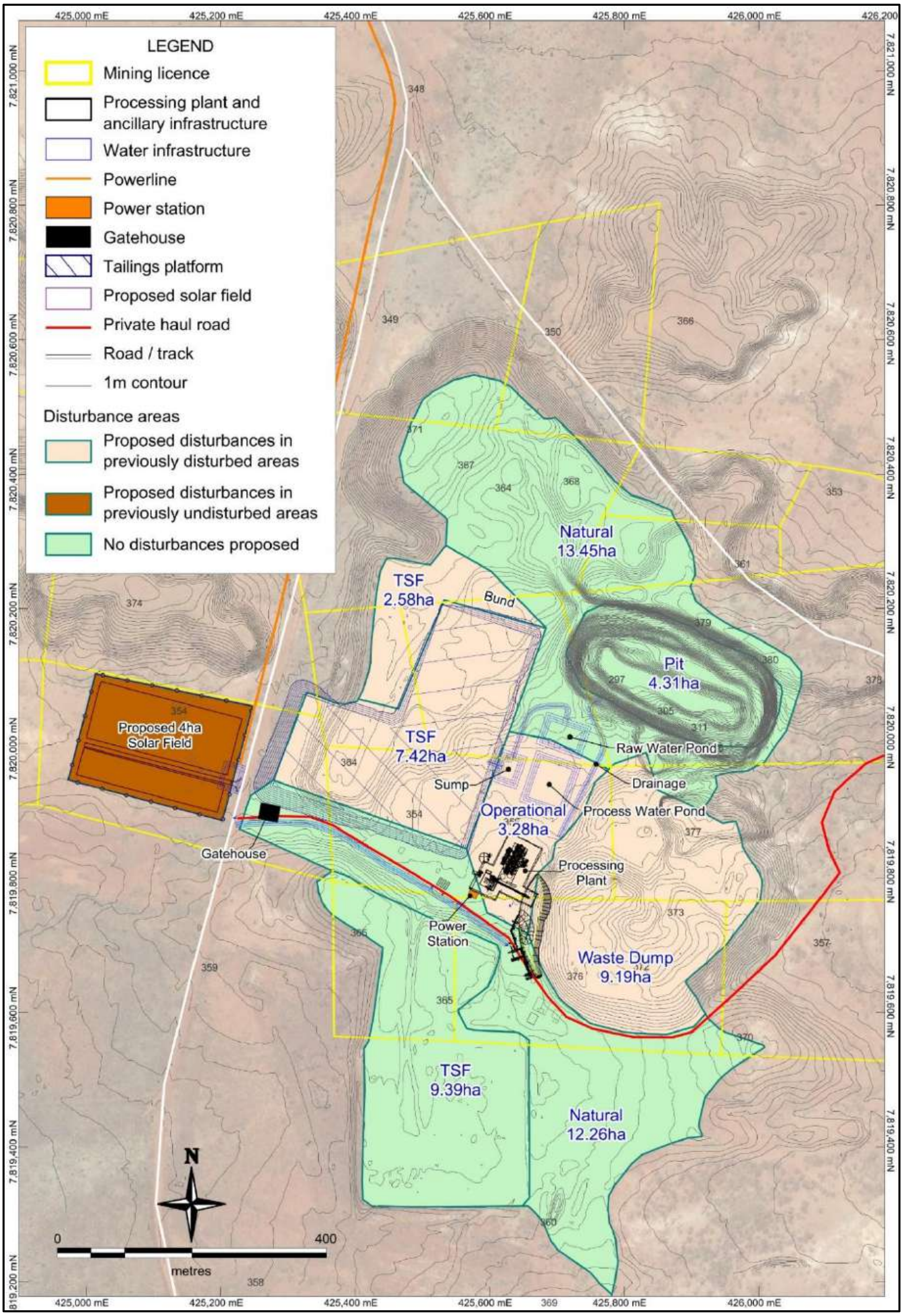

Figure 6 Catchment and Area of Proposed Disturbances

3.0 Erosion Risk Assessment

Erosion risk is assessed using the Revised Universal Soil Loss Equation (RUSLE) as per IECA (2008). This enables the prediction of the long-term, average, annual soil loss from sheet and rill erosion under specified conditions.

The RUSLE is represented by the following equation as A = R * K * LS * P * C

Where:

- A = estimated soil loss (tonnes/ha/yr)
- R = rainfall erosivity factor
- K = soil erodibility factor
- LS = slope length/gradient factor
- P = erosion control practice factor
- C = ground cover and management factor

3.1 Soil Erodibility

The soil erodibility, also referred to as the K-factor, is a numerical representation of soils' ability to resist rain's erosive energy (IECA, 2008). Taking a conservative approach, a K-factor of 0.053 has been adopted for all work areas assessed as part of this ESCP, based on the site soil textures observed on-site and tables within IECA for 'Silty gravels, poorly graded gravel-sand-silt' soil texture type (i.e., Table E5; IECA, 2008).

3.2 Slope Length Factor

The slope length factor, or LS factor, is a numerical representation of the length and slope combination. The grid LS model was developed using LiDAR data and SAGA. SAGA stands for System for Automated Geoscientific Analyses, and is a geographic information system (GIS) computer program, used for terrain analysis and geomorphometric calculations such as slope, aspect, curvatures, flow path analysis, catchment delineation, channel lines, and relative altitudes etc. SAGA used the LiDAR data to determine the range of LS factors across the site. The grid LS model was then overlaid with the catchment boundaries for the proposed disturbances on site as shown in **Figure 6**, and then the mean values of the LS within each catchment were taken for RUSLE. The mean LS factor taken for each proposed disturbance areas is shown in **Table 4** below.

Table 4 Catchment with Proposed Disturbances and LS-Factor

Catchment	Area (ha)	LS factor
Operational area (processing plants, admin, and offices)	3.28	0.27
Solar Farm	4	0.42
Tailings Area (for TSF)	10	0.48

3.3 Rainfall Erosivity Factor

The rainfall erosivity factor (R factor) is a measure of the ability of rainfall to cause erosion. Table E1 and E2 of the IECA (2008) recommends R factor only for Darwin and Katherine in Northern Territory. As Tennant Creek is located away from these two locations, and experiences different rainfall, the R factor for the site is derived from the IECA (2008) recommended methodology (using the 2-year 6-hour rainfall intensity for site).

The formula is:

$R = 164.74\ (1.1177)^{S} * S^{0.6444}$

Where, S is the 2 year ARI, 6 hour rainfall event.

The R factor derived from the IECA (2008) recommended methodology (using the 2-year 6-hour rainfall intensity for site) is 1461.

3.4 Cover Factor

The cover factor, also known as C-factor, is the influence of cover on the site that protects the disturbed area from rainfall erosion. It can be through matting, temporary or permanent vegetation, and/or chemical binders.

Ground cover on site comprises vegetation, rocks, competent gravel, and unprotected soil material. Soil binders may also be applied for dust suppression and erosion control. Existing roads are characterised by a stable gravel/soil surface. Taking a conservative approach, the C-factor adopted for this assessment was taken as the worst-case scenario, i.e., 1, which is C-factor for bare soil and erosive surfaces.

3.5 Practice Factor

The practice factor (P-factor) measures the combined effect of all support practices and management variables. It relates to compaction and construction practices across the site and how they impact the velocity and runoff and its tendency to flow directly downhill. The nominated P factor for all areas without permanent, stable ground cover is 1.3 (based on the default construction phase condition). This value has been used for this assessment.

3.6 Estimated Soil Loss

The annual soil loss rate for each catchment area was calculated based on the assessment parameters described above. The erosion risk was then derived based on Table 4.4.3 of IECA (2008). Appropriate techniques for different ranges of soil loss rates can also be determined. These are summarised in **Table 5** below. The technique type is explained further in the sections below.

Table 5 Estimated Soil Loss, Erosion Risk, and Control Type

Catchment	Annual Soil Loss Rate (tonnes/ha/year)	Erosion Risk (as per IECA, 2008)	Sediment Control Technique Type	Sediment Control Methods
Operational area	27.18	Very Low	Type 3	Sediment Trap
Solar Farm	42.28	Very Low	Type 3	Sediment Trap
Tailings Area	48.32	Very Low	Type 3	Sediment Trap

Type 1 (i.e., sediment basins) controls will not be required during construction of the project, due to the annual soil loss rate being <150t/ha/yr. As per Table 4.5.1 of IECA (2008), the default sediment control standard based on soil loss rate, Type 3 controls will be required. Further information about the sizing of these controls is discussed further in **Section 4**.

3.7 Erosion Risk

Table 6 below summarises erosion risks and control requirements across a full calendar year. Most of the construction will occur during very low erosion risk (between March to September). Typical measures to be implemented are discussed in **Section 4** below.

Table 6 Monthly Erosion Risk Rating

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	96.7	91.1	50.2	11.8	10.4	6.6	5.0	2.0	5.4	14.9	30.2	58.1
Rating	M	M	M	VL	VL	VL	VL	VL	VL	VL	L	M

M – Moderate; L – Low; VL – Very Low; Based on Table 4.4.2 of IECA (2008).

4.0 Erosion and Sediment Control

Best practice site management procedures will be implemented to control the severity and extent of soil erosion and pollutant transport during the construction and operational phase of the site. Erosion and sediment control measures required during construction and operation have been derived based on the site erosion hazard and risk. Conceptual details of the controls are provided in the sections below based on the current level of design detail.

During construction, the construction contractor will be responsible for implementing, inspecting, repairing and modifying the controls. TCMG will ensure that the construction contractor is aware of all required procedures and systems for erosion and sediment management and are provided with appropriate clearance approvals and on-ground guidance prior to giving any ground disturbance instructions. TCMG will also be responsible for preventing any environmental harm, and reporting any environmental incidents to relevant authorities, if required. Post-construction, TCMG will be accountable for the implementation, inspection, repair, and modification of the controls and will be subjected to annual internal audits and will be reported on within the annual Environmental Mining Report to be completed as a condition of Mining Authorisation.

4.1 Drainage Control

In accordance with IECA (2008), drainage controls include measures for the diversion of 'clean' stormwater runoff around and through the site; and the diversion of 'dirty' site stormwater runoff to enable treatment of sediment prior to release offsite. The clean and dirty water are defined as follows:

- **Clean water** – Clean water is defined as water that either enters the site from an external source and has not been further contaminated by sediment within the site due to either construction or mining activities. Clean water can also be water that has originated from the site and is of such quality that it does not need to be treated to achieve the required water quality standard (IECA, 2008). Site clean water constitutes surface runoff from areas of non-erodible cover, including vegetation, hardstand, soil binder etc. It also includes runoff from non-disturbed natural areas of the site.
- **Dirty water** – Dirty water is defined as water that is not clean. This includes surface runoff from disturbed areas and contaminated either from construction or mining activities. Dirty water requires treatment with appropriate controls before release from the site (IECA 2008).

Temporary drainage controls installed as part of the construction will enable the management of stormwater within work areas. Drainage controls will perform the following functions:

- Enable diversion of 'clean' up-slope water either around or through the site at non-scouring velocities through clean water drains (See **Figure 7**).
- Enable collection of 'dirty' runoff generated within construction areas and the delivery of this water to an appropriate sediment control measure through dirty water drains (see **Figure 7**). Ensuring that 'dirty' water is diverted away from sensitive receptors including [redacted] Lake Alice. The sediment control measures are discussed in **Section 4.3** below.
- Bunds across the construction area, especially around TSF area, to limit the inflow of clean water flowing into construction areas and restrict dirty water from running off the dirty water drains (**Figure 7**). Bunds will also be put across the solar field area to prevent construction dirty water running off.
- Minimise the risk of soil erosion caused by site-generated flows within the project, using 'intermediate' flow treatment and release points.

The clean water and dirty water drain will be installed for both construction as well as operational phases. The drain design diagram, and the detailed diagram is shown in **Appendix A**. The progressive ESCPs will be developed in accordance with relevant engineering drawings.

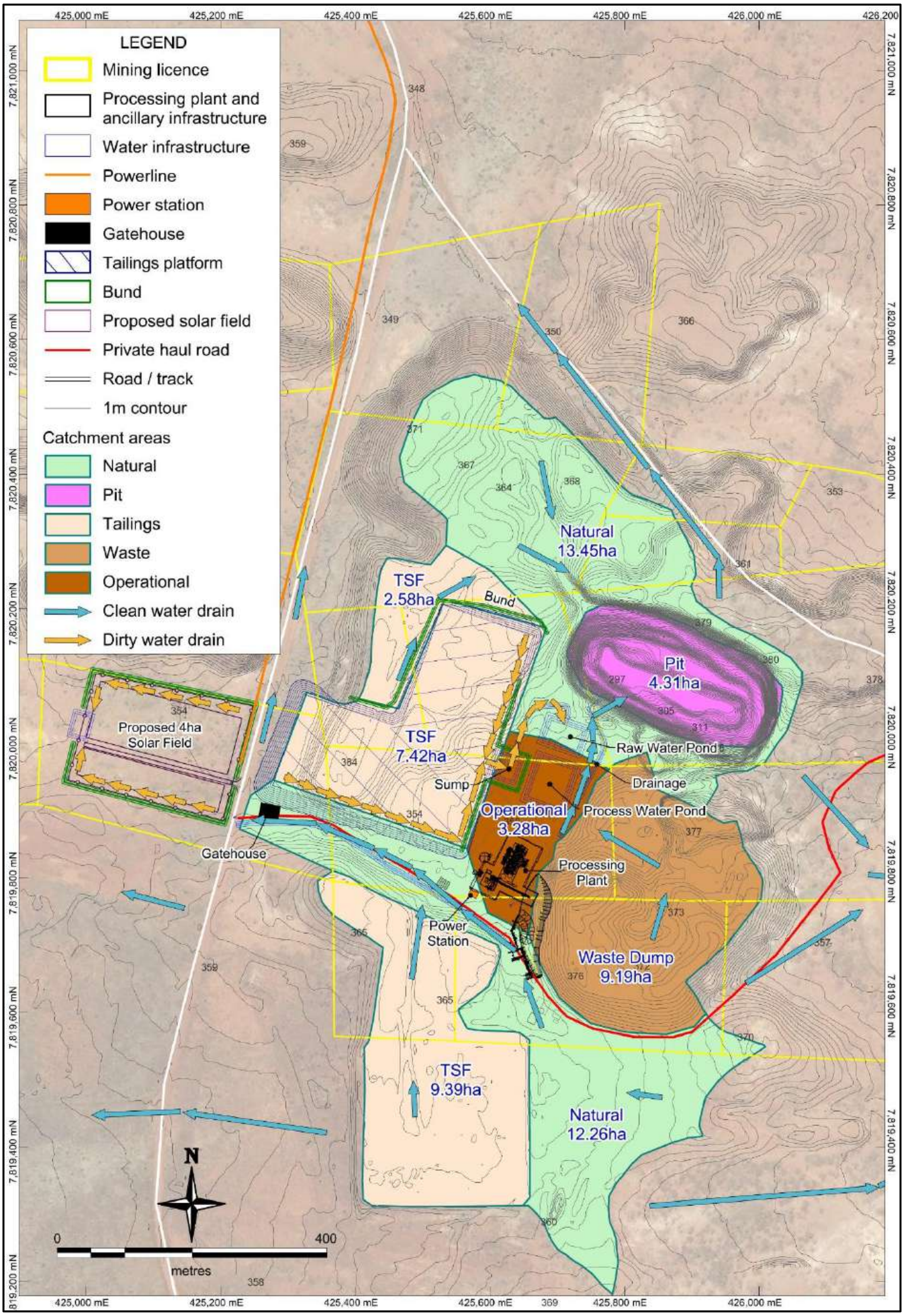

Figure 7 Clean and Dirty Water Drains in Proposed Work Areas

4.2 Erosion Control

The prevention of erosion is the primary approach for preventing adverse impacts associated with sedimentation. Construction and operation activities are to be undertaken to reduce the duration of soil exposure to erosive forces (wind and water), either by holding the soil in place or by shielding it. Measures to be used include a variety of construction practices, structural controls and vegetative measures aimed at managing runoff at a non-erosive velocity, and the protection of disturbed soil surfaces.

The specific measure(s) implemented will be based on seasonal erosion risk and construction considerations, in accordance with IECA guidelines.

Proposed controls are listed below:

- Undertaking initial construction in the dry season months as far as the schedule allows. The construction works start in March (moderate erosion risk), but most of the work will be done post-March, which has a relatively lower erosion risk (dry months).
- Minimise disturbance to existing vegetation as far as practical within the site. Land clearing will be undertaken in a staged approach and in accordance with the Environmental Management System, which includes procedures and methods for minimising levels of soil disturbance and impacts to natural drainage pathways.
- Promptly stabilising exposed post clearing either by surface cover or completed construction works. Protection of exposed surfaces are as follows:
    - Protection of soil surface (temporary and permanent), including placement of hardstand surfaces, use of soil binder, vegetation establishment (including mulch), and protection with mats & blankets (e.g., jute, geotextile) where practical.
- Application of dust suppression by wetting of exposed surfaces (water truck), application of soil binder, and/or application of soil cover.

4.3 Sediment Control

The required standard is determined from the area of disturbance and estimated soil loss. Based on the estimated soil loss (**Table 5**), a Type 3 sediment control standard applies for all areas with proposed disturbance.

As a Type 3 control, a sediment trap pond will be constructed in TSF/operation area and solar farm area to capture the dirty water and sediments from this area. The sediment trap pond of the TSF area will be converted into sump during the operational phase. Similar to erosion control, sediment control will also be a staged approach, and the sediment trap ponds will be constructed prior to further construction, to prevent any sediment-laden water from discharging from the site. The conceptual drainage layout and sediment trap pond placement for TSF/operational and solar area are shown in

Figure 8. Final location of sediment trap pond for solar farm will be designed post-clearing and further site assessment. More detailed drawing is presented in **Appendix A**. Runoff captured within these sediment traps will be re-used within the site, wherever practical (e.g., dust suppression, processing etc.), with excess treated runoff to be discharged to the receiving environment. Any other specific sediment control requirements will be assessed and documented within progressive ESCPs, and will include consideration of season and practicality of control measures, and will be in accordance with the methods outlined in IECA (2008).

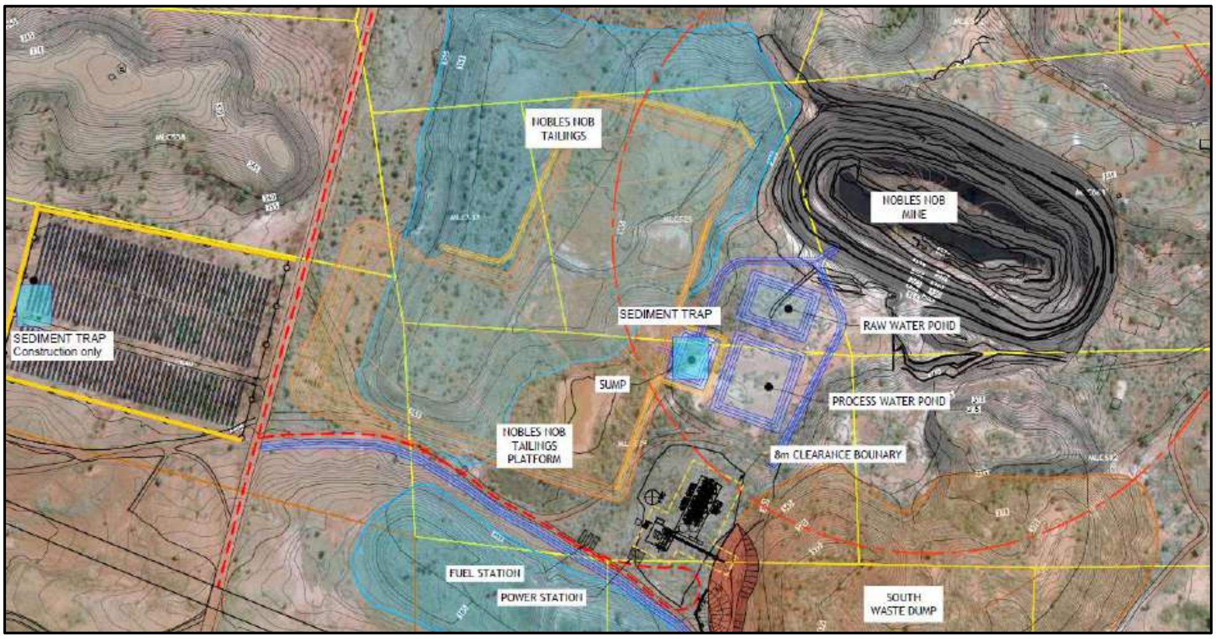

Figure 8 Drawing of Sumps (Sediment Basin) for TSF/Operational Area

4.3.1 Supplementary Sediment Control

Supplementary sediment control measures form an important component of the erosion and sediment control system when implemented in conjunction with other measures. The following supplementary controls will be implemented:

4.3.1.1 Construction Entry and Exit Shake Down

There is a possibility of sediment and soil transportation outside the construction area from the vehicle's tyres. This will be prevented by having only one construction entry/exit point for the site, unless more points are required for site access or topography. An entry/exit sediment control rock pad or vibration grid will also be installed at the entry/exit points. **Figure 9** below shows an example of a typical construction entry/exit shake-down rock pad and vibration grid used to prevent the transport of sediment off-site.

Figure 9 Example of Entry-Exit Shake Down Area (Source: Witheridge, 2012)

4.4 Management of Other Disturbed Areas

4.4.1 Roads

Roads will be designed to be water-shedding to avoid flow accumulation which could lead to erosion of the road surface and embankments. Roads will be constructed using best practice guidelines and techniques. Gravel surface material will be used with the addition of waste rock material where the upper soil profile is found to be unsuitable or substandard for road construction.

Roads will also be sprayed with water to minimise dust generation and to improve the structural integrity of the roads, to minimise sediment erosion and runoff potential. Culverts will be used in parts where the roads intersect drainage lines or diversion structures.

4.4.2 Stockpiles

Stockpiles (e.g., for topsoil) will be constructed no higher than 2 m and subsoil stockpiles no higher than 10 m as per the best practice guidelines. The slope of these stockpiles will also be kept less than 15 degrees to help minimise erosion. Stockpiles may be bunded around the perimeter to minimise sediment runoff, where necessary.

4.4.3 Dust Control

Wind erosion will be controlled by a combination of surface material and water spraying. Surfaces that require additional dust control measures, such as roads, will be sprayed with water periodically as needed.

Any cleared areas that are no longer required will be progressively rehabilitated in accordance with the guidelines. This will restore native plant cover and reduce the risk of erosion and dust generation from exposed soil surfaces.

4.4.4 Roof water

Where possible, rainwater from the roof of site buildings will be diverted into rain harvesting water tanks for use during construction and operations (e.g., dust control). Tanks will be designed for peak capacity with overflow and diversion measures in place.

4.5 Management of Restricted Areas

All areas identified as being non-clearable areas, as well as the restricted works areas and exclusion zones associated with sacred sites, will be flagged and marked on the ground. This is to restrict the movement of vehicles or persons into this area. Maps and GPS coordinates of the restrictive areas will be provided to the clearing contractors.

4.6 Monitoring

During the construction and operational phases of the mine, the stormwater runoff from the site will be monitored. Monitoring will be done as per the site Water Quality Management Plan. The samples will also be collected from the following point (when available):

- Runoff from the dirty water drains.
- Runoff from the clean water drains.
- Runoff entering the sump.
- Runoff entering the pit (from clean water drains).

Where possible, baseline data will be collected on the runoff to understand existing stormwater quality, prior to construction.

The parameters that these samples will be tested for are:

- pH
- electrical conductivity (EC)
- total suspended solids
- turbidity
- dissolved oxygen

Sampling will be undertaken in accordance with procedures set out in the Environmental Protection Authority's Water Quality Sampling Manual, and the samples will be sent to a National Association of Testing Authorities (NATA) accredited laboratory. A standard operating procedure (SOP) will be developed for sample collection.

Monitoring will also be undertaken during the construction phase to determine the impact of activities on the site and to ensure that the sediment controls have been implemented and maintained to a satisfactory standard.

4.7 Maintenance of Controls

All sediment and erosion control measures will regularly undergo maintenance to ensure they remain fully operational during the construction and operational phase of the mine.

An operational plan will be implemented, which will also include the procedure and timing for visual inspection of all controls within regular site environmental monitoring. Repairs will be carried out immediately with the appropriate reporting and documentation of details.

4.8 Triggers and Corrective Actions

The following criteria will be used to determine if the requirement for corrective actions is triggered:

- Evidence of deterioration of downstream water quality (visible evidence such as high turbidity) due to site activities.
- Evidence of significant erosion.
- Visible evidence of a failure of control measures.

If triggered, the following corrective actions will be required:

- The source of water quality deterioration to be located and inspected.
- Prevent the deterioration with prompt temporary controls.
- Inspect the existing controls, and repair where necessary. If necessary, additional controls should be constructed.
- Modify existing controls, if required, to prevent future deterioration.
- Review the management plan if significant deterioration in water quality is observed during the operational phase.

4.9 Rehabilitation

Following the completion of construction and operational activities, long-term protection of the site from erosion will be provided by the final rehabilitated landform. The draft Mine Closure Plan for the site will provide details of the site closure objectives, closure criteria for each landform, a work program to achieve the closure objective, and monitoring methods.

Permanent erosion control measures will include a combination of vegetative, hardstand and structural erosion control techniques, implemented progressively. Sediment control measures will continue to be managed and maintained until the site is assessed as being adequately stabilised.

Existing basins may be required to be retained beyond mine closure to provide ongoing water quality management (with appropriate modifications to outlets).

In relation to erosion and sediment control, the following practices will assist in achieving site stabilisation and long-term protection for downstream environments:

- Topsoil is managed to ensure the preservation of its long-term value.
- Selected plant species for revegetation are appropriate for site conditions and endemic to local vegetation communities.
- Erosion and sediment controls are to remain in place until a minimum 75 % self-sustaining ground cover (or equivalent) is achieved for disturbed areas, with a minimum of 90 % for drainage features.

Site-specific controls will be provided in a closure ESCP, which will be prepared based on the constructed site and the proposed rehabilitation program.

5.0 ESCP Management

5.1 Responsibilities

Responsibility for this ESCP, including implementation of and adherence, is summarised in **Table 7** below.

Table 7 Responsibilities

Entity	Primary Responsibility
Project Manager/Chief Operating Officer (TCMG)	- Overall implementation of the ESCP and management of environmental impacts and risks. - Ensure all employees and contractors are aware of all required procedures and systems for erosion and sediment management and are provided with all the necessary resources to implement the requirements effectively. - Ensure all employees and contractors are provided with appropriate clearance approvals and on-ground guidance prior to giving any ground disturbance instructions. - Responsible for reporting any incidents to relevant authorities if required. - Implementation, monitoring, reporting and corrective actions within the ESCP. - Undertake an annual review of the erosion and sediment control EMP.
Site Manager/Construction Manager	- Implementation of strategies, requirements, procedures and measures to ensure that appropriate environmental protection is in place. - Induction, supervising and monitoring of the ESCP. Undertake inspections, reviews and monitoring as required and stated in this plan.

	- Ensure that details of any incident/non-conformances are recorded, and relevant authorities are notified.
Safety Manager	- Develop and implement Site Safety Rules. - Ensure safety procedures and protocols have been developed and implemented before commencing any work. - Ensure all employees and contractors are provided with appropriate erosion and sediment management related training.
Employees and Contractors	- Report any non-compliance with the erosion and sediment management requirements through the event/incident reporting system. - Adherence to this ESCP and Site Safety Rules.

5.2 Environmental Notification

In the event of a major incident or non-conformance which has the potential to cause significant environmental harm, the relevant authority will be notified of the incident as soon as practicable after being made aware of the incident.

The duty to notify will be applicable to the following people:

- The personnel/contractor/sub-contractor undertaking the activity.
- The occupant of the premises where the incident occurs.

In the event of an incident, the Site Manager will document the following details:

- The time, date, nature, duration and location of the incident or non-conformance.
- The nature of the incident/non-conformance and the cause.
- Details of the circumstances in which the incident/non-conformances occurred.
- The action that has been taken and actions that are proposed to be taken to deal with the incident/non-conformance.
- All incidents and near-misses will be recorded within the Tennant Mining Environmental Incident Register in the online document management system *Skytrust*.

5.3 Training and Awareness

The requirements of this ESCP will be provided to contractors and employees through training, site induction, toolbox talks, and site alerts. Training will be part of the safety inductions that will be conducted prior to commencing site work. This will cover:

- Identification of site environmental values.
- An understanding of the requirements of applicable environmental management and monitoring plans.
- Roles and responsibilities of site personnel.
- Communication procedures (both normal and emergency).
- Incident reporting procedure to be followed on site.
- Environmental emergency response procedures.

- Site environmental controls (e.g., associated with ground clearing, weed management, erosion and sediment control, waste management, heritage, and archaeological sites/ restricted work areas etc.).
- The potential consequences of not meeting environmental obligations/responsibilities.

It will be a mandatory requirement that everyone undertaking any site work will have to be properly inducted. Records of inductions will be maintained within the Tennant Mining environmental management system in the online document management system *Skytrust*.

5.4 Inspection and Auditing

The ESC controls are to be regularly inspected. The frequency of inspections will be as follows:

- Inspected at least weekly during construction and operation as a part of site environmental inspections.
- Inspected within 24 hours of an expected high rainfall event.
- As soon as reasonably practical after a high rainfall event (i.e., > 10 mm in a 24-hour period).

Visual assessment will be carried out of surface water runoff structures, drainage structures and erosion control structures to ensure they are operating efficiently.

A site inspection checklist has been developed (see **Appendix B**).

5.5 Updates and Variation

An ESCP is a dynamic document, and it requires regular updates as the mining operations progress altering the site characteristics. Any alterations to the implementation of erosion and sediment controls within specific areas are to be recorded and outlined in updated ESCPs. This may include the following scenarios:

- Controls require alteration due to change in work practices or new stage of works is commenced.
- Controls require alteration due to change in seasonal conditions (e.g., dry season vs wet season).
- Changes occur in slope gradients and drainage paths, with their exact form unpredictable before works start.
- A change in the design occurs that materially affects the site works.
- The desired outcome (e.g., protection of receiving environments) is not being achieved under current plan.

5.6 Reporting

TCMG will undertake an annual audit of the performance of erosion and sediment controls on site, taking into consideration the weekly monitoring of controls, any repairs and maintenance carried out, and any environmental incidents recorded. Findings will be reported within the annual Environmental Mining Report, to be submitted to the Minister as required under the Mining Authorisation. If controls are not found to be adequate, this will trigger an update and variation of this plan.

6.0 References

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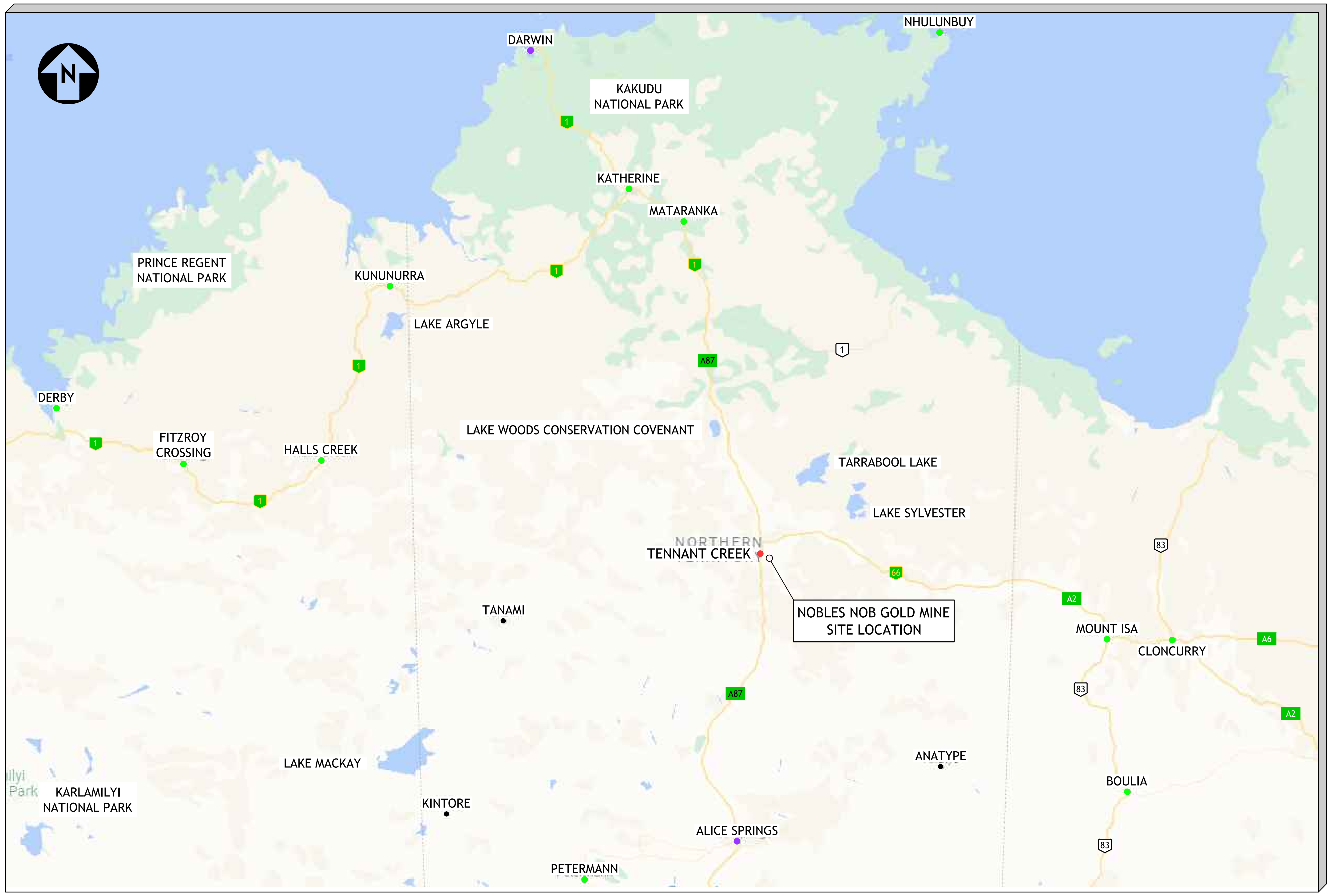
Appendix A. Drawings

TENNANT MINNG

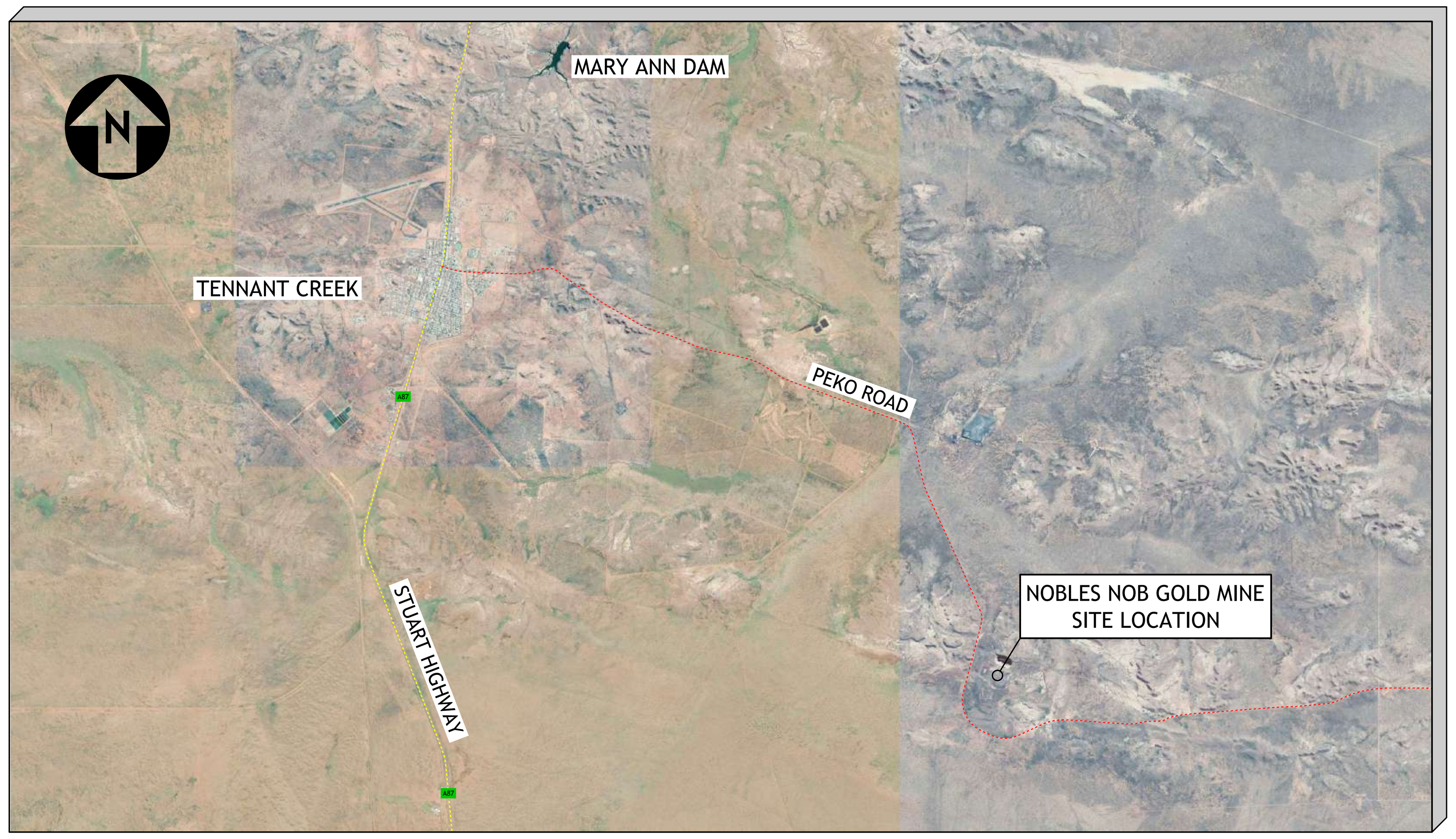
NOBLES NOB GOLD MINE

CONSTRUCTION OF EARTHWORKS AND STORMWATER DRAINAGE

JULY 2022



LOCALITY PLAN
N.T.S



MINE SITE
N.T.S

DRAWING LIST

5449-40-DWG-CI-00000	SITE LOCALITY PLAN AND DRAWING LIST
5449-40-DWG-CI-00001	GENERAL ARRANGEMENT PLAN
5449-40-DWG-CI-00002	OVERALL EARTHWORKS PLAN
5449-40-DWG-CI-00003	TSF, DRAINS & PONDS - GENERAL ARRANGEMENT & SETTING OUT PLAN
5449-40-DWG-CI-00004	TSF, DRAINS & PONDS - CROSS SECTIONS & DRAIN PROFILES
5449-40-DWG-CI-00005	PROCESS PLANT PLATFORM & STORMWATER DRAIN - GENERAL ARRANGEMENT & SETTING OUT PLAN
5449-40-DWG-CI-00006	PROCESS PLANT PLATFORM - CROSS SECTIONS & STORMWATER DRAIN PROFILE
5449-40-DWG-CI-00007	SITE ACCESS ROAD - LAYOUT & LONGITUDINAL SECTION

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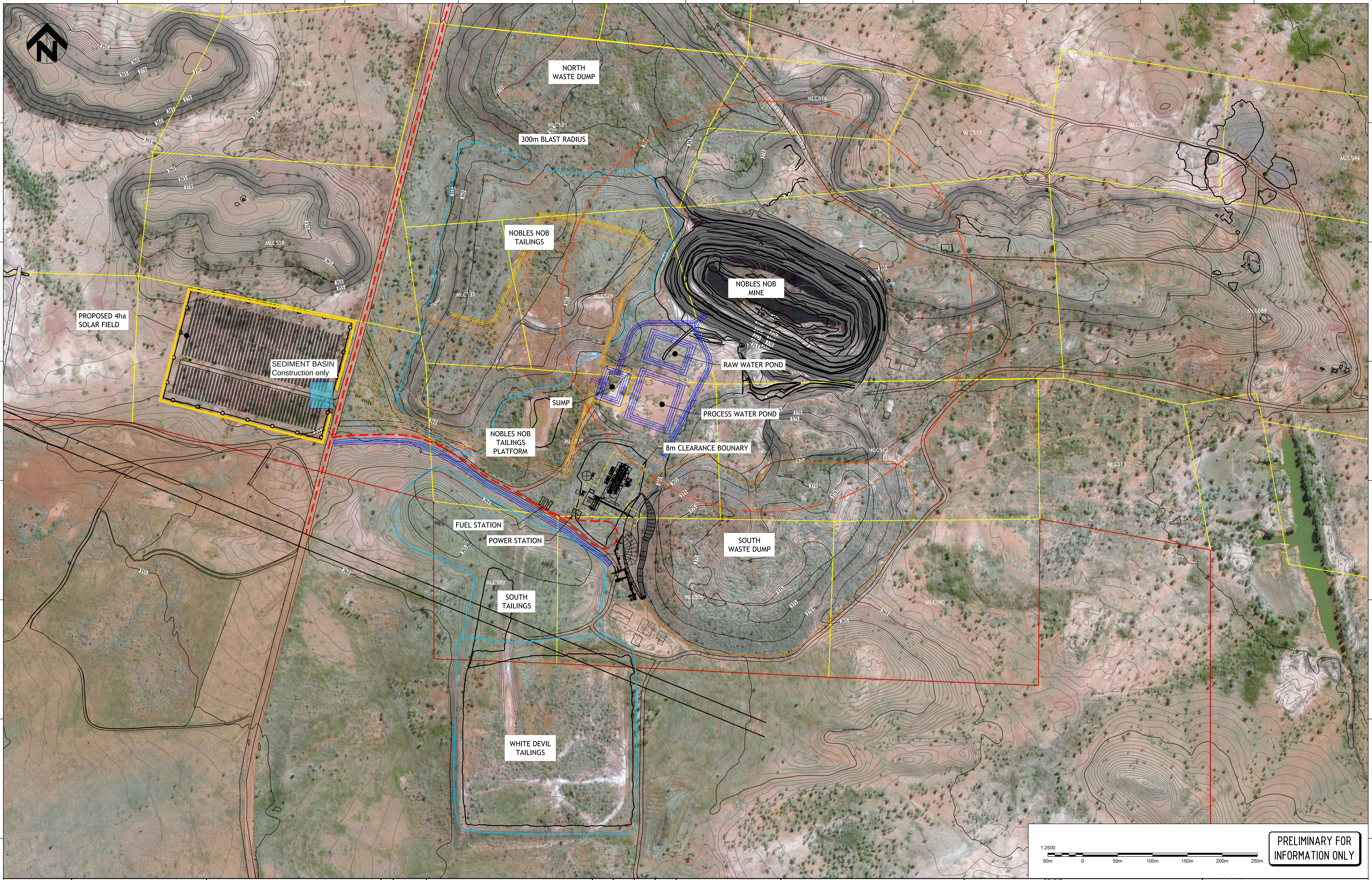
DETERMINE • DESIGN • DELIVER

TENNANT MINING

DWG: 5449-40-DWG-CI-00000
REVISION: A



PRELIMINARY FOR INFORMATION ONLY

REV	DATE	REVISION DESCRIPTION	DRAWN	CHECKED	ENGINEER	APPROVED
A	02.02.2022	ISSUED FOR REVIEW	J.G	D.P	S.W	

IN THE ABSENCE OF THE APPROVED SIGNATURE, THIS DRAWING SHALL BE TREATED AS PRELIMINARY

DRAWING NUMBER	DESCRIPTION

DRAWING REFERENCE

DRAWN	J.GREEFF	DATE 02.02.2022
DESIGNED		DATE 02.02.2022
CHECKED	D.PIENAAR	DATE 02.02.2022
ENGINEER	S.WOLMERANS	DATE 02.02.2022
APPROVED		DATE

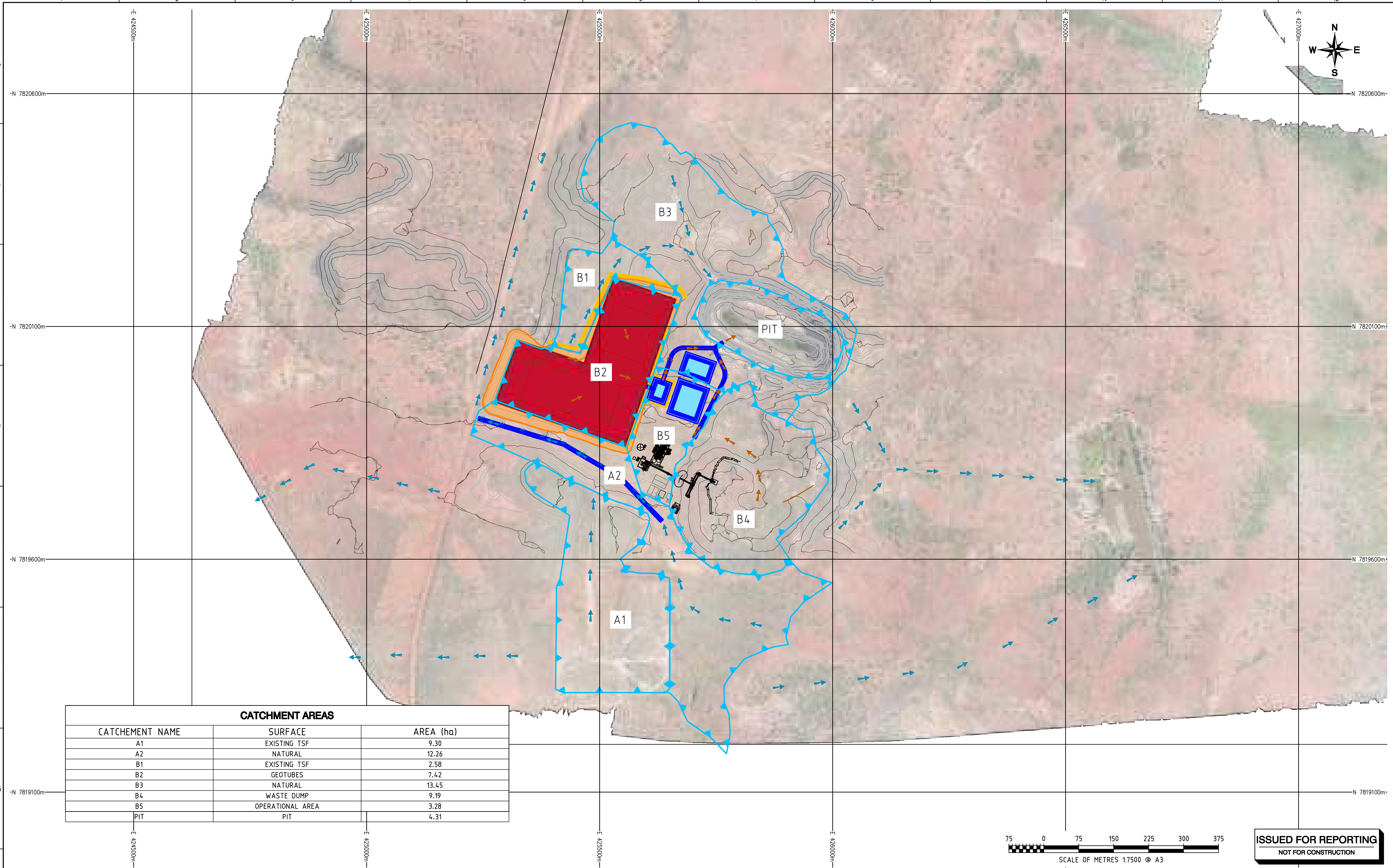
wave international
DETERMINE • DESIGN • DELIVER

CLIENT: TENNANT CREEK GOLD MINE
PROJECT: NOBLES NOB MINE
TITLE: GENERAL ARRANGEMENT PLAN

DRAWING STATUS: ISSUED FOR INFORMATION
CLIENT DWG NO
AS1100-1992 ALL DIMENSIONS IN mm

SCALE	GRID	DATUM	SIZE
1:2500	MGA94 Z 53	GDA94	A1

DWG NO: 5449-40-DWG-CI-00001 REV: A



CATCHMENT AREAS

CATCHMENT NAME	SURFACE	AREA (ha)
A1	EXISTING TSF	9.30
A2	NATURAL	12.26
B1	EXISTING TSF	2.58
B2	GEOTUBES	7.42
B3	NATURAL	13.45
B4	WASTE DUMP	9.19
B5	OPERATIONAL AREA	3.28
PIT	PIT	4.31

ISSUED FOR REPORTING
NOT FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
A	REPORT REFERENCE PLANS	18/02/22	ARL	MWJ	EJB

SCALE: 1:7,500	
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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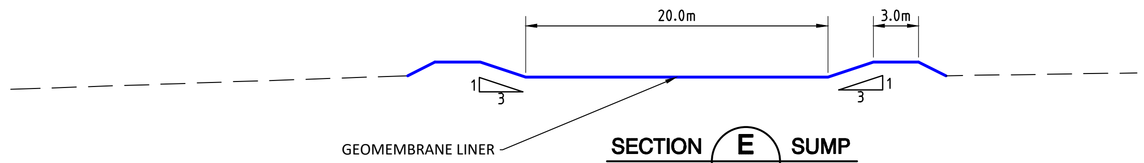
CATCHMENT PLAN
OVERALL SITE (CLOSURE)

DWG. No. 121089.01-010

SHEET SIZE A3 Rev. A

SHEET 1 OF 1



SECTION **E** SUMP
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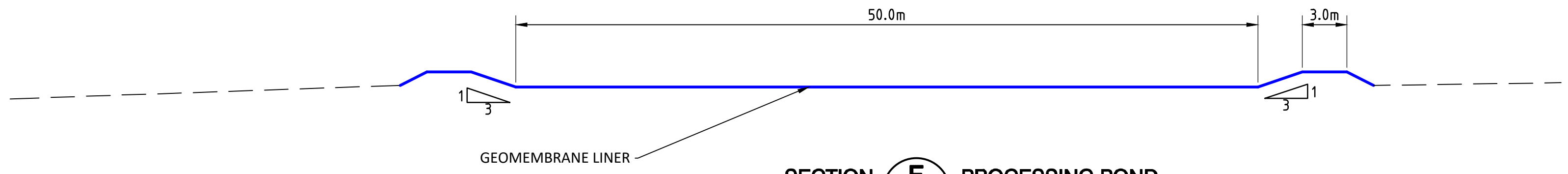

SECTION **F** PROCESSING POND
SCALE 1:500
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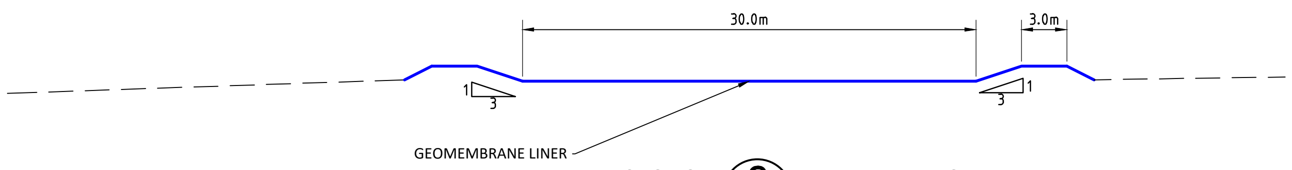

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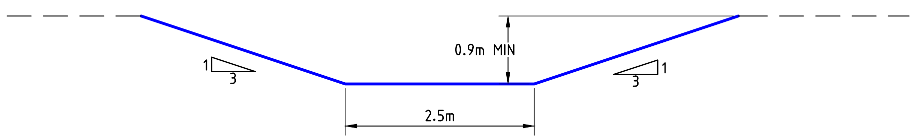

DETAIL **4** CLEAN WATER DRAIN (CWD-A)
SCALE 1:100
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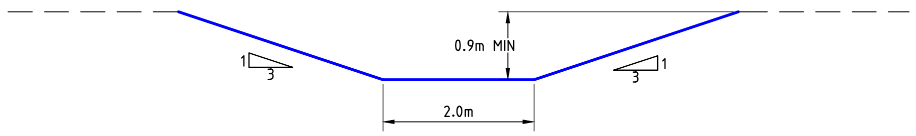

DETAIL **5** CLEAN WATER DRAIN (CWD-B)
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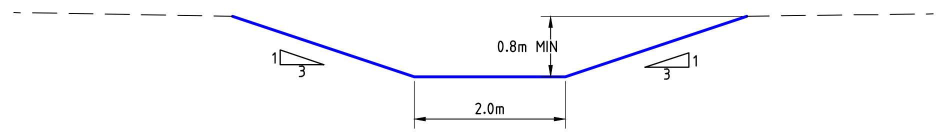

DETAIL **6** DIRTY WATER DRAIN (DWD-A)
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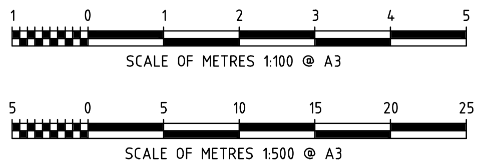

ISSUED FOR REPORTING
NOT FOR CONSTRUCTION

No.	DESCRIPTION	DATE	DRAWN	CHECK'D	APPR'D
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SCALE:	AS SHOWN
JOB No.	121089.01
DATE	FEB. 2022
DESIGN	BH
DRAWN	ARL
CHECKED	MWJ
APPROVED	EJB

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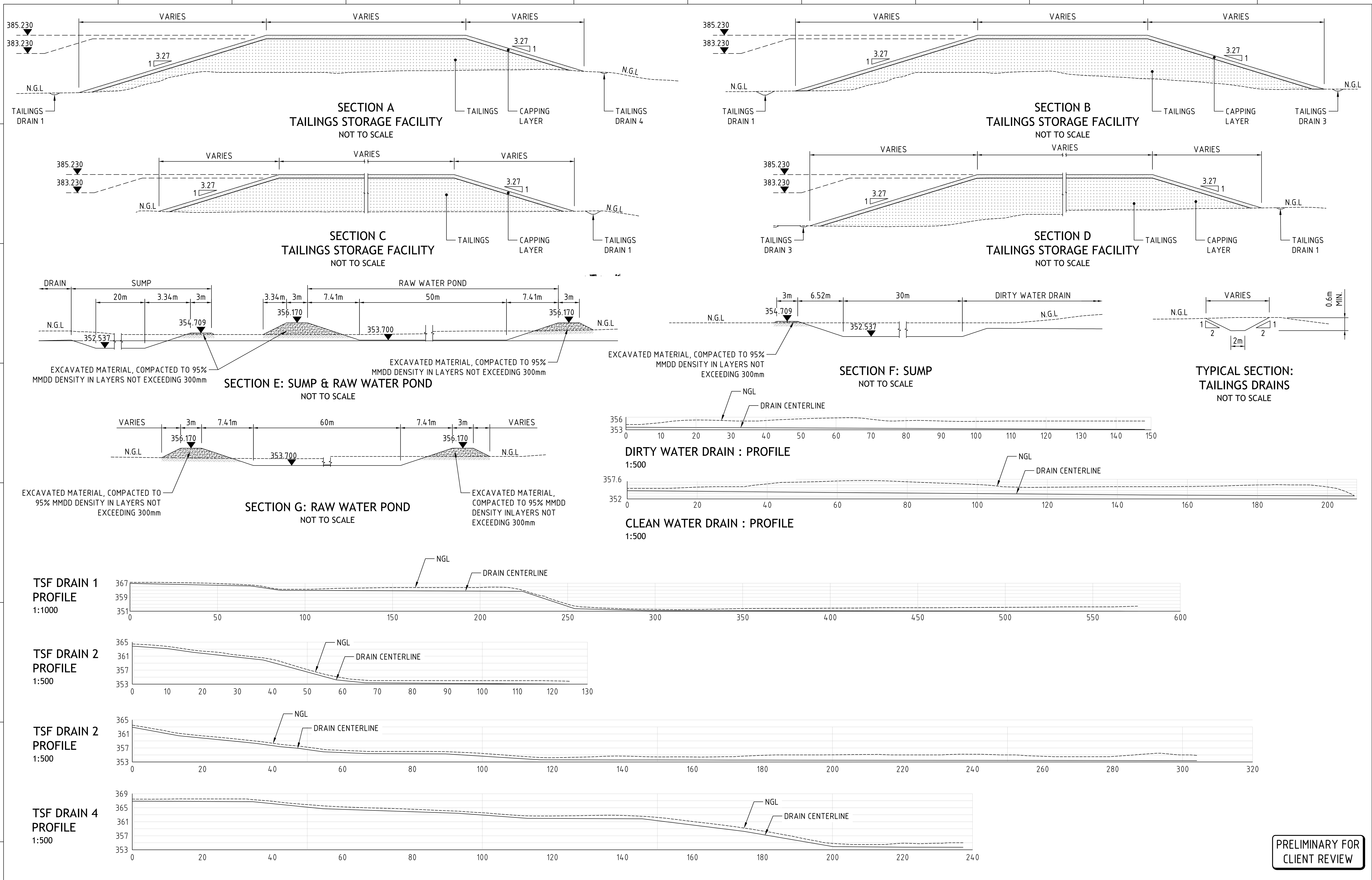
PONDS AND DRAINS
SECTIONS AND DETAILS

DWG. No.
121089.01-011

SHEET SIZE A3 Rev. A

SHEET 1 OF 1



DRAWING NUMBER	DESCRIPTION
DRAWING REFERENCE	

TENNANT MINING

REV	DATE	REVISION DESCRIPTION	DRAWN	CHECKED	ENGINEER	APPROVED
A	22.07.2022	ISSUED FOR REVIEW	J.G	D.P	S.W	S.W

IN THE ABSENCE OF THE APPROVED SIGNATURE, THIS DRAWING SHALL BE TREATED AS PRELIMINARY

		DATE
DRAWN	J.GREEFF	22.07.2022
DESIGNED	S.GELDENHUYS	22.07.2022
CHECKED	D.PIENAAR	22.07.2022
ENGINEER	S.WOLMERANS	22.07.2022
APPROVED	S.WOLMERANS	22.07.2022

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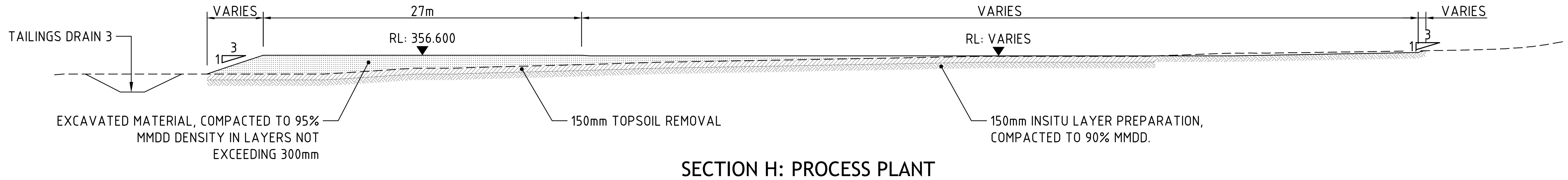
CLIENT: TENNANT MINING
PROJECT: NOBLES NOB GOLD MINE
TITLE: TAILING STORAGE FACILITY
EARTHWORKS
TSF, DRAINS & PONDS
CROSS SECTIONS & DRAIN PROFILES

DRAWING STATUS: ISSUED FOR REVIEW
CLIENT DWG NO
AS1100-1992 ALL DIMENSIONS IN mm

SCALE	GRID	DATUM	SIZE
AS SHOWN	MGA94 Z 53	GDA94	A1

DWG NO. 5449-40-DWG-CI-00004 REV A



SECTION H: PROCESS PLANT

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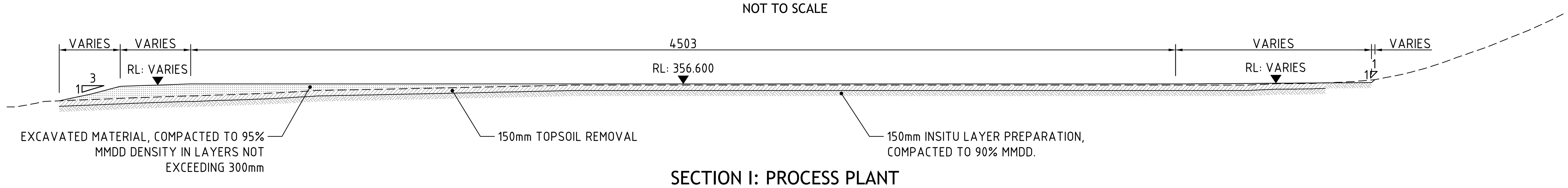

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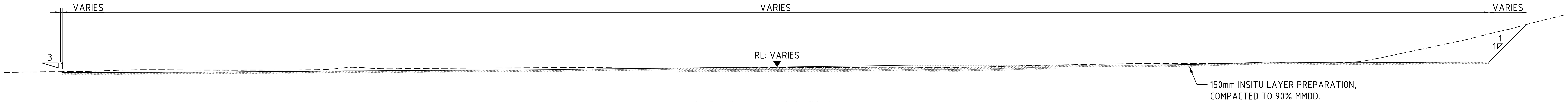

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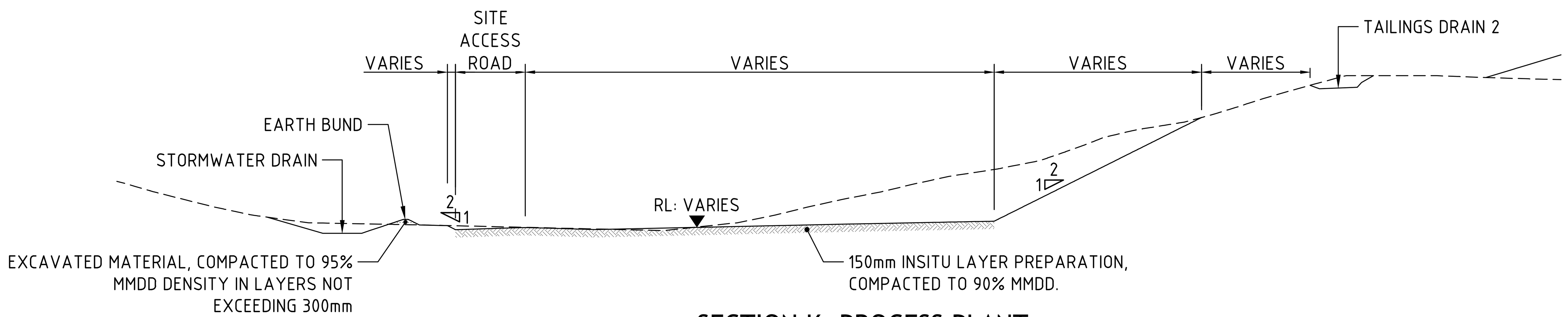

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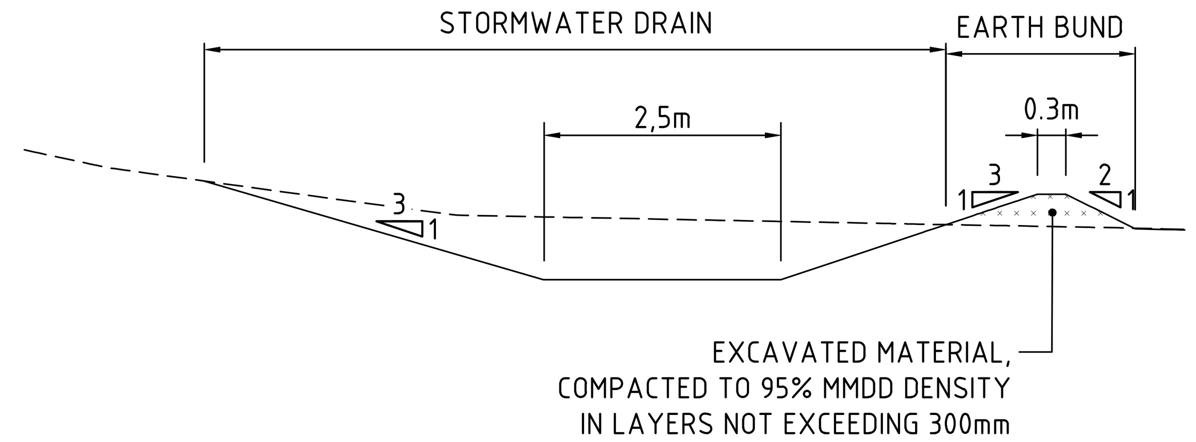
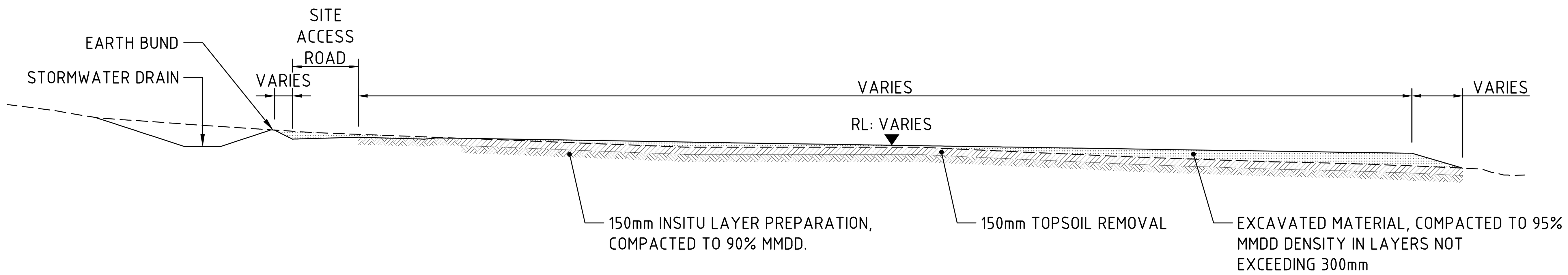


TYPICAL SECTION: STORMWATER DRAIN AND EARTH BUND

NOT TO SCALE



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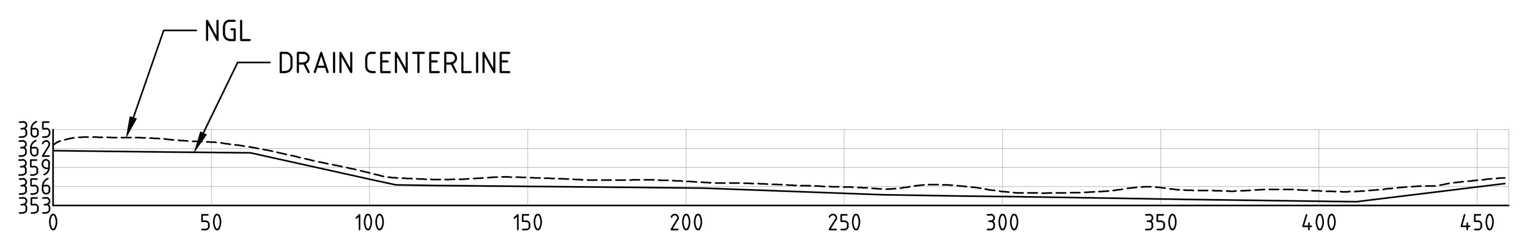
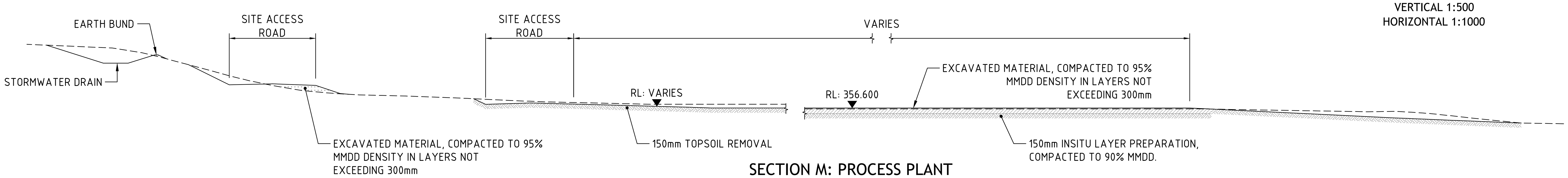


STORMWATER DRAIN: PROFILE

VERTICAL 1:500
HORIZONTAL 1:1000



SECTION M: PROCESS PLANT

NOT TO SCALE

PRELIMINARY FOR CLIENT REVIEW

DRAWING NUMBER	DESCRIPTION
DRAWING REFERENCE	

REV	DATE	REVISION DESCRIPTION	DRAWN	CHECKED	ENGINEER	APPROVED
A	22.07.2022	ISSUED FOR REVIEW	J.G	D.P	S.W	S.W

IN THE ABSENCE OF THE APPROVED SIGNATURE, THIS DRAWING SHALL BE TREATED AS PRELIMINARY

		Date
DRAWN	J.GREEFF	22.07.2022
DESIGNED	S.GELDENHUYS	22.07.2022
CHECKED	D.PIENAAR	22.07.2022
ENGINEER	S.WOLMERANS	22.07.2022
APPROVED	S.WOLMERANS	22.07.2022

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DETERMINE • DESIGN • DELIVER

CLIENT: TENNANT MINING
PROJECT: NOBLES NOB GOLD MINE
TITLE: TAILING STORAGE FACILITY EARTHWORKS - PROCESS PLANT PLATFORM - CROSS SECTIONS & STORMWATER DRAIN PROFILE

DRAWING STATUS: ISSUED FOR REVIEW
CLIENT DWG NO
AS1100-1992 ALL DIMENSIONS IN mm

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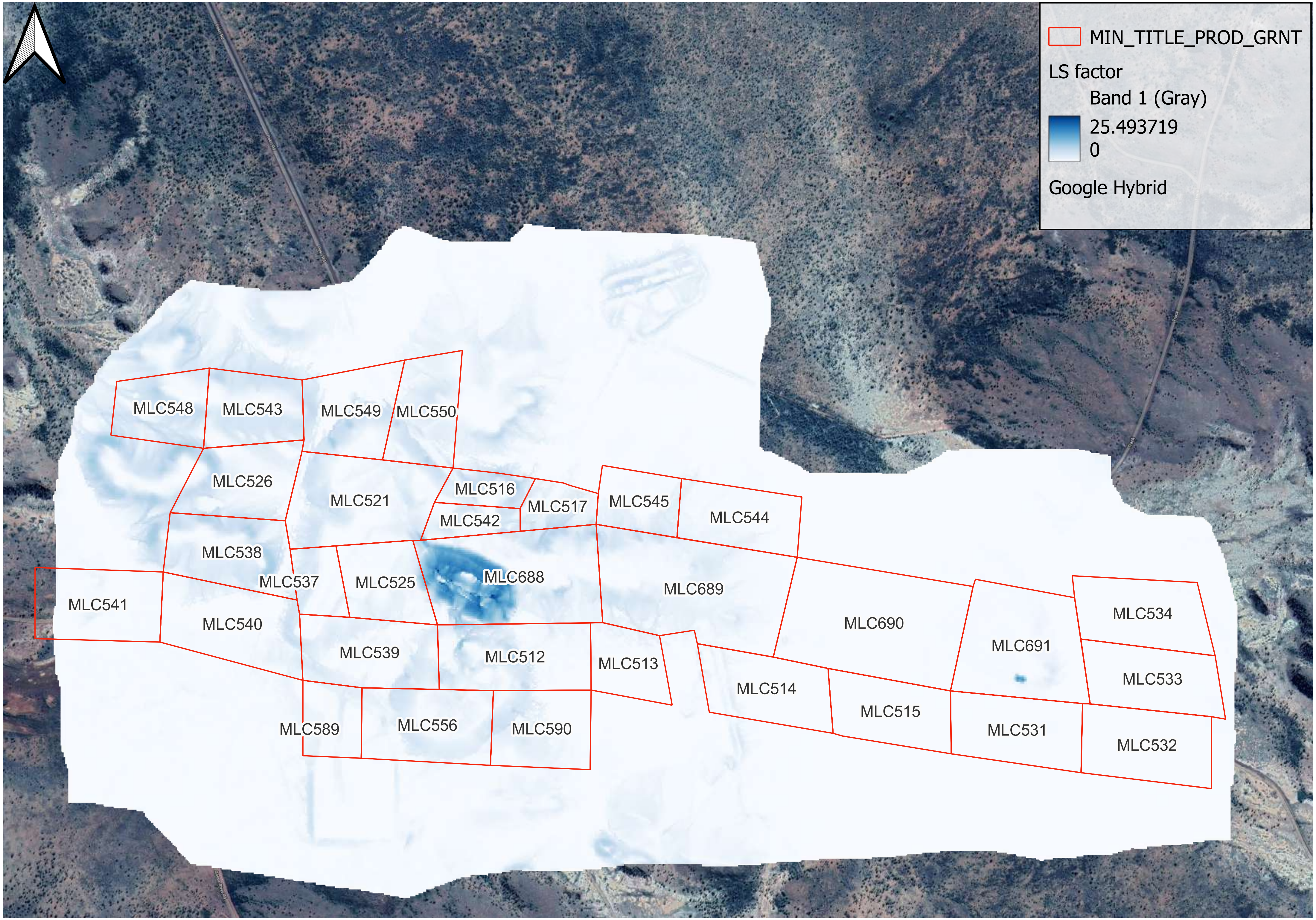
AS SHOWN	MGA94 Z 53	GDA94	A1

DWG NO: 5449-40-DWG-CI-00006
REV: A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MLC539
MLC512
MLC513
MLC514
MLC533
MLC515
MLC531
MLC532
MLC589
MLC556
MLC590

Appendix B. Site Inspection Checklist

ESC INSPECTION CHECKLIST____ ____ ____________________________ _________

INSPECTION CHECK SHEET Sheet__of__

GENERAL INFORMATIONS

Project Name: ____File No: __________________

Developer Name: ______________________ Contractor Onsite:_____________________________________

Inspection Date: ____________Time: _______Weather: ______mm of Rain Last Week:________________

Inspection Type: { } Routine Weekly { } Pre-Rain { } During Rain { } Post Rain

STAGE OF CONSTRUCTION

{ } Pre-Construction Conference: { } Clearing and Grubbing: { } Rough Grading:

{ } Finish Grading: { } Building Construction: { } Final Stabilization:

INSPECTION CHECKLIST

YES NO NA (Not Applicable)

Part 1 : Inspection on Erosion Controls Measures

{ } { } { } Is the clearing of the construction area carried out in phase?

{ } { } { } Are the areas which designated to be preserve of the existing vegetation intact is not disturbed?

{ } { } { } Are all temporary stockpiles or construction material located in approved areas and protected from erosion?

{ } { } { } Are soil stockpiles adequately stabilized with seeding and/or sediment trapping measures?

{ } { } { } Have all denuded areas requiring temporary or permanent stabilization been stabilized?
Seeded? yes/no Mulched? yes/no Gravelled yes/no

{ } { } { } Does permanent vegetation provide adequate stabilization?

{ } { } { } Are all exposed slopes protected from erosion through the implementation of acceptable soil stabilization practices?

{ } { } { } Are finished cut and fill slopes adequately stabilized?

{ } { } { } Is there any evidence of erosion of cut or fill slope?

Part 2 : Inspection on Sediment Controls Measures

{ } { } { } Have sediment-trapping facilities been constructed as a first step in stripping and grading?

{ } { } { } For perimeter sediment trapping measures are earthen structures stabilized?

{ } { } { } Are sediment basins, sediment traps, sediment fence/barriers and check dam/rock weir installed where needed as per ESC plan?

{ } { } { } Are sediment basins, sediment traps, sediment fence/barriers and check dam/rock weir properly maintained, repairs and sediment was regularly removed and clean as per ESC Plan maintenance schedule?

{ } { } { } Are sediment controls in place at site perimeter and storm drains inlets?

{ } { } { } Is the water from the construction site adequately prevented from directly entering the permanent drainage system unless it is relatively sediment free (i,e the catchment area has been permanently landscaped and/or any likely sediment has been treated)?

{ } { } { } Are the sediment controls measure onsite adequately installed and the sediment are effectively treated from the stormwater runoff from the construction site?

{ } { } { } Is there any evidence that the sediment is leaving the construction site without adequately treated?

ESC INSPECTION CHECKLIST

Part 3 : Inspection on Conveyances and Flows Controls Measures

{ } { } { } Are on-site channels. Inlet and outlet are adequately stabilized and protected?

{ } { } { } Do all operational storm drainage inlets have adequate inlet protection?

{ } { } { } Are stormwater conveyance channels adequately stabilized, protected and lined with suitable material at badly eroded stretches?

{ } { } { } Are stormwater conveyance channels, culvert, conduit, roadside ditches, toe of slopes etc, adequately stabilized and with proper inlet/outlet protection and energy dissipater?

{ } { } { } Are the outlet of sediment basins and sediment traps are adequately stabilized with proper outlet protection and energy dissipater?

{ } { } { } Are adequate check dam/rock weir or any others energy dissipater method which are used to reduce the erosive effects of flows velocity in the stormwater conveyance channels

{ } { } { } Are temporary stream crossings of non-erodible material installed where applicable?

{ } { } { } Are the stormwater conveyance channels, the riprap, check dam, rock weir, stream crossing, etc, properly maintained repairs and deposited sediment was regularly removed and clean as per ESC Plan maintenance schedule?

Part 4 : Others

{ } { } { } Are properties and waterways downstream from development adequately protected from erosion and sediment deposition due to increases in peak stormwater runoff?

{ } { } { } Are soil and mud kept off public roadways at intersections with site access roads?

{ } { } { } Are utility trenches stabilized properly?

{ } { } { } Is there any self-auditing of **ESCP** was carried out onsite (based on onsite records of inspection check sheets and inspection log book)

{ } { } { } Have all temporary control structures that are no longer needed been removed?

{ } { } { } Do any structural BMPs practices require repair or clean-out to maintain adequate function? If yes, indicate in details.

{ } { } { } Does the ESCP require revisions? If yes, explain:

Comments:

Inspected by:______________________________ Developer's Representative: ____________________

Position:__________________________________ Position:___________________________________

Signature: ______________________ Signature: ____________________

ESC INSPECTION CHECKLIST____ ____ ____ ___________________________ _________

EROSION AND SEDIMENT INSPECTION LOG

Site: ____ **Contractors on Site:** ________________________________

Heavy Equipment on Site: ____________________ **Activities on Site:**

Date: ______________________ **Weather:** ____________________ **mm of rain in the last week:** ___________

Note condition of the following measures and sediment levels where applicable

MEASURE	CONDITION/LOCATION	SEDIMENT LEVEL	ACTION REQUAIRED YES/NO	TYPE OF ACTION	ACTION COMPLETED (DATE)	INITIALS
Silt fences						
Temporary Storage Facilities						
Outlet of temporary storage facilities						
Interceptor Swales						
Steeper Slopes						
Cover of Rough Grades						
Catchbasins Filtering Controls						
Dust Control						
Mud Tracking						
Debris Control						

Other Comments (Summarize):

____

____

Inspectors Signature: ______________________________________ **Inspectors Name** ____

Appendix C. Letter of Endorsement

08 February 2023

Our ref.: EZ22220

Dr Ashish Mishra
Groundwater Manager & Principal Hydrogeologist
Tennant Consolidated Mining Group
amishra@tennantmining.com.au

Re: Erosion and Sediment Control Plan – Nobles Nob Gold Project

Dear Ashish,

I make reference to the following documents prepared by Tennant Consolidated Mining Group for the Nobles Nob Gold Project:

- *Erosion and Sediment Control Plan, Nobles Nob Gold Project* by Tennant Consolidated Mining Group Pty Ltd, ER012/Version 3.0, January 2023

This Primary ESCP provides a general overview of the erosion and sediment control measures that will be implemented to minimise impact on proposed activities to the environment.

As a Certified Professional in Erosion and Sediment Control (CPESC #11426), I certify that the plans and associated drawings and checklists in this document are fit for purpose for the approvals process.

This Primary ESCP has been developed in accordance with the following 'best practice' guidelines:

- IECA 2008, *Best Practice Erosion & Sediment Control*. International Erosion Control Association (Australasia), Picton NSW.

Progressive ESCPs for construction and operation are required to be developed by TCMG prior to the commencement of site clearing and construction works.

These documents may require multiple revisions to remain appropriate and consistent with site conditions.

Yours sincerely,

Adele Faraone
CPESC #11426

Environmental Engineer
EcOz Environmental Consultants
adele.faraone@ecoz.com.au

APPENDIX N WATER QUALITY MANAGEMENT PLAN

Water Quality Management Plan

Nobles Nob Gold Project

Tennant Consolidated Mining Group Pty Ltd

ER012/Version 0.2

JUNE 2022

Acknowledgement of Country

Tennant Mining acknowledges the Traditional Custodians of the lands on which we work and operate. We pay our respects to elders, past, present and emerging.

Disclaimer

Document Control

Version	Prepared by	Date	Approved by	Date
Draft Version 0.1	Dr Ashish Mishra	08 July 2022	Reviewed by Yemaya Smythe McGuinness	08 July 2022
Final Version 0.2	Dr Ashish Mishra	08 July 2022	Marty Costello	08 July 2022

Table of Contents

Figures

Tables

1.0 Introduction

1.1 Background

This water quality management plan (WQMP) has been developed for the Nobles Nob Gold Project (Nobles Nob), located approximately 13 kilometres (km) southeast of Tennant Creek township, in the Northern Territory. The Nobles Nob mining tenements are held by Tennant Consolidated Mining Group (TCMG), on who's behalf this document has been prepared. Gold was initially extracted at Nobles Nob from underground operations commencing in the early 1930s and then via open-cut methods from the 1960s. Open-cut mining at Nobles Nob concluded in 1985, although gold production continued until 1992.

TCMG is proposing to recommence operations at Nobles Nob. To obtain approvals, TCMG submitted a Mining Management Plan (MMP) under the Northern Territory Mining Management Act 2005. The primary purpose of the MMP is to formalise the actions to be taken and strategies to be implemented to manage potential environmental impacts, if any. This WQMP is required as part of the environmental management plan (EMP), which will be sufficient to identify and manage critical environmental risks associated with the proposed disturbance.

1.2 Plan Development

This WQMP has been prepared by a suitably qualified person, Dr Ashish Mishra. Dr Ashish Mishra is a hydrogeologist/geochemist, with expertise in management and monitoring program design, water quality assessments, and geochemical assessments. Dr Ashish has experience in conducting impact assessments, water quality assessments and trigger derivation/amendments, aquifer testing, groundwater monitoring program design, groundwater production and monitoring well program management and construction, waste rock/overburden characterisation, geochemical assessment, and acid/metalliferous drainage. Dr Ashish has also undertaken several specialised contaminant source, cause and extent identification investigations for groundwater and surface water resources, and assessment of potential environmental impacts on water resources. Dr Ashish has more than four years of experience working as a hydrogeologist and geochemist, and has a PhD in Environmental Geochemistry, Master of Science in Sustainable Resource Management and Bachelor of Technology in Biotechnology (Engineering). Dr Ashish Mishra has been engaged as an independent contractor to prepare this WQMP on behalf of TCMG.

1.3 Document Scope and Organisation

This WQMP forms part of the MMP and will sit under the site-specific EMP, and has been designed to meet required statutory and regulatory requirements by providing:

- Pre-operational and operational aims and objectives to be adopted in relation to water quality.
- Management strategies to be followed to manage and reduce impacts on water quality from proposed operations.
- A monitoring program to determine whether significant changes in water quality occur due to proposed operations.

This document has been organised as follows:

- General background (Section 1);

- Roles and Responsibilities (Section 1);
- Objectives and Targets (Section 2);
- Potential risks and impacts (Section 3);
- Review of the available water quality data (Section 4);
- Level of protection required for the site based on the National Water Quality Management Framework (ANZG, 2018) (Section 6);
- WQMP development (Section 6), including the monitoring and management plans to be implemented;
- Sampling methodology and quality assurance/quality control (QA/QC) assessment (Section 6);
- Reporting requirements of this WQMP (Section 6); and
- Review of this WQMP (Section 7).

1.4 Roles and Responsibilities

TCMG is ultimately responsible for control and management of its site facilities. TCMG's management and the Work, Health, Safety Environment (WHSE) team are ultimately responsible for the environmental performance of TCMG sites including Nobles Nob.

The WHSE team is responsible for overseeing and monitoring environmental performance including:

- overseeing all aspects of the Environmental Management System;
- providing environmental technical advice and information;
- facilitating environmental risk assessments;
- contributing to, assessing and commenting on environmental aspects of proposed developments;
- facilitating regular environmental inspections and audits; and
- maintaining the Incident Register.

TCMG management and contractors with employees are responsible for:

- providing appropriate information about the WQMP;
- providing education and training with regards to water quality management on site;
- ensuring safe work environment is developed and maintained; and
- reporting environmental incidents to the Site Manager.

The general employees of TCMG and contractors (working as employees) are responsible for:

- compliance with the health and safety instructions and policies;
- correct use of equipment;
- following procedures safely and as instructed; and
- reporting environmental incidents to the Site Manager.

All TCMG employees and contractors working at site are responsible for promptly and accurately reporting any non-compliance and environmental incidents to the Site Manager. The Site Manager will be responsible for:

- ensuring that sites are supported after any environmental incident;
- ensure all incidents are reported to authorities and investigated in accordance with legislative and regulatory requirements;

- ensure that existing procedures are reviewed to ensure they are current and relevant to the works being carried out;
- ensure that corrective actions are agreed and implemented in a timely manner post any incidents or near miss situations; and
- updating and communication of the procedures on site and any relating procedures internally with the TCMG management, TCMG WHSE team, TCMG operations, including contractors and visitors, or third-party operators.

2.0 Objectives and Targets

The overall aim of this WQMP is to ensure that water quality at the site does not deteriorate due to proposed site activities. To achieve this, objectives, targets and key performance indicators have been set. These are presented in **Table 1** below. The objectives and targets are set in accordance with the approval requirements and the environmental values (EVs) identified at Nobles Nob.

Table 1 Objectives and Targets of the WQMP

Objectives	Targets	Key Performance Indicator
1. Undertake and complete works in compliance with statutory environmental requirements.	-No breaches of license/approval conditions. -No infringements.	-Number of breaches recorded. -Number of infringements.
2. Protection and maintenance of the environmental, cultural and spiritual values of water, including ecosystems and biota. **3. Protection of groundwater and surface water users.** **4. Maintenance of suitable water supply quality for the mining operations.**	***General***: -No complaints. -No exceedances of finalised adopted guideline values/limits. ***During Construction:*** -Management strategies implemented to prevent/contain any runoff during construction. ***During Operation:*** -Water quality monitoring results comply with the finalised guideline values. -Where exceedances of guideline values occur, the changes in water quality results are within the historical ranges observed during baseline monitoring (pre-operational). -characterise the water quality of any water supplied for operations.	-Number of environmental incidents or breaches. -Number of complaints. -Number of exceedances of finalised water quality guideline values. -Number of events when exceedances are above the historical concentration range observed at that site.
5. Collect sufficient data to characterise site water quality.	-Minimum 12 months of baseline data. -Suitable coverage of seasonal variation in baseline data.	-Length and number of baseline sampling events. -Number of wet/dry seasons covered while collecting baseline data.

6. Establish clear and safe sampling methodology, in accordance with the relevant standards and guidelines.	-Monitoring carried out on a regular basis as per this WQMP -Field QA/QC practices implemented. -QA/QC assessments to validate the data collected are implemented. -No workplace incidents or injury during monitoring.	-Number of QAA/QC samples collected. -Relative Percent Difference (RPD) between field duplicate and original samples. -Number of incidents/injury during monitoring.
7. Establish clear corrective actions and trigger levels for corrective actions	-Develop triggers for corrective actions. -Establish clear corrective actions to be taken, when triggered. -Establish corrective actions in the case of an environmental incident or emergency.	-Number of times requirement for corrective actions were triggered. -Number of environmental incidents or emergency.
8. Outline reporting requirements	-Establish reporting requirements, including the frequency and timing of reports, and the data and analysis that will be included in reports.	-Number and regular timing of reports produced.

3.0 Potential Risks and Impacts

Information about the existing site conditions and potential risks are provided in the technical reports (e.g., Umwelt, 2021a; Umwelt, 2021b; ATCW, 2022) and in the MMP. Based on the information provided, the key potential water quality related risks that will be managed through this WQMP are summarised below.

3.1 During Construction

During construction on site, the potential impacts to water quality will be related to sediment loss from the site, which might lead to an increased amount of nutrients in surface water and groundwater, thereby impacting the aquatic ecosystem. In addition to that, construction earthworks have the potential to increase the risk of erosion due to clearing activities and exposure of ground surfaces. Another potential risk to water quality is from spills or leaks of fuel from vehicles and from chemicals stored on site. All these risks are characterised as moderate in the initial risk assessment (See Appendix H – Risk Assessment of the MMP). With mitigation measures such as the development and implementation of an erosion and sediment control plan (ESCP), fuel storage and handling in designated areas and in accordance with standards and guidelines, and fit-for-purpose spill management kits, these risks were characterised to be low-risk (see Appendix H – Risk Assessment of the MMP).

3.2 During Operation

During the operational phase, the potential impact to water quality is runoff from the waste rock dump and the run-of-mine (ROM) or ore stockpiles, which could introduce water with elevated concentrations of metals. Additional potential impacts identified include failure of the tailings storage facility (TSF); and overflow of contaminated process water during high rainfall events. These were characterised high risk in the initial risk assessment (See Appendix H – Risk Assessment of the MMP). Studies have been undertaken to characterise the waste rock dump, and the ROM pad, which suggested that the samples are non-acid forming and release of drainage enriched with metals is less likely. Studies have also been undertaken to determine the most appropriate location and structural layout for the TSF. This WQMP will be implemented to monitor water quality to capture any early signs of impacts and outline the appropriate corrective actions that will be taken if any contamination concerns are identified.

4.0 Baseline Water Quality Review

4.1 Overview

The information on water quality at Nobles Nob is limited, and hence new groundwater bores were installed in May/June 2021. After installation of the groundwater bores at Nobles Nob, sampling has been undertaken monthly since October 2021 (and quarterly for the upgradient sites since January 2022). Water quality samples have been collected monthly from Lake Alice (SWLA). One round of water quality samples from Nobles Nob pit was collected in 2018, and the results are discussed in the sections below. Nobles Nob pit has not been sampled since, due to issues with safe access. As part of this WQMP, more baseline samples will be collected from the Nobles Nob pit in a safe manner to capture any changes in pit water quality due to seasonal variations.

The baseline sampling effort has covered one wet season (between November 2021 to March 2022) and is currently collecting data from the dry season (March 2022 to November 2022). Compared to the longer-term climatic averages, the Tennant Creek region has experienced below-average rainfall since 2016 (Umwelt, 2021b). However, the rainfall data from Tennant Creek Airport, located approximately 14 km from Nobles Nob, suggests that the area received above-average rainfall in October and November 2021, and in January 2022 (**Figure 1**). The same data also indicates that the monthly rainfall was below-average in December 2021, and February and March 2022 (**Figure 1**).

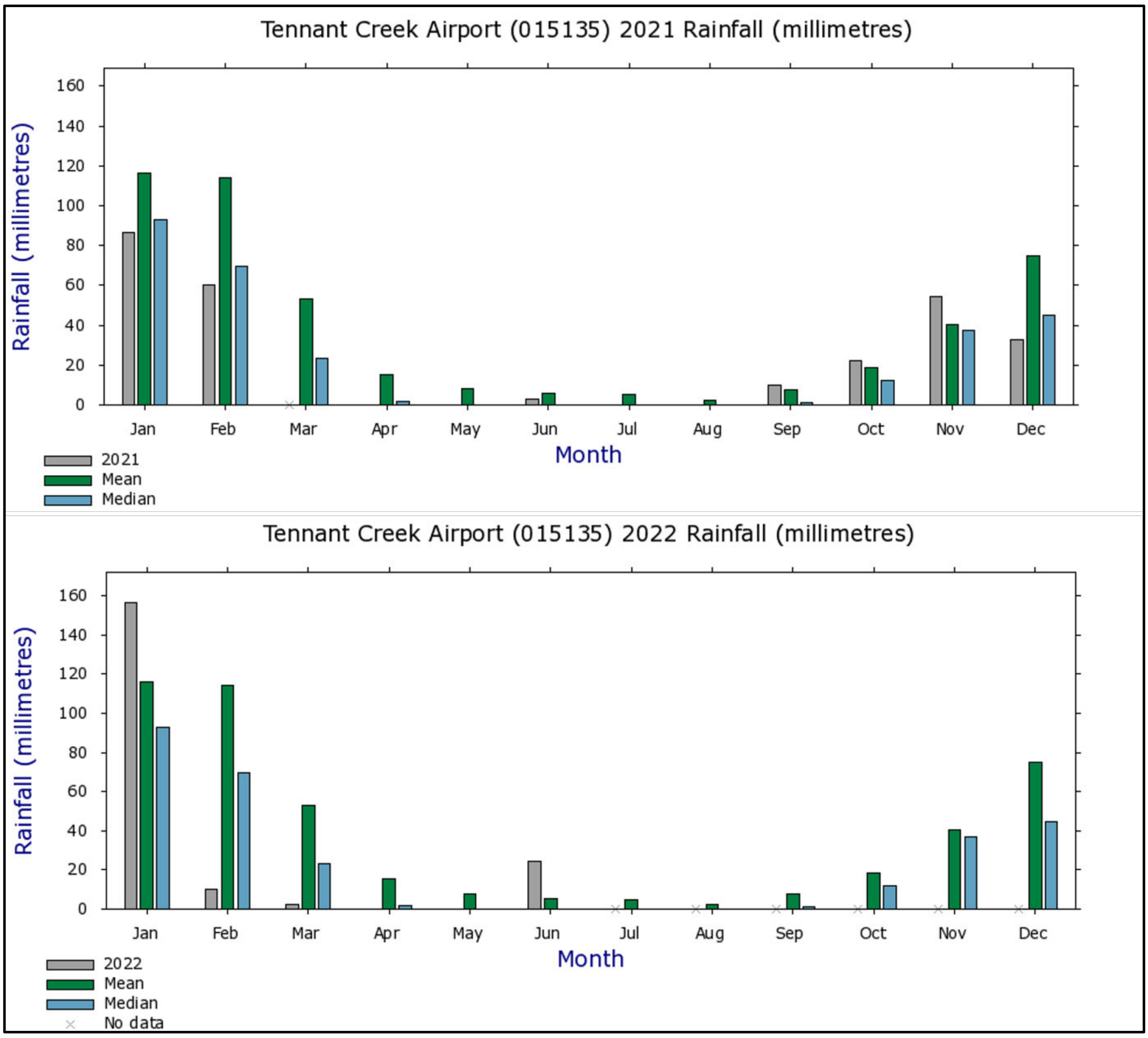

Figure 1 Monthly Rainfall at Tennant Creek Airport (Source: BoM)

The available water quality data for Nobles Nob is summarised in the sections below. The statistical summary for all parameters and all monitoring locations at Nobles Nob are presented in **Appendix A**. It summarises available water quality data using the following statistics:

- number of observations
- percentage of non-detect (i.e., below LOR)
- minimum, median, and maximum values
- percentile values (5th, 20th, 80th and 95th).

The time-series plots of the available water quality data were plotted, and the non-parametric Mann-Kendall statistical trend test was performed. These are presented in **Appendix B**. A significance level of 5% was used to determine statistically significant trends. Temporal trends were identified using Mann-Kendall statistics (tau and p-value), and the trend was considered statistically significant if the p-value was <0.05. Some locations exhibited positive or negative temporal trends in assessing available water quality data. However, these trends could be attributed to seasonality, and is difficult to evaluate unless at least 12 months of baseline data is available. These trends will be assessed, once sufficient baseline data is available (i.e., at least 12 months).

4.2 Physicochemical and Major Ions

The pH values observed at site ranged from 5.64 to 7.7, whereas the electrical conductivity (EC) values ranged from 4,500 µS/cm to 15,000 µS/cm in the groundwater bores (**Table 2**). The total dissolved solids (TDS) concentrations were also high in the groundwater bores, ranging from 3,100 mg/L to 11,000 mg/L. The median EC and TDS were recorded slightly higher in the upgradient reference bores, compared to the other groundwater bores. The median EC and TDS at upgradient bores (i.e., NNMW011, NNMW012, NNMW013, and NNMW18) were 10,000 µS/cm and 6,700 mg/L, whereas the median value of EC and TDS recorded at other groundwaters bores were 9,800 µS/cm and 6,650 mg/L. This EC and TDS recorded in the groundwater bores reflects similar results recorded in previous studies that also found that water quality in the area is highly saline and unsuitable for consumption (Umwelt, 2021b). Compared to the groundwater bores, the water in the Nobles Nob pit collected in 2018 and the water from Lake Alice recorded very low EC (maximum of 99 µS/cm at Lake Alice and 140 µS/cm at Nobles Nob pit) and TDS (120 mg/L at Lake Alice and 84 mg/L at Nobles Nob pit) (**Figure 2** and **Figure 3**). The lower EC/TDS values in the pit and Lake Alice could represent rainfall recharge.

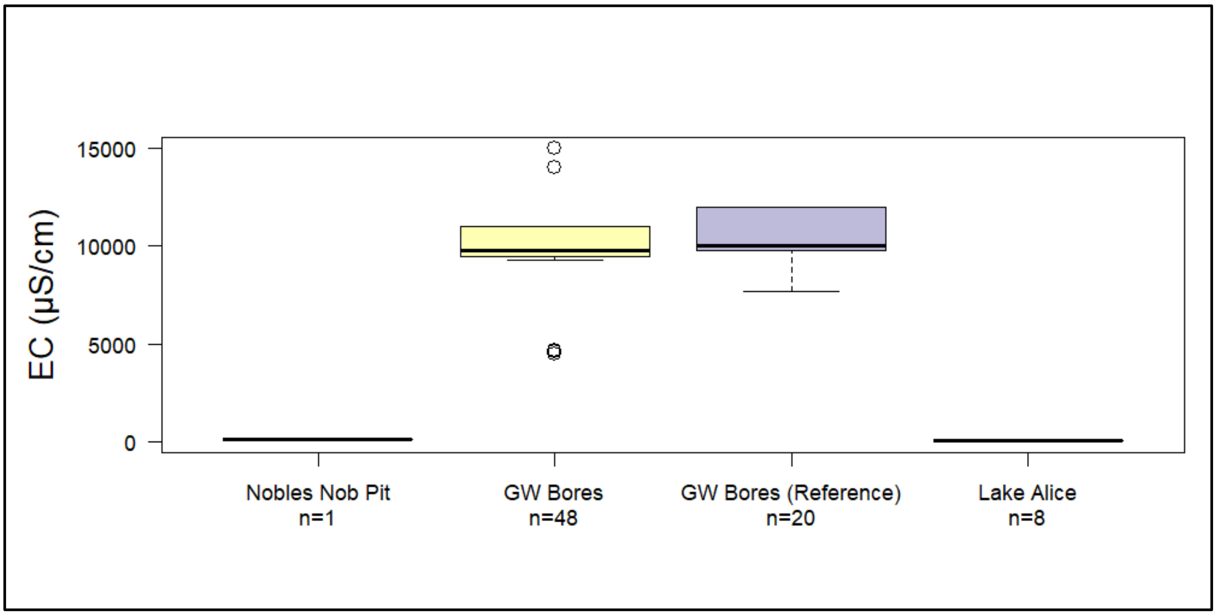

Figure 2 Boxplot Showing Electrical Conductivity at Nobles Nob

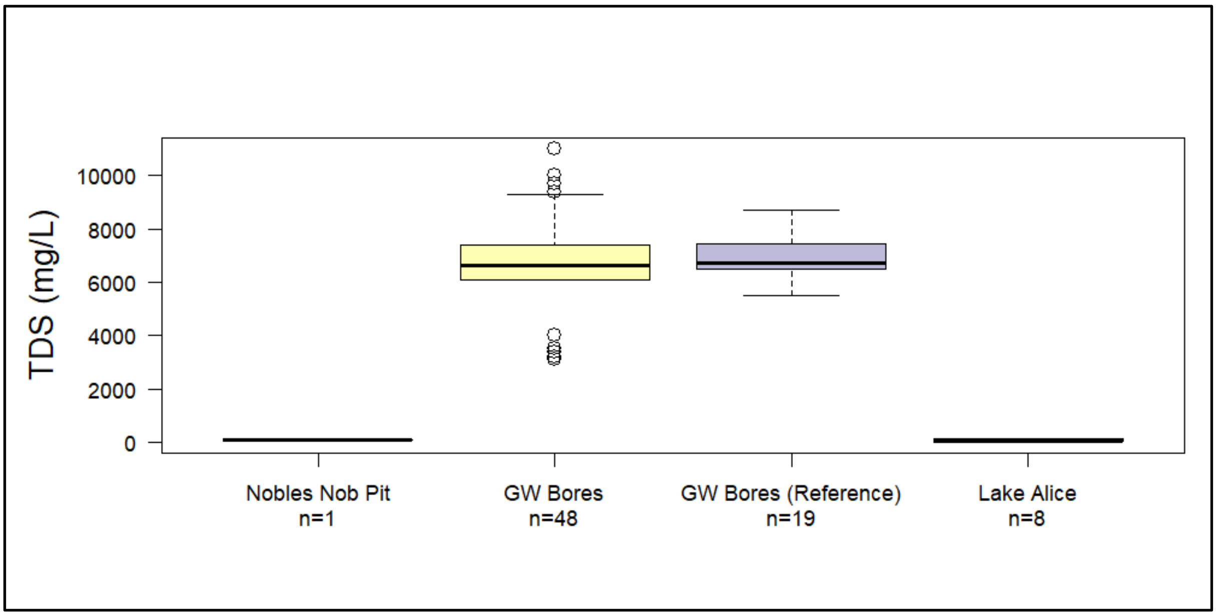

Figure 3 Boxplot Showing Total Dissolved Solids at Nobles Nob

Major ion concentrations from the water quality data suggest that the groundwater at Nobles Nob is dominated by sodium for cations (median 1,600 mg/L), and chloride for anions (median 2,800 mg/L). The major ion data suggests that the water type of all groundwater bores is sodium chloride type (**Figure 4**), further implying low recharge and influence of evaporative processes. The dominant cation in Nobles Nob pit is potassium (13 mg/L), and in Lake Alice is calcium (median 4.75 mg/L), whereas the dominant anion in Nobles Nob pit water and Lake Alice water is bicarbonate (52 mg/L at Nobles Nob pit, and median of 36.5 mg/L at Lake Alice). The Ca-HCO3+CO3 water type at Lake Alice and Nobles Nob pit indicates the influence of rainfall recharge on the open pit and Lake Alice water (**Figure 4**).

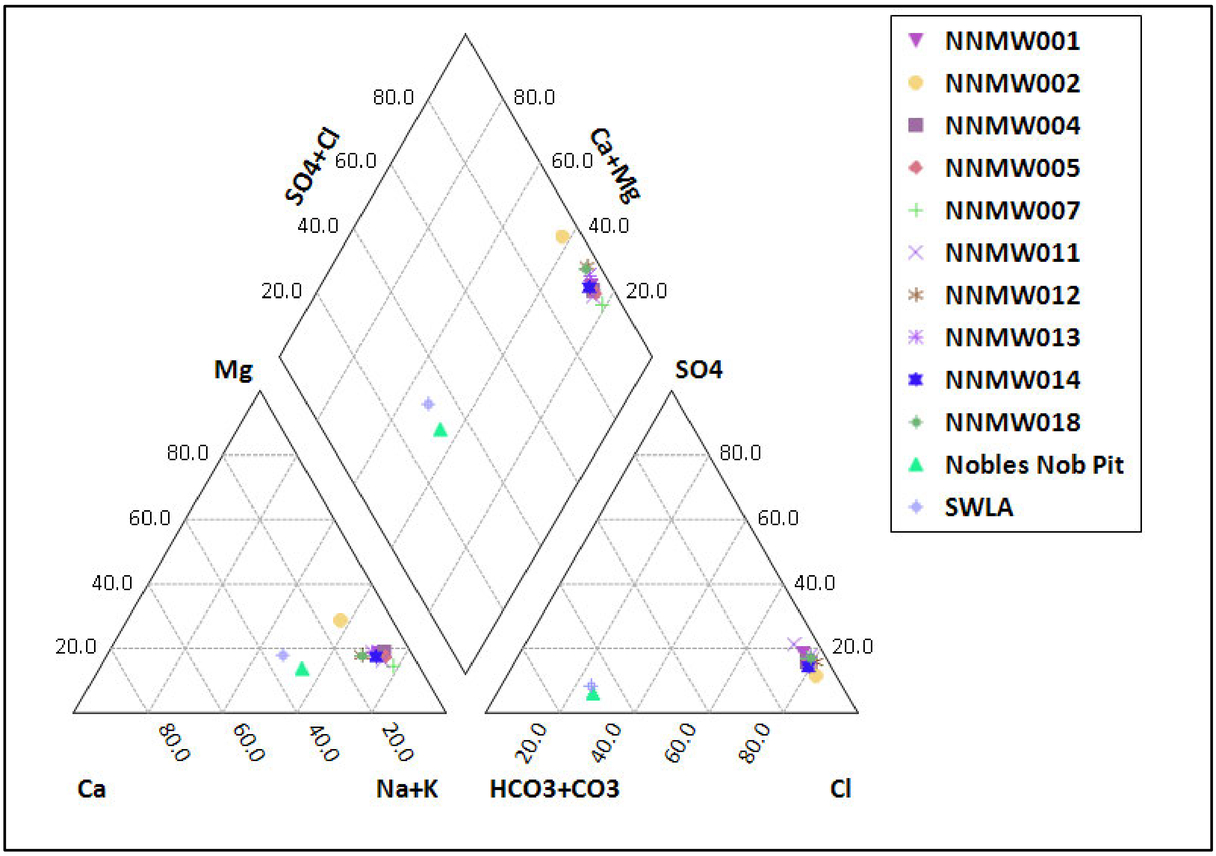

Figure 4 Piper Diagram of Water Quality at Nobles Nob (Source: Umwelt, 2021b)

4.4 Metals and Metalloids

Results for dissolved and total metals from water quality samples are presented in **Table 2** below. The concentration of many metals was recorded below the limit of reporting (LOR) at most locations. The median concentrations of most metals in groundwater bores were recorded higher than the Lake Alice samples, and Nobles Nob pit (sampled in 2018) (**Figure 5**). This reflects the influence of rainfall on the pit water is higher than on the groundwater.

To understand impacts of historical mining on water quality, cyanide concentrations were assessed. All upgradient bores (NNMW011, NNMW012, NNMW013, and NNMW018) recorded free cyanide concentrations below the LOR, whereas 90 per cent of the samples collected at upgradient bores recorded the total cyanide concentration below LOR. Free and total cyanide were recorded above LOR at bores NNMW001, NNMW004, and NNMW005 (**Figure 6**). Highest concentration of free cyanide and total cyanide was recorded at NNMW005 (0.024 mg/L free cyanide, and 0.15mg/L total cyanide). The presence of cyanide at these bores might be attributed to the fact that these bores are located very close to the historical tailings deposits, and are impacted by historical mining activities. Cyanide concentrations were not available for the Nobles Nob pit.

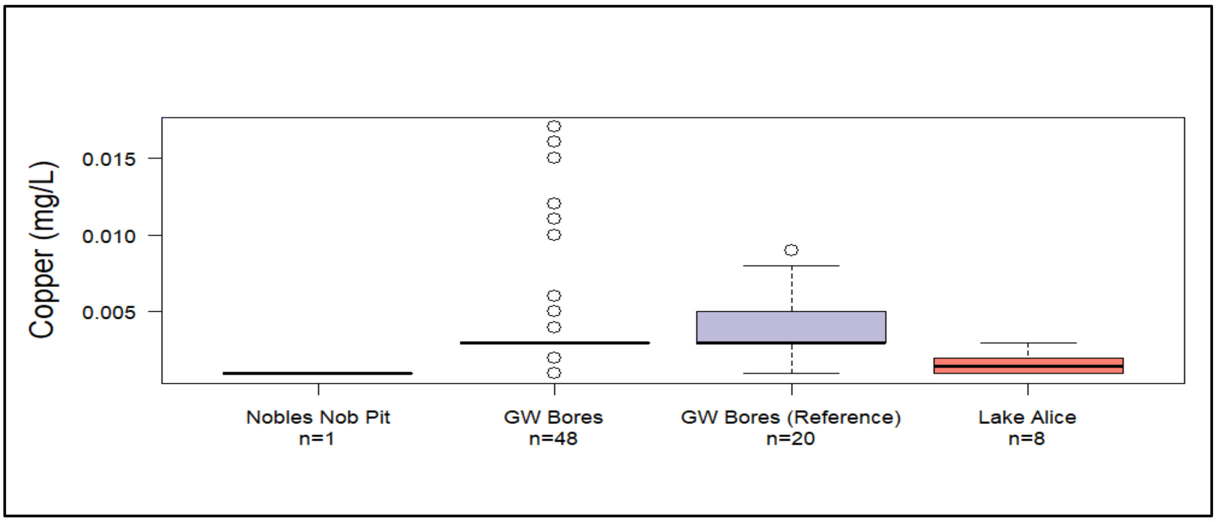

Figure 5 Boxplot Showing Dissolved Copper Concentration at Nobles Nob

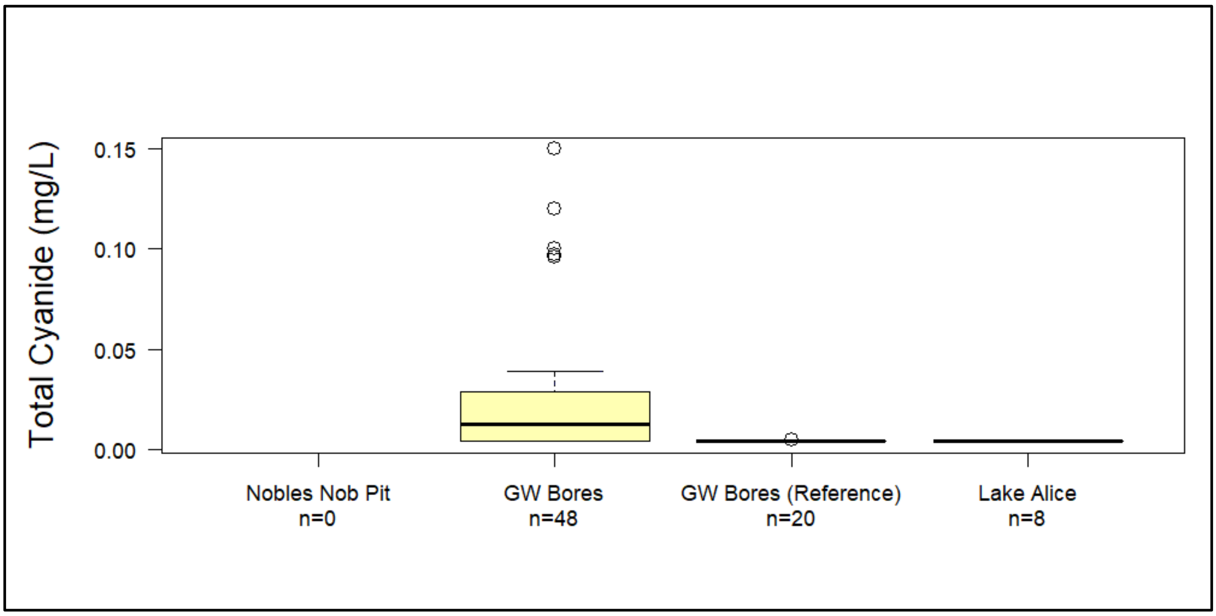

Figure 6 Boxplot Showing Total Cyanide Concentrations at Nobles Nob

Table 2 Summary of Existing Water Quality Data

Analytes	Groundwater									Lake Alice									Nobles Nob Pit	
	Number	Non-detect (%)	Min	5th %ile	20th %ile	Median	80th %ile	95th %ile	Max	**Number**	Non-detect (%)	Min	5th %ile	20th %ile	Median	80th %ile	95th %ile	Max	Number	Value
Field pH	**58**	0	5.64	5.897	6.19	6.35	6.788	7.0165	7.7	**7**	0	6.49	6.646	7.024	7.1	7.738	8.542	8.83	0	-
pH	**68**	0	6.6	6.935	7.2	7.4	7.7	7.9	8	**8**	0	6.8	6.8	6.8	6.95	7.06	7.1	7.1	1	6.9
EC	**68**	0	4500	4600	9440	9950	11600	14000	15000	**8**	0	42	43.4	51.2	67.5	83.4	94.1	99	1	140
Sulfate	**68**	0	220	240	690	845	1000	1500	1600	**8**	0	1.1	1.1	1.18	1.85	2.94	3.815	4.2	1	4
Total Dissolved Solids	**67**	0	3100	3400	6120	6700	8000	9610	11000	**8**	0	30	35.25	47	55.5	112	120	120	1	84
Calcium	**68**	0	100	120	150	210	246	339.5	360	**8**	0	3.4	3.47	3.96	4.75	5.32	5.73	5.8	1	7.3
Sodium	**68**	0	450	523.5	1400	1600	2000	2430	3100	**8**	0	2.2	2.2	2.32	3.55	5.42	6.025	6.2	1	6.8
Potassium	**68**	0	19	19.35	68	77	82	93.3	98	**8**	0	2.9	3.04	3.54	4.4	5.82	5.965	6	1	13
Magnesium	**68**	0	140	150	180	230	270	356.5	390	**8**	0	1.1	1.135	1.28	1.45	1.72	1.8	1.8	1	1.9
Bicarbonate Alkalinity as HCO3	**68**	0	120	133.5	300	355	436	470	520	**8**	0	22	24.8	30.8	36.5	40	41.3	42	1	52.46
Carbonate Alkalinity as CO3	**68**	100	5	5	5	5	5	5	5	**8**	100	5	5	5	5	5	5	5	1	3
Chloride	**68**	0	1200	1300	2540	2800	3360	4065	4600	**8**	0	4	4	4	7	9	9.65	10	1	13
Aluminium	**68**	0	0.012	0.01535	0.019	0.0245	0.0296	0.04265	0.049	**8**	0	0.12	0.148	0.208	0.42	1.88	2.52	2.8	1	<0.01
Arsenic	**68**	97.06	0.001	0.001	0.001	0.009	0.009	0.009	0.009	**8**	100	0.001	0.0017	0.003	0.003	0.003	0.003	0.003	1	<0.001
Barium	**48**	0	0.024	0.03165	0.061	0.071	0.0886	0.09465	0.11	**6**	0	0.051	0.05275	0.058	0.105	0.13	0.2275	0.26	0	-
Beryllium	**48**	89.58	2.00E-04	2.00E-04	3.00E-04	3.00E-04	0.001	0.001	0.001	**6**	66.67	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	0.000775	0.001	0	-
Boron	**48**	0	0.2	0.22	0.64	0.8	1.1	1.2	1.3	**6**	100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0	-
Cadmium	**68**	57.35	1.00E-04	1.00E-04	2.00E-04	3.00E-04	6.00E-04	0.001	0.001	**8**	87.5	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1	<0.0001
Chromium	**68**	83.82	0.001	0.001	0.002	0.003	0.003	0.003	0.007	**8**	62.5	0.001	0.001	0.001	0.001	0.00106	0.001165	0.0012	1	<0.001
Cobalt	**68**	4.41	0.001	0.003	0.006	0.0145	0.0408	0.2465	0.29	**8**	75	0.001	0.001	0.001	0.001	0.001	0.001	0.001	1	<0.001
Copper	**68**	57.35	0.001	0.001	0.003	0.003	0.005	0.01165	0.017	**8**	12.5	0.001	0.001	0.001	0.0015	0.002	0.00265	0.003	1	0.001
Iron	**20**	80	0.02	0.02	0.02	0.02	0.02	0.353	0.79	**2**	0	0.47	0.495	0.57	0.72	0.87	0.945	0.97	1	0.003
Lead	**68**	73.53	0.001	0.001	0.001	0.003	0.003	0.005	0.006	**8**	75	0.001	0.001	0.001	0.001	0.001	0.00165	0.002	1	<0.001
Manganese	**68**	1.47	0.005	0.0108	0.13	0.43	1.9	5.63	6.5	**8**	62.5	0.005	0.005	0.005	0.005	0.0224	0.0359	0.038	1	<0.005
Mercury	**68**	95.59	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	0.00014	**8**	100	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	0	-
Molybdenum	**48**	75	0.001	0.001	0.001	0.003	0.003	0.003	0.004	**6**	100	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	-
Nickel	**68**	35.29	0.001	0.00135	0.003	0.003	0.0056	0.01	0.013	**8**	62.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	1	<0.001
Selenium	**20**	0	0.002	0.0096	0.0126	0.0195	0.0234	0.03605	0.037	**2**	100	0.002	0.002	0.002	0.002	0.002	0.002	0.002	1	<0.001

Silver	**67**	89.55	5.00E-05	5.00E-05	0.00015	0.00025	0.003	0.0037	0.005	**8**	100	5.00E-05	6.75E-05	1.00E-04	0.00055	0.001	0.001	0.001	0	-
Vanadium	**20**	90	0.001	0.001	0.002	0.003	0.003	0.0031	0.005	**2**	0	0.001	0.0011	0.0014	0.002	0.0026	0.0029	0.003	1	0
Zinc	**69**	10.14	0.005	0.005	0.006	0.01	0.0204	0.0338	0.063	**8**	100	0.005	0.005	0.005	0.005	0.005	0.005	0.005	1	<0.01
Total Aluminium	**68**	0	0.03	0.0592	0.094	0.16	0.532	1.76	3.3	**8**	0	0.13	0.158	0.21	1.055	3.14	4.355	4.6	1	4.6
Total Arsenic	**68**	94.12	0.001	0.001	0.001	0.009	0.009	0.009	0.009	**8**	100	0.001	0.0017	0.003	0.003	0.003	0.003	0.003	1	0.002
Total Barium	**48**	0	0.025	0.0336	0.0646	0.0795	0.11	0.143	0.22	**6**	0	0.056	0.05625	0.057	0.115	0.18	0.27	0.3	0	-
Total Beryllium	**48**	85.42	2.00E-04	2.00E-04	3.00E-04	3.00E-04	0.001	0.001	0.002	**6**	83.33	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	0.000775	0.001	0	-
Total Boron	**48**	0	0.22	0.2235	0.654	0.805	1.06	1.2	1.3	**6**	100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0	-
Total Cadmium	**68**	51.47	1.00E-04	1.00E-04	3.00E-04	4.00E-04	8.00E-04	0.001	0.0017	**8**	100	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1	<0.0001
Total Chromium	**68**	75	0.001	0.001	0.002	0.003	0.003	0.004	0.008	**8**	62.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	1	0.009
Total Cobalt	**68**	2.94	0.001	0.00335	0.008	0.016	0.0454	0.2695	0.32	**8**	50	0.001	0.001	0.001	0.001	0.001	0.0023	0.003	1	0.004
Total Copper	**68**	27.94	0.001	0.001	0.003	0.004	0.0066	0.01665	0.025	**8**	12.5	0.001	0.001	0.001	0.0015	0.003	0.003	0.003	1	0.011
Total Lead	**68**	38.24	0.001	0.001	0.001	0.003	0.0046	0.00665	0.008	**8**	37.5	0.001	0.001	0.001	0.001	0.002	0.002	0.002	1	0.011
Total Manganese	**68**	0	0.006	0.0162	0.164	0.48	2.02	6.095	6.6	**8**	0	0.018	0.01905	0.0226	0.0325	0.0578	0.14115	0.18	1	0.23
Total Mercury	**68**	92.65	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	8.25E-05	0.00016	**8**	100	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	5.00E-05	0	-
Total Molybdenum	**48**	64.58	0.001	0.001	0.002	0.003	0.003	0.007	0.012	**6**	100	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0	-
Total Nickel	**68**	25	0.001	0.00135	0.003	0.004	0.006	0.012	0.014	**8**	62.5	0.001	0.001	0.001	0.001	0.001	0.001	0.001	1	0.003
Total Selenium	**20**	0	0.008	0.01085	0.014	0.021	0.0274	0.03855	0.049	**2**	100	0.002	0.002	0.002	0.002	0.002	0.002	0.002	1	<0.001
Total Silver	**67**	85.07	5.00E-05	6.00E-05	0.00015	0.00025	0.003	0.003	0.005	**8**	100	5.00E-05	6.75E-05	1.00E-04	0.00055	0.001	0.001	0.001	0	-
Total Vanadium	**20**	45	0.001	0.0029	0.003	0.003	0.005	0.00705	0.008	**2**	0	0.001	0.0011	0.0014	0.002	0.0026	0.0029	0.003	0	-
Total Zinc	**69**	1.45	0.005	0.006	0.008	0.013	0.025	0.042	0.07	**8**	87.5	0.005	0.005	0.005	0.005	0.005	0.00695	0.008	1	0.017
Free Cyanide pH 6	**68**	85.29	0.004	0.004	0.004	0.004	0.004	0.0083	0.024	**8**	100	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0	-
Total Cyanide	**68**	61.76	0.004	0.004	0.004	0.004	0.0266	0.1	0.15	**8**	100	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0	-

5.0 Level of Protection

In order to define management goals and water quality guideline values, the level of protection needs to be determined. As per the water quality guideline (ANZG, 2018), a corresponding level of protection can be specified by using the site-specific ecosystem conditions. These can be:

- high conservation or ecological value systems
- slightly to moderately disturbed systems
- highly disturbed systems.

Due to the area's history of mining and grazing, the majority of the area around the Nobles Nob open-cut mine is moderately to highly disturbed and significantly impacted by previous mining activities. All the registered bores within 2.5 km of Nobles Nob pit are mine-related bores, and there are no declared water users in the area. Assessment of groundwater-dependent ecosystems (GDEs) around Nobles Nob suggests that there are no GDEs within a 10 km radius of the Nobles Nob Pit. As such, the area around Nobles Nob can be characterised as a highly disturbed system. The suitable guideline values for assessing water quality have been discussed in **Section 6.7**.

6.0 Water Quality Monitoring and Management

This WQMP has been prepared to provide an early warning of emerging potential impacts on the water quality due to operations at site. This program also outlines triggers to initiate corrective site actions to mitigate water quality impacts on receiving waters, if needed. This WQMP has been designed in line with the National Water Quality Management Strategy (NWQMS) (ANZG, 2018). This WQMP also outlines the monitoring sites that are to be sampled, frequency, and parameters to be tested, sampling methodology, and assessment criteria and interim guideline values. This WQMP incorporates the recommendations made in the Groundwater Assessment Report (Umwelt, 2021b) and the Water Management Plan (ATCW, 2022).

6.1 Water Quality Monitoring Locations

The existing water quality monitoring network at Nobles Nob comprises ten monitoring bores installed in May/June 2021, and one surface water site (Lake Alice). Amongst the 10 existing groundwater bore network, two monitoring bores, NNMW001 and NNMW002, are located around the proposed processing plant and tailings storage area. These monitoring bores are designed to monitor groundwater at a depth of 90-102 metres (NNMW001) and 65.9-77.9 metres (NNMW002) below ground level to monitor for any potential seepage into the groundwater table. Bores NNMW004 and NNMW005 are located towards the west and down-gradient of the proposed processing area and tailings storage area. These bores will be monitored to verify hydraulic connectivity to the weathered horizon and early detection of potential changes in water quality due to site activities. On the other hand, bores NNMW011, NNMW012, NNMW013, and NNMW018 are background reference bores, located upstream from the proposed activities at Nobles Nob and will monitor the groundwater quality up-gradient of the site.

[redacted] water quality samples will continue to be collected from Lake Alice. Water quality samples will also be collected from the Nobles Nob pit to characterise the water quality in the pit and detect any changes in the water quality of the pit. A method for safe access to the pit for sampling will be established. Stability of a pit track is being assessed; and if deemed unsafe, a method for drone sampling will be established and implemented. Details of the existing monitoring locations and their intended purpose are included in **Table 3** below. **Table 3** also presents the proposed water quality monitoring frequency.

6.1.1 Additional Monitoring Locations

The existing groundwater bores target the regional groundwater tables, and the depth of these bores ranges from 66 m to 102 mbgl. There is potential for water to be present in the shallow weathered horizon in localised areas (Umwelt, 2021b). Therefore, in accordance with the recommendations made in the groundwater assessment for Nobles Nob (Umwelt, 2021b), an additional four shallow bores will be installed for early detection of potential seepage relevant to site activities in the proposed processing plant and tailings storage area. The proposed depth and screen intervals of these shallow bores are presented in **Table 3**. These details will be finalised once the design and construction of the processing plant, process water pond, and tailings storage are completed. In addition to these four groundwater bores, the process water pond will also be included in the monitoring network and will be monitored regularly.

Table 3 Water Quality Monitoring Locations

Bore ID	Easting*	Northing*	Depth (m)	Screen Interval	Purpose	WQ	SWL
NNMW001	425505	7819803	102	90 - 102	Located south of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Monthly	Daily (logger) and Monthly (manual)
NNMW002	425488	7819596	77.9	65.9 - 77.9			
NNMW004	425374.9	7820346	75	63 - 75	Located north-west and down-gradient of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Monthly	Daily (logger) and Monthly (manual)
NNMW005	425228.6	7820086	70	58 - 70	Located west and down-gradient of the Proposed Processing Area. Monitoring groundwater levels and quality, to verify hydraulic connectivity to shallow weathered horizon and early detection of potential connectivity or changes with site activities	Monthly	Monthly (manual)
NNMW007	424730.8	7819950	95.8	83.8 - 95.8	Located west of the Proposed Processing Area. Monitoring groundwater levels and quality, for detection of potential changes in water quality due to site activities	Monthly	Monthly (manual)
NNMW014	426075.9	7820387	69.6	57.6 - 69.6	Located north of the existing open-cut. To monitor groundwater levels and quality trends in response to existing mine features and verify regional flow directions and influence from historical mining.	Monthly	Monthly (manual)
NNMW011	426621.8	7819922	66	54 - 66	Background reference bore. To monitor groundwater level and quality trends up-gradient of site.	Quarterly	Quarterly (manual)
NNMW012	427616.9	7819830	76.6	64.4 - 76.4			
NNMW013	426527.3	7820174	78	66 - 78			
NNMW018	427151.5	7819926	78	66 - 78			
Proposed 1	TBC	TBC	~ 10	~ 4 - 10	Shallow bores for early detection of potential seepage from proposed processing area. Locations to be determined based on final plan designs.	Monthly	Daily (logger) and Monthly (manual)
Proposed 2	TBC	TBC	~ 10	~ 4 - 10			
Proposed 3	TBC	TBC	~ 20	~ 11 - 20			

Proposed 4	TBC	TBC	~ 20	~ 11 - 20			
Nobles Nob Pit	425938	7820052	-	-	To characterise the water quality at Pit, and early detection of potential changes in water quality due to site activities	Monthly	-
Lake Alice (SWLA)	426633	7819751	-	-	To characterise surface water quality on site, and early detection of any changes due to runoff from the waste rock dump.	Monthly	-
Process Water Storage Pond	TBC	TBC	-	-	To characterise the water stored on site, and to enable comparison with water quality on site	Monthly	-

*Coordinates in GDA2020 MGA Zone 53.

TBC – To be confirmed.

WQ – Water quality monitoring.

SWL – Standing Water Level (for groundwater sites only).

6.2 Water Quality Monitoring Frequency and Parameters

The frequency of monitoring for the proposed locations is shown in **Table 3** above. Based on the assessment of the available information, baseline monitoring data is to be collected from some of the sites for the initial 12 months, to collect sufficient baseline data. Following the 12 months of data collection, the monitoring frequency will be reviewed and refined.

The water quality parameters suite for this WQMP has been designed based on the key potential water quality related risks and relevant site activities. These parameters have been included in **Table 4** below, along with other metals to characterise the baseline water quality. The parameter suite will be reviewed after the initial 12 months of data collection.

6.2.1 Field Parameters

Based on the required analytes and holding times, some analytes will be recorded in the field for higher accuracy. They are as follows:

- Water temperature (in degrees Celsius)
- pH (in pH units)
- Electrical Conductivity (EC) (in µS/cm).

In addition to the above, the following parameters will also be noted in the field for interpretation only:

- Dissolved oxygen (DO) - a measure of the quantity of oxygen present in water. Water samples will indicate a lower DO value, signifying a lack of direct contact with air or that the existing oxygen is utilised in chemical and microbiological processes. Depletion of DO can encourage microbial reduction of nitrate to nitrite, sulfate to sulfide, and can increase the amount of ferrous iron in the solution. DO is usually measured in % as well as mg/L.
- Oxidation redox potential (ORP) - a measure of the oxidising/reducing conditions of the system, and a measure of a substance's ability to either oxidise or reduce another substance. This information can be useful in interpreting metal species in solutions and the possible corrosive effects of water. Characteristically, the fresh recharge waters will exhibit high and positive redox potentials, further implying oxidising conditions. ORP is usually measured in mV.

6.2.2 Laboratory Parameters

The samples for laboratory analysis will be submitted to a National Association of Testing Authorities (NATA) accredited laboratory. Laboratory analysis of the water samples will be undertaken as per the NATA accredited methods. The required laboratory parameters are outlined in **Table 4** below.

Table 4 Water Quality Monitoring Parameters

Field Parameters	Laboratory Parameters
pH	pH
Electrical Conductivity	Electrical Conductivity
Temperature	Major Anions - Na, K, Ca, Mg, hardness
Total Dissolved Solids	Major Cations - Cl, SO4, Alkalinity (CO3-, HCO3-, total alkalinity)
Dissolved Oxygen	Total Dissolved Solids
Oxidation redox potential (ORP)	Total and Dissolved Metals:

Standing Water level (SWL)*	*Aluminium* *Arsenic* *Boron* *Cadmium* *Chromium* *Cobalt* *Copper* *Iron* *Lead* *Manganese* *Molybdenum* *Mercury* *Nickel* *Selenium* *Vanadium* *Zinc*
	Free and Total Cyanide

*SWL will be measured only for groundwater monitoring locations.

The chemical processing reagents that will be used during processing activities are listed below. The water quality monitoring parameters above will capture any potential contamination from each of these:

- Quicklime in bulk dry powder form;
- Sodium Cyanide in solid form;
- Sodium Cyanide in solution;
- Sodium Hydroxide; and
- Hydrochloric acid.

6.3 Water Quality Monitoring Methodology

6.3.1 Groundwater Quality Monitoring Procedure

Groundwater quality monitoring at the monitoring locations will be conducted by a suitably qualified and experienced professional, in accordance with the *Methodology for the Sampling of Groundwater* (DPIR, 2016), the Geoscience Australia *Groundwater Sampling and Analysis – A Field Guide* (Sundaram et al., 2009), and the *Australian/New Zealand Standard (AS/NZS) 5667.11:1998 for water quality – sampling Part 11 guidance on sampling groundwater*.

6.3.1.1 Water Level Measurement

The water level in the groundwater bore is also called depth to groundwater or the standing water level (SWL). Depth to water will be measured with a water level meter and recorded before every sampling event.

The procedure to measure the depth to water level is:

- Switch on the water level meter. Check the sound button to check the light, and the sound device is working correctly.
- Lower the probe end of the water level meter slowly.
- When the sound device is activated (beep sound) and the light is lit, note the reading on the tape from top of the casing of the bore.
- Record the reading from the tape on the field sheet.

A mark will be made on the top of bore casing, so that the same point of reference for the water level reading is the same every time. The water level meter will be decontaminated before and after use at each bore. The water level meter will be maintained as per manufacturer recommendations to ensure accurate water level readings. This includes checking the tape for any stretching or tears.

Over time, the base of the monitoring bores can have sediment or silt build-up. Hence, comparing the measured total depth reading with the depth documented at the time of construction is useful to determine the status of the bore. This will be done at every sampling event.

The total depth of the bore can be measured using a weight attached to a tape measure. Use a tape measure that is at least as long as the deepest bore to be measured. The procedure is as follows:

- Lower the weight and the tape into the casing until it reaches the bottom of the bore, as this happens, the tape will become slack.
- Lift and drop the tape several times to 'feel' the bottom of the bore.
- Record the result as total depth in metres from the top of casing of the bore on the field sheets.
- Clean the tape before using it again.

6.3.1.2 Water Quality Measurement

The main methods recommended in the monitoring guidelines for groundwater sampling are:

- Low flow method.
- Bore purging method.

6.3.1.2.1 Low Flow Method

The low flow method is undertaken by specifically designed sample pumps, which usually incorporate a piston or bladder that is operated by compressed air or gas. The principle behind this method is to extract formation water through the bore screen (or slotted interval) at approximately the same rate it flows out of the pump, without disturbing the stagnant water column (Sundaram et al., 2009). This is achieved by pumping at a rate that results in a minimal drawdown of the water level within the bore. Typical flow rates for low flow sampling are in the order of 1 to 2 L/min; however, this might need to be adjusted depending on the rate of recharge of the bore.

The procedure to conduct groundwater sampling using the low flow method is as follows:

- Lower pump to the middle of the bore screen/slotted interval.
- Set pumping rate to a level that will result in a minimum drawdown of the water level. Check the water level before and during pumping and adjust the flow rate accordingly.
- Monitor field parameters to ensure stabilisation before taking the sample. Sterile gloves will be worn before collecting samples.
- When sampling for dissolved metals, make sure that the laboratory-supplied sample bottle for dissolved metals is appropriately labelled and is field filtered using a 0.45-micron filter.
- Label the sample bottles appropriately with sample location, date and time.
- Complete the field sheet.
- Preserve and pack the sample as outlined in **Section 6.5** below.

Based on the USEPA (1996) standard operating procedure, the stabilisation criteria for parameters before sampling is presented in **Table 5** below.

Table 5 Stabilisation Criteria

Analyte	Stabilisation Criteria
Temperature (°C)	± 0.2 °C
pH	± 0.1 pH Units
Electrical conductivity (EC)	± 3 % or ± 5 %

6.3.1.2.2 Bore Purging Method

To obtain a representative sample of the formation, it is necessary to remove the stagnant water from the bore casing before a sample is taken. This is called purging. It is recommended within the guidelines that at least three casing volumes of water will be removed before sampling. Usually, pumping of the bore is continued even after three casing volumes have been removed until the pH, EC, and temperature of the discharge water are stabilised (Sundaram et al., 2009).

The volume of the water to be removed is calculated using the following formula:

$V= 3\times \{\pi \times r^2 \times (TD-SWL) \times 1000\}$

Where:

- V = total volume of water to be removed in litres
- r = radius of the casing in metres (radius is half of the diameter)
- TD = total depth of the bore in metres
- SWL = standing water level in the bore in metres
- π = the constant (3.14)

The procedure to collect groundwater samples using the bore purging method is as follows:

- Lower the pump to about 1 m above the screen (if screen interval is known), or to about 1 to 2 m from the bottom of the bore (if the screen interval is not known).
- After starting the pump, establish the highest flow rate possible without causing the bore to stop yielding. For low-yielding bores that are pumped dry, let the bore recover prior to sampling and review if low flow sampling or a change in monitoring requirements is needed for the bore.
- Calculate the flow rate i.e., rate of flow per unit time (L/sec or L/min).
- Pump until the three casing volumes of water is removed and until pH, EC and temperature measurements stabilise.
- Once parameters have stabilised and three bore volumes have been purged, samples can be collected. Sterile gloves will be worn before collecting samples.
- When sampling for dissolved and total metals, make sure that the sample bottle for dissolved metals is properly labelled and is field filtered using a 0.45-micron filter.
- Label the sample bottles appropriately with sample location, date and time.
- Complete the field sheet.
- Preserve and pack the sample as outlined in **Section 6.5** below.

The stabilisation criteria presented in **Table 5** above are recommended for this method as well.

Currently, the groundwater quality at Nobles is monitored using Hydrasleeves. The method of sampling using Hydrasleeves is a no-purge, passive sampling method, which is used as an alternative to low-flow pumped sampling. The concept behind the no-purge method is that the natural flow of groundwater through the well screen results in chemical concentrations in the screen that are equal to concentrations in the surrounding formation (Freeze and Cherry, 1979; Reilly and LeBlanc, 1998). Moving forward, groundwater sampling will be collected using the low-flow method where possible. In bores where low-flow sampling is found unsuitable (i.e., causing drawdown), the bore purging method will be used.

6.3.2 Surface Water Quality Monitoring procedure

The information in this plan has been developed from *Australian/New Zealand Standards for Water Quality – Sampling parts 1, 4, and 6 (numbers 5667.1:1998; 5667.4:1998; and 5667.6:1998)* and the *Methodology for the Sampling of Surface Water* (DME, 2016). Appropriate safety precautions must be observed when collecting surface water samples.

The procedure for surface water sampling is as follows:

- The surface water sampling will be undertaken at the same location outlined in the WQMP for each round of monitoring.
- The sample will be taken from flowing, not stagnant water, where possible. Where there is no flow, such as in dams and isolated pools, samples can be collected from stagnant water. The “flow status” (for example, flowing, no flow, or pool) at the sampling point will be recorded on the field sheets at each location and during every sampling event.
- Surface water samples will be collected either by directly filling the laboratory-supplied containers from the surface water body, or by decanting the water from a collection device, which will be decontaminated before and after use (refer to the procedure presented in **Section 6.4**). Sterile gloves will be worn while collecting samples.
- Rinse the containers, where required. Fill the sample containers with the one-third of water to be sampled, rinse, and empty. Make sure that the water is emptied downstream or at a sufficient distance from the sample site to prevent mixing of rinse water with the water to be sampled and repeat the process a further two (2) times (a total of three (3) rinses). Make sure that the water used to rinse dissolved metal containers is filtered through the 0.45-micron filter. Sample containers with preservatives will not be rinsed.
- For sample collection, the bottle will be carefully plunged into the water mouth down and filled from 3 to 5 centimetres below the surface of the water, without disturbing the substrate.
- When the sampling bottle is uncapped for sampling, it is essential that the cap is protected from contamination.
- When sampling for dissolved metals, ensure that the sample bottle for dissolved metals is properly labelled and is field filtered using a 0.45-micron filter.
- Label the sample bottles appropriately with sample location, date and time.
- Complete the field sheets.
- Preserve and pack the sample as outlined in **Section 6.5**.

6.4 Decontamination of Sampling Equipment

To ensure the quality of samples collected, decontamination of monitoring equipment must be conducted consistently. All equipment that will contact the surface water (e.g., sampling pole) and groundwater (e.g., pumps and bailers) will be decontaminated prior to use at another sampling site to avoid cross-contamination. Disposable equipment intended for one-time use does not require decontamination but will be packaged for appropriate disposal.

The following procedure is required to be carried out in sequence for the decontamination of monitoring equipment:

- Use a non-phosphate and PFAS free detergent and tap or potable water wash, using a brush if necessary.
- Rinse with tap or potable water three times.
- Rinse three times with deionised water.

Sterile gloves will be worn by anyone handling the monitoring equipment.

6.5 Sample Handling, Preservation, Storage and Transport

6.5.1 Sample Handling

Samples shall be handled in a way to ensure their integrity is maintained and that they continue to represent the groundwater and surface water source conditions from which they were sampled, until the time of their analysis. Prior to the commencement of a sampling event, an assessment of the analytical holding times shall be made, and the sampling will be planned accordingly to ensure that holding times are minimised and are not exceeded wherever possible.

All samples will be placed in laboratory-provided containers using single-use disposable nitrile gloves. Duplicates will be collected in the field. Sample bottles shall be filled to the top of the sample container, minimising air gaps, and securely sealed.

All samples will be clearly labelled with unique sample identification numbers, sample date and time, sample location, and sampler's initials. In the case of field duplicates, sample containers will be labelled so as not to reveal the sample identification number, sample data and time, or sample location to the laboratory. An indelible pen shall be used for labelling to ensure that the lettering is not erased during transit to the laboratory.

6.5.2 Sample Preservation

Information on the appropriate sample container, preservation technique, and holding times, based on the parameters analysed under this WQMP is presented in **Table 6** below. The maximum holding times outlined are based on information stated in AS/NZS 5667.1:1998, however due to the remote location of Nobles Nob and distance to an accredited laboratory, the 24 hour holding time is not currently achievable. The holding time and preservation will therefore be confirmed with the contracted laboratory undertaking the analysis to inform the relevant interpretation of results.

After sampling is completed at each site, the sample containers will be checked to ensure details on the containers and labels are correct. The samples will then be kept and transported in an esky or a cooler box with ice or ice bricks to preserve the samples. Sample preservation will limit degradation and dispatch to the laboratory for analysis will occur as soon as practically possible.

Table 6 Water Quality Sample Storage and Preservation Procedure

Determinant	Type of Container	Preservation Procedure	Maximum Holding Time
Acidity and alkalinity	Plastic or glass	Fill container completely to exclude air and refrigerate (below 4 °C).	14 days
Metals	Acid washed plastic or glass	Acidify with nitric acid to pH 1 - 2 and refrigerate. Filtration of the sample must be performed prior to acidification*.	1 month

Major Cations	Plastic	Acidification is not required, though the addition of nitric acid sufficient to lower pH to 1 - 2 will enable determination of concentration with metals analysis.	1 week to
Chloride	Plastic or glass	None required.	1 month
Total Dissolved Solids/Total Suspended Solids	Plastic or glass	Filter on site and freeze.	24 hours
Iron	Plastic or glass	Freeze	24 hours
Sulfate	Plastic or glass	Refrigerate	1 week

6.5.3 Sample Storage and Transportation

All samples will be kept chilled in an esky with ice or ice bricks or dedicated site refrigerator prior to dispatch to the NATA registered laboratory under chain of custody procedures. Samples will be transported directly to the primary laboratory to ensure that the required holdings times are minimised. Since some parameters have very short recommended holding times (for example, the holding time for pH is six hours), in-situ or field measurement is important for these parameters.

6.5.4 Chain of Custody Forms

Chain of Custody (CoC) forms shall be completed, documenting the sample name (Sample ID) and parameters that are to be analysed. The CoC documents the chain of events from sample collection to delivery at the laboratory and provides a traceable account of sample handling. The CoC form shall be signed by both the sample collector/dispatcher and the receiving laboratory. Date and time of sample relinquishment and receipt at the laboratory will be documented. The CoC for each sampling event will be recorded.

6.6 Quality Assurance and Quality Control

Quality Assurance (QA) is the collection of policies, procedures, and actions established to provide and maintain data integrity and accuracy (Sundaram et al., 2009). In order to meet the objective of the WQMP, it is essential that a rigorous and thorough program of checks, comparisons and communication is implemented in the form of a QA system. Quality Control (QC) is a sample or procedure intended to verify the performance characteristics of a system (Sundaram et al., 2009). QC samples ensure that if there is any significant change in the sample results, due to contamination during sampling, handling and transportation, it will be picked up by QC sample.

The field QA/QC plan adopted for water quality monitoring has been designed to achieve precision, accuracy, representativeness, completeness and comparability of the data set, and that the data set is of acceptable quality to meet the objectives of this WQMP.

6.6.1 Field QA/QC

The field QA/QC procedures to be adopted during water quality monitoring and the corresponding acceptable control limits are presented in **Table 7** below.

Table 7 Field QA/QC

Data type	Comments and Acceptable Control Limits
Sampling Team	Sampling personnel will be comprised of personnel trained in conducting groundwater and surface water sampling.
Record Keeping	All field activities are to be recorded and maintained in field documents and field sheets.
Sampling Locations	Prior to any sampling undertaken, sampling locations will be confirmed.
Sample Collection	Groundwater and surface water samples will be collected into appropriate laboratory sampling bottles, using a fresh pair of disposable nitrile gloves.
Calibration of Field Equipment	The field water quality meter will be calibrated as per the manufacturer's recommendation before each sampling event. Calibration records will be kept for each sampling event.
Sample Nomenclature	Samples will be named as outlined in the WQMP. The same name is to be used for each sampling event for consistency.
Decontamination	Phosphate-free detergent and deionised water is to be used to decontaminate sampling instrumentation between samples, with consumable sampling equipment not to be reused between sample locations (for example, gloves). Deionised water will be used for rinses.
QA/QC	All fieldwork will be conducted in accordance with this WQMP.
Chain of Custody Forms	CoC procedures are required for all sample transfers. Laboratory CoC sheets list sample numbers, date of collection, and requested analyses. The analytical suite required will be in accordance with the WQMP and is to be reviewed by a SQP prior to submission to the laboratory.
Preservation	All samples will be sent to the laboratory in appropriately preserved containers, with sample preservation including packing samples with ice in eskies / cooler boxes.
Blind Samples	A blind sample is a duplicate of the primary field sample, which are both sent to the same laboratory for analysis to determine any differences in results within the same laboratory.
	Blind samples will be prepared in accordance with the procedures included in *Section 8 of Australian Standard AS4482.1-1997*. The frequency of replicate testing will be at least one (1) for each sampling event.
Field Blank Samples	A field blank sample contains laboratory-prepared water (usually DI water), that is sampled in the appropriate containers following the same process of groundwater and surface water sampling. The field blank is then placed in the esky that contains the samples.
	The field blank sample will not detect any metals above the limit of reporting (LOR). The field blank samples are used to determine any cross-contamination between samples during sampling or when placed in the esky during transit.
Logging and Location Marking	A visual assessment will be made of any markers (for example, odour, colour, or sheen on water) and GPS readings taken at each sample location.

6.6.2 Data Management

The data gathered from water quality monitoring will be collated into a database which will include:

- A site plan showing monitoring location.
- Periodic photos from monitoring locations during each sampling event.
- Enter the field results in a spreadsheet along with other details such as:
    - Sample location
    - Date sample was collected (day, month and year)
    - Time sample was collected in a 24-hour format
    - Field parameters recorded
    - Units of field parameters
    - Comments (for example, dry or insufficient water to sample, murky water etc.)
- A record of the chain of custody of the samples from sampling through to analysis.
- Compare the field result with appropriate background levels and previous results to ensure that none of the entries is off by a significant order.

In addition to the above-mentioned list, the following records will also be kept for each sampling event:

- Field sheets with all field observations for each monitoring location sampled.

The laboratory data gathered from the laboratory water quality monitoring will be collated into a database which will include:

- Laboratory analysis certificates.
- Spreadsheets with laboratory results for each sampling event.

It is important that a consolidated database for field and laboratory results be maintained for water quality monitoring at Nobles Nob. To facilitate adequate maintenance of the monitoring database, the following will be implemented:

- Ensure that there is no variability in the naming conventions of the sampling points for monitoring locations. Site names will be updated as per this WQMP to ensure that the field and laboratory data also have the same name.
- Make sure that the field results are monitored consistently in the same units. It will be helpful to prepare a template of field sample sheets or tabular spreadsheet and provide that to the sampling team to populate. This way, uniformity in results, units, and values can be attained.
- Make sure that the laboratory results are issued in consistent units and with consistent detection limits or LOR. This can be achieved by communicating to the contracted laboratory.
- Ask the contracted laboratory to issue the laboratory results in the same template for every sampling round. This will minimise variability in the data and will make compiling the monitoring database easier. This can be achieved by communicating with the contracted laboratory.
- Review and quality check of laboratory results will be undertaken for each monitoring round, before adding the results to the database. This includes checks of the results against historical results for each sample location. Data validation will be undertaken before adding the results to the database.

- A database management system such as MonitorPro or ESDAT will be considered for maintenance of environmental monitoring data. These database management systems are effective in maintaining large environmental databases.

6.6.3 Data Review, Validation, and Verification

The data collected will be reviewed, validated and verified for each sampling event. The specific requirements which will be checked during data validation are:

- Duplicate sample data: assess for the precision and reliability of the analysis by comparing the results between the sample and duplicate.
- Blank sample data: assess for accuracy and if any contamination occurred during sampling by reviewing the results of field blank results
- Overall data assessment: consistency of units and limit of reporting.

Field duplicate samples will be submitted to the laboratory as blind or mask samples. Relative percent differences (%RPD) will be calculated for each pair of original and duplicate results. The formula to derive RPD is as follows:

$$RPD\ (\%) = \left[\frac{Sample\ Conc. - Duplicate\ conc.}{Mean\ of\ Sample\ and\ Duplicate\ conc.}\right] \times 100$$

The RPD then uses the limit of reporting (LOR) to identify thresholds for valid reproducibility. These include:

- Mean of sample and duplicate < 10 times LOR: there is no RPD limit (reproducibility is valid)
- 10 times LOR < mean of sample and replicate < 20 times LOR: the RPD range limit is 0% to 50% for a valid duplicate
- Mean of sample and replicate > 20 times LOR: the RPD range limit is 0% to 20% for a valid duplicate.

If the RPD exceeds the threshold percentage, the results are considered unreliable and require further investigation. Only one duplicate sample needs to be collected per sampling event.

6.7 Water Quality Assessment Protocols

6.7.1 Assessment Criteria and Guideline Values (Interim)

The water quality monitoring results will be assessed against criteria, which will provide an early warning for any potential impacts due to activities on site. The Nobles Nob area does not have any defined Water Quality Objectives (WQOs). Due to the lack of sufficient available baseline water quality data at Nobles Nob, developing site-specific criteria is not possible at this time. The site-specific criteria to assess water quality will therefore be developed following sufficient observations, once a minimum of 12 months of baseline water quality data has been recorded.

For the period until sufficient water quality data is available, interim guideline values have been developed in accordance with ANZECC & ARMCANZ (2000) guideline values for livestock drinking water, and Australian drinking water guidelines (NHMRC, NRMMC, 2011) (**Table 8**).

To determine their suitability, the data from the existing baseline program was compared to the interim guideline values. This involved comparing the computed criteria (i.e., 80th percentiles of the baseline data) with the interim guideline values. The comparison suggested that the proposed interim guideline values of the following parameters are unsuitable:

- Electrical Conductivity

- Sulfate
- Total Dissolved Solids
- Iron
- Manganese
- Selenium
- Free and total cyanide (unsuitable only for NNMW005)

Where the interim guideline values for livestock drinking water and Australian drinking water were found unsuitable, the second level of interim guideline values (called Interim Limits) were established (**Table 8**). These Interim Limits were derived using the 80th percentile of the baseline data. It is possible that the Interim Limits might not be suitable for all monitoring locations, and for those locations, individual site-specific guideline values will be derived, once sufficient data is available. These interim guideline values and limits will be revised as soon as we have a minimum of 12 months baseline water quality data from Nobles Nob.

Table 8 Proposed Interim Guideline Values to Assess Water Quality

Parameters	Interim Guideline Values	Interim Limit^^	Units
pH*	6-9	-	pH Units
EC**	5970	11600	µS/cm
Total Dissolved Solids (TDS)**	4000	8000, 10000 for NNMW005	mg/L
Sulfate	1000	1060 for NNMW001, 1560 for NNMW005, and 1100 for NNMW011	mg/L
Aluminium	5	-	mg/L
Arsenic	0.5	-	mg/L
Boron	5	-	
Cadmium	0.01	-	mg/L
Chromium	1	-	mg/L
Cobalt	1	-	mg/L
Copper	1	-	mg/L
Iron*	0.2	0.268 for NNMW004, 0.636 for NNMW018, and 0.87 for SWLA01	mg/L
Lead	0.1	-	mg/L
Manganese*	0.2	1.9; 6.34 for NNMW001, 4.86 for NNMW012, for total manganese – 6.56 for NNMW001 and	mg/L

		5.36 for NNMW012	
Molybdenum	0.15	-	mg/L
Mercury	0.002	-	mg/L
Nickel	1	-	mg/L
Selenium	0.02	0.034	mg/L
Zinc	20	-	mg/L
Free Cyanide^	0.007	0.0178 for NNMW005	mg/L
Total Cyanide#	0.08	0.112 for NNMW005	mg/L

Note: * Interim guideline values for pH, Iron, and Manganese has been derived from ANZECC Irrigation guideline values (ANZECC & ARMCANZ, 2000).
** Interim guideline values for TDS have been adapted from the levels specified for Beef cattle. Interim guideline values for EC has been calculated using conversion from adapted TDS using equation 4.6 of ANZECC & ARMCANZ (2000)
^Interim guideline values for Free Cyanide has been derived from ANZG (2018) default guideline value for aquatic ecosystem (95% level of species protection).
#Interim guideline value for Total Cyanide has been adapted from Australian drinking water guidelines (NHMRC, NRMMC, 2011).
^^ Interim limits have been derived using 80th percentile of all groundwater sites combined. Specific interim limits (such as 10000 mg/L TDS for NNMW005) has been derived using site-specific 80th percentiles.

6.7.2 Trigger for Corrective Actions

In order to manage the water quality on site, the monitoring results will be assessed against the guideline values outlined in **Section 6.7.1** above, which will provide an early warning for any potential changes in the water quality at Nobles Nob. Based on the available water quality data the below criteria have been established to trigger corrective actions:

- If the water quality results exceed the guideline values in **Table 8**, compare them with the interim limits (if available). If the water quality results exceed the interim guideline values and interim limits (if provided) mentioned in **Table 8**, and the concentrations are higher than that recorded in the upstream sites (e.g., NNMW011, NNMW012, NNMW013, and NNMW018), this will trigger corrective action.
- If the water quality results exhibit an increasing temporal trend in three (3) consecutive monitoring events (after baseline data collection is over), and the concentrations are outside the historical concentration range recorded during baseline data collection, this will trigger corrective action.

In addition to the above, any water quality impacts observed from construction activities, such as excessive erosion, acidic runoff, etc. will trigger corrective actions. Any environmental incident or emergency will also trigger corrective actions.

6.7.3 Corrective Actions

When a corrective action criterion is triggered, the following corrective actions will be implemented:

- Implement appropriate controls and contingency responses identified in the risk assessment and the EMP.
- In the event of exceedances, verify the water quality results, and ensure that the results are representative, and free of any errors occurred at the laboratory or during sampling.
- If required, re-test the sample in the laboratory, if the laboratory has sufficient samples to retest. Otherwise, resample and re-test the location with exceedances.

- In the event of genuine exceedances (i.e., exceedance is not an error), compare the exceedances with historical data. If an exceedance is within the historical range, continue monitoring the concentration.
- If an exceedance is outside the historical range, investigate potential sources of exceedances and undertake mitigation works. Including identification of contamination source; and prevention, capture, diversion, or prevention of any discharges from operations, as necessary.
- If required, install a system to prevent ongoing impact (e.g., installation of a seepage interception system, pump back bores etc.).

An investigation will assess the potential for environmental harm and will include a written report outlining:

- Details of the investigations carried out, including source and cause of the exceedances and criterion.
- Actions taken to prevent environmental harm.

In the case of an environmental incident or emergency, incident response shall be initiated immediately, if safe to do so. The Site Manager will be notified as soon as practicable to allocate resources onsite if available. In the case of environmental incident involving release of contaminated water, the cause of the release will be remedied immediately, if safe or possible to do so. Protection to the clean water drains and surface water bodies will be ensured, where possible, during the initial response. The general plan of action will include, but will not be limited to, the following:

- Identify environmental incident or emergency
- Cease or contain the cause of the incident. Notify the Site Manager or TCMG management.
- Initiate immediate site level response, where safe to do so
- Notify the relevant regulator, and emergency services if required
- Remediate, if possible. Consult Environmental professional, if needed
- Investigate the cause of incident, and submit a report outlining impacts from the incident, and ways to avoid such incidents in future.

6.8 Reporting

As part of this WQMP, an annual monitoring summary report will be prepared summarising the preceding 12 months of monitoring.

Additionally, a quarterly internal monitoring summary technical note will be prepared (after baseline data has been collected), summarising:

- All monitoring data, exceedances, and temporal trends, if any.
- All mitigation measures implemented, or changes to the monitoring program.

Any non-compliance or incident will be recorded in an incident reporting form and entered into the incident - complaint register. Any action(s) undertaken as corrective action to mitigate environmental harm from the non-compliance or incident will also be recorded.

A copy of relevant reports, management plans, procedures, approvals and licences will be maintained at the site, along with all relevant records showing compliance and non-compliance events. These can be provided to the regulators on request.

Any significant environmental accidents and incidents will be reported to the Department of Industry, Tourism and Trade (DITT) via a Notification of an Environmental Incident form as required under S29 of the Mining Management Act 2001. Any significant pollution events will also be reported to the NT EPA Pollution Hotline.

6.9 Summary of Water Quality Monitoring Program

The summary of this WQMP is presented in **Table 9** below.

Table 9 Summary of the WQMP

Item	Description
Aim	Ensure that the water quality at the site is maintained and does not deteriorate.
Objectives and Targets	Objectives and Targets from **Section 1**
Responsible Person	TCMG management, TCMG WHSE team, Site Manager, TCMG employees and contractors.
Actions / Mitigation Measures	-Implement the relevant plans, such as Erosion and Sediment Control Plan, Fuel storage and handling procedures etc. -Revise the interim guideline values once sufficient baseline data is collected. -Review and revise this WQMP as necessary, after sufficient baseline data is collected.
Monitoring	Implement a monitoring program as outlined in **Section 6** of this WQMP.
Reporting	-An annual monitoring summary report will be prepared summarising the preceding 12 months of monitoring. -A quarterly internal monitoring summary technical note will be prepared (after baseline data has been collected). -Any non-compliance or incident will be recorded on the incident reporting form (or similar) and entered into the incident-complaint register. -Any action(s) undertaken as corrective action to mitigate environmental harm from the non-compliance or incident will also be recorded. -Any significant environmental incidents will be reported to DITT and any other relevant authorities.
Trigger for Corrective Actions	-If the water quality results exceed the guideline values in Table 8, compare them with the interim limits (if available). If the water quality results exceed the interim guideline values and interim limits (if provided) mentioned in Table 8, and the concentrations are higher than that recorded in the upstream sites (e.g., NNMW011, NNMW012, NNMW013, and NNMW018), corrective actions will be triggered. -If the water quality results exhibit an increasing temporal trend in three (3) consecutive monitoring events (after baseline data collection is over), and the concentrations are outside the historical concentration range recorded during baseline data collection, corrective actions will be triggered.

Corrective Actions	-Implement appropriate controls and contingency responses identified in the risk assessment and the EMP. -In the event of exceedances, verify the water quality results, and ensure that the results are representative, and free of any errors occurred at the laboratory or during sampling. -If required, re-test the sample in the laboratory, if the laboratory has sufficient samples to retest. Otherwise, resample and re-test the location with exceedances. -In the event of genuine exceedances (i.e., exceedance is not an error), compare the exceedances with historical data. If an exceedance is within the historical range, continue monitoring the concentration. -If an exceedance is outside the historical range, investigate potential sources of exceedances and undertake mitigation works as necessary. -If required, install a system to prevent potential impact (e.g., installation of a seepage interception system, pump back bores etc.).
Review of this WQMP	This WQMP will be reviewed annually by an appropriately qualified person to determine if the WQMP continues to meet the requirements.

7.0 Review of this WQMP

This WQMP will be reviewed annually by an appropriately qualified person to determine if the WQMP continues to meet the requirements. The review will include:

- An assessment of the outcome of the WQMP against the objectives and targets.
- A review of the adequacy of the monitoring locations, frequencies, and development of water quality triggers.
- Any required increase in monitoring locations to monitor impacts on water quality adequately.
- Additional quality assurance and quality control measures, if required.
- Revision of monitoring parameters and/or frequency, if required.
- Expanding the existing monitoring network over time to enable ongoing impact evaluations.

As required, this WQMP may be updated or revised based on the outcomes of the review process. The WQMP will also be reviewed if:

- A review of the QA/QC results is non-acceptable. The monitoring procedures outlined in this WQMP will be reviewed and revised as necessary.
- Any relevant changes in legislation, approvals or other factors, that requires a review of this WQMP. The site activities alter the level of risk with respect to the objectives and targets of this WQMP, resulting in a review of the risk assessment.

8.0 References

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Appendix A. Statistical Summary

sites	statistic	Field pH	pH	EC	Sulfate	Total Disso	Aluminium
NNMW001	Number	7	8	8	8	8	8
NNMW001	non-detect(%)	0	0	0	0	0	0
NNMW001	Min	6.19	7.2	11000	970	7100	0.016
NNMW001	5th %ile	6.211	7.2	11000	970	7100	0.01705
NNMW001	20th %ile	6.278	7.24	11000	974	7140	0.0206
NNMW001	Median	6.46	7.5	11000	980	7300	0.025
NNMW001	80th %ile	6.496	7.76	11000	1060	7520	0.0276
NNMW001	95th %ile	6.815	7.8	11000	1100	8055	0.0332
NNMW001	Max	6.95	7.8	11000	1100	8300	0.036
NNMW002	Number	7	8	8	8	8	8
NNMW002	non-detect(%)	0	0	0	0	0	0
NNMW002	Min	5.64	6.6	4500	220	3100	0.012
NNMW002	5th %ile	5.7	6.635	4500	223.5	3135	0.01235
NNMW002	20th %ile	5.848	6.74	4500	230	3200	0.0134
NNMW002	Median	5.9	7	4600	240	3400	0.016
NNMW002	80th %ile	6.518	7.26	4700	250	3500	0.0182
NNMW002	95th %ile	6.869	7.365	4700	269.5	3825	0.01965
NNMW002	Max	6.98	7.4	4700	280	4000	0.02
NNMW004	Number	7	8	8	8	8	8
NNMW004	non-detect(%)	0	0	0	0	0	0
NNMW004	Min	6.18	7.1	9300	680	6100	0.015
NNMW004	5th %ile	6.18	7.17	9475	683.5	6275	0.01605
NNMW004	20th %ile	6.196	7.3	9800	734	6600	0.0184
NNMW004	Median	6.31	7.55	10000	810	6950	0.0225
NNMW004	80th %ile	6.506	7.7	10600	840	7160	0.025
NNMW004	95th %ile	6.862	7.83	11000	859.5	7460	0.025
NNMW004	Max	7	7.9	11000	870	7600	0.025
NNMW005	Number	7	8	8	8	8	8
NNMW005	non-detect(%)	0	0	0	0	0	0
NNMW005	Min	6.08	7.1	14000	990	8700	0.024
NNMW005	5th %ile	6.086	7.135	14000	1063.5	8910	0.02575
NNMW005	20th %ile	6.106	7.2	14000	1240	9340	0.0306
NNMW005	Median	6.19	7.45	14000	1500	9550	0.0415
NNMW005	80th %ile	6.332	7.66	14600	1560	10000	0.0458
NNMW005	95th %ile	6.679	7.765	15000	1600	10650	0.0483
NNMW005	Max	6.82	7.8	15000	1600	11000	0.049
NNMW007	Number	7	8	8	8	8	8
NNMW007	non-detect(%)	0	0	0	0	0	0
NNMW007	Min	6.25	7.1	9500	780	6100	0.017
NNMW007	5th %ile	6.259	7.135	9500	783.5	6100	0.0177
NNMW007	20th %ile	6.288	7.28	9500	794	6100	0.0194
NNMW007	Median	6.42	7.5	9650	800	6150	0.0225
NNMW007	80th %ile	6.592	7.82	9800	852	6320	0.0242
NNMW007	95th %ile	6.964	7.965	9865	873	6725	0.0263
NNMW007	Max	7.12	8	9900	880	6900	0.027
NNMW011	Number	4	5	5	5	5	5

NNMW011	non-detect(%)	0	0	0	0	0	0
NNMW011	Min	6.09	7.2	10000	1000	6500	0.021
NNMW011	5th %ile	6.1125	7.24	10000	1000	6520	0.0224
NNMW011	20th %ile	6.18	7.36	10000	1000	6580	0.0266
NNMW011	Median	6.265	7.4	10000	1100	6700	0.028
NNMW011	80th %ile	6.386	7.7	10200	1100	6720	0.0284
NNMW011	95th %ile	6.494	7.7	10800	1100	6780	0.0296
NNMW011	Max	6.53	7.7	11000	1100	6800	0.03
NNMW012	Number	4	5	5	5	5	5
NNMW012	non-detect(%)	0	0	0	0	0	0
NNMW012	Min	6.2	7	12000	900	8100	0.024
NNMW012	5th %ile	6.2075	7.04	12000	904	8120	0.0242
NNMW012	20th %ile	6.23	7.16	12000	916	8180	0.0248
NNMW012	Median	6.26	7.3	12000	920	8200	0.029
NNMW012	80th %ile	6.482	7.72	12000	960	8460	0.032
NNMW012	95th %ile	6.7205	7.78	12000	990	8640	0.035
NNMW012	Max	6.8	7.8	12000	1000	8700	0.036
NNMW013	Number	4	5	5	5	5	5
NNMW013	non-detect(%)	0	0	0	0	0	0
NNMW013	Min	6.24	7.1	9700	810	6500	0.018
NNMW013	5th %ile	6.2595	7.14	9720	814	6500	0.019
NNMW013	20th %ile	6.318	7.26	9780	826	6500	0.022
NNMW013	Median	6.41	7.4	9800	830	6600	0.024
NNMW013	80th %ile	6.614	7.72	9920	868	6720	0.0264
NNMW013	95th %ile	6.7985	7.78	9980	892	6780	0.0276
NNMW013	Max	6.86	7.8	10000	900	6800	0.028
NNMW014	Number	7	8	8	8	8	8
NNMW014	non-detect(%)	0	0	0	0	0	0
NNMW014	Min	6.33	7.2	9400	670	6200	0.022
NNMW014	5th %ile	6.345	7.2	9400	673.5	6235	0.0227
NNMW014	20th %ile	6.396	7.28	9400	684	6340	0.026
NNMW014	Median	6.77	7.5	9550	795	6400	0.031
NNMW014	80th %ile	7.068	7.76	9660	846	6620	0.034
NNMW014	95th %ile	7.523	7.865	9830	856.5	7155	0.03985
NNMW014	Max	7.7	7.9	9900	860	7400	0.043
NNMW018	Number	4	5	5	5	4	5
NNMW018	non-detect(%)	0	0	0	0	0	0
NNMW018	Min	6.23	7.1	7700	660	5500	0.02
NNMW018	5th %ile	6.266	7.12	7940	662	5605	0.0204
NNMW018	20th %ile	6.374	7.18	8660	668	5920	0.0216
NNMW018	Median	6.67	7.5	9800	710	6300	0.023
NNMW018	80th %ile	6.898	7.74	11200	828	6520	0.0264
NNMW018	95th %ile	6.9295	7.86	11800	882	6655	0.0276
NNMW018	Max	6.94	7.9	12000	900	6700	0.028
SWLA01	Number	7	8	8	8	8	8
SWLA01	non-detect(%)	0	0	0	0	0	0
SWLA01	Min	6.49	6.8	42	1.1	30	0.12

SWLA01	5th %ile	6.646	6.8	43.4	1.1	35.25	0.148
SWLA01	20th %ile	7.024	6.8	51.2	1.18	47	0.208
SWLA01	Median	7.1	6.95	67.5	1.85	55.5	0.42
SWLA01	80th %ile	7.738	7.06	83.4	2.94	112	1.88
SWLA01	95th %ile	8.542	7.1	94.1	3.815	120	2.52
SWLA01	Max	8.83	7.1	99	4.2	120	2.8

Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead
8	6	6	6	8	8	8	8	2	8
100	0	83.33333	0	50	100	0	62.5	100	37.5
0.001	0.087	3.00E-04	0.6	1.00E-04	0.001	0.026	0.001	0.02	0.001
0.0038	0.0875	3.00E-04	0.61	0.00017	0.0017	0.02635	0.0017	0.02	0.0017
0.009	0.089	3.00E-04	0.64	3.00E-04	0.003	0.0286	0.003	0.02	0.003
0.009	0.091	3.00E-04	0.675	0.00035	0.003	0.0345	0.003	0.02	0.003
0.009	0.093	3.00E-04	0.7	4.00E-04	0.003	0.0492	0.003	0.02	0.004
0.009	0.10575	0.000825	0.7075	0.000465	0.003	0.0618	0.0043	0.02	0.0053
0.009	0.11	0.001	0.71	5.00E-04	0.003	0.066	0.005	0.02	0.006
8	6	6	6	8	8	8	8	2	8
100	0	83.33333	0	50	100	0	75	100	75
0.001	0.066	2.00E-04	0.2	1.00E-04	0.001	0.002	0.001	0.02	0.001
0.00275	0.06625	2.00E-04	0.205	0.000135	0.00135	0.0034	0.00135	0.02	0.00135
0.006	0.067	2.00E-04	0.22	2.00E-04	0.002	0.006	0.002	0.02	0.002
0.006	0.072	2.00E-04	0.22	2.00E-04	0.002	0.008	0.002	0.02	0.002
0.006	0.075	2.00E-04	0.23	2.00E-04	0.002	0.0148	0.0026	0.02	0.002
0.006	0.07575	8.00E-04	0.2375	0.000265	0.002	0.01665	0.003	0.02	0.0033
0.006	0.076	0.001	0.24	3.00E-04	0.002	0.017	0.003	0.02	0.004
8	6	6	6	8	8	8	8	2	8
100	0	83.33333	0	50	100	0	87.5	50	87.5
0.001	0.073	3.00E-04	0.88	1.00E-04	0.001	0.026	0.001	0.02	0.001
0.0038	0.07325	3.00E-04	0.8975	0.00017	0.0017	0.02635	0.0017	0.0355	0.0017
0.009	0.074	3.00E-04	0.95	3.00E-04	0.003	0.0278	0.003	0.082	0.003
0.009	0.087	3.00E-04	0.99	3.00E-04	0.003	0.0365	0.003	0.175	0.003
0.009	0.093	3.00E-04	0.99	0.00036	0.003	0.0518	0.003	0.268	0.003
0.009	0.0945	0.000825	0.9975	0.000465	0.003	0.0647	0.00365	0.3145	0.00365
0.009	0.095	0.001	1	5.00E-04	0.003	0.071	0.004	0.33	0.004
8	6	6	6	8	8	8	8	2	8
87.5	0	100	0	100	0	0	0	50	100
0.001	0.058	0.001	1	0.001	0.001	0.1	0.01	0.02	0.001
0.001	0.05975	0.001	1.025	0.001	0.001	0.128	0.01	0.02	0.001
0.001	0.065	0.001	1.1	0.001	0.001	0.2	0.0104	0.02	0.001
0.001	0.067	0.001	1.1	0.001	0.002	0.245	0.0115	0.02	0.001
0.001	0.068	0.001	1.1	0.001	0.003	0.286	0.0156	0.02	0.001
0.00165	0.07025	0.001	1.1	0.001	0.0056	0.29	0.01665	0.02	0.001
0.002	0.071	0.001	1.1	0.001	0.007	0.29	0.017	0.02	0.001
8	6	6	6	8	8	8	8	2	8
100	0	83.33333	0	37.5	75	0	87.5	100	87.5
0.001	0.054	3.00E-04	1.1	1.00E-04	0.002	0.006	0.001	0.02	0.001
0.0038	0.05475	3.00E-04	1.125	0.00017	0.00235	0.006	0.0017	0.02	0.0017
0.009	0.057	3.00E-04	1.2	3.00E-04	0.003	0.0068	0.003	0.02	0.003
0.009	0.065	3.00E-04	1.2	0.00035	0.003	0.012	0.003	0.02	0.003
0.009	0.066	3.00E-04	1.2	0.00046	0.003	0.0168	0.003	0.02	0.003
0.009	0.069	0.000825	1.275	0.000565	0.00326	0.0245	0.003	0.02	0.0043
0.009	0.07	0.001	1.3	6.00E-04	0.0034	0.028	0.003	0.02	0.005
5	3	3	3	5	5	5	5	2	5

100	0	100	0	40	100	60	60	100	80
0.001	0.024	3.00E-04	0.76	1.00E-04	0.001	0.001	0.001	0.02	0.001
0.0026	0.0241	3.00E-04	0.764	0.00014	0.0014	0.0014	0.0014	0.02	0.0014
0.0074	0.0244	3.00E-04	0.776	0.00026	0.0026	0.0026	0.0026	0.02	0.0026
0.009	0.025	3.00E-04	0.8	3.00E-04	0.003	0.003	0.003	0.02	0.003
0.009	0.025	0.00072	0.812	0.00044	0.003	0.0044	0.0042	0.02	0.0032
0.009	0.025	0.00093	0.818	0.00056	0.003	0.0056	0.0078	0.02	0.0038
0.009	0.025	0.001	0.82	6.00E-04	0.003	0.006	0.009	0.02	0.004
5	3	3	3	5	5	5	5	2	5
100	0	100	0	80	80	0	20	50	80
0.001	0.082	0.001	0.62	4.00E-04	0.001	0.01	0.003	0.02	0.001
0.001	0.0831	0.001	0.622	0.00052	0.001	0.0102	0.003	0.0225	0.001
0.001	0.0864	0.001	0.628	0.00088	0.001	0.0108	0.003	0.03	0.001
0.001	0.093	0.001	0.64	0.001	0.001	0.015	0.004	0.045	0.001
0.0026	0.096	0.001	0.67	0.001	0.0038	0.0156	0.0062	0.06	0.002
0.0074	0.0975	0.001	0.685	0.001	0.0062	0.0174	0.0068	0.0675	0.005
0.009	0.098	0.001	0.69	0.001	0.007	0.018	0.007	0.07	0.006
5	3	3	3	5	5	5	5	2	5
100	0	100	0	60	100	0	20	100	40
0.001	0.044	3.00E-04	0.76	1.00E-04	0.001	0.008	0.003	0.02	0.001
0.0026	0.0451	3.00E-04	0.762	0.00014	0.0014	0.0084	0.003	0.02	0.0014
0.0074	0.0484	3.00E-04	0.768	0.00026	0.0026	0.0096	0.003	0.02	0.0026
0.009	0.055	3.00E-04	0.78	3.00E-04	0.003	0.011	0.005	0.02	0.003
0.009	0.07	0.00072	0.792	0.00034	0.003	0.0122	0.0056	0.02	0.0036
0.009	0.0775	0.00093	0.798	0.00046	0.003	0.0158	0.0074	0.02	0.0054
0.009	0.08	0.001	0.8	5.00E-04	0.003	0.017	0.008	0.02	0.006
8	6	6	6	8	8	8	8	2	8
87.5	0	83.33333	0	50	100	0	62.5	100	62.5
0.002	0.056	3.00E-04	0.74	1.00E-04	0.001	0.005	0.001	0.02	0.001
0.00445	0.05675	3.00E-04	0.7525	0.00017	0.0017	0.00535	0.0017	0.02	0.0017
0.009	0.059	3.00E-04	0.79	3.00E-04	0.003	0.0064	0.003	0.02	0.003
0.009	0.0665	3.00E-04	0.82	3.00E-04	0.003	0.0075	0.003	0.02	0.003
0.009	0.071	3.00E-04	0.83	0.00036	0.003	0.01	0.003	0.02	0.0036
0.009	0.074	0.000825	0.83	4.00E-04	0.003	0.01325	0.00495	0.02	0.00465
0.009	0.075	0.001	0.83	4.00E-04	0.003	0.015	0.006	0.02	0.005
5	3	3	3	5	5	5	5	2	5
100	0	100	0	60	100	0	80	50	80
0.001	0.07	2.00E-04	0.63	1.00E-04	0.001	0.003	0.001	0.02	0.001
0.002	0.0708	0.00021	0.633	0.00012	0.0012	0.0032	0.0012	0.0585	0.0014
0.005	0.0732	0.00024	0.642	0.00018	0.0018	0.0038	0.0018	0.174	0.0026
0.009	0.078	3.00E-04	0.66	3.00E-04	0.003	0.006	0.003	0.405	0.003
0.009	0.0876	0.00072	0.672	0.00038	0.003	0.0086	0.0032	0.636	0.0032
0.009	0.0924	0.00093	0.678	0.00062	0.003	0.0104	0.0038	0.7515	0.0038
0.009	0.094	0.001	0.68	7.00E-04	0.003	0.011	0.004	0.79	0.004
8	6	6	6	8	8	8	8	2	8
100	0	66.66667	100	87.5	62.5	75	12.5	0	75
0.001	0.051	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.47	0.001

0.0017	0.05275	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.495	0.001
0.003	0.058	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.57	0.001
0.003	0.105	1.00E-04	0.05	1.00E-04	0.001	0.001	0.0015	0.72	0.001
0.003	0.13	1.00E-04	0.05	1.00E-04	0.00106	0.001	0.002	0.87	0.001
0.003	0.2275	0.000775	0.05	1.00E-04	0.001165	0.001	0.00265	0.945	0.00165
0.003	0.26	0.001	0.05	1.00E-04	0.0012	0.001	0.003	0.97	0.002

Manganes	Mercury	Molybden	Nickel	Selenium	Silver	Vanadium	Zinc	Total Alum	Total Arse
8	8	6	8	2	8	2	8	8	8
0	100	100	0	0	87.5	100	12.5	0	100
3.6	5.00E-05	0.001	0.003	0.022	5.00E-05	0.003	0.005	0.094	0.001
3.775	5.00E-05	0.0015	0.00335	0.02275	8.50E-05	0.003	0.005	0.0996	0.0038
4.34	5.00E-05	0.003	0.004	0.025	0.00015	0.003	0.0054	0.114	0.009
5.55	5.00E-05	0.003	0.004	0.0295	0.001575	0.003	0.0085	0.13	0.009
6.34	5.00E-05	0.003	0.0052	0.034	0.003	0.003	0.012	0.334	0.009
6.5	5.00E-05	0.003	0.00665	0.03625	0.00365	0.003	0.0257	0.669	0.009
6.5	5.00E-05	0.003	0.007	0.037	0.004	0.003	0.032	0.83	0.009
8	8	6	8	2	8	2	8	8	8
0	100	100	0	0	100	100	0	0	100
0.021	5.00E-05	0.001	0.004	0.01	5.00E-05	0.002	0.005	0.11	0.001
0.02975	5.00E-05	0.00125	0.004	0.01005	6.75E-05	0.002	0.005	0.215	0.00275
0.064	5.00E-05	0.002	0.0044	0.0102	1.00E-04	0.002	0.0054	0.426	0.006
0.255	5.00E-05	0.002	0.0075	0.0105	0.00105	0.002	0.0065	0.88	0.006
1.1	5.00E-05	0.002	0.0112	0.0108	0.002	0.002	0.0098	1.96	0.006
1.23	5.00E-05	0.002	0.01265	0.01095	0.002	0.002	0.01165	2.985	0.006
1.3	5.00E-05	0.002	0.013	0.011	0.002	0.002	0.012	3.3	0.006
8	8	6	8	2	8	2	8	8	8
0	100	100	87.5	0	100	100	25	0	100
0.33	5.00E-05	0.001	0.001	0.02	5.00E-05	0.003	0.005	0.081	0.001
0.33	5.00E-05	0.0015	0.0017	0.02025	8.50E-05	0.003	0.005	0.08695	0.0038
0.342	5.00E-05	0.003	0.003	0.021	0.00015	0.003	0.0058	0.0988	0.009
0.425	5.00E-05	0.003	0.003	0.0225	0.001575	0.003	0.007	0.155	0.009
0.648	5.00E-05	0.003	0.003	0.024	0.003	0.003	0.0112	0.342	0.009
0.817	5.00E-05	0.003	0.003	0.02475	0.003	0.003	0.0146	0.539	0.009
0.88	5.00E-05	0.003	0.003	0.025	0.003	0.003	0.016	0.63	0.009
8	8	6	8	2	7	2	9	8	8
0	62.5	50	0	0	85.71429	50	0	0	87.5
0.39	5.00E-05	0.001	0.002	0.013	0.00025	0.001	0.012	0.13	0.001
0.3935	5.00E-05	0.001	0.00235	0.0135	0.00025	0.00105	0.0148	0.158	0.001
0.404	5.00E-05	0.001	0.003	0.015	0.00025	0.0012	0.019	0.21	0.001
0.54	5.00E-05	0.001	0.004	0.018	0.00036	0.0015	0.025	0.27	0.001
0.744	1.00E-04	0.001	0.0046	0.021	0.005	0.0018	0.0352	0.556	0.001
0.8985	0.000126	0.00325	0.00825	0.0225	0.005	0.00195	0.0538	0.925	0.0023
0.93	0.00014	0.004	0.01	0.023	0.005	0.002	0.063	1.1	0.003
8	8	6	8	2	8	2	8	8	8
0	100	66.66667	100	0	87.5	100	12.5	0	100
0.085	5.00E-05	0.002	0.001	0.017	6.00E-05	0.003	0.005	0.084	0.001
0.08955	5.00E-05	0.00225	0.0017	0.01715	9.15E-05	0.003	0.0057	0.08715	0.0038
0.1108	5.00E-05	0.003	0.003	0.0176	0.00015	0.003	0.007	0.1038	0.009
0.175	5.00E-05	0.003	0.003	0.0185	0.001575	0.003	0.009	0.145	0.009
0.186	5.00E-05	0.003	0.003	0.0194	0.003	0.003	0.0174	0.206	0.009
0.203	5.00E-05	0.003	0.003	0.01985	0.003	0.003	0.02165	0.5745	0.009
0.21	5.00E-05	0.003	0.003	0.02	0.003	0.003	0.022	0.76	0.009
5	5	3	5	2	5	2	5	5	5

20	100	100	60	0	80	100	0	0	100
0.005	5.00E-05	0.001	0.001	0.018	6.00E-05	0.003	0.008	0.094	0.001
0.005	5.00E-05	0.0012	0.0014	0.01805	7.80E-05	0.003	0.008	0.0946	0.0026
0.005	5.00E-05	0.0018	0.0026	0.0182	0.000132	0.003	0.008	0.0964	0.0074
0.005	5.00E-05	0.003	0.003	0.0185	0.00015	0.003	0.008	0.15	0.009
0.0096	5.00E-05	0.003	0.0046	0.0188	0.00072	0.003	0.0174	0.206	0.009
0.0144	5.00E-05	0.003	0.0064	0.01895	0.00243	0.003	0.0306	0.254	0.009
0.016	5.00E-05	0.003	0.007	0.019	0.003	0.003	0.035	0.27	0.009
5	5	3	5	2	5	2	5	5	5
0	100	100	0	0	100	100	0	0	60
2.7	5.00E-05	0.001	0.005	0.002	5.00E-05	0.001	0.007	0.15	0.001
3	5.00E-05	0.001	0.005	0.0026	9.00E-05	0.0011	0.008	0.152	0.001
3.9	5.00E-05	0.001	0.005	0.0044	0.00021	0.0014	0.011	0.158	0.001
4.3	5.00E-05	0.001	0.006	0.008	0.00025	0.002	0.014	0.29	0.001
4.86	5.00E-05	0.001	0.0078	0.0116	0.0008	0.0026	0.0152	1.58	0.0026
5.34	5.00E-05	0.001	0.0102	0.0134	0.00245	0.0029	0.0158	1.82	0.0074
5.5	5.00E-05	0.001	0.011	0.014	0.003	0.003	0.016	1.9	0.009
5	5	3	5	2	5	2	5	5	5
0	100	0	0	0	80	100	20	0	100
0.17	5.00E-05	0.002	0.002	0.02	1.00E-04	0.003	0.005	0.073	0.001
0.226	5.00E-05	0.0021	0.0024	0.0205	0.00011	0.003	0.0054	0.0752	0.0026
0.394	5.00E-05	0.0024	0.0036	0.022	0.00014	0.003	0.0066	0.0818	0.0074
0.69	5.00E-05	0.003	0.005	0.025	0.00015	0.003	0.01	0.16	0.009
0.932	5.00E-05	0.003	0.0062	0.028	0.00072	0.003	0.0162	0.672	0.009
1.058	5.00E-05	0.003	0.0068	0.0295	0.00243	0.003	0.0228	1.668	0.009
1.1	5.00E-05	0.003	0.007	0.03	0.003	0.003	0.025	2	0.009
8	8	6	8	2	8	2	8	8	8
0	100	33.33333	75	0	87.5	50	25	0	87.5
0.089	5.00E-05	0.002	0.001	0.02	6.00E-05	0.003	0.005	0.03	0.002
0.09215	5.00E-05	0.00225	0.0017	0.0208	9.15E-05	0.0031	0.005	0.04295	0.00445
0.1068	5.00E-05	0.003	0.003	0.0232	0.00015	0.0034	0.0054	0.0746	0.009
0.14	5.00E-05	0.003	0.003	0.028	0.001575	0.004	0.006	0.0945	0.009
0.166	5.00E-05	0.003	0.003	0.0328	0.003	0.0046	0.0086	0.156	0.009
0.235	5.00E-05	0.003	0.00365	0.0352	0.003	0.0049	0.0298	0.836	0.009
0.27	5.00E-05	0.003	0.004	0.036	0.003	0.005	0.041	1.2	0.009
5	5	3	5	2	5	2	5	5	5
0	100	100	0	0	80	100	0	0	100
0.56	5.00E-05	0.001	0.002	0.01	5.00E-05	0.003	0.01	0.048	0.001
0.574	5.00E-05	0.0011	0.0022	0.0104	6.00E-05	0.003	0.0104	0.0482	0.002
0.616	5.00E-05	0.0014	0.0028	0.0116	9.00E-05	0.003	0.0116	0.0488	0.005
0.92	5.00E-05	0.002	0.003	0.014	0.00015	0.003	0.02	0.055	0.009
1.7	5.00E-05	0.0026	0.0032	0.0164	0.00072	0.003	0.0256	0.1064	0.009
2	5.00E-05	0.0029	0.0038	0.0176	0.00243	0.003	0.0304	0.1466	0.009
2.1	5.00E-05	0.003	0.004	0.018	0.003	0.003	0.032	0.16	0.009
8	8	6	8	2	8	2	8	8	8
62.5	100	100	62.5	100	100	0	100	0	100
0.005	5.00E-05	0.001	0.001	0.002	5.00E-05	0.001	0.005	0.13	0.001

0.005	5.00E-05	0.001	0.001	0.002	6.75E-05	0.0011	0.005	0.158	0.0017
0.005	5.00E-05	0.001	0.001	0.002	1.00E-04	0.0014	0.005	0.21	0.003
0.005	5.00E-05	0.001	0.001	0.002	0.00055	0.002	0.005	1.055	0.003
0.0224	5.00E-05	0.001	0.001	0.002	0.001	0.0026	0.005	3.14	0.003
0.0359	5.00E-05	0.001	0.001	0.002	0.001	0.0029	0.005	4.355	0.003
0.038	5.00E-05	0.001	0.001	0.002	0.001	0.003	0.005	4.6	0.003

Total Bariu	Total Bery	Total Boro	Total Cadn	Total Chro	Total Coba	Total Copp	Total Lead	Total Man	Total Merc
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	50	100	0	50	25	0	100
0.097	3.00E-04	0.65	1.00E-04	0.001	0.029	0.001	0.001	3.9	5.00E-05
0.09775	3.00E-04	0.6525	0.00017	0.0017	0.0311	0.0017	0.0017	4.285	5.00E-05
0.1	3.00E-04	0.66	3.00E-04	0.003	0.0354	0.003	0.003	5.08	5.00E-05
0.115	3.00E-04	0.705	0.00035	0.003	0.04	0.003	0.0035	6.05	5.00E-05
0.13	4.00E-04	0.71	0.00046	0.003	0.0518	0.0046	0.0056	6.56	5.00E-05
0.13	0.00085	0.71	0.000565	0.003	0.0654	0.0063	0.00665	6.6	5.00E-05
0.13	0.001	0.71	6.00E-04	0.003	0.071	0.007	0.007	6.6	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	50	75	0	37.5	12.5	0	100
0.096	2.00E-04	0.22	1.00E-04	0.001	0.003	0.001	0.001	0.099	5.00E-05
0.0995	2.00E-04	0.22	0.000135	0.00135	0.00405	0.00135	0.00135	0.13085	5.00E-05
0.11	2.00E-04	0.22	2.00E-04	0.002	0.006	0.002	0.0024	0.19	5.00E-05
0.13	2.00E-04	0.225	2.00E-04	0.002	0.0085	0.002	0.003	0.305	5.00E-05
0.17	2.00E-04	0.24	0.00026	0.002	0.0166	0.0042	0.0036	1.66	5.00E-05
0.2075	8.00E-04	0.24	0.000365	0.00265	0.01965	0.00565	0.00465	1.83	5.00E-05
0.22	0.001	0.24	4.00E-04	0.003	0.02	0.006	0.005	1.9	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	50	100	0	62.5	50	0	87.5
0.075	3.00E-04	0.92	1.00E-04	0.001	0.031	0.001	0.001	0.34	5.00E-05
0.076	3.00E-04	0.93	0.00017	0.0017	0.031	0.0017	0.0017	0.3435	5.00E-05
0.079	3.00E-04	0.96	3.00E-04	0.003	0.0326	0.003	0.003	0.354	5.00E-05
0.095	3.00E-04	0.99	3.00E-04	0.003	0.039	0.003	0.003	0.445	5.00E-05
0.1	3.00E-04	1	0.00046	0.003	0.0546	0.0036	0.0046	0.676	5.00E-05
0.115	0.000825	1	0.000695	0.003	0.07	0.00465	0.005	0.8505	5.00E-05
0.12	0.001	1	8.00E-04	0.003	0.077	0.005	0.005	0.91	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	100	0	100	0	0	0	50	0	50
0.063	0.001	1	0.001	0.002	0.12	0.014	0.001	0.42	5.00E-05
0.06625	0.001	1	0.001	0.002	0.141	0.0147	0.001	0.427	5.00E-05
0.076	0.001	1	0.001	0.002	0.2	0.016	0.001	0.46	5.00E-05
0.0775	0.001	1.1	0.001	0.002	0.265	0.016	0.001	0.565	7.50E-05
0.08	0.001	1.1	0.001	0.0046	0.302	0.0216	0.0016	0.758	0.000138
0.083	0.001	1.175	0.001	0.00695	0.3165	0.02395	0.00395	0.8955	0.000157
0.084	0.001	1.2	0.001	0.008	0.32	0.025	0.005	0.92	0.00016
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	37.5	75	0	50	50	0	100
0.057	3.00E-04	1.2	1.00E-04	0.002	0.007	0.003	0.001	0.11	5.00E-05
0.0585	3.00E-04	1.2	0.00017	0.00235	0.00805	0.003	0.0017	0.1135	5.00E-05
0.063	3.00E-04	1.2	3.00E-04	0.003	0.0124	0.003	0.003	0.136	5.00E-05
0.0755	3.00E-04	1.2	4.00E-04	0.003	0.016	0.003	0.003	0.185	5.00E-05
0.076	3.00E-04	1.2	5.00E-04	0.003	0.0182	0.003	0.004	0.206	5.00E-05
0.07825	0.000825	1.275	0.000695	0.00365	0.02485	0.00365	0.0053	0.2165	5.00E-05
0.079	0.001	1.3	8.00E-04	0.004	0.028	0.004	0.006	0.22	5.00E-05
3	3	3	5	5	5	5	5	5	5

0	100	0	20	100	40	20	60	0	100
0.025	3.00E-04	0.76	1.00E-04	0.001	0.001	0.001	0.001	0.006	5.00E-05
0.0251	3.00E-04	0.764	0.00014	0.0014	0.0014	0.0016	0.0014	0.0062	5.00E-05
0.0254	3.00E-04	0.776	0.00026	0.0026	0.0026	0.0034	0.0026	0.0068	5.00E-05
0.026	3.00E-04	0.8	4.00E-04	0.003	0.005	0.004	0.003	0.01	5.00E-05
0.0272	0.00072	0.818	0.00056	0.003	0.0088	0.0054	0.0046	0.0144	5.00E-05
0.0278	0.00093	0.827	0.00074	0.003	0.0142	0.0096	0.0064	0.0216	5.00E-05
0.028	0.001	0.83	8.00E-04	0.003	0.016	0.011	0.007	0.024	5.00E-05
3	3	3	5	5	5	5	5	5	5
0	66.66667	0	80	40	0	0	60	0	100
0.089	0.001	0.63	4.00E-04	0.001	0.01	0.002	0.001	2.8	5.00E-05
0.0901	0.001	0.631	0.00052	0.001	0.0104	0.0024	0.001	3.08	5.00E-05
0.0934	0.001	0.634	0.00088	0.001	0.0116	0.0036	0.001	3.92	5.00E-05
0.1	0.001	0.64	0.001	0.002	0.015	0.005	0.001	4.4	5.00E-05
0.112	0.001	0.664	0.001	0.0048	0.0164	0.0074	0.0028	5.36	5.00E-05
0.118	0.001	0.676	0.001	0.0072	0.0206	0.0116	0.0052	5.54	5.00E-05
0.12	0.001	0.68	0.001	0.008	0.022	0.013	0.006	5.6	5.00E-05
3	3	3	5	5	5	5	5	5	5
0	66.66667	0	40	60	0	0	0	0	100
0.044	3.00E-04	0.76	3.00E-04	0.003	0.008	0.003	0.001	0.18	5.00E-05
0.0454	3.00E-04	0.764	3.00E-04	0.003	0.009	0.0036	0.0014	0.238	5.00E-05
0.0496	3.00E-04	0.776	3.00E-04	0.003	0.012	0.0054	0.0026	0.412	5.00E-05
0.058	3.00E-04	0.8	5.00E-04	0.003	0.013	0.006	0.004	0.7	5.00E-05
0.0754	0.00132	0.812	0.00074	0.0032	0.0156	0.0106	0.0044	0.96	5.00E-05
0.0841	0.00183	0.818	0.00146	0.0038	0.0174	0.0154	0.0056	1.14	5.00E-05
0.087	0.002	0.82	0.0017	0.004	0.018	0.017	0.006	1.2	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	83.33333	0	37.5	100	0	25	37.5	0	100
0.057	3.00E-04	0.78	1.00E-04	0.001	0.006	0.002	0.001	0.094	5.00E-05
0.0585	3.00E-04	0.7825	0.00017	0.0017	0.006	0.00235	0.0017	0.0996	5.00E-05
0.063	3.00E-04	0.79	3.00E-04	0.003	0.0064	0.003	0.003	0.118	5.00E-05
0.0685	3.00E-04	0.82	4.00E-04	0.003	0.009	0.0035	0.003	0.14	5.00E-05
0.072	3.00E-04	0.84	4.00E-04	0.003	0.01	0.0046	0.0046	0.17	5.00E-05
0.07575	0.000825	0.8625	0.00053	0.003	0.0139	0.0063	0.0063	0.2545	5.00E-05
0.077	0.001	0.87	6.00E-04	0.003	0.016	0.007	0.007	0.3	5.00E-05
3	3	3	5	5	5	5	5	5	5
0	100	0	40	100	0	0	40	0	100
0.071	2.00E-04	0.63	1.00E-04	0.001	0.003	0.001	0.001	0.56	5.00E-05
0.072	0.00021	0.633	0.00014	0.0012	0.0032	0.0016	0.0014	0.58	5.00E-05
0.075	0.00024	0.642	0.00026	0.0018	0.0038	0.0034	0.0026	0.64	5.00E-05
0.081	3.00E-04	0.66	4.00E-04	0.003	0.009	0.004	0.003	0.95	5.00E-05
0.0894	0.00072	0.684	0.00048	0.003	0.0094	0.0052	0.0048	1.78	5.00E-05
0.0936	0.00093	0.696	0.00072	0.003	0.0106	0.0058	0.0072	2.02	5.00E-05
0.095	0.001	0.7	8.00E-04	0.003	0.011	0.006	0.008	2.1	5.00E-05
6	6	6	8	8	8	8	8	8	8
0	83.33333	100	100	62.5	50	12.5	37.5	0	100
0.056	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.001	0.018	5.00E-05

0.05625	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.001	0.01905	5.00E-05
0.057	1.00E-04	0.05	1.00E-04	0.001	0.001	0.001	0.001	0.0226	5.00E-05
0.115	1.00E-04	0.05	1.00E-04	0.001	0.001	0.0015	0.001	0.0325	5.00E-05
0.18	1.00E-04	0.05	1.00E-04	0.001	0.001	0.003	0.002	0.0578	5.00E-05
0.27	0.000775	0.05	1.00E-04	0.001	0.0023	0.003	0.002	0.14115	5.00E-05
0.3	0.001	0.05	1.00E-04	0.001	0.003	0.003	0.002	0.18	5.00E-05

Total Moly	Total Nicke	Total Seler	Total Silve	Total Vana	Total Zinc	Free Cyani	Total Cyan	Calcium	Sodium
6	8	2	8	2	8	8	8	8	8
83.33333	0	0	87.5	100	0	87.5	0	0	0
0.001	0.003	0.027	6.00E-05	0.003	0.007	0.004	0.021	200	1500
0.0015	0.00335	0.02755	9.15E-05	0.003	0.007	0.004	0.02135	203.5	1535
0.003	0.004	0.0292	0.00015	0.003	0.0074	0.004	0.022	210	1600
0.003	0.005	0.0325	0.001575	0.003	0.011	0.004	0.026	215	1750
0.003	0.0062	0.0358	0.003	0.003	0.0146	0.004	0.0288	220	1920
0.003	0.00765	0.03745	0.003	0.003	0.03255	0.00465	0.03455	233	2065
0.003	0.008	0.038	0.003	0.003	0.042	0.005	0.037	240	2100
6	8	2	8	2	8	8	8	8	8
83.33333	0	0	100	0	0	100	100	0	0
0.001	0.004	0.012	5.00E-05	0.005	0.006	0.004	0.004	100	450
0.00125	0.004	0.0121	6.75E-05	0.0051	0.00635	0.004	0.004	103.5	457
0.002	0.0044	0.0124	1.00E-04	0.0054	0.0074	0.004	0.004	110	486
0.002	0.0075	0.013	0.00105	0.006	0.01	0.004	0.004	120	525
0.002	0.0128	0.0136	0.002	0.0066	0.014	0.004	0.004	120	556
0.002	0.014	0.0139	0.002	0.0069	0.0166	0.004	0.004	120	605.5
0.002	0.014	0.014	0.002	0.007	0.018	0.004	0.004	120	630
6	8	2	8	2	8	8	8	8	8
100	75	0	87.5	50	12.5	62.5	0	0	0
0.001	0.001	0.022	6.00E-05	0.003	0.005	0.004	0.023	160	1400
0.0015	0.0017	0.02215	9.15E-05	0.003	0.00535	0.004	0.0237	160	1435
0.003	0.003	0.0226	0.00015	0.003	0.0064	0.004	0.0254	160	1540
0.003	0.003	0.0235	0.001575	0.003	0.0085	0.004	0.026	165	1600
0.003	0.003	0.0244	0.003	0.003	0.0136	0.0056	0.0292	180	1940
0.003	0.0043	0.02485	0.003	0.003	0.0205	0.00665	0.03585	180	2100
0.003	0.005	0.025	0.003	0.003	0.024	0.007	0.039	180	2100
6	8	2	7	2	9	8	8	8	8
33.33333	0	0	71.42857	0	0	25	0	0	0
0.001	0.003	0.014	0.00025	0.001	0.021	0.004	0.039	190	2100
0.001	0.003	0.01455	0.00025	0.0012	0.0218	0.004	0.05895	207.5	2100
0.001	0.0034	0.0162	0.00026	0.0018	0.0242	0.0044	0.0964	244	2100
0.007	0.004	0.0195	0.00039	0.003	0.026	0.0075	0.1	255	2400
0.01	0.0046	0.0228	0.005	0.0042	0.038	0.0178	0.112	272	2500
0.0115	0.0102	0.02445	0.005	0.0048	0.0584	0.02295	0.1395	286.5	2890
0.012	0.013	0.025	0.005	0.005	0.07	0.024	0.15	290	3100
6	8	2	8	2	8	8	8	8	8
66.66667	62.5	0	75	50	0	100	100	0	0
0.002	0.001	0.019	7.00E-05	0.003	0.008	0.004	0.004	120	1400
0.00225	0.0017	0.01905	9.80E-05	0.00305	0.008	0.004	0.004	127	1435
0.003	0.003	0.0192	0.00015	0.0032	0.0084	0.004	0.004	140	1540
0.003	0.003	0.0195	0.0016	0.0035	0.011	0.004	0.004	140	1600
0.003	0.003	0.0198	0.003	0.0038	0.0184	0.004	0.004	150	1800
0.003	0.003	0.01995	0.003	0.00395	0.02395	0.004	0.004	150	1865
0.003	0.003	0.02	0.003	0.004	0.025	0.004	0.004	150	1900
3	5	2	5	2	5	5	5	5	5

100	40	0	80	100	0	100	100	0	0
0.001	0.001	0.02	7.00E-05	0.003	0.008	0.004	0.004	190	1400
0.0012	0.0014	0.02045	8.60E-05	0.003	0.0084	0.004	0.004	192	1440
0.0018	0.0026	0.0218	0.000134	0.003	0.0096	0.004	0.004	198	1560
0.003	0.003	0.0245	0.00015	0.003	0.014	0.004	0.004	210	1700
0.003	0.0048	0.0272	0.00072	0.003	0.0442	0.004	0.004	220	1920
0.003	0.0072	0.02855	0.00243	0.003	0.0598	0.004	0.004	220	1980
0.003	0.008	0.029	0.003	0.003	0.065	0.004	0.004	220	2000
3	5	2	5	2	5	5	5	5	5
66.66667	0	0	100	0	0	100	100	0	0
0.001	0.005	0.008	5.00E-05	0.004	0.011	0.004	0.004	260	1500
0.001	0.0052	0.0083	9.00E-05	0.0042	0.012	0.004	0.004	278	1540
0.001	0.0058	0.0092	0.00021	0.0048	0.015	0.004	0.004	332	1660
0.001	0.007	0.011	0.00025	0.006	0.018	0.004	0.004	350	1800
0.0022	0.012	0.0128	0.0008	0.0072	0.0258	0.004	0.004	360	2040
0.0028	0.012	0.0137	0.00245	0.0078	0.0462	0.004	0.004	360	2160
0.003	0.012	0.014	0.003	0.008	0.053	0.004	0.004	360	2200
3	5	2	5	2	5	5	5	5	5
0	0	0	80	50	0	100	60	0	0
0.002	0.004	0.024	0.00015	0.003	0.006	0.004	0.004	200	1300
0.0021	0.0042	0.0245	0.00015	0.0031	0.0062	0.004	0.004	202	1320
0.0024	0.0048	0.026	0.00015	0.0034	0.0068	0.004	0.004	208	1380
0.003	0.006	0.029	0.00025	0.004	0.011	0.004	0.004	210	1500
0.0036	0.0074	0.032	0.0018	0.0046	0.0186	0.004	0.0042	222	1640
0.0039	0.0086	0.0335	0.0027	0.0049	0.0264	0.004	0.0048	228	1760
0.004	0.009	0.034	0.003	0.005	0.029	0.004	0.005	230	1800
6	8	2	8	2	8	8	8	8	8
16.66667	50	0	87.5	50	0	100	100	0	0
0.002	0.001	0.027	6.00E-05	0.003	0.006	0.004	0.004	190	1300
0.00225	0.0017	0.0281	9.15E-05	0.00315	0.00635	0.004	0.004	197	1335
0.003	0.003	0.0314	0.00015	0.0036	0.0074	0.004	0.004	210	1400
0.003	0.003	0.038	0.001575	0.0045	0.008	0.004	0.004	210	1450
0.003	0.0036	0.0446	0.003	0.0054	0.0108	0.004	0.004	220	1620
0.00375	0.00465	0.0479	0.003	0.00585	0.0315	0.004	0.004	226.5	1765
0.004	0.005	0.049	0.003	0.006	0.042	0.004	0.004	230	1800
3	5	2	5	2	5	5	5	5	5
100	0	0	80	50	0	100	100	0	0
0.001	0.002	0.011	8.00E-05	0.003	0.013	0.004	0.004	220	1000
0.0011	0.0022	0.01135	8.40E-05	0.00305	0.013	0.004	0.004	222	1040
0.0014	0.0028	0.0124	9.60E-05	0.0032	0.013	0.004	0.004	228	1160
0.002	0.004	0.0145	0.00015	0.0035	0.022	0.004	0.004	280	1500
0.0026	0.005	0.0166	0.00072	0.0038	0.0302	0.004	0.004	296	1640
0.0029	0.005	0.01765	0.00243	0.00395	0.0338	0.004	0.004	314	1760
0.003	0.005	0.018	0.003	0.004	0.035	0.004	0.004	320	1800
6	8	2	8	2	8	8	8	8	8
100	62.5	100	100	0	87.5	100	100	0	0
0.001	0.001	0.002	5.00E-05	0.001	0.005	0.004	0.004	3.4	2.2

0.001	0.001	0.002	6.75E-05	0.0011	0.005	0.004	0.004	3.47	2.2
0.001	0.001	0.002	1.00E-04	0.0014	0.005	0.004	0.004	3.96	2.32
0.001	0.001	0.002	0.00055	0.002	0.005	0.004	0.004	4.75	3.55
0.001	0.001	0.002	0.001	0.0026	0.005	0.004	0.004	5.32	5.42
0.001	0.001	0.002	0.001	0.0029	0.00695	0.004	0.004	5.73	6.025
0.001	0.001	0.002	0.001	0.003	0.008	0.004	0.004	5.8	6.2

Potassium	Magnesiur	Bicarbonat	Bicarbonat	Carbonate	Carbonate	Chloride
8	8	8	8	8	8	8
0	0	0	0	100	100	0
73	210	280	340	5	5	2700
73.35	224	280	343.5	5	5	2770
74	250	284	350	5	5	2940
77	260	290	355	5	5	3000
78.6	266	300	366	5	5	3120
82.25	270	306.5	370	5	5	3265
84	270	310	370	5	5	3300
8	8	8	8	8	8	8
0	0	0	0	100	100	0
19	140	100	120	5	5	1200
19	143.5	100	123.5	5	5	1235
19	150	104	130	5	5	1300
19.5	150	115	135	5	5	1300
20	160	126	152	5	5	1300
20.65	160	130	160	5	5	1365
21	160	130	160	5	5	1400
8	8	8	8	8	8	8
0	0	0	0	100	100	0
76	210	320	390	5	5	2600
76.35	217	327	397	5	5	2635
77.4	234	340	414	5	5	2700
80.5	250	350	420	5	5	2850
85	270	356	436	5	5	3100
92.85	283	366.5	446.5	5	5	3165
96	290	370	450	5	5	3200
8	8	8	8	8	8	8
0	0	0	0	100	100	0
79	260	350	430	5	5	3400
82.15	281	357	437	5	5	3505
88.8	332	370	454	5	5	3820
91.5	355	380	465	5	5	4050
95.2	378	396	476	5	5	4100
97.3	390	400	486.5	5	5	4425
98	390	400	490	5	5	4600
8	8	8	8	8	8	8
0	0	0	0	100	100	0
77	160	250	300	5	5	2300
77.35	163.5	250	303.5	5	5	2335
78	174	250	310	5	5	2480
80	180	265	325	5	5	2700
82.2	186	276	336	5	5	2800
83	190	371	457	5	5	2865
83	190	420	520	5	5	2900
5	5	5	5	5	5	5

0	0	0	0	100	100	0
77	180	350	420	5	5	2600
77	186	354	426	5	5	2620
77	204	366	444	5	5	2680
78	220	370	450	5	5	2700
80.6	222	382	462	5	5	2720
82.4	228	388	468	5	5	2780
83	230	390	470	5	5	2800
5	5	5	5	5	5	5
0	0	0	0	100	100	0
72	230	190	240	5	5	3500
72.4	238	194	242	5	5	3500
73.6	262	206	248	5	5	3500
75	280	220	270	5	5	3500
76.8	282	252	310	5	5	3520
79.2	288	258	310	5	5	3580
80	290	260	310	5	5	3600
5	5	5	5	5	5	5
0	0	0	0	100	100	0
68	200	210	250	5	5	2700
68.4	206	216	260	5	5	2700
69.6	224	234	290	5	5	2700
71	230	250	310	5	5	2800
73.6	240	262	312	5	5	2980
75.4	240	268	318	5	5	3520
76	240	270	320	5	5	3700
8	8	8	8	8	8	8
0	0	0	0	100	100	0
67	190	300	360	5	5	2400
67.35	197	303.5	363.5	5	5	2470
68.4	214	314	378	5	5	2600
70	220	330	400	5	5	2650
73.8	230	336	410	5	5	2800
77.6	230	346.5	416.5	5	5	2865
79	230	350	420	5	5	2900
5	5	5	5	5	5	5
0	0	0	0	100	100	0
59	180	230	280	5	5	2100
59.2	180	234	286	5	5	2180
59.8	180	246	304	5	5	2420
61	210	250	310	5	5	2500
64.2	226	272	332	5	5	2860
70.8	244	278	338	5	5	3040
73	250	280	340	5	5	3100
8	8	8	8	8	8	8
0	0	0	0	100	100	0
2.9	1.1	18	22	5	5	4

3.04	1.135	20.1	24.8	5	5	4
3.54	1.28	25.2	30.8	5	5	4
4.4	1.45	29.5	36.5	5	5	7
5.82	1.72	33	40	5	5	9
5.965	1.8	33.65	41.3	5	5	9.65
6	1.8	34	42	5	5	10

Appendix B. Time-series Plots

See attached.

APPENDIX O DUST MANAGEMENT PLAN

TENNANT MINING

Dust Management Plan

Nobles Nob Gold Project - Nobles Nob & Juno

Tennant Consolidated Mining Group Pty Ltd

Final Version 1.1

December 2022

Acknowledgement of Country

Tennant Mining acknowledges the Traditional Owners of the lands on which we work. We pay our respects to elders, past, present and emerging.

Disclaimer

Document Control

Version	Personnel	Date
Draft V0.1	Prepared by Yemaya Smythe McGuinness	17/10/2022
Revision V0.2	Reviewed by Ashish Mishra	28/10/2022
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Final V1.1	Reviewed by DITT	16/12/2022

Table of Contents

1 Introduction

This dust management plan has been prepared for the Nobles Nob Gold Project. To provide guidance for the management of the site and meet environmental requirements and conditions of the Mining Authorisation (1123-01) under the Northern Territory *Mining Management Act 2001,* which took effect on 15 August 2022; and commitments made in the approved Mining Management Plan (MMP).

Tennant Consolidated Mining Group (TCMG) holds the title to and operates the Nobles Nob mining tenements, listed in Appendix A. TCMG currently conducts mining exploration on these tenements, with the plan to commence site preparatory works, construction, mining and gold processing operations on site in 2023. TCMG are the nominated operator of the nearby Juno mining tenements, the title is currently held by Tennant Gold Pty Ltd, as listed in Appendix A. TCMG plans to access the Juno tenements for the purposes of dewatering the existing mine workings, groundwater extraction, and potential future mining. It is planned to pipe this extracted water across to the Nobles Nob tenements within a connecting infrastructure corridor, for use in mining and processing operations. Collectively these operations are known as the Nobles Nob Gold Project (the Project).

1.1 Scope & objectives

This dust management plan has been prepared to meet Condition 23 of the Mining Authorisation (1123-01) under the Northern Territory *Mining Management Act 2001,* granted on 15 August 2022. The scope of this plan is to outline the dust management measures that will be implemented throughout site activities including earthworks, construction, and operation. To minimise dust emissions and ensure dust related impacts to site and surrounds are appropriately monitored and mitigated.

The objectives of this dust management plan are to:

- Comply with all applicable legislation, regulations, and approval conditions;
- Address any specific dust management requirements of land owners;
- Outline mitigation measures to manage and minimise the impact of dust emissions from the Project on the community and environment;
- Establish a dust monitoring program to monitor dust levels against national air quality standards;
- Establish a complaints process to investigate any complaints relating to dust in a timely manner;
- Detail corrective actions and responsibilities in the event of an exceedance of a dust trigger level or a legitimate complaint; and
- Outline reporting requirements related to dust management.

This management plan is applicable to all activities associated with the site and will be implemented by all personnel (including contractors) involved in onsite project activities.

1.2 Key site contacts

The Project has two back-to-back site managers, whose contact details are listed below.

Site Manager

Matt Golovanoff
Phone: 0414 867 084
Email: mgolovanoff@tennantmining.com.au

Alternative Site Manager

Michael Hicks
Phone: 0409 703 908
Email: mhicks@tennantmining.com.au

2 Project Area

Nobles Nob is located approximately 13 km southeast of Tennant Creek in the Northern Territory; and Juno is located approximately 10 km southeast of Tennant Creek, and 5 km west of Nobles Nob. The Project area encompasses a total of 419 ha, with 253 ha within Nobles Nob mining tenements, 102 ha within Juno tenements, and 64 ha within the infrastructure corridor between the two sites.

The Nobles Nob and Juno mine sites have been inactive since the 1980s, with only rehabilitation, care and maintenance, and exploration activities undertaken since then. Nobles Nob was historically mined for gold over a period of over 50 years from the late 1930s to the 1980s, with a processing plant located at the same location as the new one will be constructed. Juno was an underground polymetallic mine that operated from 1967 to 1977 and was processed along with ore from other sites at the neighbouring Peko Mine processing plant.

The new Nobles Nob Gold Project involves the construction of a 700 kt+ CIL ore processing plant at Nobles Nob and associated infrastructure, including a tailings storage facility, water management infrastructure including raw and process water dams, water extraction monitoring bores and a water pipeline, a solar field, and energy generation infrastructure. Ore processing, mining and tailings storage activities will occur at the Nobles Nob site, with only water extraction and pipeline activities planned for the Juno site within the initial stages of the project. Once the Juno mine is operational the infrastructure corridor will be used for vehicle access, a water pipeline, and a potential haulage road. Overall the majority of site works will occur at Nobles Nob. The site infrastructure layout at Nobles Nob is shown in Figure 2.1 below.

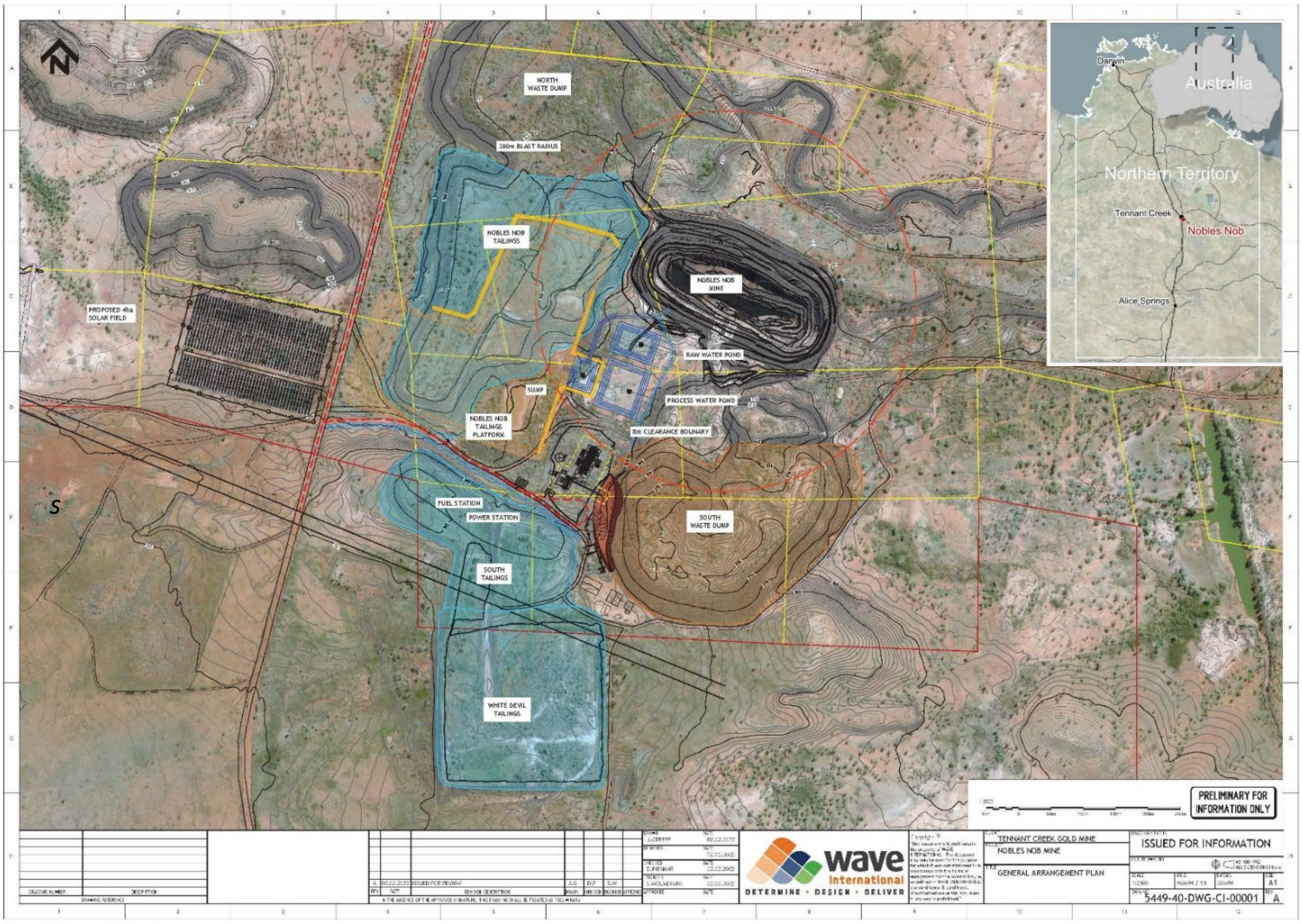

Figure 2.1 Nobles Nob site infrastructure layout.

3 Site Conditions

The Project site is within an *Arid Climate Zone*, as classified by the NT Water Resource Climate Zones, and a *Hot Arid Desert Climate (BWh)* according to the Köppen-Geiger Classificaiton. The Tennant Creek area experiences high temperatures, low rainfall, and high evaporative loss. With a mean daily maximum temperature of 32.1 °C; mean annual rainfall of 466.7 mm concentrated between November and February; a mean number of 181 clear days of sunshine per year; and mean daily evaporation of 10.8 mm (BOM 2022).

There are few permanent surface water bodies in the region, with the majority of available water sourced from groundwater aquifers. The underlying aquifer mapped within the project area is described as *Fractured and Weathered Rocks, with sandstone, conglomerate, minor volcanics* (NR Maps 2022). The climate and geological conditions within the project area mean that the soil is typically dry. This will make it more prone to dust when fine soil is disturbed.

According to the Australian Soil Classification, the dominant soils at Nobles Nob are Kandosol, Rudosol and Tenosol. With Kandosol predominant in the northern part of the infrastructure area including the tailings storage areas and solar field; and Tenosol in the south including the southern wasterock dump and the processing plant. Kandosols are often referred to as red, yellow and brown earth. Rudosols are very shallow soils with minimal soil development and include very shallow rocky and gravelly soils across rugged terrain and pure sand soils in deserts. Areas in the north with more soil development are therefore likely to be more prone to dust when disturbed. However, most of these areas are previously disturbed, with little soil development. The only undisturbed area is the solar field, which will be at a higher risk of dust emissions when cleared.

Average wind speed varies between 15.8 km/h in the afternoon, which is considered *light winds* on the Beaufort Scale; and 22.1 km/h in the morning, which is considered *moderate wind*s on the Beaufort scale. Average monthly wind speeds are fairly consistent throughout the year, with stronger gusts more frequent during the winter months. Wind direction is predominantly East to South-east and is considered *Calm* only 2% of the time (BOM 2022). Wind roses which show the frequency of occurrence of wind speed and direction for the Tennant Creek Airport are included in Appendix B. This will need to be considered in dust management and monitoring on site.

4 Statutory Requirements

The following legislation, statutory obligations and guidelines were considered during the preparation of this dust management plan.

4.1 Commonwealth legislation

There are requirements under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* to provide for the protection of the environment and promote sustainable development and sustainable use of natural resources.

The *National Environment Protection Council Act 1994* establishes the role of the National Environment Protection Council to set National Environment Protection Measures. The *National Environment Protection (Ambient Air Quality) Measure* is in force, with the stated desired environmental outcome of *ambient air quality that minimises the risk of adverse health impacts from exposure to air pollution*. Within the Measure standards are set for air quality pollutants including particulates, and measurement protocols. For particulates the standards are for small airborne particulate matter measuring 10 micrometres in diameter or smaller (PM10); and measuring 2.5 micrometres in diameter or smaller (PM2.5), as outlined in Table 4.1 below. There are no maximum allowable exceedances of these standards. Dust will therefore need to be managed on site to maintain air quality below these standards.

Table 4.1 Standards for particulate pollutants in the NEPM Measure for Ambient Air Quality

Pollutant	Averaging period	Maximum concentration standard*
Particles as PM_{10}	1 day	50 µg/m^3
	1 year	25 µg/m^3
Particles as $PM_{2.5}$	1 day	25 µg/m^3
	1 year	8 µg/m^3

**Concentrations to be calculated as the arithmetic mean of one-hour records over the averaging period. 1 day = calendar day average; 1 year = calendar year average. Measurements are in microgram per cubic metre referenced to a temperature of 0 degrees Celsius and an absolute pressure of 101.325 kilopascals.*

This management plan has been prepared to reduce the impacts of dust on the environment and maintain air quality within the NEPM limits to protect community health.

4.2 NT Environmental Legislation

In the Northern Territory, the *National Environment Protection Council (Northern Territory) Act 1994* is in force, which mirrors the national legislation outlined above. The *Environment Protection Act 2019* also imposes general environmental duty – which means a person must not carry out any activity that causes or is likely to cause environmental harm, unless measures to prevent or minimise the harm have been taken. As well as a duty to notify of environmental harm – to inform the administering authority and landowner or occupier when an incident has occurred that may have caused or threatens serious or material environmental harm.

The *Northern Territory Environment Protection Authority Act 2012* establishes the NT Environment Protection Authority (EPA) as an independent body to advise and report on the implementation of environmental legislation and promote ecologically sustainable development. The NT EPA has set out guiding environmental factors and objectives for key environmental areas. The objective for the factor of Air Quality is to: *Protect air quality and minimise emissions and their impact so that* *environmental values are maintained*. This management plan has been prepared to meet the legislated duties and EPA objective.

4.3 NT Mineral Laws and Regulations

The Northern Territory *Mining Management Act 2001* requires approval of a Mining Management Plan (MMP) for mining authorisation approval, prior to any mining activity (including exploration or operational activities) taking place. An MMP for the Project has been approved, with mining authorisation given as of 15 August 2022. With the following condition of approval:

> **Condition 23:** *A detailed Dust Management Plan, for the purposes of minimising dust emissions and ensuring dust-related impacts to the site and surrounds are appropriately mitigated, must be submitted to the Department for approval prior to the commencement of ground disturbing works.*

The MMP also contains commitments in relation to dust management and controls to be implemented on site, as outlined in Table 4.2 below.

Table 4.2 Commitments relating to dust management contained within the MMP for the Nobles Nob Gold Project

Management actions & Mitigation measures	Targets / performance indicators	Monitoring	Corrective actions and contingencies	Reporting and record keeping
• Dust generated during site activities will be managed through dust suppression controls • Controls will include the use of water carts where necessary • Stockpiles of soil will be covered and kept to heights <3 m • Any vehicle transporting waste or other materials that may produce dust will be covered during transportation	• No complaints regarding dust	• Visual monitoring of dust levels within the Project area during site works • If dust becomes an issue, mitigation measures will be implemented	• Implement more dust suppression activities where required • Community notification will be undertaken, where work is likely to cause impact on the public and nearby residents	• Incident reporting records will be kept • A complaints register will be maintained

This management plan has been prepared to meet the commitments and requirements under the Act, including fulfilment of condition 23 of approval, and commitments made in the MMP.

4.4 Guidelines and strategies

The following guidelines associated with the management of dust have been considered during the preparation of this management plan:

- Airborne Contaminants, Noise and Vibration – Leading Practice Sustainable Development Program for the Mining Industry (DIIS 2009)
- Good Practice guide for assessing and managing the environmental effects of dust emissions (NZME 2001)
- Good practice guide: control and measurement of nuisance dust and PM10 from the extractive industries (MIRO 2011)
- Guideline Dust emissions (DWER 2021)

4.5 Landowner consultation

The Project site is located on Aboriginal freehold land scheduled under the *Aboriginal Land Rights (Northern Territory) Act 1976*, owned by the Warumungu Aboriginal Land Trust. Traditional owners of these sites have been consulted through the Central Land Council during project development, and dust emissions were identified as a key community concern in relation to site works. This dust management plan has been prepared to reduce the risk of dust concerns for the landowners resulting from site works.

5 Site Risk Assessment

There is a potential for dust emissions to be generated from site activities and vehicle movement at all stages of the project, including earthworks, construction, and run of mine. The amount, composition and size of the Project's dust emissions will be influenced by a number of factors, including the nature of the source materials disturbed or handled, the intensity of on-site activities, the climatic conditions being experienced, and the degree of dust mitigation measures implemented during operation.

Mining activities with the potential to generate significant airborne particulate matter during the Project's operation include:

- Wheel generated dust emissions from vehicle movements on unsealed roads
- Dust from uncovered loads during vehicle movement
- Dust from clearing activities
- Dust generated from exposed soil in disturbed areas
- Dust generated from stockpiles
- Dust from extraction of the open cut pit
- Dust from materials handling, crushing, and dumping.

These activities will be concentrated around the main processing area, as shown in the site infrastructure layout in Figure 2.1. The key areas in which dust emissions are more likely include:

- Site access road and tracks on site
- All infrastructure areas during earthworks and construction activities
- Waste rock dump (Southern WRD) to be processed
- Nobles Nob pit during excavation activities
- Run-of-mine (ROM) pad
- Solar field during and post clearing activities.

Given the predominant wind direction of east to south-east, during processing activities there is the potential for wind to blow dust from the wasterock dump and ROM pad across site towards the processing plant, tailings area, and solar field, as shown in Figure 2.1.

6 Mitigation Measures

Based on the site risk assessment undertaken, mitigation measures have been identified to reduce the risk of dust emissions on site. Table 6.1 below outlines the key risks identified, the associated mitigation measures that will be implemented on site, and the responsible personnel. Dust mitigation measures will be implemented in high-risk areas and during activities with the potential to generate dust. The aims will be to minimise visual dust emissions on site as measured by monitoring activities; to maintain dust levels below the NEPM standards for ambient air quality; and avoid community complaints.

Table 6.1 Dust risk and mitigation measures

Dust risk	Mitigation measures	Responsible personnel
Dust emissions from disturbed areas	Active work areas will be wetted down with water trucks as required, to minimise the production of airborne dust.	Site Manager and water cart operators
	Unused disturbance areas will be kept to a minimum. Vegetation clearing and topsoil stripping is to be conducted immediately before overburden stripping begins.	TCMG management and Site Manager
	Vegetation clearing and topsoil stripping will be avoided as much as possible when wind conditions and low moisture promote dust generation.	TCMG management and Site Manager
	Cleared vegetation will be windrowed to reduce surface wind speeds.	TCMG management and Site Manager
	The rehabilitation of disturbed areas will be performed as soon as practicable. The forming of final surfaces will be avoided during dry and windy weather.	TCMG management and Site Manager
Dust emissions from dumps and stockpiles	As the wasterock dump is progressively removed for processing, the remaining areas will be rehabilitated as soon as practicable. Disused roads will be windrowed off as appropriate to prevent vehicular access.	TCMG management and Site Manager
	Stockpiles of soil will be covered and kept to heights <3 m.	TCMG management and Site Manager
Dust emissions from traffic movement	Vehicles will be operated at speeds that avoid the generation of excessive dust, with maximum speeds of 40 km/hr on site. Speed limits will be sign posted.	Site Manager and vehicle operators
	Water trucks will regularly wet down unsealed roads and tracks that are in frequent use. The frequency of watering will be determined by the traffic frequency and wind conditions.	Site Manager
	Any dropped ore or waste rock will be graded off the road surface as soon as possible, to minimise the chance of fines and dust being generated.	Site Manager and vehicle operators

Dust risk	Mitigation measures	Responsible personnel
	Graded ore will be pushed into a heap where it can be recovered.	
	Any vehicle transporting waste or other materials that may produce dust will be covered during transportation.	Site Manager and vehicle operators
Dust emissions from material handling during operations	Drop heights will be minimised when handling ore, soil and waste rock, and double handling will be avoided wherever practicable.	Site Manager and operators
	Overloading will be avoided to limit spillage during transit.	Site Manager and operators
Dust emissions from drilling	Drilling rigs will be fitted with effective dust control and collection equipment. Dust curtains, water sprays and air extraction systems will be implemented wherever practicable.	Site Manager and drill operators
	Drill pads and adjacent hardstand areas; as well as drill cuttings including dust cones will be wetted down to prevent dust generation. Care will be taken when moving drilling equipment not to disturb drill cuttings.	Site Manager and drill operators
	In the event of defects that prevent the effective operation of a drill rig dust suppression system, the drill rig operator will cease operations until the defect is rectified.	Site Manager and drill operators
Dust exposure to operators	Personnel operating trucks, earthmoving or loading equipment will ensure the cab windows are closed so cab dust (air con) filter systems can operate effectively during operations as appropriate to the machine.	Operators
	Vehicle cab dust filter systems will be maintained to ensure the system remains effective.	Operator management
	Operators to remain within the dust filtered cab during operations as much as practicable. Vehicle operators are to report defective cab dust filter systems in accordance with a preventative maintenance schedule.	Operators

6.1 Training and Awareness

The requirements of this plan will be provided to contractors and employees through training, site induction, toolbox talks, and site alerts. Training will be part of the safety inductions that will be conducted prior to commencing site work. It will be a mandatory requirement that everyone undertaking any site work will have to be properly inducted. All inductions are to be recorded in the TCMG Training Register on *Skytrust*.

Site inductions will cover:

- Identification of site environmental values
- An understanding of the requirements of applicable environmental management and monitoring plans
- Roles and responsibilities of site personnel
- Communication procedures (both normal and emergency)
- Incident reporting procedure to be followed on site
- Environmental emergency response procedures
- Site environmental controls required to be implemented
- The potential consequences of not meeting environmental obligations/responsibilities.

6.2 Complaint management

Any community complaints received in relation to dust concerns will be recorded and follow-up action taken as warranted. It will be the responsibility of the Stakeholder Engagement Manager to liaise with the complainant, and the Site Manager to implement the appropriate site investigations and controls. All complaints and follow up actions are to be recorded in the TCMG Training Register on *Skytrust*. Follow up actions may include some or all of the following steps, as appropriate to the nature of the complaint:

- Liaison with the complainant to verify the concerns and assure them that a follow up investigation will occur as appropriate
- A visual site inspection of the site of the complaint
- An investigation of meteorological conditions at the time of the incident
- An investigation of potential dust generating sources in the vicinity of the complaint site
- A review of visual and depositional dust monitoring results
- If the site of the complaint is outside of the depositional monitoring area, a new monitoring site could be established if the concern is ongoing and not explained by an exceptional event
- A review and adjustment of dust controls on site, e.g. increased frequency of water carts during related disturbance activities
- Communication with the complainant to explain the actions taken and ensure that the concerns have been addressed.

7 Monitoring

7.1 Visual monitoring

Regular site monitoring will be undertaken to visually monitor for dust and ensure the mitigation measures are appropriately implemented on site. This will be included in weekly environmental monitoring to be conducted on site, once site works commence. Monitoring of all active work areas will be undertaken, including the site access road and tracks being utilised.

In cases where dust emissions are observed, this will be recorded and reported to the site manager. The site manager will then adjust the type or frequency of dust mitigation measures as appropriate.

All operational staff will also be responsible for reporting excessive dust observed on site to the site manager. Details of this will be included within site environmental inductions, which are required to be completed by all site personnel upon commencing site works.

7.2 Dust deposition monitoring

Dust deposition gauges will be installed at monitoring stations and monitored monthly during all active site works. These will be located to the west of site, downwind of the prevailing wind conditions, as shown in Figure 7.1 below.

The monthly dust deposition monitoring program will measure dust deposition (fall out) data for the management of background dust levels in accordance with *AS/NZS 3580.10.1:2016: Methods for sampling and analysis of ambient air: Determination of particulate matter - Deposited matter - Gravimetric method*. This will be achieved by sampling dust particulate matter at the designated dust deposition monitoring locations every 30 days following the methodology outlined in Appendix C.

The dust deposition gauges will provide deposited dust results (total solids) in g/m^2/month. The analysis of samples will be undertaken at a NATA accredited laboratory. Monthly results will be analysed for any exceedances of the NEPM measures for Ambient Air Quality as shown in Table 4.1.

If exceedances of the NEPM measures for Ambient Air Quality are exceeded on a given month, samples will also be analysed for ash content, combustible matter, total soluble matter and total insoluble matter to assist in determining possible contamination and dust sources.

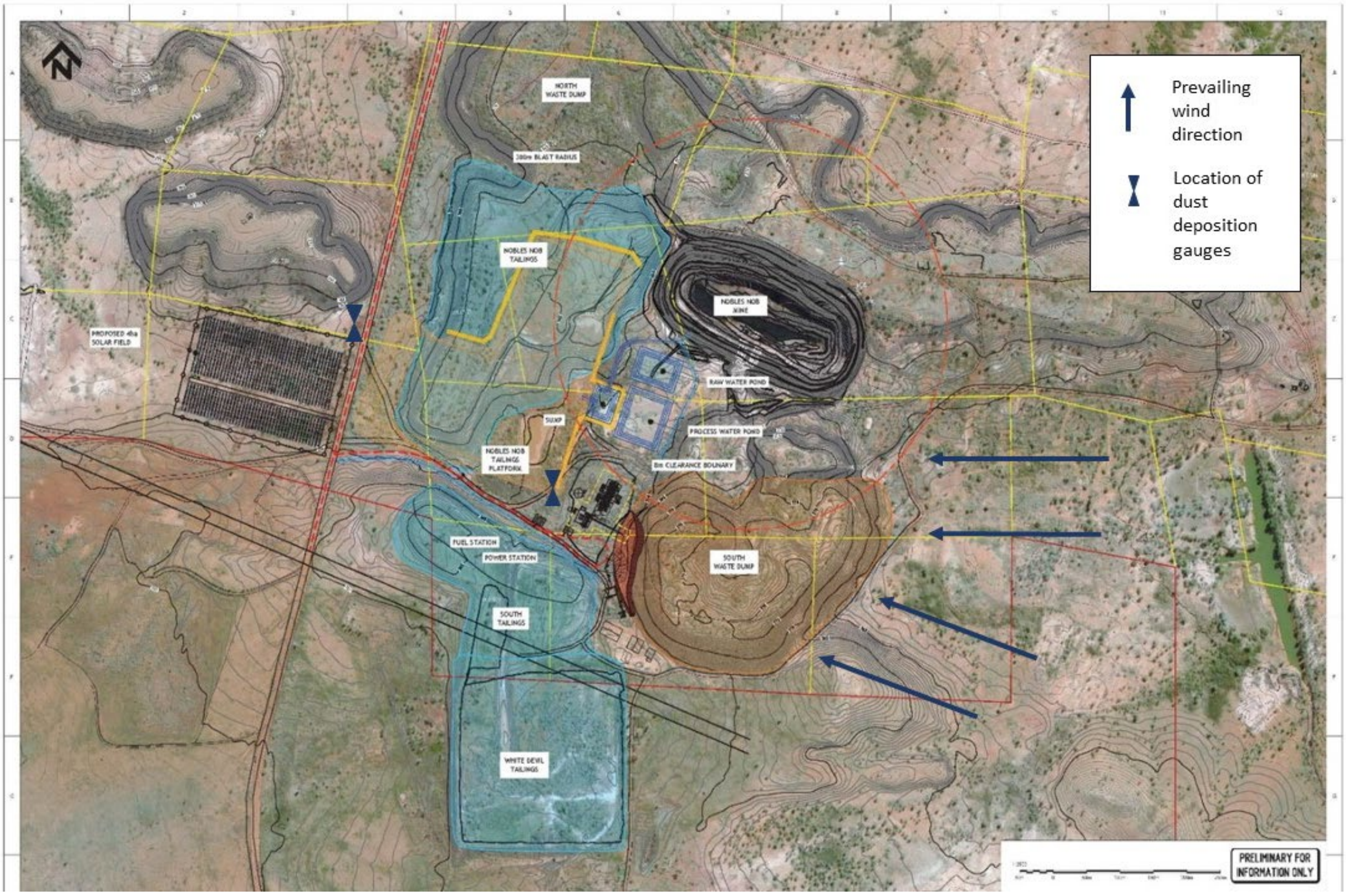

Figure 7.1 Location of dust deposition monitoring stations on site

8 Record Keeping and Reporting

8.1 Record keeping

Records will be kept within the Tennant Mining environmental management system, training register, and incident register, within the online document management system *Skytrust.* This includes:

- Weekly environmental monitoring field inspection sheets
- Records of inductions
- All incidents and near-misses
- Any community complaints received.

In the event of an incident, the Site Manager will record the following details:

- The time, date, nature, duration and location of the incident or non-conformance;
- The nature of the incident/non-conformance and the cause;
- Details of the circumstances in which the incident/non-conformances occurred; and
- The actions that have been taken and are proposed to be taken to deal with the incident/non-conformance.

If a community complaint is received, the personnel receiving the complaint will record the following details:

- The date and time of the complaint;
- The nature of the complaint (e.g. dust);
- The method by which the complaint was received (e.g. by telephone);
- The name and title of the person who received the complaint;
- The personal details of the complainant, if made available, or if no details were provided, a note to that effect.

The Site Manager will then be responsible for following up on the complaint, and will record the following information:

- The action taken in relation to the complaint, including any follow-up contact, the outcome of investigations and any required on-going actions; and
- Any follow-up actions taken, or reasons why no action was taken.

8.2 Notification procedure

In the event of an environmental incident the DITT Chief Executive Officer will be notified of the occurrence via a Notification of an Environmental Incident Form as soon as practicable, as required by section 29 of the *Mining Management Act 2001*. Any significant pollution events will also be reported to the NT EPA Pollution Hotline:

NT EPA Pollution Hotline
Phone: 1800 064 567

The duty to notify will be applicable to the following people:

- The personnel/contractor/sub-contractor undertaking the activity; and
- TCMG management as the responsible operator of the site.

8.3 Reporting

TCMG's Environmental Manager will prepare an annual report detailing the implementation of this management plan in the year prior. This information will be included within the annual Environmental Mining Report to be submitted to the NT Mining Authority. This will include:

- Details of site control activities implemented to address dust emissions
- An indication of the implementation success and suitability of the mitigation measures outlined in Table 6.1
- Details of weekly visual monitoring, including any excessive dust observed, and the mitigation measures implemented in response
- Details of monthly dust deposition monitoring results, any exceedances of the NEPM guidelines for ambient air quality, details of contributing events, and measures implemented in response
- Any modifications to controls required to improve dust management on site.

8.4 Review

Monitoring and reporting information will be used to track and assess the effectiveness of dust management practices. Where found ineffective, or improvements or modifications have been identified, this will trigger a review of this management plan. This management plan will also be reviewed and updated with any significant alterations in project planning and development, or site layout.

9 References

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Appendix A. Mining Tenements

The mining tenements the subject of this management plan include those listed in Table A below, comprising the historic Nobles Nob and Juno mining areas.

Table A Mining tenements to which this dust management plan applies.

Site	Tenement	Title Holder	Nominated Operator
Nobles Nob	MLC512	TCMG	TCMG
Nobles Nob	MLC513	TCMG	TCMG
Nobles Nob	MLC514	TCMG	TCMG
Nobles Nob	MLC515	TCMG	TCMG
Nobles Nob	MLC516	TCMG	TCMG
Nobles Nob	MLC517	TCMG	TCMG
Nobles Nob	MLC521	TCMG	TCMG
Nobles Nob	MLC525	TCMG	TCMG
Nobles Nob	MLC526	TCMG	TCMG
Nobles Nob	MLC531	TCMG	TCMG
Nobles Nob	MLC532	TCMG	TCMG
Nobles Nob	MLC533	TCMG	TCMG
Nobles Nob	MLC534	TCMG	TCMG
Nobles Nob	MLC537	TCMG	TCMG
Nobles Nob	MLC538	TCMG	TCMG
Nobles Nob	MLC539	TCMG	TCMG
Nobles Nob	MLC540	TCMG	TCMG
Nobles Nob	MLC541	TCMG	TCMG
Nobles Nob	MLC542	TCMG	TCMG
Nobles Nob	MLC543	TCMG	TCMG
Nobles Nob	MLC544	TCMG	TCMG
Nobles Nob	MLC545	TCMG	TCMG
Nobles Nob	MLC548	TCMG	TCMG
Nobles Nob	MLC549	TCMG	TCMG
Nobles Nob	MLC550	TCMG	TCMG
Nobles Nob	MLC556	TCMG	TCMG
Nobles Nob	MLC589	TCMG	TCMG
Nobles Nob	MLC590	TCMG	TCMG
Nobles Nob	MLC688	TCMG	TCMG
Nobles Nob	MLC689	TCMG	TCMG
Nobles Nob	MLC690	TCMG	TCMG
Nobles Nob	MLC691	TCMG	TCMG
Juno	MCC284	Tennant Gold Pty Ltd	TCMG
Juno	MLC154	Tennant Gold Pty Ltd	TCMG
Juno	MLC155	Tennant Gold Pty Ltd	TCMG
Juno	MLC45	Tennant Gold Pty Ltd	TCMG
Juno	MLC46	Tennant Gold Pty Ltd	TCMG
Juno	MLC47	Tennant Gold Pty Ltd	TCMG
Juno	MLC578	Tennant Gold Pty Ltd	TCMG
Juno	MLC579	Tennant Gold Pty Ltd	TCMG
Juno	MLC652	Tennant Gold Pty Ltd	TCMG
Juno	MLC68	Tennant Gold Pty Ltd	TCMG

Appendix B. Wind Roses for Tennant Creek Airport

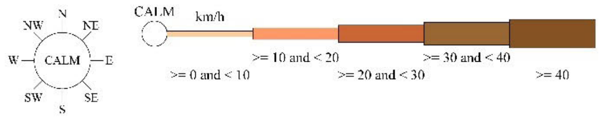
Rose of Wind direction versus Wind speed in km/h (25 Jul 1969 to 10 Aug 2022)

Custom times selected, refer to attached note for details

TENNANT CREEK AIRPORT

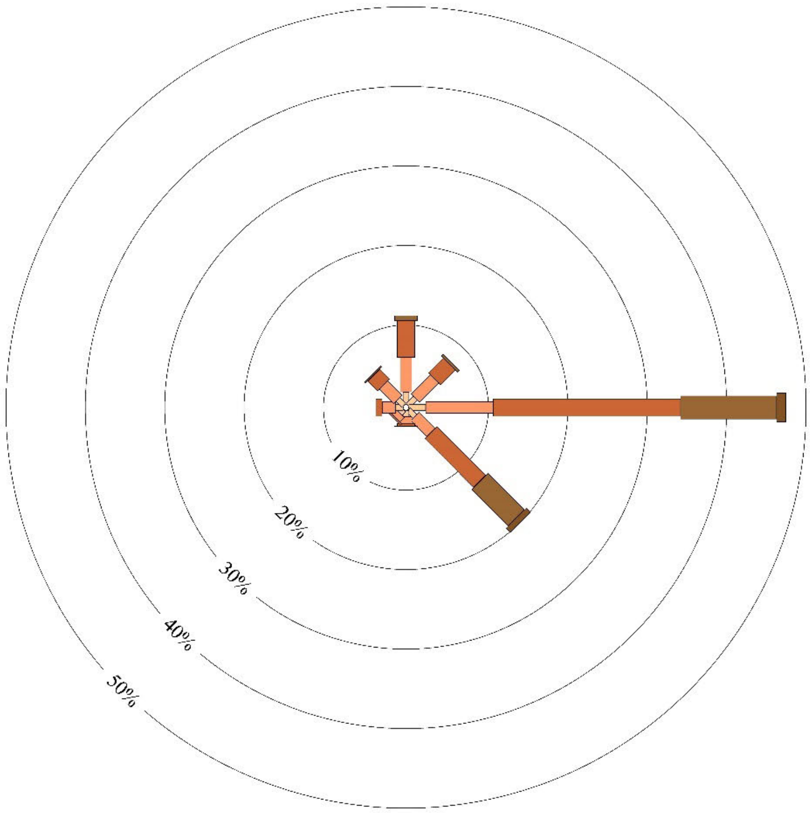
Site No: 015135 • Opened Jan 1969 • Still Open • Latitude: -19.6423° • Longitude: 134.1833° • Elevation 375.m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
21618 Total Observations

Calm 2%



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Rose of Wind direction versus Wind speed in km/h (25 Jul 1969 to 10 Aug 2022)

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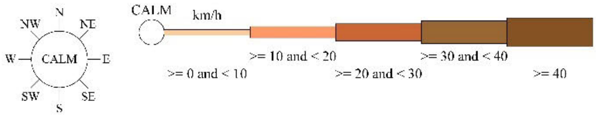
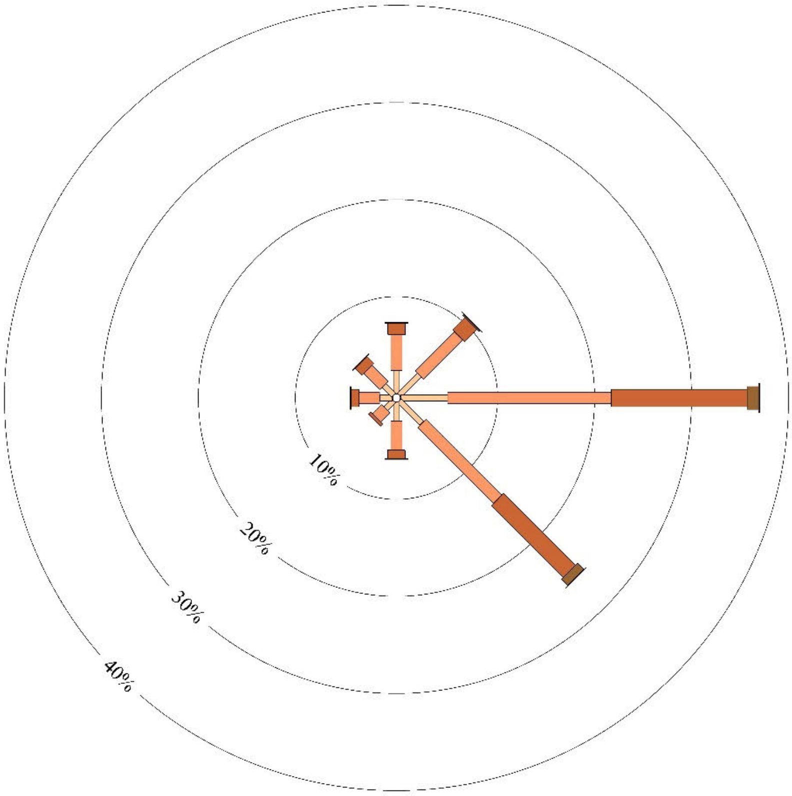


3 pm
21423 Total Observations

Calm 2%



Australian Government
Bureau of Meteorology

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Appendix C. Methodology for dust depositional monitoring

Australian Standard *AS/NZS 3580.10.1:2016: Methods for sampling and analysis of ambient air: Determination of particulate matter - Deposited matter - Gravimetric method* outlines the equipment required to collect depositional dust samples. The key equipment is a deposit gauge, which comprises a 150 ± 10 mm diameter funnel inserted into a glass bottle (at least 4 L in size) through a rubber stopper. This equipment is to be provided by the NATA accredited laboratory used for analyses. The deposit gauge and stand are erected so that the height of the top of the funnel is 2 m ± 0.2 m above the ground level of the immediate surrounding area. A typical depositional monitoring gauge and site setup is shown in Figure C below.

Once the gauge is installed on site, the following procedure is to be followed:

- After 30 days ± 2 days, any deposited matter in the funnel is washed into the glass bottle using distilled water;
- The funnel is then removed and the glass bottled sealed with a lid;
- The glass bottle is appropriately labelled to denote site location, the date sampling began and ended, and the funnel diameter to the nearest millimetre; and
- A fresh bottle is then prepared and installed in the dust gauge with a clean funnel.

The glass bottle can also collect rainwater and other material such as bugs and leaf litter, etc. This does not contaminate the sample and should not be removed in the field. However, it is recommended that the type of any contamination be noted for each sample at the time of collection (for example, note the presence of bird droppings, leaf litter, sticks, spider webs, Christmas beetles, etc. or whether the bottle was broken). This record may help explain unusual results (such as high insoluble matter) during laboratory analysis.

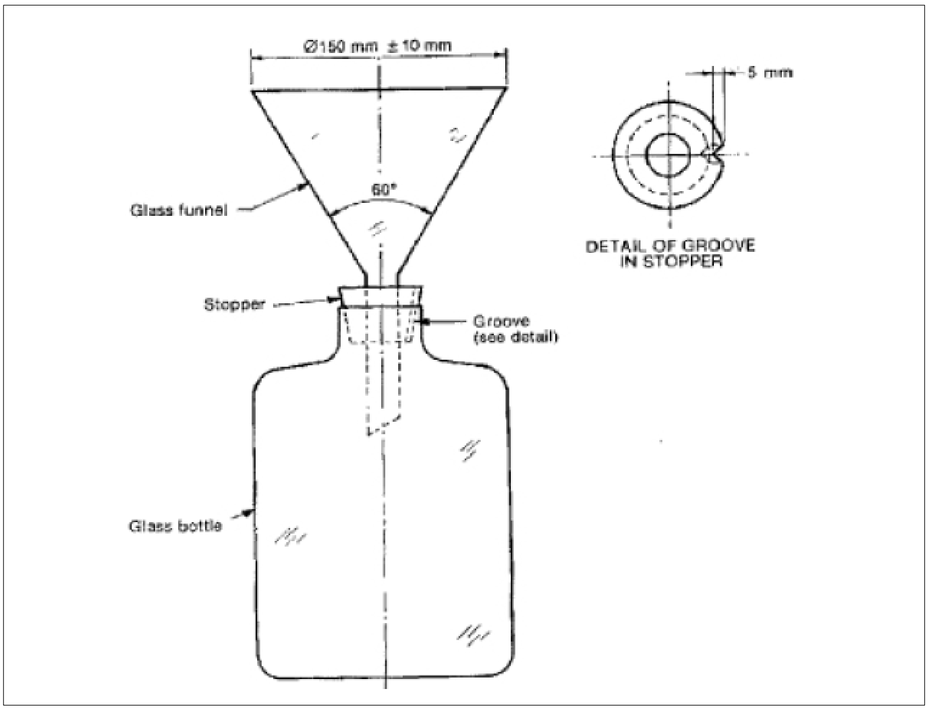

Figure C. Typical deposition dust bottle, field setup on stand, and sample bottle replacement.

APPENDIX P ENVIRONMENTAL POLICY

Tennant Consolidated Mining Group
Environmental Policy

1. Introduction

Tennant Mining is committed to sustainable development. We recognize that the long-term sustainability of our business is dependent upon good stewardship in both the protection of the environment and our communities. We will ensure that all employees, directors, officers, contractors, agents, consultants and any other party representing Tennant Mining are aware of this policy and the responsibilities which it sets out.

2. Policy objectives

Tennant Mining's Environmental objectives include:

- To comply with all applicable environmental laws, regulations and requirements;
- To undertaking proactive environmental management practices; and
- To implement effective environmental risk management.

3. Scope

This policy applies to all employees, directors, officers, contractors, agents, consultants and any other party representing Tennant Mining wherever it operates across the world.

4. Policy statements

- We recognise that sustainability is an integral and multi-disciplinary part of our business that must be considered in all decisions;
- We will comply at all times with environmental laws and regulations with the objective to go beyond compliance to undertake proactive environmental management practices;
- We continuously review our operations to identify, assess and control environmental impact and actively promote the reduction of waste within our operation;
- We will set company-wide environmental targets and performance against these targets will be monitored, measured and reported on to the Board;
- We will report any actual or potential environmental incidents or spills irrespective of the severity and report on our environmental performance;
- We recognize the increasing awareness within our industry of climate change and the need to participate in solutions that address the long-term impact of climate change, including where feasible, the reduction of greenhouse gas emissions;
- We recognize the sensitivity around water management and water scarcity, where we will aim to constantly improve water management systems and their efficiency, and to monitor our usage of water resources in our areas of operation; and
- We are committed to transparent communication and stakeholder engagement with interested and affected parties on environmental aspects of our activities.

5. To achieve the objectives we will:

- Develop a culture that recognises the importance of demonstrating environmental leadership behaviour by embedding this as an expectation in all our planning, systems and procedures;
- Work to continually improve our environmental performance over time, including with regard to increasing our energy efficiency and reducing emissions and waste, and to promote sustainable development in the areas in which we operate;
- Undertake all necessary environmental assessments for our operations and use the best available evidence to identify how we can prevent, minimise, mitigate or remediate any harmful effects of our operation on the environment;
- Monitor, maintain and improve, where required, environment risks through the use of robust systems, governance and assurance processes;

- Work to ensure that we have technically sound plant and equipment; and work that is well designed, planned, executed, supervised and approved by trained and competent people;
- Provide appropriate levels of training, development and mentoring to ensure our employees and contractors are aware of the requirements of this policy and how it is implemented;
- Encourage our people to collaborate and share learnings to proactively prevent environmental incidents;
- Learn from incidents and strive to continually improve our environmental performance;
- Strive to be transparent in our public disclosure on environmental matters, particularly those relating to risk management systems in place and mitigation of environmental risk; and
- Conduct effective, meaningful, and comprehensive stakeholder engagement processes throughout the life of operations.

6. Policy Review

This policy will periodically be reviewed by the Board to ensure it continues to meet both regulatory and contemporary industry standards and practices.

APPENDIX Q SECURITY CALCULATION