



Submitted to: QKR Namibia Navachab Gold Mine (Pty) Ltd.
Attention: Mr George Botshiwe
P O Box 150
Karibib, Namibia.

REPORT:

NAVACHAB GOLD MINE ON ML 31, KARIBIB ERONGO REGION – AMENDMENT REPORT

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Client Name: Mr George Botshiwe

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Authors: Environmental Compliance Consultancy (Pty) Ltd

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ENVIRONMENTAL COMPLIANCE CONSULTANCY CONTACT DETAILS:

We welcome any enquiries regarding this document and its content. Please contact:



Environmental Compliance Consultancy
PO Box 91193, Klein Windhoek, Namibia
Tel: +264 81 669 7608
Email: info@eccenvironmental.com

Quality Assurance

Authors:



Monique Jarrett

Environmental Compliance Consultancy

Checked By:



Carlene Baufeldt

Environmental Compliance Consultancy

Approved By:



Jessica Bezuidenhout

Environmental Compliance Consultancy

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EXECUTIVE SUMMARY

Environmental Compliance Consultancy (Pty) Ltd (ECC) has been engaged by QKR Namibia Navachab Gold Mine (Pty) Ltd (“the Proponent” or “Navachab”) to prepare and submit an environmental clearance certificate amendment application. This is a draft amendment to the approved trial underground mining and current operational mining activities on mining licence 31 (ML 31), in accordance with the Environmental Management Act, No. 7 of 2007, and the 2012 Regulations. This draft amendment report is thus an update of the report to include phase II of the Underground exploration drive and an underground mine. In addition to this the Proponent also intends to install an additional explosives magazine to store ammonium nitrate (AN) and fuel oil (FO) (ANFO) bags (40 000 kg). This third magazine is included in the amendment report and assessment, and update to the OEMP.

SCREENING PHASE

The screening phase determined that the most likely potential environmental and social impacts could include:

- Surface water and groundwater impacts
- Air quality impacts
- Biodiversity (flora and fauna) impacts
- Noise impacts
- Waste impacts
- Built environment impacts
- Heritage impacts
- Visual impacts
- Socio-economic: economic impacts

SCOPING PHASE

This draft scoping report, with impact assessment, (or amendment report) scoped the available data and any gaps that need to be filled; determined the spatial and temporal scope; identified the assessment methodology; and determined and assessed which impacts were likely to be significant (the main focus of the assessment) from the additional activities that will be taking place as part of this phase II of underground mining activities and the addition of an extra explosives magazine.

The scope of the assessment was determined through assessing the proposed Project against the receiving environment obtained through a desktop review, available site-specific literature, previous amendment report for the trial underground mining activities. The study area extends beyond the mining licence boundary and includes the nearby receptors, such as farmsteads and Karibib town, regarding groundwater-related impacts only.

ASSESSMENT PHASE

The findings of the assessment chapter (Chapter 7) provided the basis for determining the significance of potential impacts. Final mitigation measures and recommendations are based

on the cumulative experience of the consulting team and the client, taking into consideration the potential environmental and social impacts.

A summary of those impacts and their ratings after mitigation are shown below. On a scale from 1 to 12, low to high, the beneficial (B) and negative (N) impact significance is stated. Some variation between the sub-sections of these aspects exists so the average significance is stated for some aspects.

Socio-economic environment: Economic		Socio-economic environment: Social		Biophysical environment	
National and local economy	B6	Visual impacts	N2	Surface water impacts	N3
Job creation and skills development	B4	Air quality impacts	N2	Groundwater impacts	N3
		Heritage impacts	N3	Soil impacts	N1
		Noise impacts	N1	Biodiversity (fauna and flora) impacts	N3
		Waste impacts	N3	Waste impacts	N3
		Built environment impacts	N3	Cumulative impacts	N3
		Cumulative impacts	N2		

In terms of section 44 in amending an environmental clearance certificate, these noted changes, and potential related impacts have been re-assessed in this report and will be submitted to the mining commissioner (MC) at the Ministry of Industries, Mines and Energy (MIME) as the component authority, the environmental commissioner (EC) at the Ministry of Environment, Forestry and Tourism (MEFT), other government stakeholders and registered interested and affected parties for their review and comment for a period of 7 days from 10 November 2025 – 17 November 2025. The phases of the amendment (scoping and impact assessment) are provided in Figure 1.

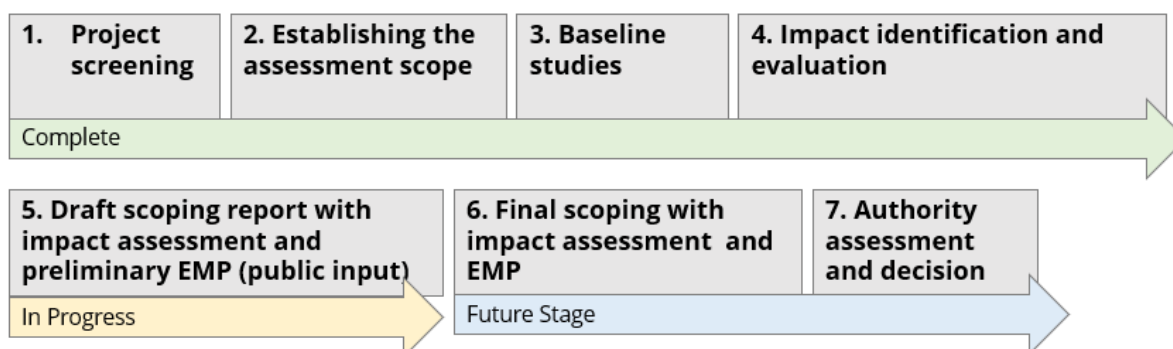


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ABBREVIATIONS

ABBREVIATION	DESCRIPTION
%	percentage
~	approximately
<	greater than
>	less than
°C	degrees Celsius
μPa	micro pascal
Airshed	Airshed professional Planning (Pty) Ltd
AMD	acid mine drainage
AMSL	Above mean sea level
AN	ammonia nitrate
AN16	Anomaly 16 mining area
ANFO	ammonium nitrate and fuel oil
AQIA	Air Quality Impact Assessment
ARD	acid rock drainage
ASTM	American Society for Testing and Materials
Au	gold
BID	background information document
CaCO ₃	calcium carbonate
CBD	Convention on Biological diversity
CBD	Convention on Biological diversity
CIA	cumulative impact assessment
CIL	carbon-in-leach
CIP	carbon in pulp
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CM	control marble
CN	cyanide
CO	carbon monoxide
CO ₂	carbon dioxide
CoM	Namibia Chambers of Mines
CRF	cemented rock fill
CT	cable bolts
dBA	decibels
dBA	decibels A-weighted
DCP	dynamic core penetration
DCS	dynamic cable support bolts
DEAF	Department of Environmental Affairs and Forestry
DMS	dense media separation
DoF	Department of Forestry
DWA	Department of Water Affairs
E	east
e.g.	for example
EAP	environmental assessment practitioner

ABBREVIATION	DESCRIPTION
ECC	Environmental Compliance Consultancy (Pty) Ltd
ECO	environmental control officers
EMA	Environmental Management Act, No 7 of 2007
EMP	environmental management plan
ENE	east - northeast
EPRP	emergency preparedness and response plan
ERC	Erongo Regional Council
ESIA	environmental and social impact assessment
FAO	Food and Agriculture Organisation of the United Nations
FO	fuel oil
FW	footwall
g	gram
g/m	grams per metre
GBV	gender based violence
GDP	gross domestic product
HAZMAT	hazardous material
HDPE	high-density polyethylene
HGB	hollow grouted bolts
HIV/AIDS	human immunodeficiency virus / acquired immunodeficiency syndrome
HME	heavy mining equipment
HT	high temperature
HW	hanging wall
Hz	hertz
I&APs	interested and affected parties
IARC	International Agency for Research on Cancer
ICMM	International Council on Mining and Minerals
IFC	International Finance Corporation
IT	integrated tool carrier
kg	kilograms
km	kilometres
km/h	kilometres per hour
km ²	square kilometres
KRC	Karibib Town Council
kVA	kilovolt-ampere
kW	kilowatts
kWh/m ² /day	Kilowatt-hour per metres squares per day
L/min	litres per minute
LAeq	equivalent continuous sound level representing a single, constant noise level that contains the same total energy as fluctuating sound over a specific period of time
LHD	load-haul-dump
LNAPL	light non-aqueous phase liquid
LOM	life of mine

ABBREVIATION	DESCRIPTION
LP	long period
LP	low pressure
LR,dn	The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the period of a day and night
LReq,d	The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the day-time period
LReq,d	The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the night-time period
LS	lower schist
m	metre
m/d	metre per day
m/day	metre per day
m ³ /day	cubic metres per day
MAFWLR	Ministry of Agriculture, Fisheries, Water and Land Reform
masl	metres above sea level
mbgl	meters below ground level
MC	marble-calc-silicate
MDM	marble and dolomitic marble
MEFT	Ministry of Environment, Forestry and Tourism
mg/L	milligram per litre
mg/l NO ₃ ⁻ -N	Nitrate concentrate
mg/m ² /day	milligrams per metres squared per day
MHSS	Ministry of Health and Social Services
MIME	Ministry of Industries, Mines and Energy
ML	mining licence
mm	millimetre
MSDS	material safety data sheets
Mt	million tonnes
N\$	Namibian dollar
N/A	Not applicable
NAQ	Navachab air quality
NCE	Namibia Chamber of Mines
NDP 6	National Development Plan 6
NH ₄ NO ₃ ,	Nitroglycerine
NHC	National Heritage Council
No.	number
NOx	nitrogen oxides
NQ	noise quality
NSA	Namibian Statistics Agency
NSR	noise sensitive receptors
NW	north-west
OEMP	operational environmental management plan
OHSE	operational health, safety and environment

ABBREVIATION	DESCRIPTION
p.a.	per annum
P.O. Box	Post office box
Pa	Pascal
PCDs	pollution control dams
PM	particulate matter
PM10	particulate matter with an aerodynamic diameter of less than 2.5µm (thoracic particles)
PM2.5	particulate matter with an aerodynamic diameter of less than 10µm (respirable particles)
PN	pressure nominal
PPE	personnel protective equipment
Pty	Propriety
QKR	QKR Navachab Gold Mine (Pty) Ltd or Navachab
RH	relative humidity
RoD	record of decision
ROM	run of mine
SANS	South African National Standards
SCZ	Southern Central Zone
SEQT	safety, environment, quality and training management plan
SHE	safety, health and environment
SLOS	sublevel open stoping
SOP	standard operating procedure
SOx	sulphur oxides
STP	Sewage Treatment Plan
SW	southwest
SWMP	storm water management plan
t	tonnes
TB	tuberculosis
TDS	total dissolved solids
TNT	Trinitrotoluene
ToR	terms of reference
TSF	tailings storage facility
TSP	total suspended particulates
US	upper schist
USD	United States of America Dollar
V	volts
VOC	volatile organic compounds
VPM	vertical power mill
WHO	World Health Organisation
WRB	World Reference Base for Soil Resources
WRD	waste rock dump

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Environmental Compliance Consultancy (Pty) Ltd (ECC) has been engaged by QKR Namibia Navachab Gold Mine (Pty) Ltd (“the Proponent” or “Navachab”) to prepare and submit an environmental clearance certificate amendment application. This is an amendment to the approved trial underground mining and current operational mining activities on mining licence 31 (ML 31), in accordance with the Environmental Management Act, No. 7 of 2007, and the 2012 Regulations. The environmental clearance certificate for the activities on ML 31 is valid from 19 December 2022 to 19 December 2025 (Appendix A). An environmental clearance certificate renewal application is therefore submitted together with this environmental scoping report, with impact assessment, and updated operational environmental management plan (OEMP) (Appendix B), for the amendment application.

The Navachab gold mine is owned and operated by QKR Namibia Navachab Gold Mine (Pty) Ltd. The mine is located on Navachab Farm No. 58, which is located approximately 180 km north-west of Windhoek and approximately 10 km from Karibib, Erongo Region, Namibia (Figure 2).

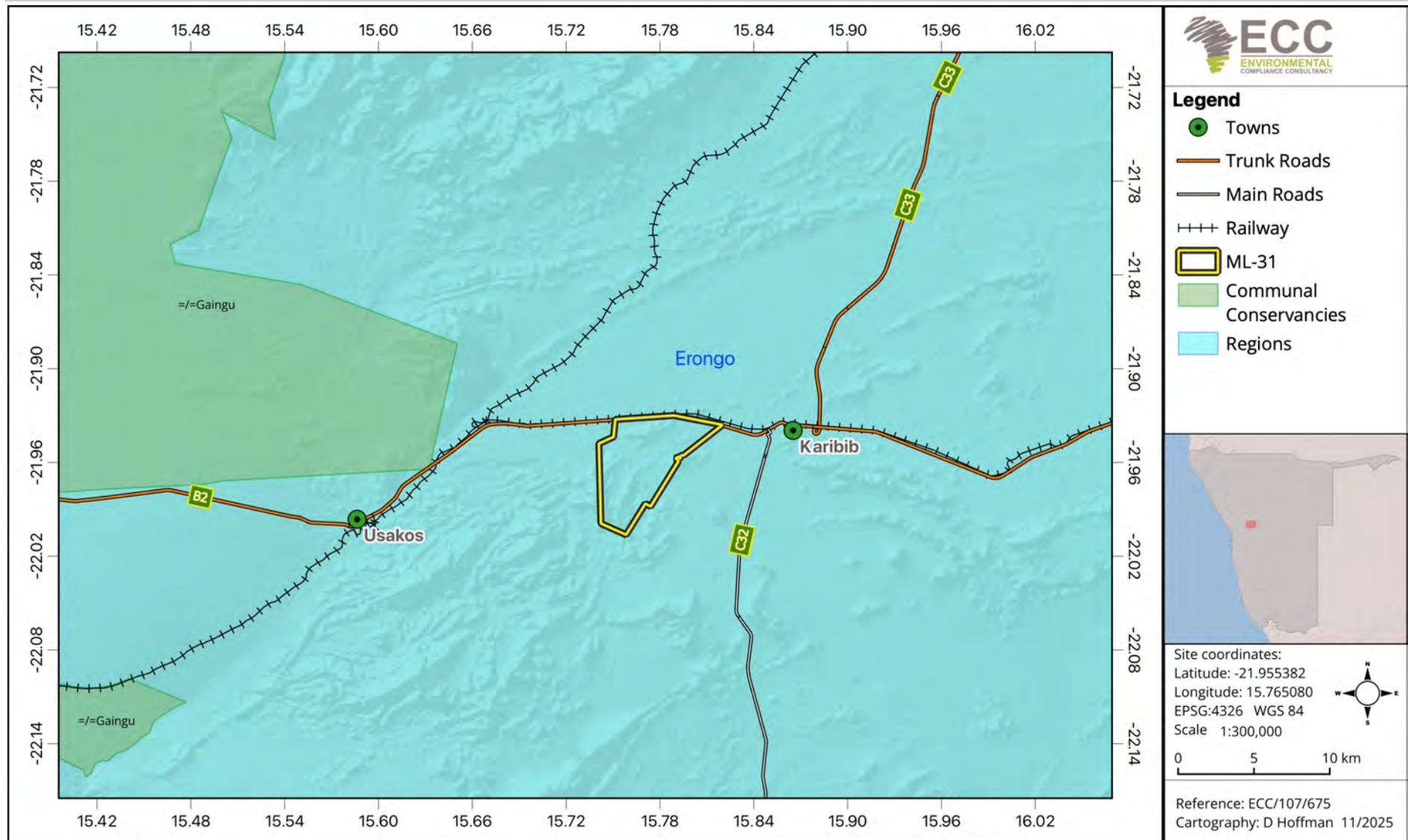


Figure 2 - Location of QKR Namibia Navachab Gold Mine on ML 31 and their accessory works area, where the Project is located

The previous amendment report (scoping report with impact assessment) (ECC, 2010) (Appendix C) updated the approved environmental and social impact assessment (ESIA) report for ML 31, to incorporate the impact assessment and revised environmental management plan (EMP) for the 2021 trial underground mining activities. This amendment report is thus an update of the aforementioned report to include phase II of the Underground exploration drive and an underground mine. In addition to this the Proponent also intends to install an additional explosives magazine to store ammonium nitrate (AN) and fuel oil (FO) (ANFO) bags (40 000 kg). This third magazine is included in the amendment report and assessment, and update to the OEMP.

The Proponent's existing environmental clearance certificate for ML 31, which includes the approved trial underground project consists of the following activities:

- Open pit operations of the main open pit and commencement of mining operations at Steenbok satellite pit (2025), adjacent to Gecko satellite pit;
- Gold production in the carbon-in-pulp (CIP) processing plant from the above-mentioned open pits. Currently no active mining is taking place at Gecko satellite pit;
- Tailings storage facility 2 and 3 operations;
- Co-disposal of waste rock and gold filter cake/fines on all waste rock dumps;
- Inclusion of an additional raw water dam;
- Upgrades to existing over head power line infrastructure and a sub-station;
- Interlock bricking manufacturing plant utilising filter cake and dense media separation (DMS) reject materials
- Existing two explosives magazines;
- Linear infrastructure;
- Upgrades to the reload crusher;
- Administrative, functional, support and engineering departmental services and buildings, including contractors; and
- Trial underground mine, which was phase 1 of their underground mine operations, has now been completed. This included:
 - Exploration development totalling 3 948 m (2 947 m of waste and 1 001 m of ore) from two portals and ramps – one in the North Pit for the North Shoot zone and one in the South pit for the Main Shoot zone;
 - Diamond drilling (NQ-size) for exploration of 17 121 m with an average hole length of 210 m; and
 - Stope grade control diamond drilling to define stope shapes totalling 2 319 m

In addition to the current operations, Navachab now intends to commence with the second phase, which is full-scale underground mining to extract ore at depth and install an additional explosives magazine.

This phase includes:

- One (1) surface board ventilation raise to assist with the underground ventilation for a total of 170 m;
- Stopping (using a sublevel open stoping method);
- Continued development;
- Exploration drilling of the Main Shoot;
- Raise bored ventilation connection of North Shoot and Main Shoot; and
- Series of interconnected exhaust drop raises;

1.2 THE PURPOSE OF THE AMENDMENT REPORT

The Phase 1 trial underground mining was successfully completed, and the Proponent now intends to proceed to Phase 2, involving full-scale underground operations. Additionally, a third explosives magazine is required for these operations and is situated between the two current and active magazine sites. As a result, an additional scoping report, with impact assessment, (i.e. amendment report) and update to Navachab's operational environmental management plan (OEMP) is required to reflect finalised updates to the site layout, proposed infrastructure and activities. The potential impacts of these changes have been assessed in this amendment report, which will be submitted to the mining commissioner at the Ministry of Industries, Mines and Energy (MIME) as the competent authority and the environmental commissioner at the Ministry of Environment, Forestry and Tourism (MEFT) for a record of decision (RoD).

This amendment report will be split into the following chapters:

- Chapter 1 is an introduction to the proposed Project and scoping report, with impact assessment;
- Chapter 2 provides details about the assessment approach;
- Chapter 3 provides additional detail on the legal environment and requirements;
- Chapter 4 provides sufficient detail on the Project to identify and assess potential impacts;
- Chapter 5 provides an overview of the related baseline information, identifying all relevant biophysical and social aspects;
- Chapter 6 provides an overview of the methodology for identifying and evaluating impacts in chapter 7
- Chapter 7 provides the findings of the impact assessment;
- Chapters 8 and 9 cover the conclusion and bibliography, respectively.

1.3 THE PROPONENT OF THE PROPOSED PROJECT

The Proponent for the Project is detailed in Table 1.

Table 1 – Proponent's details

Company Representative:	Contact Details:
George Botshiwe QKR Navachab Gold Mine Managing director	P.O. Box 150 Karibib, Namibia George.Botshiwe@navachab.com.na +264 81 122 4888

1.4 ENVIRONMENTAL REQUIREMENTS

The Environmental Management Act, 2007, and its regulations, stipulates that an environmental clearance certificate is required before undertaking any of the listed activities that are identified in the Act and its regulations. Potential listed activities triggered by the Project are provided in Table 2.

Table 2 – Activities potentially triggered by the Project

Source: Environmental Management Act, 2007, and its regulations

Listed activity	As defined by the regulations of Act	Relevance to the project
Waste management, treatment, handling and disposal activities	2.2 Any activity entailing a scheduled process referred to in the Atmospheric Pollution Prevention Ordinance, 1976. 2.3 The import, processing, use and recycling, temporary storage, transit or export of waste.	– The Project has established waste sites (either ore stockpiles or waste rock dumps) for the disposal of mineralised and non-mineralised waste. With the expansion of underground mining activities, additional waste and ore material will be generated. – Mining waste and ore will be stockpiled separately in respective stockpiles. – Co-disposal of filter cake and waste rock in the accessory works area. – Portable toilet/chemical toilets and established facilities (either with a septic tank or connected to the main onsite sewage treatment system) will be used during mining activities – Hazardous and non-hazardous solid waste will be generated during operational activities and will be removed by a skip, temporarily stored on site in the waste cells, potentially treated in the bioremediation site if contaminated with hydrocarbons and will be disposed of at the nearest landfill site or recycling company – Hazardous waste may be generated by the operation. – Explosives waste from additional blasting operations, that will be required to be burned on site at the currently approved cyanide burning area. Requirements as per Section 10.23.7 of the Explosives Regulations 1972. – Construction of an additional explosives magazine.

Listed activity	As defined by the regulations of Act	Relevance to the project
Mining and quarrying activities	3.1 The construction of facilities for any process or activities which requires a licence, right or other form of authorisation, and the renewal of a licence, right or other form of authorisation, in terms of the Minerals (Prospecting and Mining Act), 1992. 3.2 Other forms of mining or extraction of any natural resources whether regulated by law or not. 3.3 Resource extraction, manipulation, conservation and related activities.	– This listed activity infers the provisions of the Minerals (Prospecting and Mining) Act 33 of 1992. The very nature of the Project is mining, which therefore triggers this listed activity. The Proponent proposes to commence with full scale underground mining. – The licence for the proposed additional explosives magazine(s) is also discussed in this Act and the Mine Safety Regulations and is included in the accessory works application that was approved by the Ministry of Industries, Mines and Energy (MIME). (Section 4.4 Mining infrastructure and services and Section 4.4.6 Explosives selection and charging practises).
Forestry activities	(4.) The clearance of forest areas, deforestation, afforestation, timber harvesting or any other related activity that requires authorisation in term of the Forest Act, 2001 (Act No. 12 of 2001) or any other law.	– Limited vegetation clearing is required for the construction of the proposed additional explosive magazine.
Water resource developments	8.1 The abstraction of ground or surface water for industrial or commercial purposes. 8.2 The abstraction of groundwater at a volume exceeding the threshold authorised in terms of a law relating to water resources.	– Groundwater will be abstracted to support the operational activities through identified abstraction boreholes, with approved abstraction licences, from the Department of Water Affairs, as required by the Water Resources Management Act, No. 11 of 2013 and 2023 Regulations. – Groundwater will also be pumped out as the underground is excavated and will form part of the abstraction or pit dewatering licence requirements.

Listed activity	As defined by the regulations of Act	Relevance to the project
		- Water for operational activities will also be sourced from the on-site ponds. - Dust suppression will be conducted. (Section 4.4.9.2 water supply)
Hazardous substance treatment, handling and storage	9.1 The manufacturing, storage, handling or processing of a hazardous substance defined in the Hazardous Substances Ordinance, 1974. 9.2 Any process or activity which requires a permit, licence or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste. 9.3 The bulk transportation of dangerous goods using pipelines, funiculars or conveyors with a throughput capacity of 50 tons or 50 cubic meters or more per day. 9.4 The storage and handling of dangerous goods, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic meters at any one location.	- The mining operations, additional explosives magazine and proposed process plant trigger's this activity, as both fuel and hazardous substances are required for mining and processing. - Bulk fuel will be required for onsite generation of electricity (generators) and for refuelling the mining fleet. - Consumer installation certificates are required for bulk fuel storage and dispensing. - Construction and operation of an additional explosives' magazine in line with Section 22 of the Explosives Act, Act 26 of 1956 and Section 7.2.1 of the Explosives Regulations 1972. - Portable toilet/chemical toilets and established facilities (either with a septic tank or connected to the main onsite sewage treatment system) will be used during mining activities. - A wastewater treatment, discharge and re-use licence from DWA is in place for operational and processing related activities. - Hazardous waste generated during mining activities will either be treated at the on-site bioremediation facility or disposed offsite at a registered landfill site (e.g. Walvis Bay).

Listed activity	As defined by the regulations of Act	Relevance to the project
		- Burning of cyanide in the cyanide burn pit located in the processing plant. A permit is in place for this from MIME. - Explosives handling, storage and waste will be managed by an authorised blaster and contractor. (Section 4.4.9 Auxiliary services)

2 APPROACH TO THE AMENDMENT ASSESSMENT

2.1 PURPOSE AND SCOPE OF THE AMENDMENT ASSESSMENT

This scoping report, with impact assessment, (or amendment report) aims to scope the available data and any gaps that need to be filled; determine the spatial and temporal scope; identify the assessment methodology; and determine and assess which impacts are likely to be significant (the main focus of the assessment) from the additional activities that will be taking place as part of this phase II of underground mining activities and the addition of an extra explosives magazine.

The scope of the assessment was determined through assessing the proposed Project against the receiving environment obtained through a desktop review, available site-specific literature, previous amendment report for the trial underground mining activities (ECC, 2020) (Appendix C), monitoring data and site reports.

2.2 THE ASSESSMENT PROCESS

The ECC environmental and social impact assessment (ESIA) methodology applied to this amendment report has been developed using the International Finance Corporation (IFC) standards and models, in particular Performance Standard 1, 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2017) (International Finance Corporation, 2012); Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008); international and national best practice; and over 25 years of combined EIA experience.

The findings of the assessment chapter (Chapter 7) provide the basis for determining the significance of potential impacts. Final mitigation measures and recommendations are based on the cumulative experience of the consulting team and the client, taking into consideration the potential environmental and social impacts. The process followed through this assessment process is illustrated in Figure 3 and detailed further in the following sections. This assessment chapter thereby informing decisions on whether to grant approval, consent, or support for the proposed Project.

1. Project screening	2. Establishing the assessment scope	3. Baseline studies
Complete	Complete	Complete
The first stages of an environmental and social (ESIA) process is to undertake a screening exercise to determine whether the Project triggers listed activities under the Environmental Management Act, 2007, and its regulations. The screening phase of the Project is a preliminary analysis to determine how the Project might interact with its biophysical, social and economic environments. The outcome of the screening phase established that the Project triggered listed activities, as detailed in chapter 1, Table 2, due to material changes that require an amendment to the current environmental clearance certificate for mining licence (ML) 31. 	Where an ESIA is required, the second stage is to scope the assessment. The main aim of this stage is to determine which impacts are likely to be significant; to scope the available data and any gaps that need to be filled; to determine the spatial and temporal scope; and to identify the assessment methodology. It was determined for this amendment application, that a scoping report, with impact assessment (chapter 7), is sufficient. The scope of this assessment was determined through undertaking a preliminary assessment of the proposed Project against the receiving environment. Feedback from consultation with the public and the Proponent informs this process. The following environmental and social topics were scoped into the assessment, as there have the potential for significant impacts to occur. Cumulative impacts are also considered. These are: SOCIAL ENVIRONMENT • Air quality – dust, gases and odours • Noise • Socio-economic • Visual – magazine • Heritage - magazine BIOPHYSICAL ENVIRONMENT • Ground and surface water • Soil • Waste management The following topics were scoped out of the assessment and are therefore not discussed further in this report. • An assessment of safety impacts or risks associated with underground mining activities are not included within the scope of this assessment and will be addressed by the Proponent in a site-specific safety management plan. • Biodiversity and visual for underground mining, as there is already an existing open pit, and the area is already disturbed. • Heritage and culture as this is an existing open pit and the depth at which the Proponent is mining there is no chance of finding new artifacts or bones. • Blast and vibration is negligible as the levels of vibration will not differ from the current blast and vibration levels 	A robust baseline is required, to provide a reference point against which any future changes associated with a Project can be assessed, and to allow suitable mitigation and monitoring to be identified. The region and general area have been studied for various projects and assessments. This literature was available to be referenced. The Project site-specific area has been studied as part of the scoping report, with impact assessment process, and the following has been conducted as part of this assessment: • Desktop studies; and • Groundwater specialist report. The environmental and social baselines are provided in this amendment assessment. 

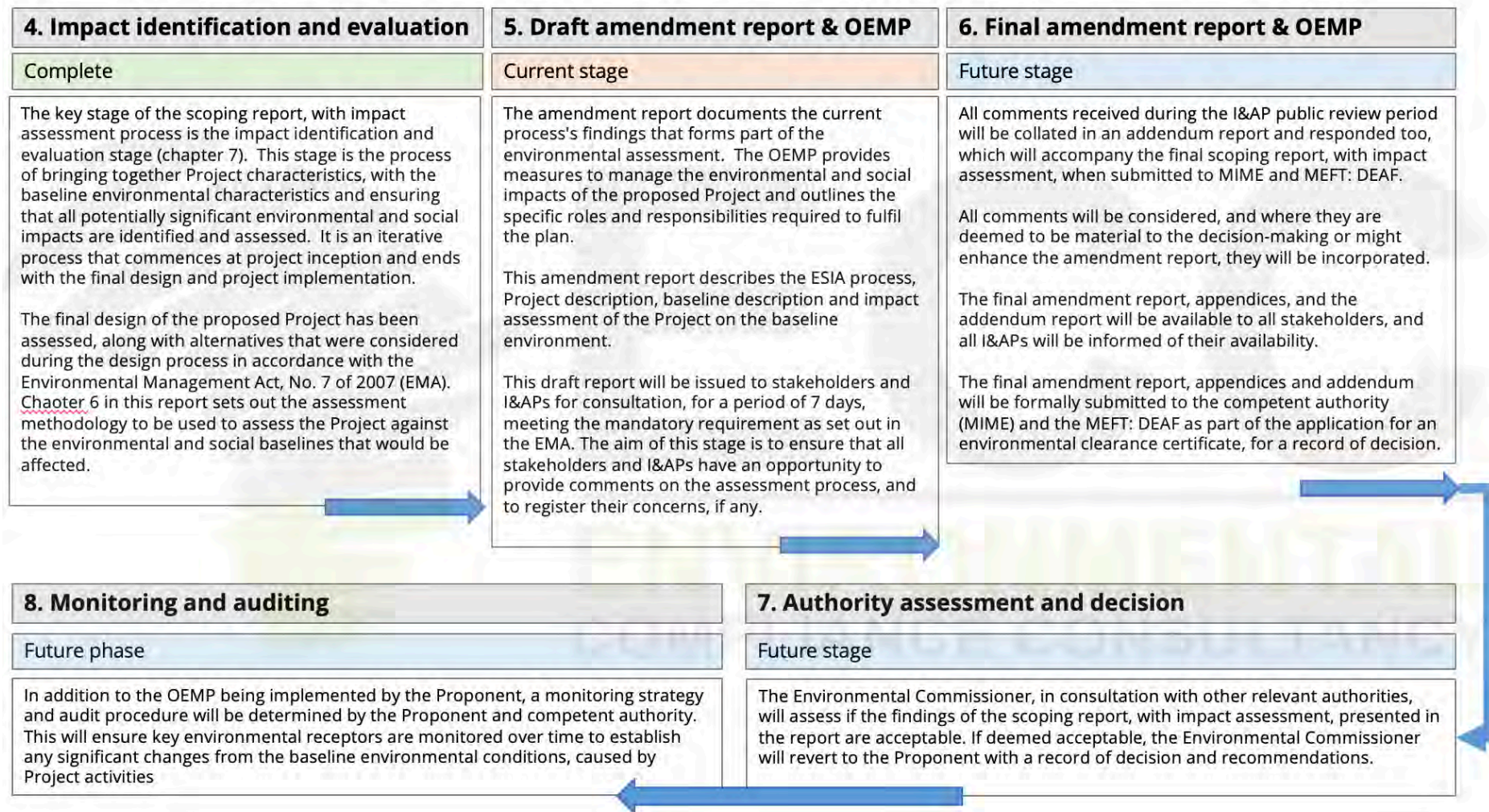


Figure 3 - ECC ESIA method

2.3 STUDY AREA

The scoping report, with impact assessment, study area was defined according to the geographic scope of the receiving environment and potential impacts that could arise because of the proposed Project within that area. The receiving environment is a summary term for the biophysical and socio environment that is described in the baseline chapter (Chapter 5). The study area is presented in Figure 4. The study area extends beyond the mining licence boundary and includes the nearby receptors, such as farmsteads and Karibib town, regarding groundwater-related impacts only.

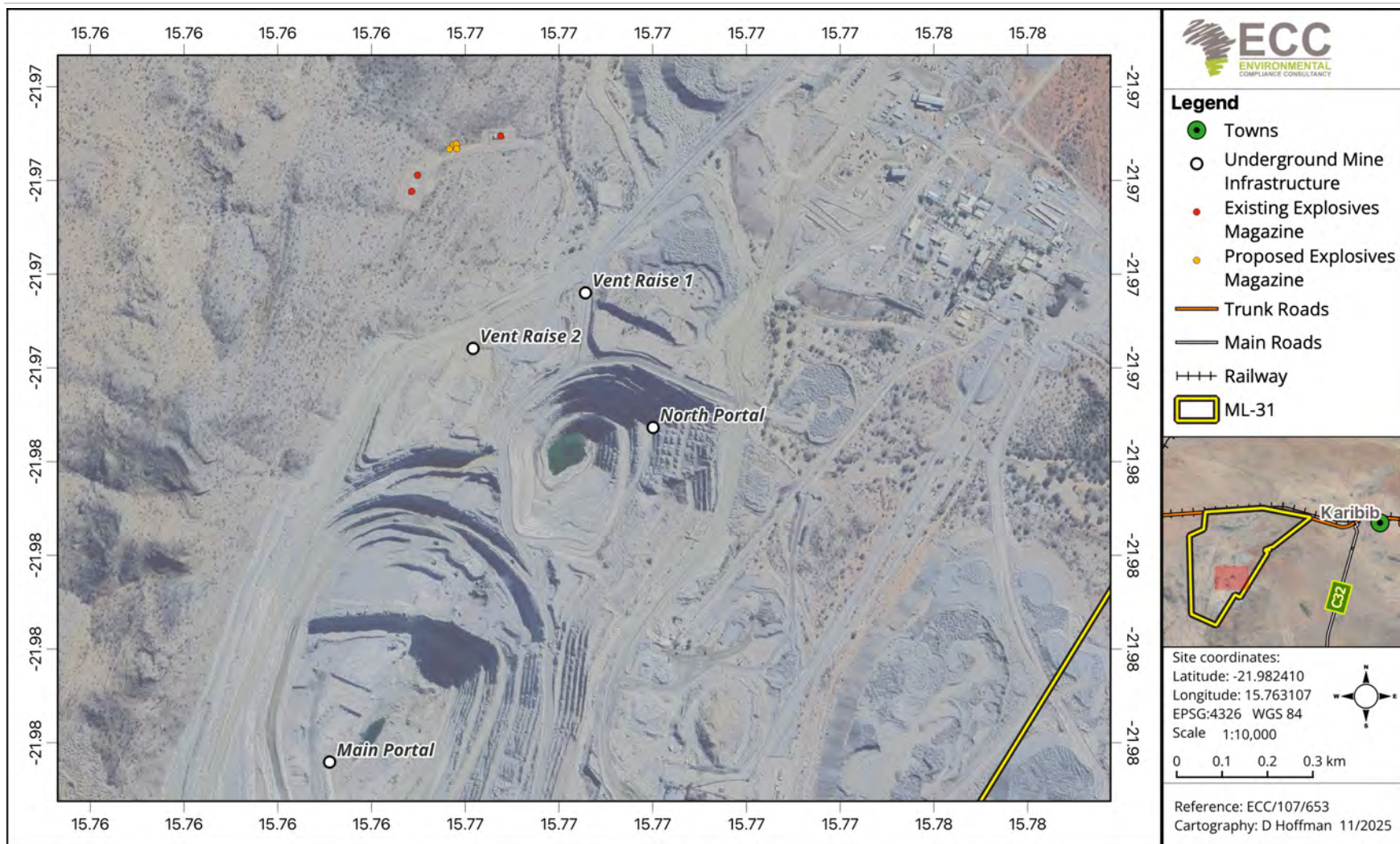


Figure 4 - Current open pit, underground mining portal, ventilation raise positions and the location of the proposed and existing explosive magazines

2.4 PUBLIC CONSULTATION

Public participation and consultation are requirements stipulated in Section 21 of the Environmental Management Act, No. 7 of 2007 and its 2012 Regulations, for a project that requires an environmental clearance certificate. Consultation is a compulsory and critical component of the ESIA process for achieving transparent decision-making and can provide many benefits and is ongoing during the ESIA process.

The objectives of the public participation and consultation process are to:

- Provide information on the Project, and introduce the overall Project concept and plan;
- Determine the relevant government, regional and local regulating authorities;
- Listen to and understand community issues, record concerns, and questions;
- Explain the process of the ESIA and timeframes involved; and
- Establish a platform for ongoing consultation.

The Proponent is applying for this amendment in accordance with section 39 of the EMA. As per the requirements for an amendment, the Environmental Commissioner may only amend a condition of an environmental clearance certificate under this section if he or she is satisfied that the amendment will not have a significant effect on the environment and the interests of any other person are not adversely affected. In terms of section 44 in amending an environmental clearance certificate, the amendment will be communicated and made available to all stakeholders and interested or affected parties for a public review period of 7 days.

2.4.1 IDENTIFICATION OF KEY STAKEHOLDERS AND INTERESTED AND AFFECTED PARTIES

A stakeholder mapping exercise was undertaken to identify individual stakeholders or groups of stakeholders. A summarised list of stakeholders that will be engaged during the public consultation process for this amendment is given below:

- Previously and currently, directly and indirectly affected interested and affected parties (including farm owners on adjacent farms);
- Ministry of Industries, Mines and Energy (MIME);
- Ministry of Environment, Forestry and Tourism (MEFT);
- Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR);
- Chamber of Mines (CoM);
- Namibian Chamber of Environment (NCE);
- Karibib Town Council; and
- Erongo Regional Council

3 REGULATORY FRAMEWORK

The Project area is located outside of any national parks or areas of known significance and does not trigger the requirements of the revised National Policy on prospecting and mining in protected areas, other areas with high value species and environmentally sensitive areas by MEFT and MIME (2024/2025 – 2034/2035). However, multiple heritage sites have been discovered on ML 31. Nevertheless, no archaeological sites have been located where the Proponent envisions the explosives magazine being placed.

Since the promulgation of the Water Resource Management Act (No 11. of 2013) and the Water Resource Management Resource Regulations of 2023, the entire Namibia is considered a groundwater-controlled area. This means there are strict measures which cover regulation of borehole construction, licensing, aquifer protection, record-keeping and prevention of groundwater wastage.

A thorough review of the relevant legal legislation has been conducted for the proposed amendment. Table 3 details the current licences and permits held by the Proponent for ML 31, Table 4 lists the relevant legal requirements specific to the Project, Table 5 details the national policies and plans relevant to the Project and Table 6 details the permits and licences relevant to the Project.

3.1 CURRENT AND VALID PERMITS

Table 3 – The current and valid permits held by the Proponent for the Project

Permit:	Permit/Licence/Certificate	Authority	Issue date	Expiry date	Validity	Status
Main mining area under mining licence 31						
ML 31 renewal	M46/4/31	MIME	30 October 2018	31 October 2033	15 years	Issued and valid
Environmental clearance TSF 3	Environmental clearance certificate	MEFT	20 March 2024	30 March 2027	3 years	Issued and valid
Environmental clearance ML 31	Environmental clearance certificate	MEFT	19 December 2022	19 December 2025	3 years	Issued and valid – includes ML 31 accessory works into approval
Consumer installation certificate - Diesel and petrol	CI/1517/2002	MIME	02 January 2002	N/A	Permanent	Issued and valid
Consumer installation certificate - HME DIESEL	CI/2417/2004	MIME	28 September 2004	N/A	Permanent	Issued and valid
Consumer installation certificate - New petrol	CI/1517/2010	MIME	23 July 2010	N/A	Permanent	Issued and valid

Permit:	Permit/Licence/Certificate	Authority	Issue date	Expiry date	Validity	Status
Consumer installation certificate - New diesel	CI/1517/2010	MIME	25 November 2010	N/A	Permanent	Issues and valid
Used mineral oil permit	11/2023	MIME	04 September 2024	04 September 2025	1 year	Valid – application for renewal submitted to MIME 21 August 2025
Wastewater treatment, effluent discharge and reuse licence	Permit 624	MAFWLR	25 April 2018	24 April 2023	5 years	A renewal application was submitted on 24 April 2023. A preliminary permit was granted in 2024 and in March 2025 a new application was submitted – waiting approval.
Exemption permit to burn specific products in controlled areas	Permit	MoHSS	06 October 2008	No expiry date	No expiry date	Issued and valid

3.2 NATIONAL REGULATORY FRAMEWORK

Table 4 – Details of the regulatory framework as it applies to the Project

National regulatory framework	Summary	Applicability to the Project
Minerals (Prospecting and Mining) Act No. 33 of 1992	Section 50 (i) requires <i>“an environmental impact assessment indicating the extent of any pollution of the environment before any mining operations are being carried out and an estimate of any pollution, if any, likely to be caused by such prospecting operations or mining operations”</i> Section 50 sets out that in addition to any term and condition contained in a mineral agreement and any term and condition contained in any mineral licence, it shall be a term and condition of any mineral licence that the holder of such mineral licence shall: Exercise any right granted to him or her in terms of the provisions of this Act.	The Proponent already holds a valid mining licence for this proposed Project and a valid environmental clearance certificate for their current mining operations on ML 31. The proposed amendment to include full scale underground mining and an additional explosives magazine to cater for the additional mining requirements requires an amendment application to the current approved environmental clearance certificate. An accessory works permit will be required for the Project; the Proponent will ensure the mine plans are approved by the Chief Inspector of Mines.
Environmental Management Act, 2007 (Act No. 7 of 2007) and associated regulations, including the Environmental Impact Assessment Regulation, 2007 (No. 30 of 2011)	The Environmental Management Act (EMA) (7 of 2007) has been compiled and is regulated by the Ministry of Environment, Forestry and Tourism (MEFT). This Act was gazetted on 27 December 2007 (Government Gazette No. 3966) and the Environmental Impact Assessment Regulations: Environmental Management Act, 2007 (Government Gazette No. 4878) were promulgated on 6 February 2012.	The Proponent seeks an amendment to the Environmental Clearance Certificate for ML 31 to include full-scale underground mining operations and the addition of an explosive’s magazine, as per the listed activities that require environmental clearance. The Proponent is hereby submitting the application for an amendment and subsequent renewal of ML 31 environmental clearance certificate (this amendment

National regulatory framework	Summary	Applicability to the Project
	Section 39 of the Environmental Management Act, 2007 states that the Environmental Commissioner may amend a condition of an environmental clearance certificate: – If the certificate holder consents to or requests an amendment or – At the initiative of the Environmental Commissioner, by giving written notice to the holder of the certificate The Environmental Commissioner may require the holder of the environmental clearance certificate to make an application in the prescribed form and manner to the Environmental Commissioner for the proposed amendment. Requires that projects with significant environmental impact be subject to an environmental assessment process (Section 27). In terms of this legal framework certain identified activities may not commence without an Environmental Clearance - a certificate that is issued by MET. This environmental clearance can only be granted after consideration of an EIA.	report (scoping report with impact assessment) to address potential impacts) accompanied by the prescribed form (Form 1), in accordance with the Act. This Act and its regulations have informed and guided this amendment process. Impacts identified through this amendment assessment application have been addressed throughout this report (and relevant studies) and Project specific OEMP.
Water Resources Management Act (Act No. 11 of 2013) and associated Water Resource	Regulation 66 (1) states that a person who intends to apply for a licence under section 72 of the Act must apply to the Executive Director on a form approved by the Minister, which form is obtainable from the offices or official website	Activities in the underground mine should be prevented from polluting the underground water. Licences will be required for both groundwater disposal from underground dewatering activities and for the disposal

National regulatory framework	Summary	Applicability to the Project
Management Regulations, No. 269 (2023)	of the Ministry (Sections 66(1)) and Section 67 of the Regulations requires effluent discharge to comply with the water quality standards of Annexure 11.	of wastewater or effluent generated within the underground mine.
National Heritage Act, No. 27 of 2004.	The Act provides for the protection and conservation of places and objects of heritage significance and the registration of such places and objects. It also makes provision for archaeological impact assessments. If applicable, the relevant permits must be obtained before disturbing or destroying a heritage site as set out in the Act.	Any heritage resources discovered would require heritage consent and a permit from the NHC for relocation. The site has conducted previous extensive heritage assessments therefore, sites are already known for the Project area, and none are located within the proposed Project footprint. Therefore, impacts are not likely to occur. However, MEFT may still require heritage consent for this amendment.
Mines, Works and Minerals Ordinance 20 of 1968 and associated Mine Health and Safety Regulation (GN 199 of 1970)	Part IX – Ventilation, Gases and Dust, sections 9.3, 9.4, 9.5, 9.6, 9.7, 9.11, 9.14 and 9.25 and Part of the Act mandates specific air quantities per person and per excavation to dilute exhaust gases and maintain fresh air. The mine manager must ensure fresh air is delivered via main ventilation fans and backup systems, using Ex-proof fans in gas-prone areas and employing strategies like bulkheads to manage airflow effectively. Compliance requires a detailed ventilation plan, real-time monitoring, and a comprehensive mandatory Code of Practice (COP) addressing gas detection,	As this is an underground mine the Proponent is required to ensure that there is adequate ventilation being supplied to the underground needed to maintain fresh air. Additionally, the Proponent will be required to mandatory COP. The Proponent will be required to apply for an exemption (Section 93) as initially the Project will only have one access.

National regulatory framework	Summary	Applicability to the Project
	prevention of ignition from sources like static electricity and friction and detailed procedures for emergency situations. Additionally, Section 91 of the Act stipulates that Every mine shall be provided with shafts or outlets to surface such that except as permitted in terms of regulation 93 every person employed underground in such mine shall have available to him not less than two separate and independent shafts or outlets affording means of egress from underground to surface. Section 93 of the Act stipulates that a single shaft or outlet to the surface may be accepted as sufficient egress from underground workings if not more than ten persons are engaged, or if up to two hundred persons are employed with written approval from the Chief Inspector. It is also permitted during shaft sinking, winze or adit development, or where one of the required outlets is temporarily unavailable, provided that restoring access is given priority over all other work	
Labour Act, No. 11 of 2007	The Labour Act, No. 11 of 2007 (Regulations relating to the Occupational Health & Safety provisions of Employees at Work promulgated in terms of Section 101 of the Labour Act, No. 6 of 1992 - GN156, GG 1617 of 1 August 1997)	The proposed Project will comply to stringent health and safety policies, including the compulsory use of specific PPE in designated areas to ensure adequate protection against health and safety risks. Proper storage and labelling of hazardous substances are required. The

National regulatory framework	Summary	Applicability to the Project
		Project will ensure that employees in charge of and working with hazardous substances are aware of the specific hazardous substances in order not to compromise worker and environmental safety.
Forestry Act No 12 of 2001	This Act promotes the sustainable management and use of forest resources, supports the establishment of community forests, provides for the protection of forest resources, and establishes a framework for forest management plans. It also establishes the Forestry Council, appoints forest officials, and sets out regulations for the control of forest fires and the handling of forest produce. As per Section 12 (1) stipulates that a person is not authorised to harvest, transport, sell, market, transit, export or import forest produce without a valid licence for harvesting or permit for transport, marketing, transit, export or import as set out in the form of Forms 12 to 16 as set out in Annexure 1	The Proponent will be required to clear land for the construction of the explosive's magazine. Therefore, the Proponent will require a land harvesting permit.
Explosives Act, No.26 of 1956 and its associated regulations the Explosive Regulations of 1972	The Act regulates the manufacture, import, export, storage, and use of explosives, requiring permits and licenses for these activities. Section 22 of the regulations require each magazine to have a responsible magazine ganger, maintain strict safety and security standards, store only authorised explosives in controlled conditions, keep accurate records, and report or dispose of defective or expired stock under inspector guidance. Access, fire risks, and handling are	The Proponent will construct and operate an additional explosives' magazine. Explosives waste from additional blasting operations, will be required to be burned on site, adjacent to the on-site waste facility.

National regulatory framework	Summary	Applicability to the Project
	tightly controlled, and closure or private storage needs official approval. Additionally, Section 7.2.1 of the Explosives stipulates pertains to the appointment of a magazine ganger. It mandates that the licensee of every magazine must appoint a trustworthy individual, acceptable to the Chief Inspector of Explosives, to serve as the magazine master. This person is solely responsible for the magazine and ensuring compliance with the regulations	

3.3 NATIONAL POLICIES AND PLANS

Table 5 – Namibian national policies and plans applicable to the Project

Policy or plan	Summary	Applicability to the Project
Vision 2030	Vision 2030 sets out the nation's development programmes and strategies to achieve its national objectives. It sets out eight themes to realise the country's long-term vision. Vision 2030 states that the overall goal of the vision is to improve the quality of life of the Namibian people to a level in line with the developed world.	The planned Project shall meet the objectives of Vision 2030 and shall contribute to the overall development of the country through continued employment opportunities.
Sixth National Development Plan (NDP6)	The NDP6 is the sixth plan in the series of seven five-year national development plans that outline the objectives and	The planned Project supports meeting the objectives of the NDP6 through creating opportunities for continued employment by extending the mine life.

Policy or plan	Summary	Applicability to the Project
	aspirations of Namibia’s long-term vision as expressed in Vision 2030. There are four pillars on which NDP6 is built, these are: – Economic growth, transformation and resilience; – Human development and community resilience; – Environmental sustainability; and – Effective governance and public service delivery.	
Minerals Policy	The Minerals Policy was adopted in 2002 and sets guiding principles and direction for the development of the Namibian mining sector while communicating the values of the Namibian people. It sets out to achieve several objectives in line with the sustainable development of Namibia’s natural resources. The policy strives to create an enabling environment for local and foreign investments in the mining sector and seeks to maximise the benefits for the Namibian people from the mining sector while encouraging local participation, amongst others. The objectives of the Minerals Policy are in line with the objectives of the Sixth National Development Plan that include the reduction of poverty, employment creation and economic empowerment in Namibia.	The proposed Project conforms with the Policy, which has been considered throughout the scoping report, with impact assessment, process.

3.4 NATIONAL PERMITS AND LICENCES

Table 6 - Permits and licences relevant to the Project

Permit or licence	Act / Regulation	Related activities requiring permits / licence	Relevant Authority
Environmental clearance certificate	Environmental Management Act, No. 7 of 2007	Required for all listed activities shown in Table 2.	Ministry of Environment, Forestry and Tourism (MEFT): Department of Environmental Affairs and Forestry (DEAF)
Mining licence	Section 90 (2) (A) of the Minerals Act, No. 33 of 1992	Written permission from the mining commissioner.	Ministry of Industries, Mines and Energy (MIME): Directorate of Mines
Accessory works permit	Section 52 (1) (D) of the Minerals (Prospecting and Mining) Act, No. 33 of 1992	Written permission for the erection of any accessory works will need to be submitted to the Chief Inspector of Mines and permission may be granted by the mining commissioner.	Ministry of Industries, Mines and Energy (MIME): Directorate of Mines
The transport of explosives at night	Section 6 of the Explosive Act, No. 26 of 1956	Explosives will be transported from its place of storage to place of use, which will require a licence additionally the transport of explosives at night will require a separate licence.	Ministry of Home Affairs, Immigration and Security Services (MHAISS): Namibian Police (NamPol)
Groundwater disposal licence	Section 64 (1) – (5) of the Water Resource Management Act (No 11. of 2013) and Section 47 (1) and (2) of the water Resource Management Regulations	The Proponent will need to dispose of water abstracted from the underground necessitating the requirement for this licence.	Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR): Department of Water Affairs (DWA)
Abstraction licence	Section 44 and 48 of the Water Resource Management Act (No 11. of 2013)	The Proponent will require this licence to abstract water required for the underground mining activities	Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR): Department of Water Affairs (DWA)

Permit or licence	Act / Regulation	Related activities requiring permits / licence	Relevant Authority
Wastewater treatment, effluent discharge and reuse licence	Section 69 (1) – (6), 70 (1) - (3), 72 (1) and (2) and Section 76 (1) of the Water Resource Management Act (No. 11 of 2013)	The Proponent will require this permit to dispose of or store or deposit of, or dealing otherwise with, wastewater, effluent or waste and to reuse the wastewater produced by the underground mining activities	Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR): Department of Water Affairs (DWA)
Licence for explosives magazine	Minerals (Prospecting and Mining) Act, No. 33 of 1992; Mine Safety Regulations and Explosive Act, 1956 (Act No. 26 of 1956) of and Explosive Regulations of 2014	This is also covered under the accessory works application.	Ministry of Industries, Mines and Energy (MIME): Directorate of Mines and Ministry of Home Affairs, Immigration, Safety and Security (MHAISS): Namibian Police (NamPol)
Permit for the storage and use of explosives,	Explosive Act, 1956 (Act No. 26 of 1956) of and Explosive Regulations of 2014	Necessary for explosives and blasting.	Ministry of Home Affairs, Immigration, Safety and Security (MHAISS): Namibian Police (NamPol)

4 PROJECT DESCRIPTION AND PROPOSED PROJECT AMENDMENTS

4.1 PROJECT OVERVIEW

In December 2019 Navachab initiated a study to assess the feasibility of developing an underground trial mine conducted by JDS Energy and Mining Inc and the underground mining contractor Brynecut, who will carry out the work. This study explored the potential for underground mining at Navachab by utilising an updated mineral resource model, revised cost estimates and new geotechnical parameters.

In 2021, Navachab launched the trial underground mining initiative, known as Project //Khaima. The trial mining presented favourable, leading to the conceptual study for a full-scale underground mine, which recommended further exploration into the feasibility of underground operations. The trial phase focused on the construction of a 5.5 m x 5.5 m portal drive and was supported by a dedicated team of approximately 90 external contractors. The trial mine pulled in an investment of over N\$160 million and the project was designed to run through the end of 2021. The purpose of the trial was to assess the technical and economic viability of transitioning from open pit to underground mining as a means of extending the mine's operational life and enhancing ore recovery.

The trial was successfully completed within the planned timeline and laid the foundation for additional underground infrastructure. As part of the post-trial development phase, Navachab invested in advanced processing equipment, including the installation of a Swiss Tower Mills (vertical power mill) VPM10, which supports improved throughput and gold recovery. Following the trial's success, Navachab secured significant financing, approximately USD 155 million (around N\$2.9 billion) to fund the next stage of underground mine development and broader expansion of the mine's infrastructure.

This strategic shift yields considerable long-term benefits. In 2025, the Navachab board approved an extension of the mine's life, with mining operations now projected to continue until 2036 and processing operations extended until 2045. This was a marked increase from previous projections of 2033 and 2042, respectively. Since the conclusion of the trial, over USD 30 million (~ N\$545 million) has been invested in underground exploration, development and technological upgrades.

Overall, the underground trial confirmed the technical viability and strategic value of integrating underground mining with Navachab's existing open-pit operations. The trial underground Project has not only unlocked access to deeper ore bodies but also ensured the long-term sustainability of the mine through enhanced resource utilisation, modern processing capabilities and continued employment opportunities within the region.

Since the trial mine has been deemed successful, an amendment to the underground trial mine scoping report, with impact assessment (ECC, 2020) (Appendix C), is underway (this report), considering applicable changes required for full operations are not included in the previous amendment application for ML 31.

It is assumed that any potential underground ore will substitute open pit ore or low-grade stockpiles in the processing plant but not replace the current mining operations. The underground mine is based on a conventional long hole open stoping operation. This mining method is suitable for the vertical and sub-vertical orebody at Navachab.

4.2 CURRENT OPERATIONS

The mine has undergone significant expansion and modernisation over the last five years. It currently operates one open pit, from which gold-bearing ore is extracted and has two satellite pits currently not being mined, in each respective ML. However, as of 2025 mining operations are commenced at Steenbok satellite pit, adjacent to Gecko satellite pit.

Mining is conducted using conventional load and haul methods, with a monthly average of 1.4 million tonnes of material moved, using a fleet of 13 haul trucks. The mine processes approximately 1.5 million tonnes of ore per annum, yielding an annual gold production of around 50 000 ounces. Overburden is systematically deposited on designated waste rock dumps (WRDs) located to the north, south and east of the open pits, while low-grade ore is stockpiled near the run-of-mine (ROM) pad for potential future processing.

Following extraction, the ore is transported to an on-site carbon-in-pulp (CIP) processing plant, where it undergoes crushing, milling, leaching and gold recovery. The gold is then refined into gold bars, which are shipped off-site as the final product. Tailings from the processing plant represents the main waste stream and is managed through a tailings storage facility (TSF). Approximately 35 000 tonnes per month of tailings is pumped to the TSF in slurry form, with the remaining fraction handled as filter cake for co-disposal on the waste rock dumps or potential alternative use (e.g. interlocks).

The mine's water requirements are met via the NamWater bulk water supply pipeline from Swakoppoort Dam, while electrical power is supplied through the NamPower national grid, ensuring a stable source of energy for mining and processing operations. Additionally, a suite of standby diesel generators is maintained on-site to ensure operational continuity during power outages. The underground trial mine part of Project //Khaima operates independently on a 500 kVA generator, with an additional 500 kVA backup unit in place to ensure energy redundancy.

4.3 PROPOSED PROJECT AMENDMENTS

Phase 2 of the underground mining activities will consist of the following:

- One (1) Surface bored ventilation raise to assist with the underground ventilation for a total of 170 m;
- Stopping using a sublevel open stopping method;
- Continued development of the underground mine and extraction of ore;
- Exploration drilling of the main shoot;
- raise bored ventilation connection of north chute and main chute; and
- A series of interconnected exhaust drops raises.

Addition of an additional explosives magazine to cater for underground mining activities, which will store 40 000 kg of ammonium nitrate (AN) and fuel oil (FO) (ANFO) bags. This magazine is positioned between the two existing magazines for open pit mining operations shown in Figure 5, Figure 6 and Figure 7.

The current contract will span five years and is expected to create more than 150 new jobs during the execution period.

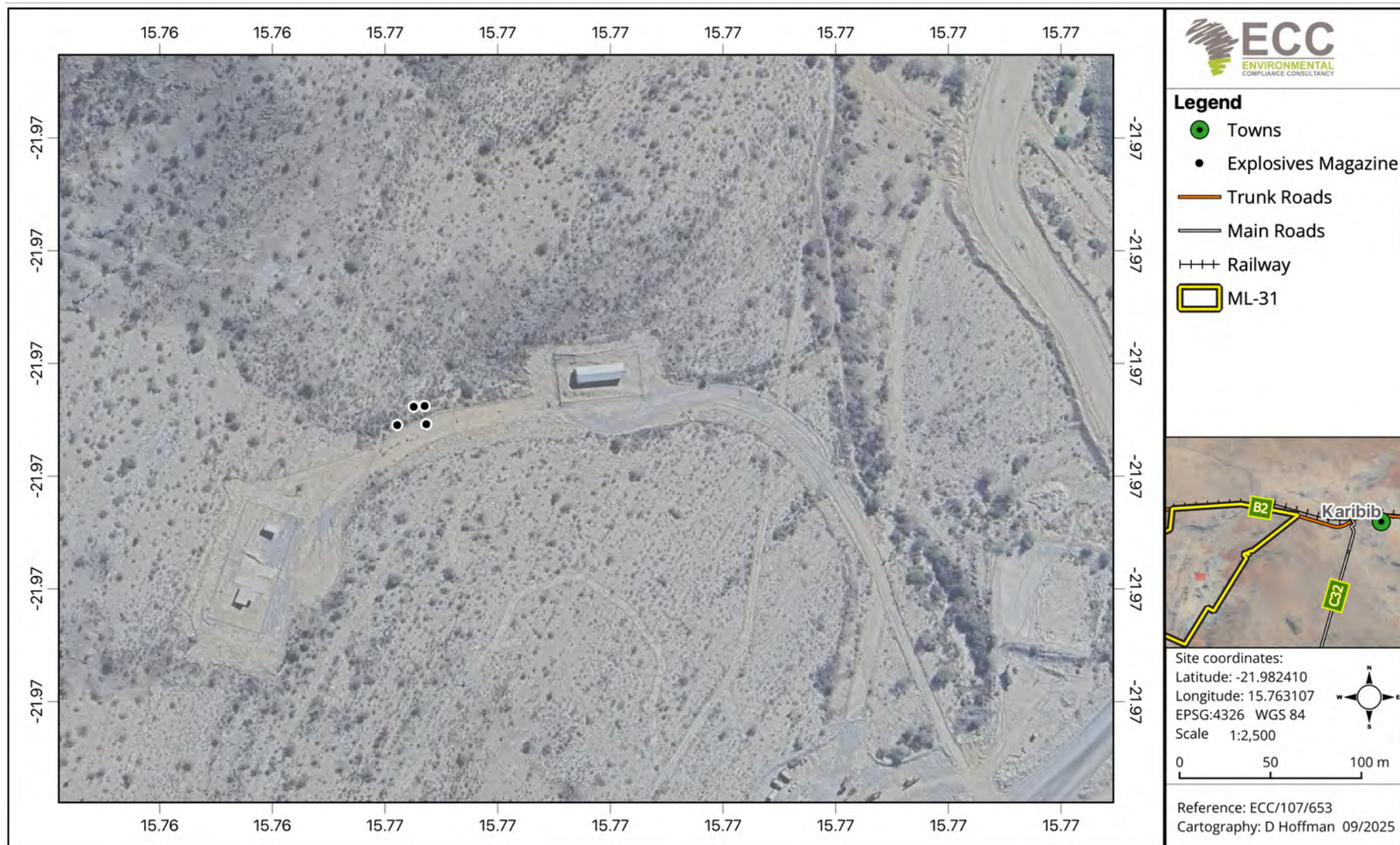


Figure 5 - Shows the possible locations of the proposed additional explosives magazine



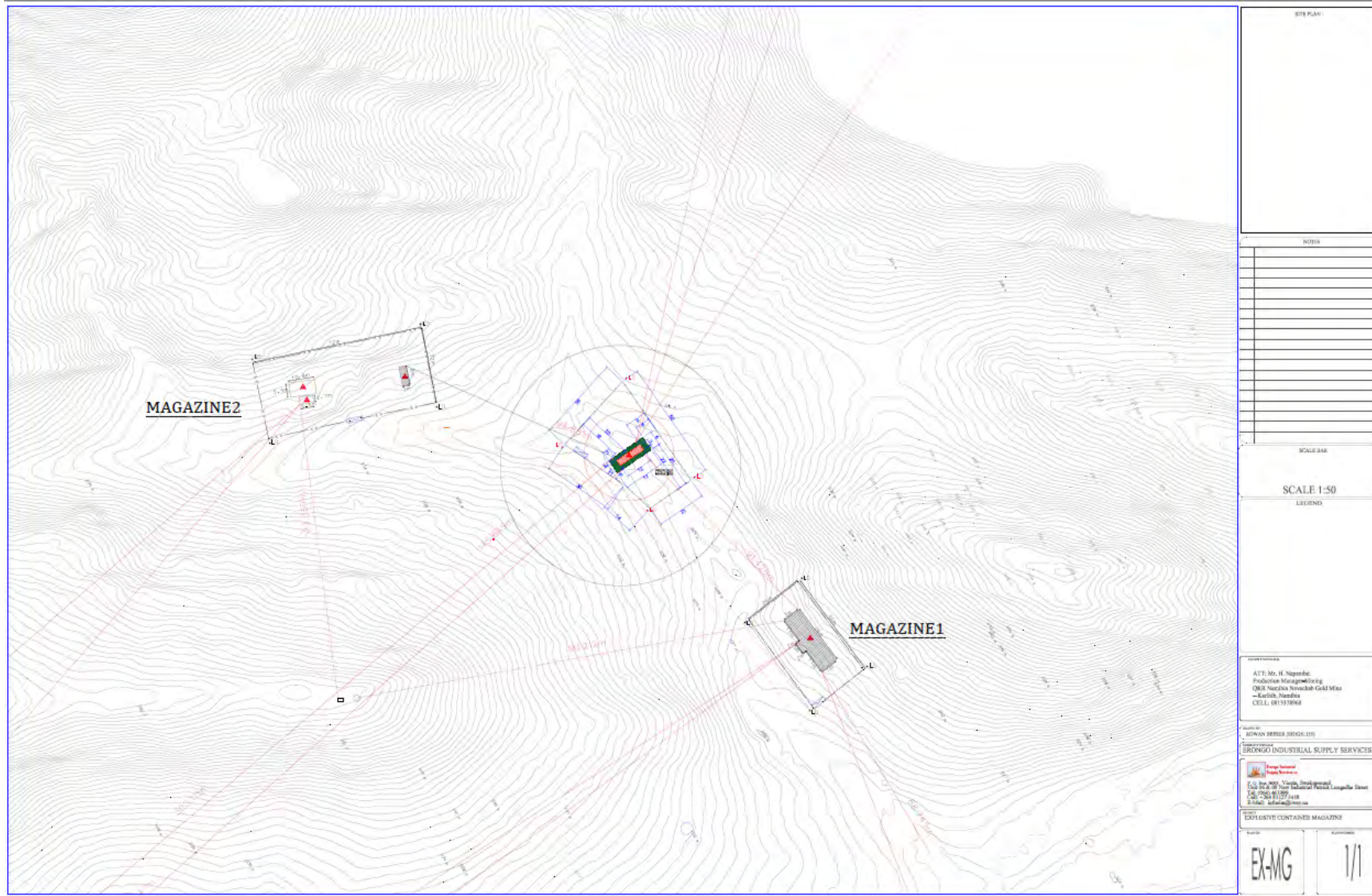


Figure 7 - Magazine yard layout include the two existing explosive magazine and the proposed third explosive magazine

4.4 UNDERGROUND MINING, INFRASTRUCTURE AND SERVICES

4.4.1 DECLINE AND ACCESS DEVELOPMENT

Underground access will be established through one portal located within the existing Navachab main open pit, with a second entry being developed only after ~3 years. The main shoot decline will originate from the 950 m bench in the south pit and will be driven approximately 4 133 m (Phase 2: 3 049 m), with an additional 1 839 m (Phase 2: 1 637 m) of ancillary development, including drill bays, safety bays, stockpile stations, ventilation drives and sumps. The north chute decline will commence from the 1 040 m bench in the north pit and will be driven for 1 930 m (Phase 2: full length), plus 709 m (Phase 2: 502 m) of ancillary infrastructure.

The decline will be constructed at an average gradient of -14%, with cross-sectional dimensions of 5.5 m in width and 5.8 m in height. The primary objective is to establish exploration access, though secondary mining faces may be opportunistically developed to maintain contractor efficiency. No diamond drilling metres are planned for Phase 2.

4.4.2 GROUND SUPPORT

4.4.2.1 Face meshing

For this Project, face meshing has been included, to align with Byrnegut's (Byrnegut Mining, n.d.) (Appendix E) minimum operational standards, as shown in Figure 8 to Figure 11:

- For faces up to and including 6.5 m in height:
 - o A minimum of eight (8) 47 mm x 900 mm split sets installed in a 1.2 m x 1.2 m pattern (Dice 5);
 - o At least one sheet of mesh installed, centrally and toward the top of the face; and
 - o Maximum allowable mesh gaps:
 - Mesh to side walls: 1.0 m
 - Mesh to floor: 3.5 m
 - Mesh to backs: 0.5 m
- For faces exceeding 6.5 m in height:
 - o A minimum of thirteen (13) 47 mm x 900 mm split sets installed in a 1.2 m x 1.2 m pattern (Dice 5);
 - o At least two sheets of mesh installed centrally and toward the top of the face; and
 - o Maximum allowable mesh gaps:
 - Mesh to side walls: 1.0 m
 - Mesh to floor: 1.5 m
 - Mesh to backs: 0.5 m

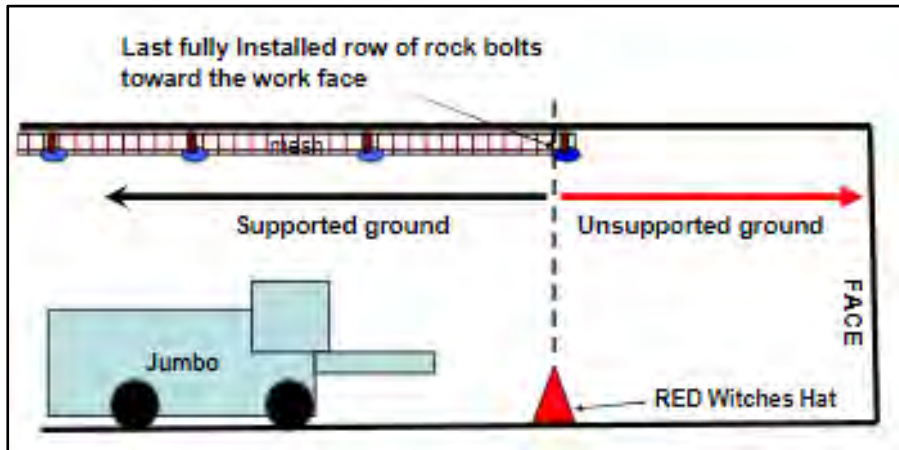


Figure 8 - The minimum Byrnegut standard for the position of the witches' hats in relation to the last fully installed and secure row of rock bolts toward the work face (Brynegut Mining, n.d.)

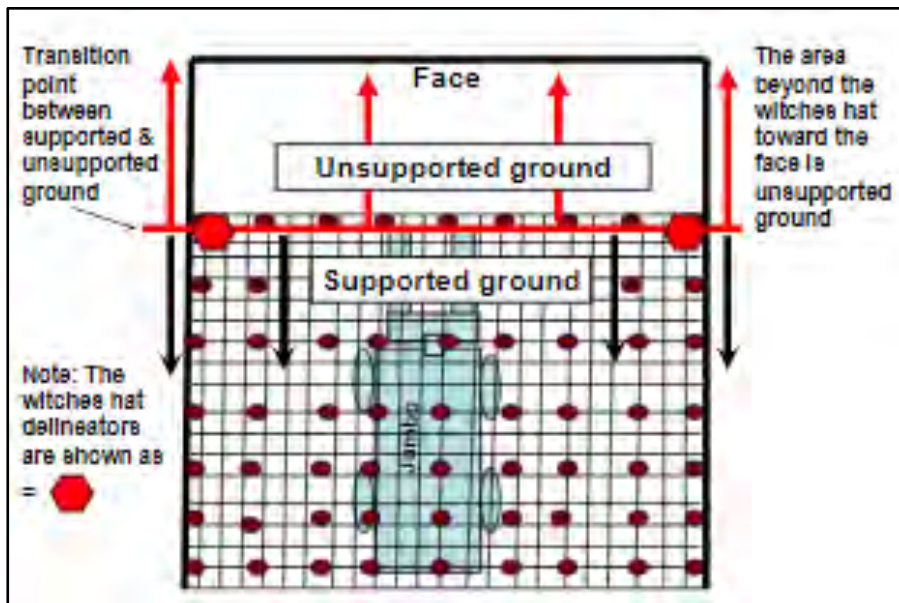


Figure 9 - A plan view of the minimum standard for the position of the witches' hats in relation to the last fully installed and secure row of rock bolts toward the work face (Brynegut Mining, n.d.)

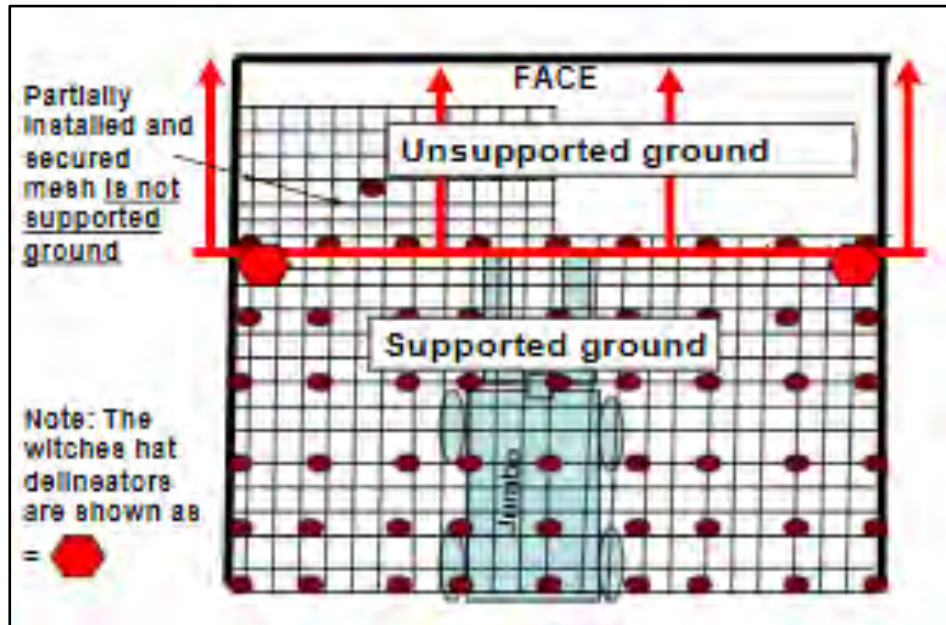


Figure 10 - Partially supported ground that sits ahead of the last fully installed row of rock bolts (any partially supported ground is classified as unsupported ground) (Bryne cut Mining, n.d.)

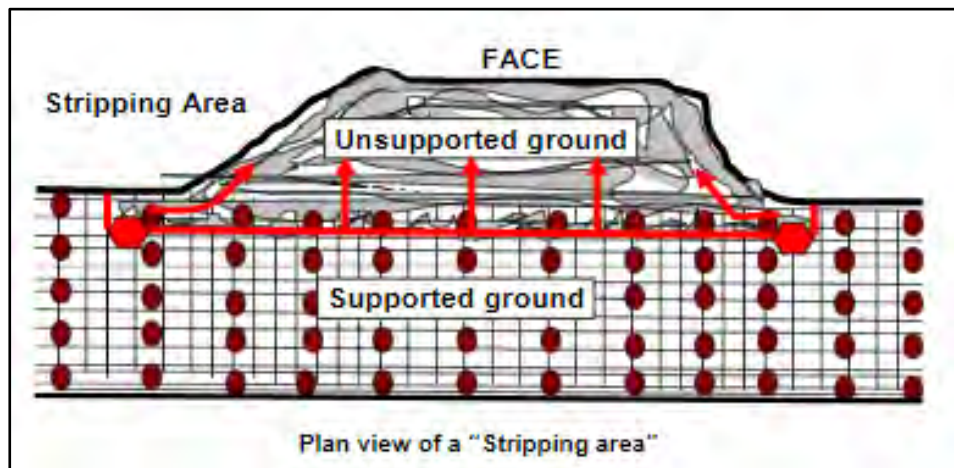


Figure 11 - Minimum standard for positioning the witch's hats in relation to the last fully installed row of rock bolts in a stripping scenario (Bryne cut Mining, n.d.)

4.4.2.2 Split set installation

Where needed, split set rock bolts may be installed in accordance with Bryne cut's standard operating procedures and in full compliance with the relevant Jumbo Operations Task Risk Management (TRM) guidelines for underground mining.

All split set installations will be carried out with strict adherence to safety protocols, ensuring that all personnel are well clear of unsupported ground during operations.

The installation process involves:

1. Drilling the bolt hole using one boom of the jumbo.

2. Installing the split set bolt immediately into the freshly drilled hole using the alternate boom.

Hole diameters will be strictly controlled using calibrated bit gauges to ensure compatibility with the specified bolt size. This is critical for achieving proper friction anchorage and ensuring the effectiveness of the support system.

In cases where overlapping mesh from adjacent development rounds must be secured, particularly where resin bolts, cable bolts (CT), hollow grouted bolts (HGB), dynamic cone penetration (DCP) and dynamic cable support bolts (DCS), or other types that are part of the ground support profile, shorter split set bolts will be used to pin mesh overlaps effectively and maintain structural integrity.

4.4.2.3 Portal stabilisation and steel structure setup

Portal faces will be assessed for geotechnical risk to determine whether additional scaling will be required using mechanical or alternative methods. Ramp material may be placed and support requirements will be marked out to guide subsequent scaling and installation activities. Standard face support will typically include the use of rock bolts, cable bolts and mesh, all of which will be installed using a jumbo drill. If necessary, grouting will be performed using an integrated tool carrier (IT) and work basket. Ramps will be constructed to achieve the required heights, and the installation process will proceed in three stages.

Depending on the size of the catch berm above the portal, a catchment fence may be installed above each portal to intercept small rocks or debris dislodged from the pit walls.

Once portal support has been completed, drill and blast (boring and firing) operations will commence. The chosen blasting method will depend on the anticipated ground conditions, the working area available in front of the portal and any infrastructure that will need to be relocated or protected in advance.

Each blast round will be evaluated to determine whether steel set installation is necessary, and support (mesh and bolts) will be applied after each cut. Ideally, the portal will advance by 15 – 20 metres before steel sets are installed. Construction of the steel sets will begin during the final stages of development so that they can be positioned immediately after the final cut has been supported and the concrete footings have cured. Byrncut will typically provide for 10-metre steel sets per portal. These sets will include timber lagging between vertical elements, with timber used to wedge the sets into the backs. Finally, shotcrete will be applied to seal any gaps between the steel sets and the portal face.

The portal support approach will be heavily influenced by site-specific ground conditions, available equipment, defined support requirements, bench geometry and the space available at each portal location.

4.4.3 UNDERGROUND DEVELOPMENT CYCLE, BORING, FIRING AND GROUND CONTROL

Bryne cut investigated the following two methods for the underground development cycle:

Method 1: the development cycle for a bolt and mesh drive profile will be completed in the following sequence:

- Mark up face, wash out and delineate sockets (butts);
- Face bored out by twin-boom jumbo;
- The bored-out cut will be charged using a Normet charge rig and blasted, after which adequate time will be allowed for ventilation and fume clearance before re-entry ;
- The loader will bog waste and transfer it to the waste rock stockpile;
- Extension of services/ventilation if required;
- A type of mechanical scaler machine (commonly the Robog/REBOG scaler), which is used underground to safely remove loose rock (scaling) from the backs and walls after blasting, before ground support like bolts and mesh are installed; and
- Cycle repeated.

Method 2: the development cycle for a bolt and fibrecrete drive profile will be completed in the following sequence:

- Mark up face, wash out and delineate sockets (butts);
- Face bored out by twin-boom jumbo;
- The bored-out cut will be charged using a Normet charge rig and blasted, after which adequate time will be allowed for ventilation and fume clearance before re-entry ;
- The loader will bog waste and transfer it to the WRD;
- Extension of services/ventilation if required;
- Backs and face will be scaled with twin boom jumbo;
- Normet Spraymec will hydroscale, then spray a layer of shotcrete over the unsupported ground;
- Rebog of scaled material;
- Installation of support bolts or surface mesh with twin boom jumbo; and
- Cycle repeated.

Laser survey systems will ensure that the development remains properly aligned and at the correct elevation. A Sandvik LH621i loader, or an equivalent machine, will clear blasted material from the development face and move it the WRD. The loader will then fill empty underground trucks, such as the Sandvik TH663i, which will haul the material to the appropriate location based on whether it is classified as ore or waste. These trucks allow for either operator-in-cab driving or remote/automated operation depending on how the mine is set up. By default, these loaders have a cab where an operator sits but many operations use them in tele-remote or autonomous mode for safety near the development face.

Development will be carried out using twin-boom drilling jumbos. Telescopic rails will be used to enhance productivity by maximising the round length per set-up in the main access

tunnels. The split feed length will be adjusted to suit the drive dimensions, allowing for efficient and accurate ground support installation at the optimal bolt angle. This configuration enables the installation of 2.4 m bolts during the support cycle and drill rods up to 4.9 m during face drilling. Round length will depend on observed ground conditions and geological data.

For underground mining projects with more than 900 m of lateral development per month, an automated Sandvik DD422i is typically used. This advanced drill allows continuous, unmanned operation during shift changes and breaks. Byrnegut has tested newer jumbo models and observed increased advance per blast and reduced overbreak due to programmable drill patterns.

Development advances exceeding 4.5 m per blast are anticipated to use an automated Sandvik DD422i.

Blast holes at the face will be drilled at 45 – 48 mm in diameter, while reamer holes will be 102 mm. Perimeter holes will be drilled according to the designated heading size, with spacing and burden adjusted based on the ground conditions. Standard development drilling patterns will be followed, including closer spacing for profile holes to limit overbreak and maintain excavation within design tolerances. Bit gauging will ensure compatibility with bolt dimensions, and regular installation and marking of pull-rings will facilitate routine pull-testing of ground support systems.

Face markup will be carried out by either the jumbo operator or the shift supervisor before each drilling round begins. During this process, existing sockets (butts) will be cleaned and clearly marked. To maintain construction tolerances, all faces will be marked before drilling, and both grade and centre lines will be kept within 10 m of the face. Drilling will strictly follow the marked-up face. Regular jumbo maintenance, including daily servicing, will ensure boom alignment is maintained, allowing for accurate and parallel hole drilling.

4.4.4 UNDERGROUND MINING METHODOLOGY AND EQUIPMENT

The selected mining method for the contractual period (5 years) is sublevel open stoping (SLOS). Stope development will include crosscuts from the exploration declines to sublevels and along-strike drifts for drilling and extraction. Sublevel intervals are planned at 25 m vertical spacing, with stope widths ranging from 5 m to 20 m depending on geological conditions. Access crosscuts may range in gradient from -15% to +15%. Sublevel drifts, generally in ore, will be developed under strict survey and geological control.

Stoping will involve long-hole drilling using mechanised drill rigs, with blasthole diameters and spacing designed for optimal ore recovery and dilution control shown in Table 7. All stope blasting will be conducted using electronic detonators. A total of 9199 m of stope development is planned, targeting the extraction of approximately 1.9 million tonnes (Mt) of

ore over a three-year period. This production will contribute to funding the broader exploration program and support the transition to long-term underground mining.

Table 7 - Role of equipment used in the Project (Bryne cut Mining, n.d.)

Machine	Description
Sandvik DL432i-9C	Long hole capable of drilling 89 mm blast holes and drill string.
Sandvik LH617i LHD with Sandvik Automine or similar	Stope bogging (conventional and tele-remote with navigation guidance) and truck loading.
Sandvik TH663	Haulage of stope ore to designated tip points.
Caterpillar 930/962, Volvo L120H or similar integrated tool carrier	Stope charging back up basket (if required with emulsion unit a larger IT may be used).
Normet EC-3 (emulsion) or similar charge carrier	Stope charging carrier fitted with a hose pusher and local explosive supplier emulsion pump.
Toyota Landcruiser, Toyota Twin cabs or similar Light Vehicle	Personnel transport, underground explosives transport, supervision and maintenance transport.

4.4.4.1 Production cycle sequence

The production cycle will commence with survey mark-up by Navachab and proceed according to the following steps:

- Survey mark-up: marking of long holes and slot positions to be drilled in accordance with the design specifications.
- Drilling: execution of drilling activities using either long hole rigs or the Rhino unit, following the approved drilling designs.
- Up hole survey: completion of uphold surveys on every second ring, focusing on the longest hanging wall (HW) and footwall (FW) holes to ensure drilling accuracy.
- Hole preparation: cleaning and preparation of drilled holes for subsequent charging operations.
- Charging and blasting: charging of long holes in line with the approved blast designs, followed by blasting and ensuring safe fume clearance.
- Post-blast activities: watering down of blasted areas to suppress dust and ensure safety, followed by bogging using either conventional or tele-remote equipment, depending on ground conditions and operational requirements.

4.4.4.2 Long hole drilling methodology

Long hole drilling will be executed using a dedicated long hole drill rig. Depending on site-specific requirements, rigs may be equipped with either a boom-mounted or horseshoe-style mast; however, the horseshoe configuration is preferred due to its superior drilling productivity. Both configurations necessitate a minimum drive dimension of 5.0 m (height) x 5.0 m (width) to accommodate the drill boom and rod carousel.

Rig selection will be based on orebody geometry, drive orientation and stope design. While boom-mounted rigs offer greater versatility, their deployment will be confirmed following a detailed assessment of geological and geotechnical conditions.

Sandvik long hole drill models are the preferred choice and can be equipped with remote drilling capability, enhancing safety by allowing the operator to drill from a secure location, especially in areas near previously blasted ground.

Drilling will accommodate blast hole diameters ranging from 76 mm to 102 mm, and holes may be drilled in either the uphole or downhole direction, as dictated by the stope or rise design. Standard drill rods of 1.8 m in length will be employed. Where necessary, holes will be reamed to diameters between 127 mm and 200 mm, subject to drill rig capability and operational requirements.

Hole mark-up will be conducted by the Navachab Survey department. To ensure consistency in drill execution and alignment with the design, a site- and rig-specific standard for hole set-out will be collaboratively developed by Byrncut and the Survey department. This protocol will ensure the quality and repeatability of drill patterns and optimal performance across all long hole drilling operations.

4.4.4.3 Post-blast mucking and material handling

Following each blast, the backs and walls of the excavation will be watered down to suppress dust generation during the bogging cycle. Development faces will be mucked, and the broken rock will be loaded directly into haul trucks, where available, for immediate transport to the nearest waste rock stockpile. Where trucks are not immediately accessible, material will be loaded directly to waste rock stockpile for subsequent removal.

Direct loading will be prioritised wherever possible to minimise material rehandling; however, the primary focus remains on ensuring the face is promptly cleared and prepared for the application of ground support.

4.4.4.4 Haulage and traffic control

All underground trucking and traffic movements within the decline will be managed using a two-way radio communication system. Loaded trucks travelling uphill will be given priority over all other vehicles, reducing the need for reversing or complex manoeuvring under load, thereby improving safety and efficiency.

A site-specific traffic management plan will be implemented at underground mining activities start-up to govern vehicle interactions, right-of-way rules, designated passing bays and emergency protocols.

Speed limitations will be enforced:

- Uphill travel speeds will be restricted based on the equipment's power and load-bearing capabilities; and
- Downhill speeds will be controlled using gear lock-out systems on the trucks to prevent over speeding and ensure safe descent.

Ore will be hauled to designated run-of-mine (ROM) stockpiles at the 950 m bench in the south Pit and the 1 040 m bench in the north pit. Waste rock will be transported to a specific waste dump at the 950 m bench. Haulage may involve up to a 6 km round trip from the portal to the stockpile. Ore movement from stopes will utilise tele-remote-operated load-haul-dump (LHD) units, either directly to the surface or via transfer to underground trucks.

4.4.5 MINE PLAN

The proposed mining schedule for the underground exploration development is presented in Table 8. This should be read in conjunction with Table 8. The breakdown of this schedule is detailed in Figure 12- Figure 24 and Table 9- Table 12.

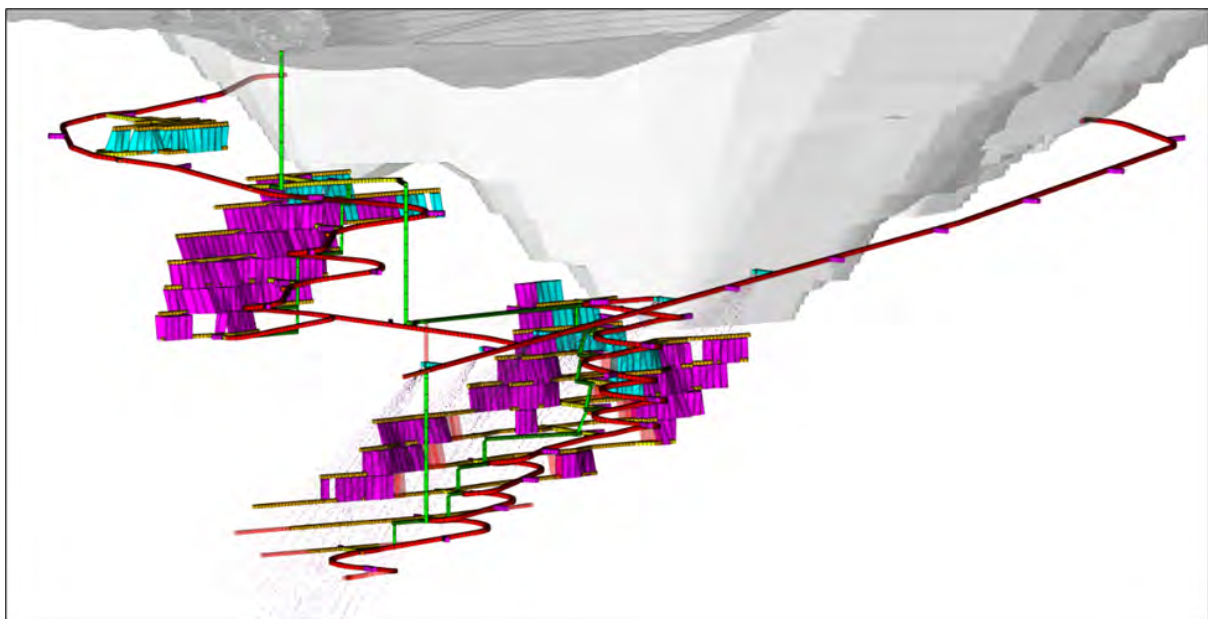


Figure 12 - Completed underground mine schedule of Phase 1 and Phase 2

Table 8 - Mining schedule for Phase 2

Total	Unit	Y3	Y4	Y5
Lateral development	metres	5 215	4 611	4 036
Drop raise	metres	137	159	99
Raise bore	metres	169	0	139
Diamond drilling	metres	38 080	0	0
Stope tonnes	tonnes	523 501	748 453	647 289
Total waste	tonnes	349 651	209 105	179 040
Total ore	metres	605 374	899 991	789 036
NS – north shoot				

Total	Unit	Y3	Y4	Y5
NS - lateral development	metres	2 747	1 038	0
NS - drop raise	metres	107	55	0
NS - raise bore	metres	0	0	0
NS - exploration diamond drilling	metres	0	0	0
NS - stope tonnes	tonnes	507 958	535 849	63 726
NS - total waste	tonnes	150 704	57 432	0
NS - total ore	tonnes	577 000	559 304	63 726
MS – main shoot				
MS - lateral development	metres	2 468	3 573	4 036
MS - drop raise	metres	30	104	99
MS - raise bore	metres	169	0	139
MS - exploration diamond drilling	metres	38 080	0	0
MS - stope tonnes	tonnes	15 543	212 604	583 564
MS - total waste	tonnes	198 947	151 673	179 040
MS - total ore	tonnes	28 374	340 687	725 311

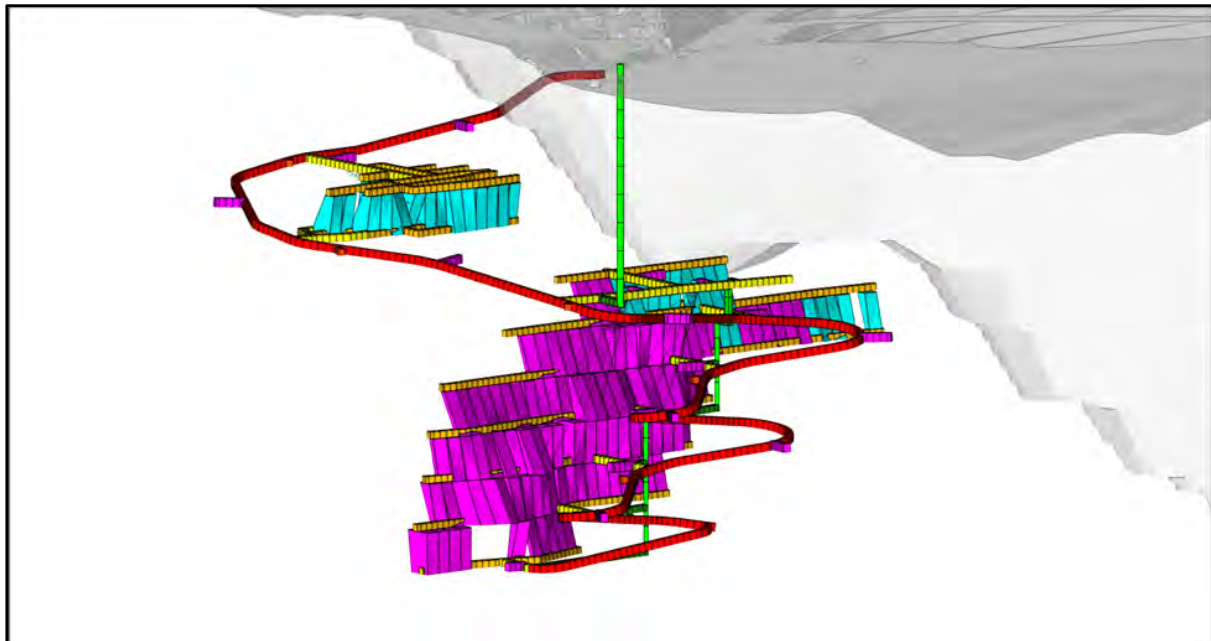
Table 9 - Scope of work for Phase 2

	Phase 2 (m)	5 Year Total
main shoot - decline development	3 049	4 133
main shoot - access development	758	758
main shoot - exploration platform development	89	156
main shoot - remuck development	454	589
main shoot - sump development	117	117
main shoot - ventilation drive development	978	978
main shoot - ore drive development	4 633	4 633
north shoot - decline development	1 042	1 930
north shoot - access development	469	1,034
north shoot - exploration platform development	0	20
north shoot - remuck development	193	329
north shoot - sump development	34	54
north shoot - ventilation drive development	274	306
north shoot - ore drive development	1 773	2 774
main shoot - exploration diamond drilling	38 080	52 321
north shoot - exploration diamond drilling	0	2 880

	Phase 2 (m)	5 Year Total
north shoot - grade control drilling	0	2 319
main shoot - production stoping	811 711	811 711
north shoot - production stoping	1 107 533	1 107 533
main shoot - ventilation raise bore	307	307
north shoot - ventilation raise bore	0	170
main shoot - exhaust drop raise	232	232
north shoot - exhaust drop raise	162	162

Table 10 - Decline development overview

	Phase 2 (m)	5-year total
main shoot - decline development	3 049	4 133
main shoot - ancillary development	1 637	1 839
north shoot - decline development	1 042	1 930
north shoot - ancillary development	502	709


Figure 13 - Isometric view of the north shoot 5 Yr development

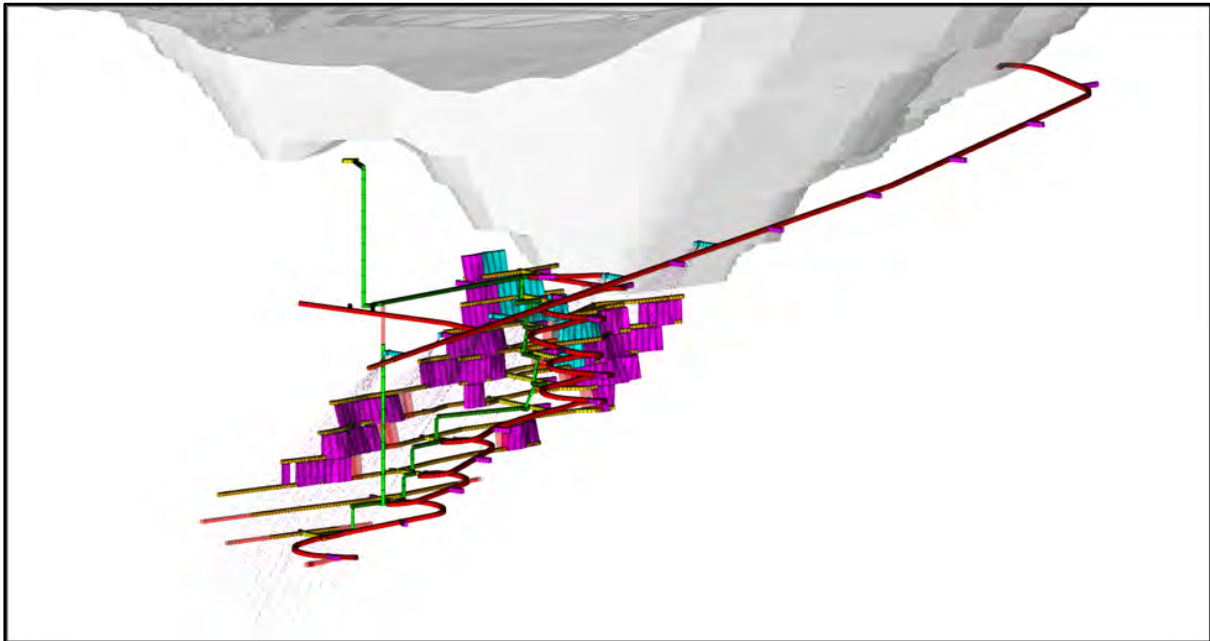


Figure 14 - Isometric view of the main shoot 5 Yr development

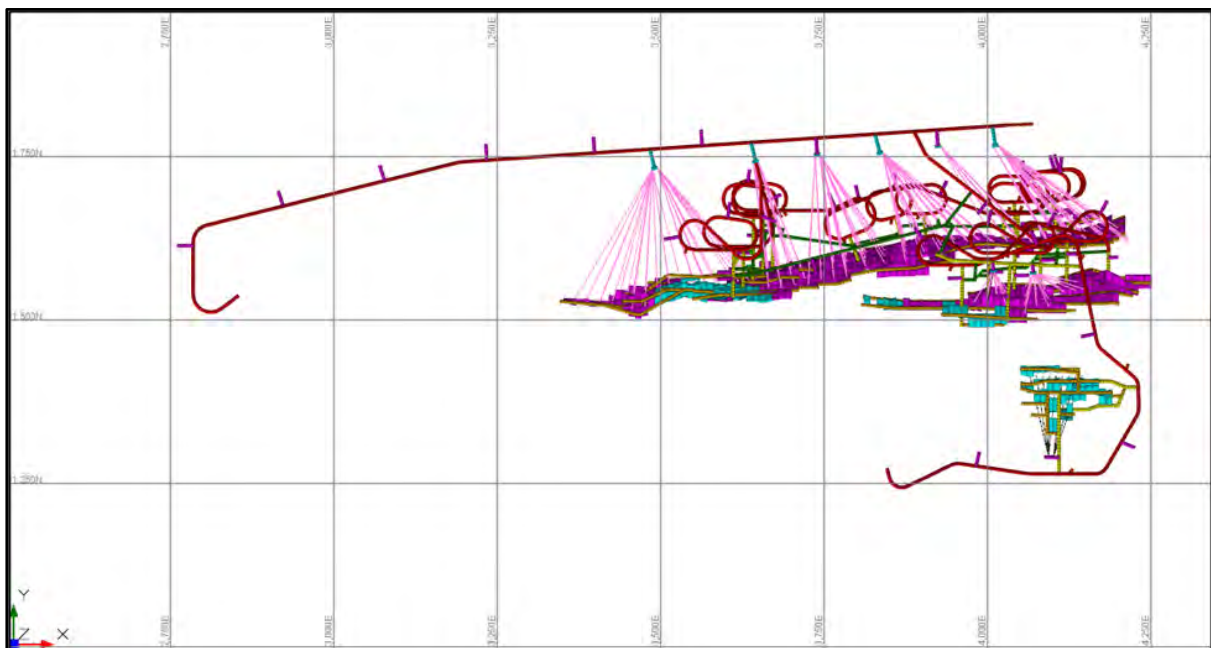


Figure 15 - Plan view of main and north shoot development for 5-year contract

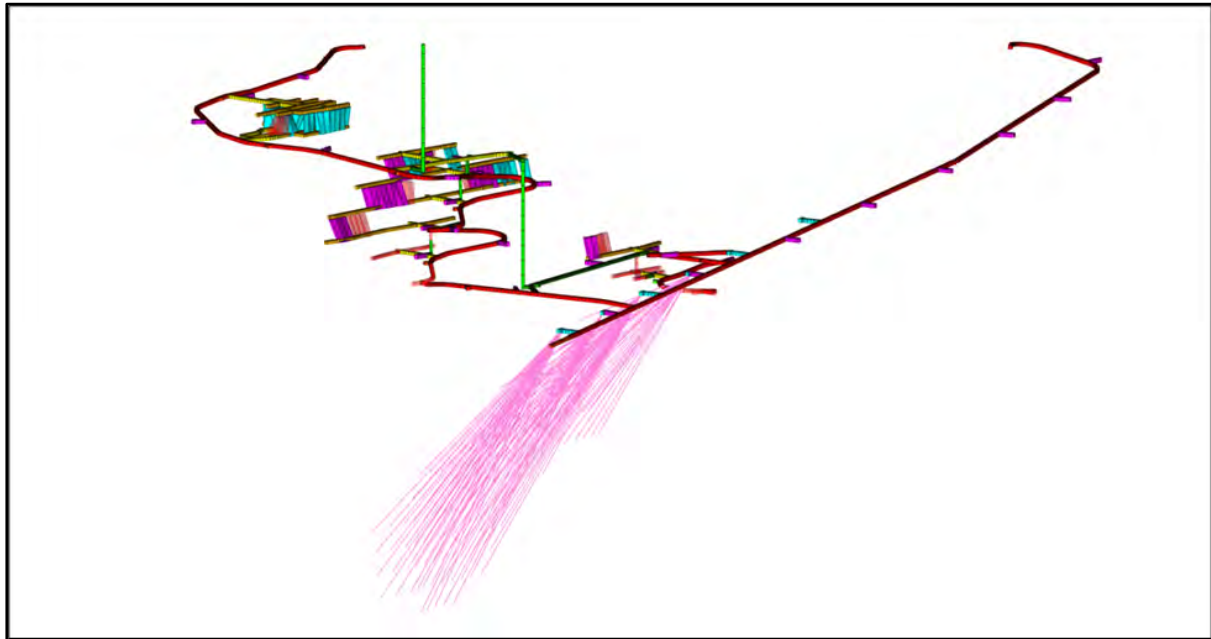


Figure 16 - Isometric view main and north shoot showing phase 2 drilling

Table 11 - Stope development overview

	Phase 2 (m)	Total
main shoot - access	758	758
main shoot - ore drive	4 633	4 633
north shoot - access	469	1 034
north shoot - ore drive	1 773	2 774

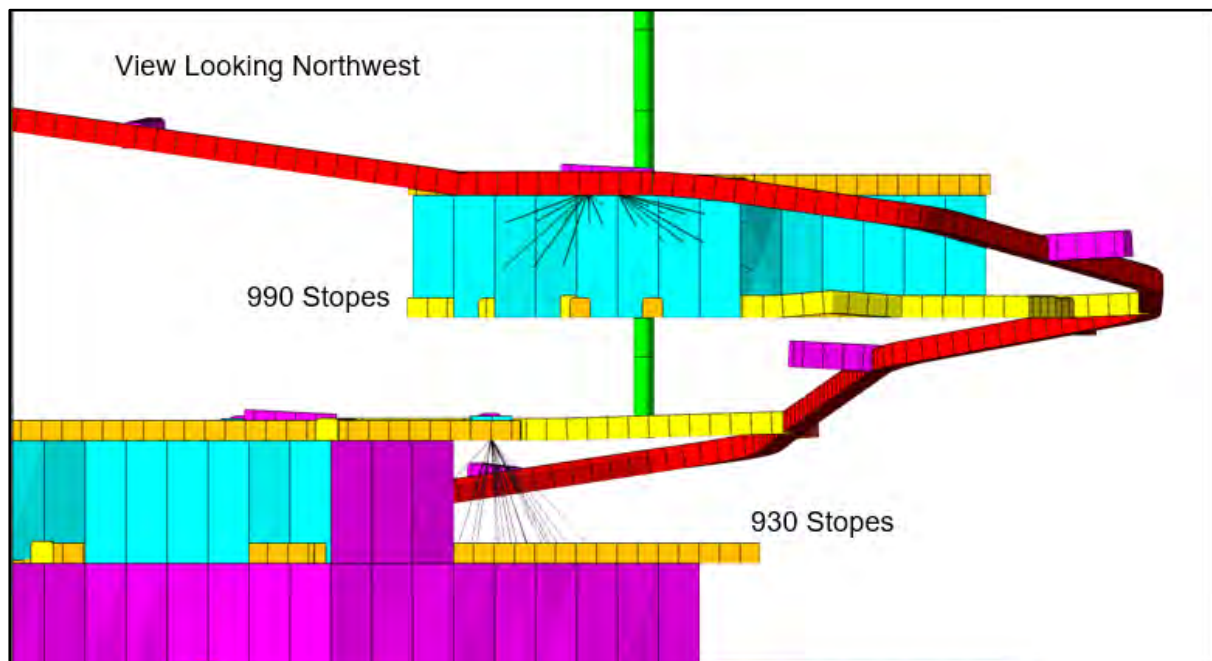


Figure 17 - Underground exploration stoping elevation view 990 m sub level north shoot

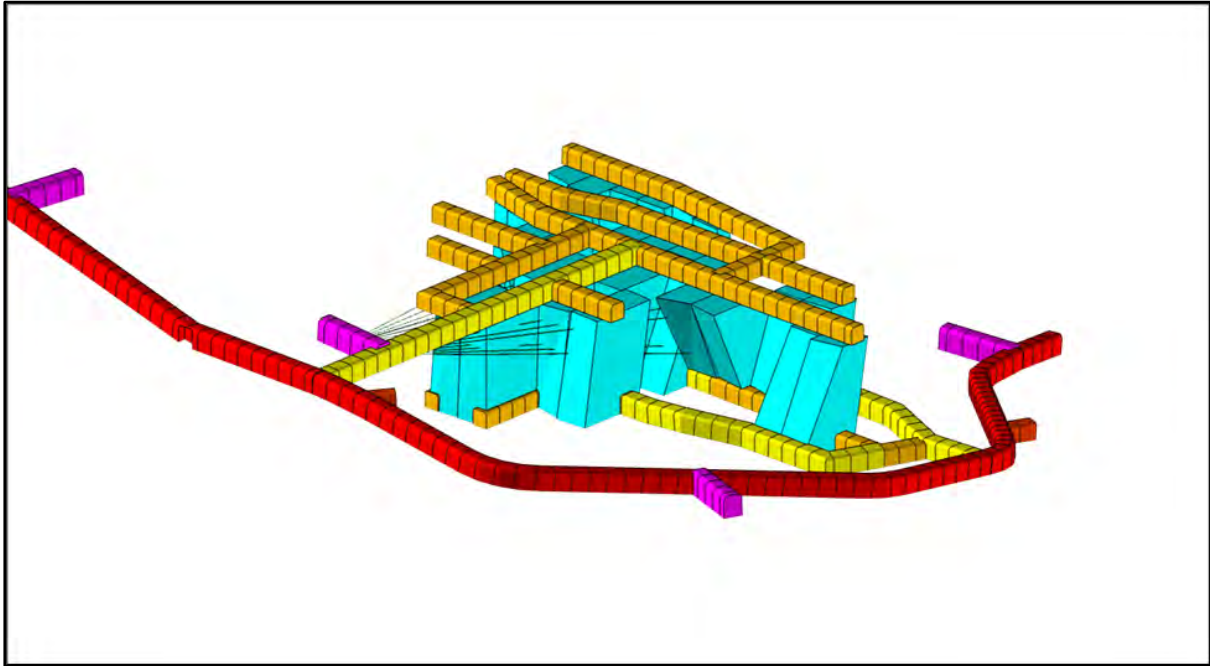


Figure 18 - Oblique view of planned development and stoping, 990 m sub level – north shoot

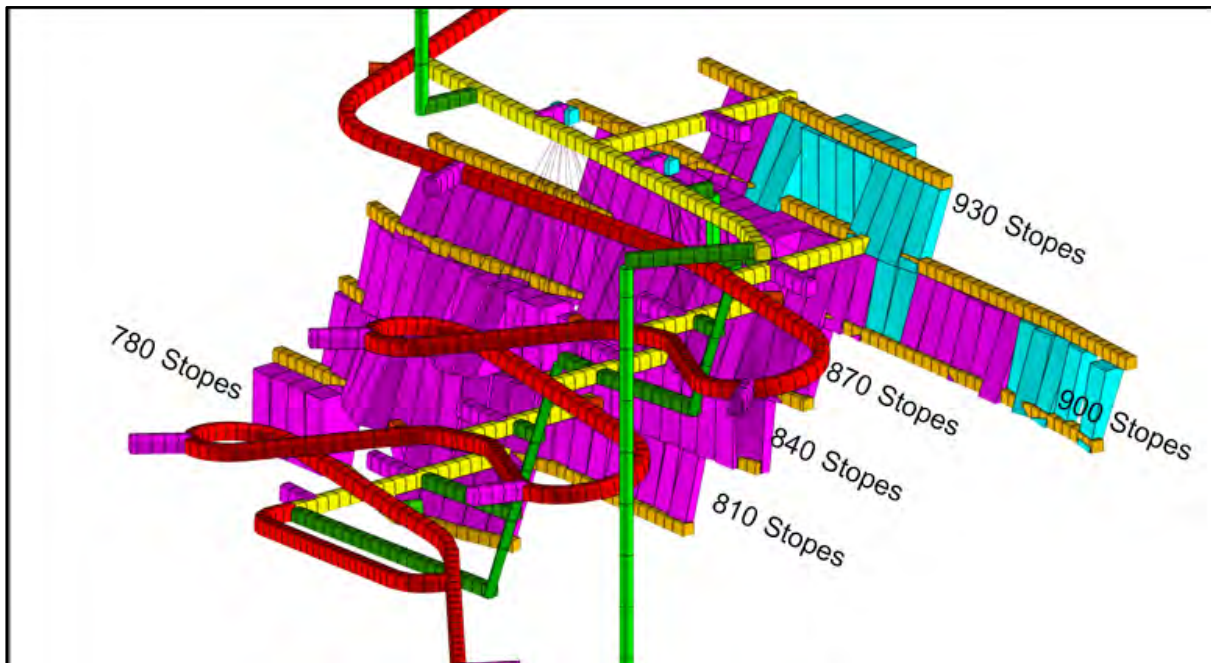


Figure 19 - Isometric view of 780 m through 930 m elevation stopes north shoot

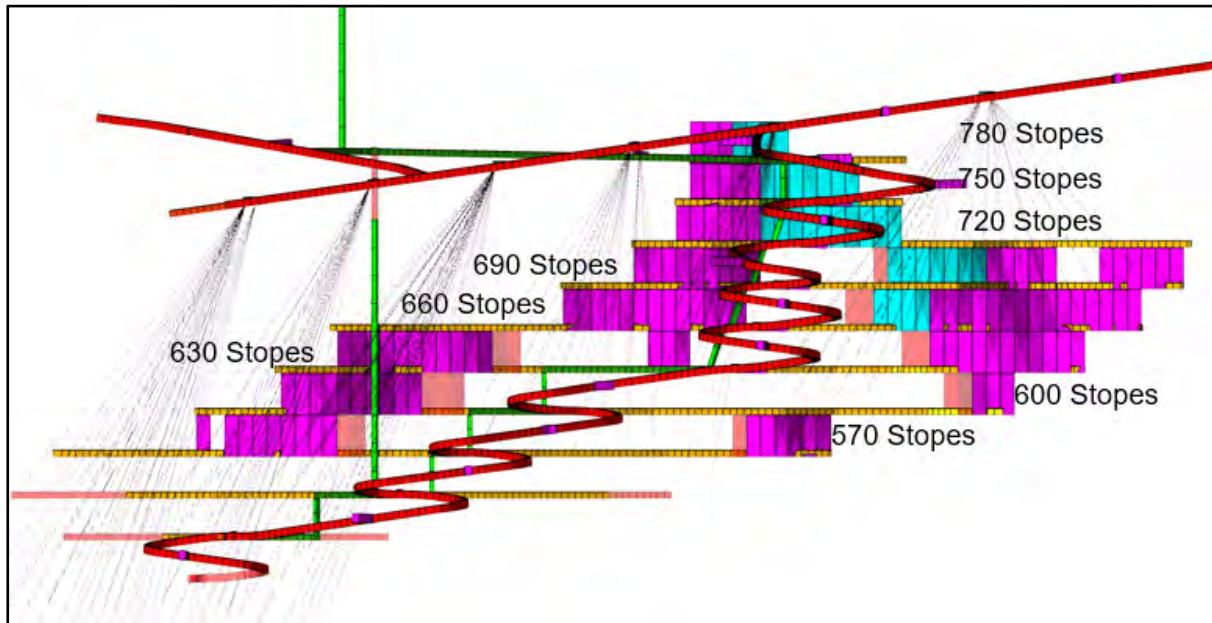


Figure 20 - Long section view of 570 m through 780 m stopes main shoot

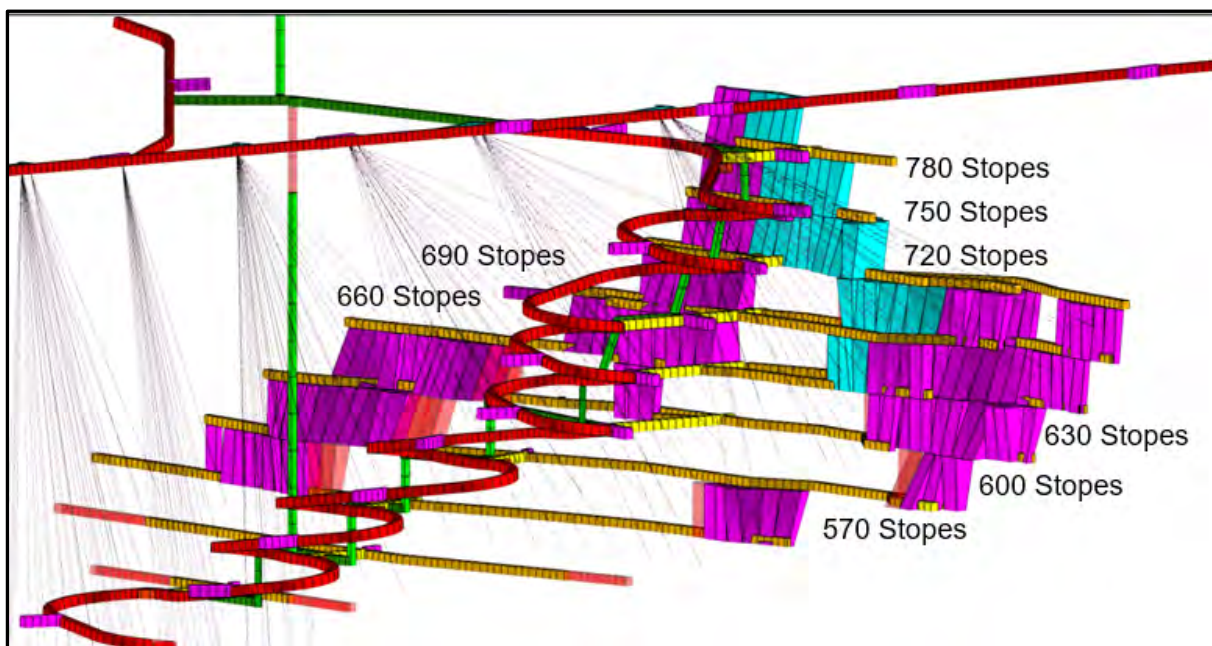


Figure 21 - Isometric view of all mining stopes within phase 2 from 570 m through 780 m stopes main shoot

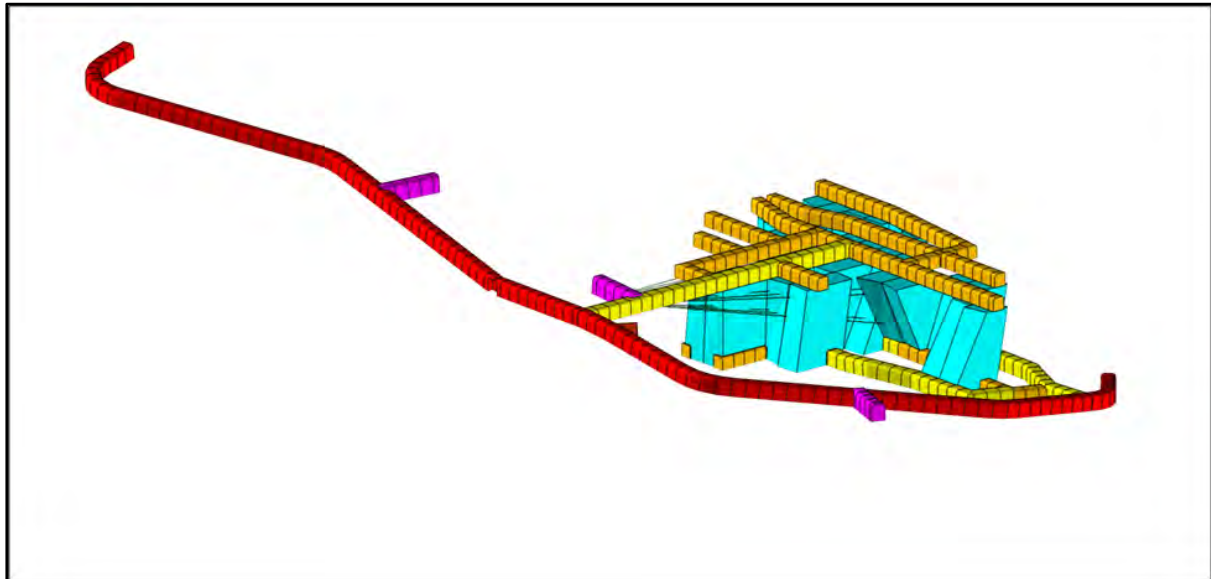


Figure 22 - Oblique view of planned development and stoping - 990 m RL north shoot

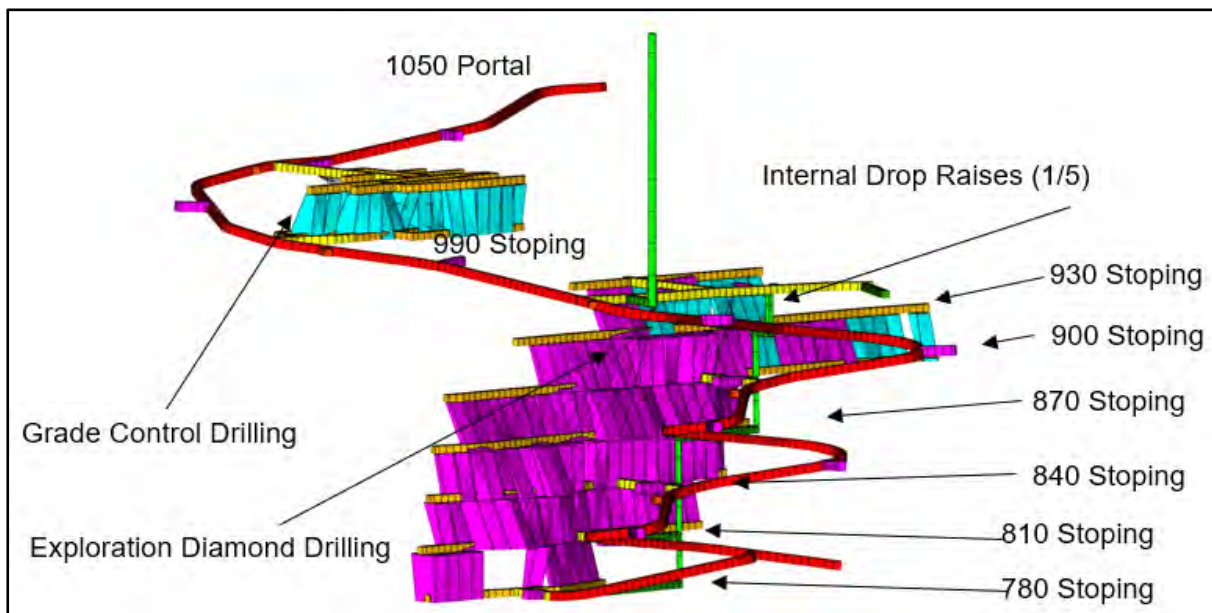


Figure 23 - Oblique view of planned development and stoping - north shoot

Table 12 - Total production and development ore and gold mined

	Phase 2 (tonnes)	5 Year total
main shoot - production tonnes	811 711	811 711
main shoot - development tonnes	282 661	282 661
north shoot - production tonnes	1 107 533	1 107 533
north shoot - development tonnes	92 497	132 730
Total - tonnes	2 294 401	2 334 634

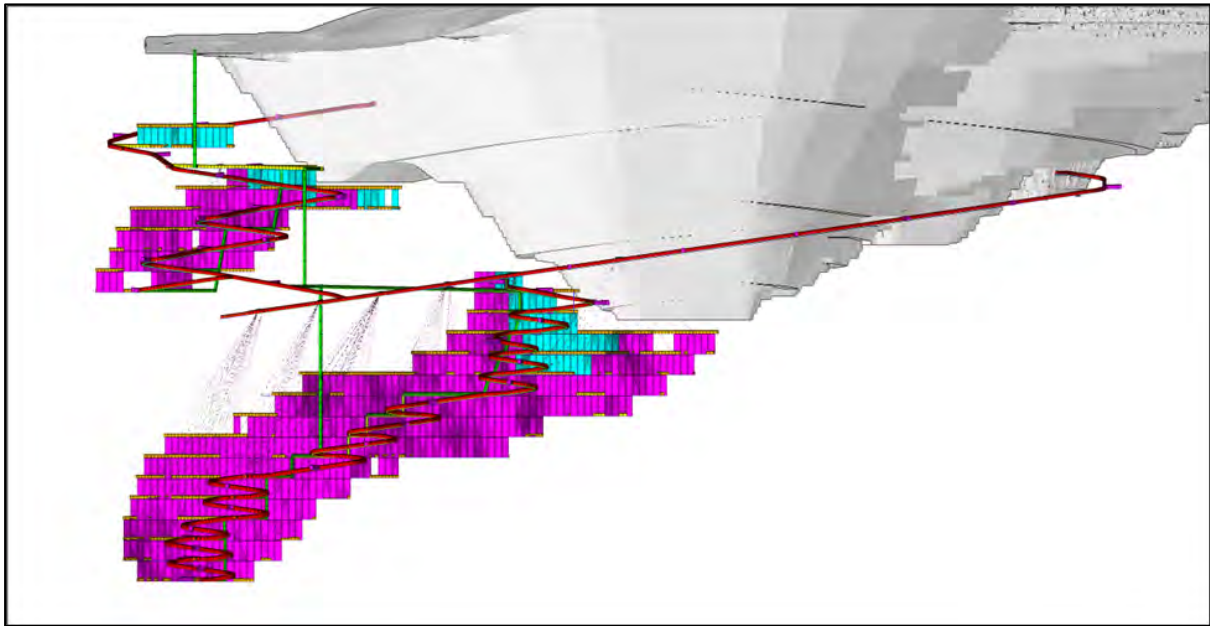


Figure 24 - Cross-section view of proposed full mine

	Unit	Phase 2	5 Year total
main Shoot - length of drop raise total	Metres	232	232
main Shoot - number of drop raises	No.	9	9
main shoot - length of raise bore total	Metres	307	307
main Shoot - number of raise bore holes	No.	1	1
north shoot - length of drop raise total	Metres	162	162
north shoot - number of drop raises	No.	6	6
north shoot - length of raise bore total	Metres	0	170
north shoot - number of raise bore holes	No.	-	1

4.4.6 EXPLOSIVES SELECTION AND CHARGING PRACTISES

For the proposed underground mining operations, emulsion explosives have been selected as the primary bulk product. These will be supplied by the contractor. An additional explosives magazine is also being constructed to cater for the additional explosives that will be required for the underground mine. This includes storage of 40 000 kg of ammonium nitrate and fuel oil (ANFO) bags.

4.4.6.1 Development charging

Development charging will utilise emulsion as the main charge medium. Each blast hole will be primed with a Nonel (shock tube) detonator, encased in a 25 – 60 g PETN cast primer. Nonel detonators will be of the long period (LP) series with lead lengths ranging from 4.7 m to 6.0 m, depending on the depth of the charge hole, to facilitate ease of connection.

At the development face, detonators will be connected using 5 grams per metre (g/m) detonating cord and initiation will be achieved via two electric detonators.

Perimeter control holes will be charged using either a low-density emulsion or a decoupled explosive product (e.g. plastic barrel-type systems), subject to availability within the country and site-specific ground conditions. Controlled perimeter blasting trials will be conducted to determine the most effective method for minimising overbreak and ensuring wall stability.

4.4.6.2 Production charging

Production charging will also use emulsion explosives as the bulk product, with initiation achieved via electronic detonators. Detonator lead lengths of 15 m, 24 m and 30 m will be selected based on individual hole depths.

All production holes will be primed using 90 g to 250 g Pentex Stopeprime boosters (with spiders) or equivalent, with selection dependent on the hole diameter. Electronic detonators will be placed every 8 m –10 m of charge length, in accordance with best practice to ensure effective energy distribution and fragmentation.

4.4.6.3 Initiation procedures and safety

Development blasts will be initiated with two electric detonators, connected to the face via detonating cord. A bell wire or firing line will extend back to a designated firing point, from which the blast will be initiated using a shot exploder.

Blasting will only proceed after clearance of all personnel from the designated blast area and confirmation that the underground tagboard has been cleared in accordance with mine safety protocol.

4.4.6.4 Design

For Phase 2 production blast designs, including both drilling patterns and charging layouts, will be prepared by the legally assigned Drill and Blast Engineers. These designs will be issued in advance of scheduled blasting activities to support uninterrupted stoping operations and ensure alignment with production schedules.

All blast plans will be developed to ensure they are clear, practical and easily interpreted by charge-up crews. Proper training will be provided to ensure crews are fully competent in understanding and executing the designs safely and effectively.

4.4.6.5 Storage

The surface magazine (i.e. magazine No. 3) (Figure 5), provided by the Proponent, will serve as the primary explosive's storage facility for the underground mining activities. The contractor's team will evaluate the feasibility of establishing a working party magazine underground to facilitate more efficient delivery of explosives to underground charging locations, as operationally required. This will require additional approvals by the Chief Inspector of Explosives before this activity can go ahead.

4.4.7 VENTILATION

Ventilation equipment will be installed concurrently with face drilling wherever feasible. However, due to the complexity and physical constraints of the tasks, the installation of heavy-duty pump lines and the extension of permanent ventilation ducting will be carried out in separate, scheduled cycles. Phase 2 includes the excavation of one surface-bored ventilation raise, totalling approximately 170 m to augment the underground ventilation system. Additional ventilation infrastructure will comprise a raised-bored connection between the north shoot and the main shoot, as well as a series of interconnected exhaust drop raises. Two primary ventilation raises are currently envisioned, with supplementary inter-level raises ranging from 30 m to 310 m in length, extending from the underground development to the surface. Raises shorter than 30 m will be constructed using drop-raising methods, with cross-sections ranging between 3.5 m and 5 m in diameter.

After the face has advanced sufficiently from the end of the permanent ducting, 40 m typically, the shot bag will be replaced with the permanent ducting. This installation process will require the fan on which the ducting is to be installed to be turned off. By maintaining the permanent ducting at a distance from the face, this will minimise blast damage and result in more efficient ventilation of the headings.

Permanent ventilation ducting will be installed on catenary cable properly tensioned and secured to selected jumbo rock bolts. All ventilation ducting will consist of flexible bags with diameters ranging from 1 200 mm to 1 400 mm, selected according to the specific ventilation demand, as well as the dimensions of the drives and equipment.

The contractor is responsible for designing and implementing a compliant, efficient mechanical ventilation system that meets regulatory airflow and air quality standards.

4.4.8 DEWATERING AND PUMPING

The mine dewatering strategy for the underground mining activities is tailored to the specific mine design and will be implemented through a staged pumping system involving decline faces, sumps and hopper tanks. The system incorporates a variety of pump types to manage water inflows efficiently throughout the development phases.

4.4.8.1 Stage 1: Face dewatering

Initial dewatering will be carried out using submersible Flygt pumps installed at the decline faces. Standard flows will be managed with 8 kilowatt (kW) units, while higher flow requirements will be addressed using 20 kW pumps. Discharge from the face will be directed to the nearest sump. These sumps will be connected through a staged reticulation system utilising 110 mm piping. All associated electrical infrastructure, including power cables, starters and distribution boards, has been accounted for in the system design. Spare pumps will be maintained on site to ensure operational continuity.

4.4.8.2 Stage 2: Sump transfer

Secondary dewatering will be managed by medium-sized pumps (ranging from 20 kW to 37 kW) positioned in mine sumps. These pumps can deliver similar flow rates as the stage 1 units but are designed for extended pumping distances. Initially, water will be transferred to the boxcut sump. As mine development progresses, the staged transfer will continue to subsequent sumps or to the hopper of a larger mono pump, typically rated between 55 kW and 90 kW.

4.4.8.3 Stage 3: Long-distance pumping

The final stage of the dewatering process will involve the use of large helical rotor pumps, designed to handle moderate water volumes at high head pressure. These units are suitable for long-distance pumping where high frictional losses occur due to extended poly pipe runs. In the early stages, discharge will be directed into the boxcut sump. Once the main pump stations are commissioned, these pumps will be relocated deeper into the mine and installed in excavated pump cuddies, discharging directly into the primary pump stations.

4.4.8.4 System design considerations

A combination of submersible pumps, mono tanks, sumps and drainage lines will be utilised to develop an efficient and reliable dewatering system. The system configuration will be based on achieving optimal performance while meeting the specific water-handling requirements of the Project.

4.4.9 AUXILIARY SERVICES

Bryne cut will be responsible for the provision and installation of auxiliary services, including fuel, water and power supply. These services will be positioned to minimise the risk of damage from mobile equipment and will be mounted as close to the wall as practically achievable. In addition, Bryne cut will install mine services such as water supply, dewatering, and compressed air using high-density polyethylene (HDPE) piping. Main travel ways will utilise 110 mm diameter pipes, while 63 mm diameter pipes will be used in level ore drives. To limit interference between construction/service crews and the development team, air, water and pump lines will be installed a safe distance back from the working face. The air and water pipelines will be rated at an internal pressure nominal (PN) of 12.5, while dewatering lines will be rated at PN 16.

4.4.9.1 Fuel supply

A Satstat fuel bowser will be set up near the portal, with the option to move it underground later. The fuel bladders inside will be refilled from the surface facility.

4.4.9.2 Water supply

The Proponent will provide water to the underground portal entrance. From this point, the Contractor will establish and maintain the underground water distribution system using a 150 mm pipeline (or equivalent) to support drilling and related activities. On the 950 m and 1050

m underground benches, all permanent water infrastructure will be installed and maintained by the Contractor.

Service water will be supplied by the Proponent. This will be delivered from a surface storage tank via a pipeline down the high wall with a valve connection or alternatively transported to underground tanks by water tankers. The valve outlet flange will constitute the defined Navachab battery limit for service water delivery.

The Contractor will be responsible for managing all underground water, ensuring that discharged water will be hydrocarbon-free before release to the pit. Hydrocarbons separated from the treatment of underground mine water will be disposed of in compliance with applicable regulations. Treated underground water will be discharged to surface, from where it will report to the open pit sump and be managed by the Proponent.

Additionally, wastewater generated underground will be treated, recirculated, and reused solely as service water within underground operations.

4.4.9.3 *Power supply*

As mentioned in section 1.4, power for mining and processing is sourced from the NamPower grid, supported by standby diesel generators. The current trial mine runs on a 500 kilovolt amperes (kVA) generator with an additional 500 kVA unit for backup. For the full scale mining the following power will be supplied by low and high voltage cables:

- Low voltage cable 1000 V

Low voltage cables will be installed from the IT service basket using certified cable hangers or those provided by the Proponent. Installation is expected to occur in sections ranging from 100 to 250 m. Between these sections, a jumbo extension cable will be used to supply power to the jumbo. The low-voltage cable is used to supply electrical power to the development jumbo, installed in staged lengths and connected via extension cables as mining advances.

- High voltage cable 11 kV

High voltage cables will be installed from the IT service basket using certified cable hangers or those provided by the Proponent. The spacing of installations will depend on the length of the low voltage cable runs originating from each substation. The high-voltage cables are used to transmit electrical power from the IT service basket to downstream distribution points, installed using certified hangers at specified intervals.

4.4.9.4 *Communications*

Communication infrastructure will be installed using the IT service basket. All underground equipment and light vehicles will be equipped with two-way radios to maintain effective communication. A dedicated channel will be assigned to the underground operations, with additional channels available for general communication.

4.4.10 EQUIPMENT REQUIREMENTS

The following mobile and ancillary equipment are required for underground mining operations:

- Remote-capable underground loaders (teleoperation preferred);
- Long-hole production drilling, bolting and meshing;
- Cable bolting equipment (or equivalent);
- Underground diamond drilling rigs (NQ (which is 47.6 mm core diameter) core up to 500 m); and
- Maintenance facilities and oil separation systems.

Table 13 provides a list of equipment as a reference guide for water and air usage required at a site

Table 13 - Equipment list for water and air usage required at a site

Equipment	Minimum water flow	Recommended water flow	Minimum air flow	Maximum air flow
DD421 Jumbo	150 L/min	130 L/min	250 L/min	350 L/min
DL431 Solo	240 L/min	300 L/min	200 L/min	300 L/min

4.5 REHABILITATION AND CLOSURE

The underground extension will increase the life of mine and extend mining operations by approximately 10 years. No changes are envisaged to the existing closure plan for surface infrastructure. At closure, all equipment and cables will be reclaimed from the underground workings before the decline and ventilation shafts (planned for future use) will be sealed. A monitoring casing will be installed in the vent shaft seal to monitor the rebounding water table and water quality in the workings. The underground mine will be incorporated into the updated mine closure plan being developed to align with the Namibian mine closure policy developed by MIME.

5 ENVIRONMENTAL AND SOCIAL BASELINE

5.1 BASELINE DATA COLLECTION

This section describes the findings of a desktop study for the amendment report. The desktop study included a review of existing literature, spatial data generated through monitoring activities and publicly available reports pertaining to the receiving biophysical and socio-economic environments of the Project area.

5.2 CLIMATE

Climate and weather information for the Project was obtained from the weather station present on the Navachab mine site. The area has a semi-desert climate, characterised by very low and variable rainfall, high evaporation rates and pronounced diurnal temperature fluctuations. Summers are typically hot, while winters are generally mild.

5.2.1 TEMPERATURE

Temperature data from April 2024 to March 2025 was used to display the weather on an annual basis. It should be noted that due to technical difficulties with the weather station experienced in quarter 2 of 2025, climate data was analysed for this period. The hottest months generally extend from November to January, whereas the coldest months occur between June and August. The summer period from November to January is characterised by warm conditions, with average maximum temperature of approximately 36 °C and a minimum of 19 °C (Figure 25). During winter the lowest average temperature is 9°C with a maximum average temperature of 28 °C. Overall, the climate demonstrates relatively stable annual temperature patterns, with moderate seasonal variation rather than extreme fluctuations.

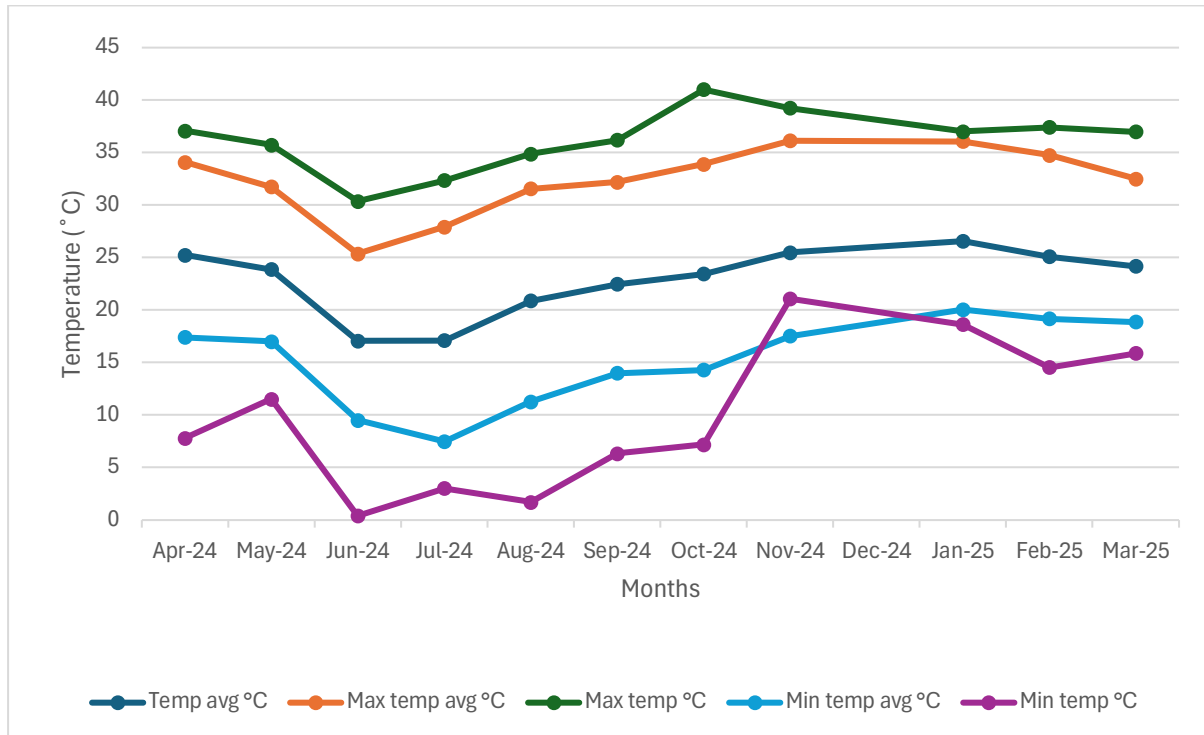


Figure 25 - Temperature recorded by the Navachab onsite weather station between April 2024 and March 2025

5.2.2 WIND

The average wind speed from April 2024 to March 2025 captured on site, ranges from 1 km/h to 10.5 km/h, with highest wind speed recorded in June and October, respectively. Dominant winds are namely east-northeast winds (ENE) Figure 26).

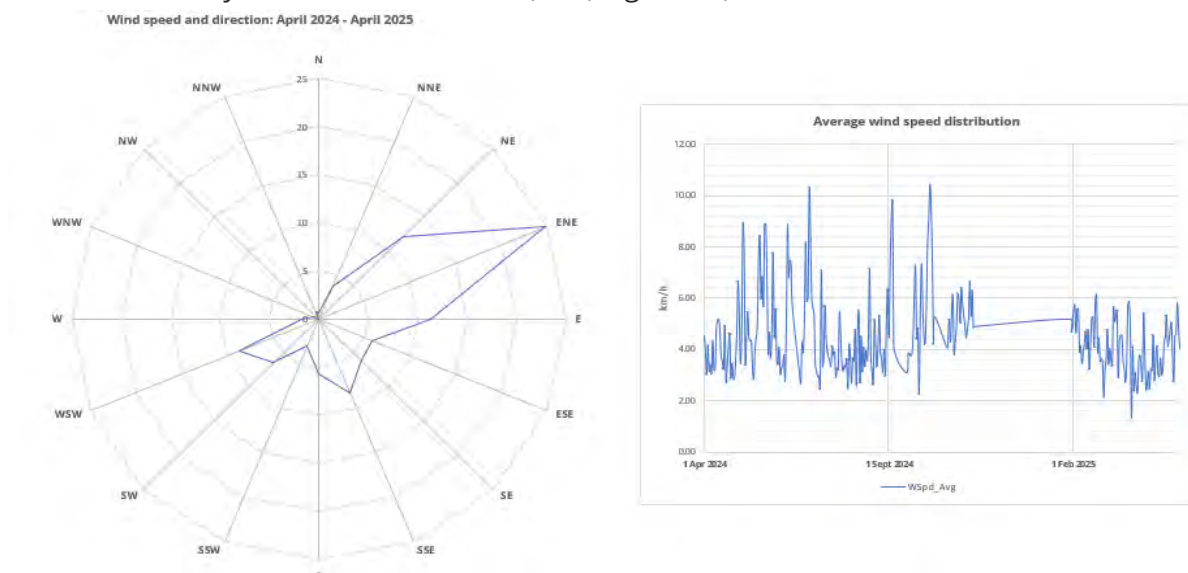


Figure 26 - Wind direction and average wind speed distribution between April 2024 and March 2025

5.2.3 RAINFALL AND EVAPORATION

Average annual rainfall observed between April 2024, and March 2025 recorded a value of 105 mm, with rainfall seasons typically occurring over two months per year (February and March) as shown by Figure 27. In contrast, potential evaporation is substantially higher, estimated between 2 240 and 2 380 mm per year. This imbalance highlights the arid to semi-arid climatic regime, where evapotranspiration significantly exceeds rainfall, resulting in limited effective recharge to groundwater resources (Mendelsohn, Jarvis, Roberts, & Robertson, 2002). Due to the position of the underground mining activities in the main pit, rainfall can have an influence and therefore this will be considered for the dewatering plan for underground mining activities to be developed by the Proponent.

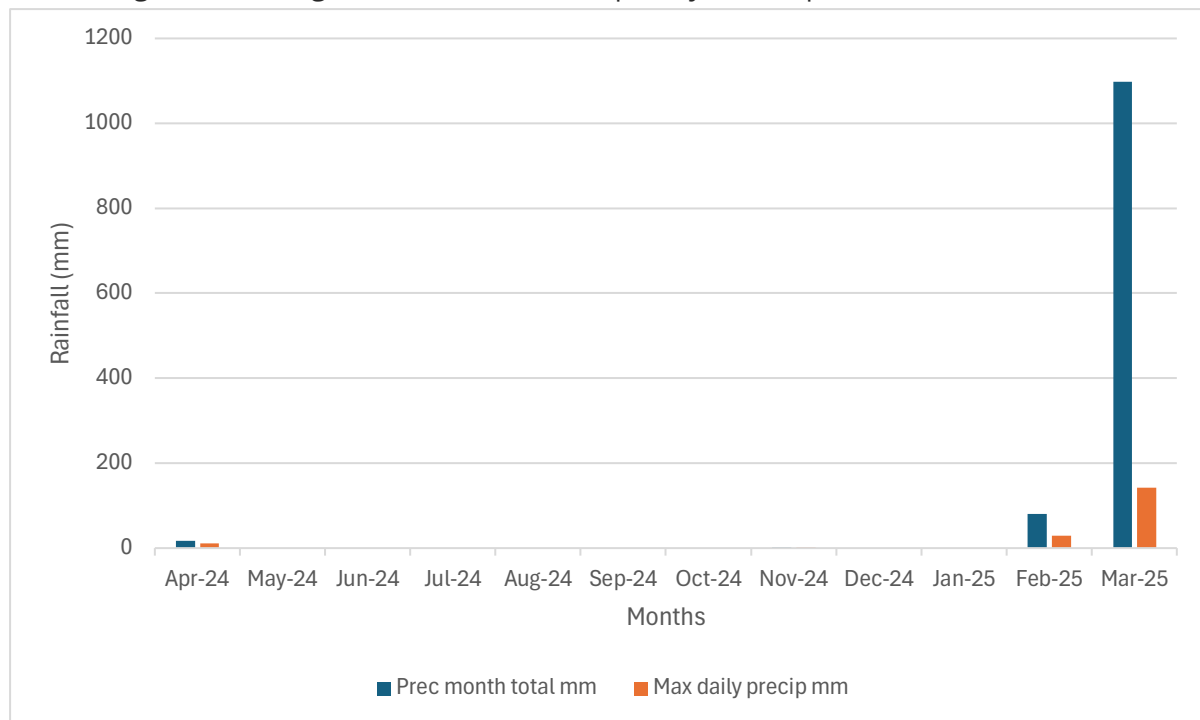


Figure 27 - Precipitation recorded by the site weather station between April 2024 and March 2025

5.2.4 SOLAR RADIATION AND HUMIDITY

The annual average solar radiation is between 5.8 to 6.0 kWh/m²/day, which is moderate for Namibia but considered high internationally (Atlas of Namibia Team, 2022). The months with the highest humidity is typically between January and March when rainfall is most common, experiencing a relative humidity (RH) of 60 to 70%, while the driest months, June to September, have a humidity between 20 and 30% RH (Weather Spark, n.d.).

5.3 AIR QUALITY

The below sections describe the activities related to the management of air quality on the Navachab Gold Mine during daily operational activities.

5.3.1 DUST SUPPRESSION

Dust suppression on site comprises of activities such as water spraying of gravel roads, stockpiles, laydown areas and the application of chemical binding dust suppressants, especially during the dry season. The dust monitoring program consists of depositional dust gauges with buckets that measure fall out dust, that are collected monthly. The dust stations comply with the American standard for depositional (settleable) dust monitoring (ASTM D1739).

5.3.2 DEPOSITION FALL OUT DUST MONITORING

Fallout dust, categorised as nuisance dust, is routinely monitored through depositional dust stations to track patterns and highlight areas requiring stronger dust suppression. Furthermore, third-party compliance monitoring helps determine whether fallout dust has an impact on stakeholders situated near the mine's operations.

The depositional dust monitoring results are compared to the dust fallout limits as provided by the South African National Standard (SANS) limit of 1200 mg/m²/day for industrial activities, as an average value over a 28 – 32-day period. Third-party receptor gauges are to comply with the residential limit of 600 mg/m²/day (Table 14 and Table 15). The dust monitoring stations conform to the Standard Test Method for Collection and Measurement of dust fall (ASTM D1739-98), designed primarily to study long-term trends and obtain fall out dust datasets.

Table 14 - SANS (1929:2011) Ambient air quality evaluation criteria for dust deposition

Band number	Band description	Dust rate (d) mg/m ² /day	Comments
1	Residential	D < 600	Permissible for residential and light commercial.
2	Industrial	600 < D < 1200	Permissible for heavy commercial and industrial.
3	Action	1200 < D < 2400	Requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year.
4	Alert	2400 < D	Immediate action and remediation required following the first incidence of dust fallout rate being exceeded. Incident report to be submitted to the relevant authority.

Table 15 - The target, action and alert threshold values from the SANS 1929:2011 ambient air quality monitoring standards

Level	Dust fallout (mg/m ² /day)	Averaging period	Permitted frequency of exceeding dust fallout rate
Action residential	D < 600	30 days	Three within any year, no two sequential months.

Level	Dust fallout (mg/m ² /day)	Averaging period	Permitted frequency of exceeding dust fallout rate
Action industrial	D < 1200	30 days	Three within any year, not sequential months.
Alert threshold	D < 2400	30 days	None. First incidence of dust fall rate exceeded requires remediation and compulsory report to relevant authorities.

Navachab's air quality (NAQ) network comprises of 10 fallout dust gauges (NAQ01N-10). According to the most recent data recorded from July 2024 to July 2025, the following observations were made Figure 28):

NAQ04 surpassed the permissible industrial threshold in November 2024 (1 216 mg/m²/day) and April 2025 (1 324 mg/m²/day). The location where NAQ04 was located was turned into a WRD; therefore, NAQ04 was relocated to Pit control and renamed to NAQ04N.

NAQ07 surpassed the permissible industrial threshold in November 2024 (1 585 mg/m²/day) and December 2024 (1 622 mg/m²/day).

In April 2025 NAQ03 (2 598 mg/m²/day), NAQ05 (2 771 mg/m²/day) and NAQ07(4 781 mg/m²/day) exceeded the alert threshold limit. April 2025 has unusually high values compared to the other months throughout the year. Although there have not been consecutive exceedances, dust gauges that show a history of large increases should be closely monitored.

The remainder of the dust gauges did not exceed the industrial limit during the reporting period.

Figure 29 below provides an overview of the depositional monitoring stations.

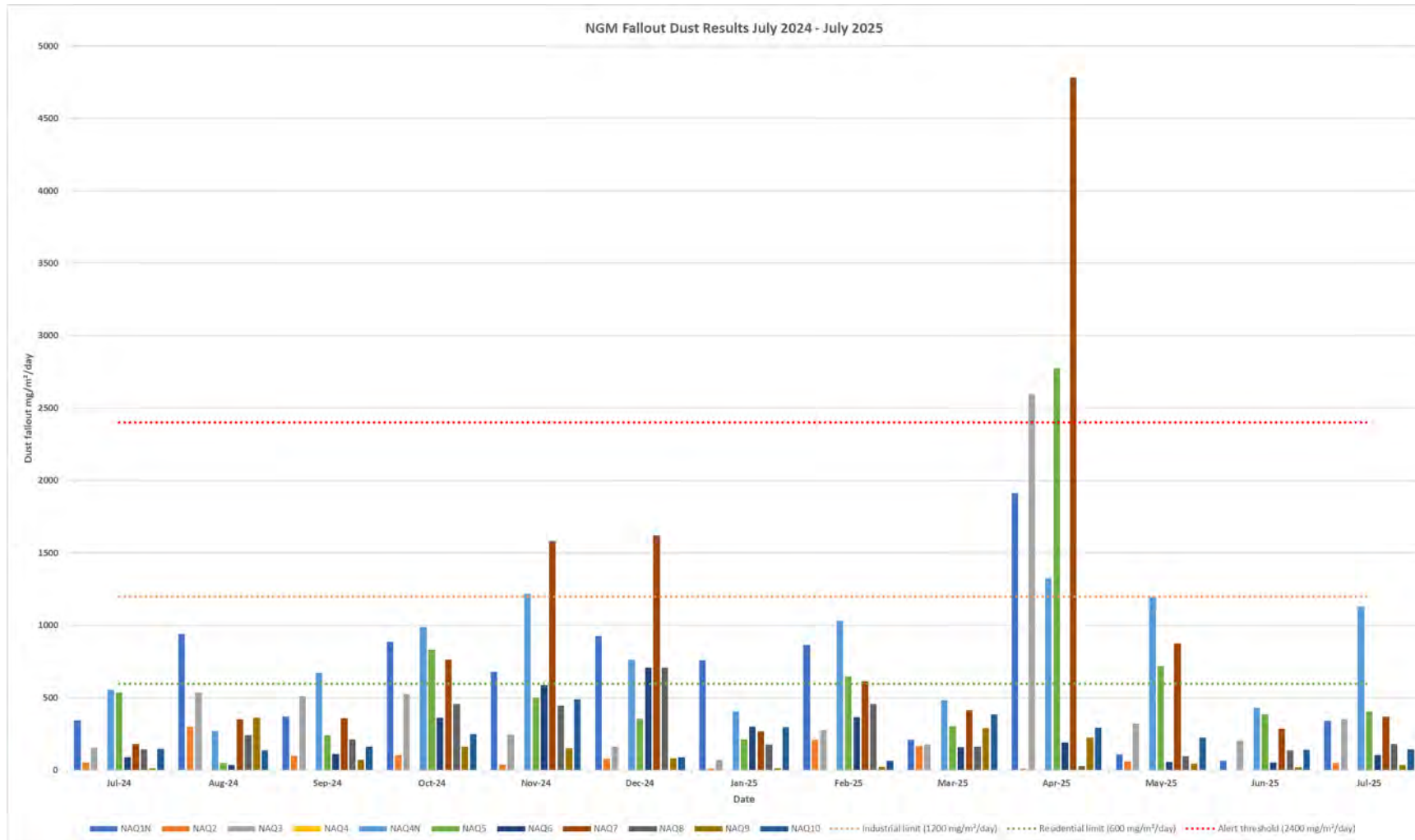


Figure 28 - Mine dust fallout results from July 2024 to July 2025

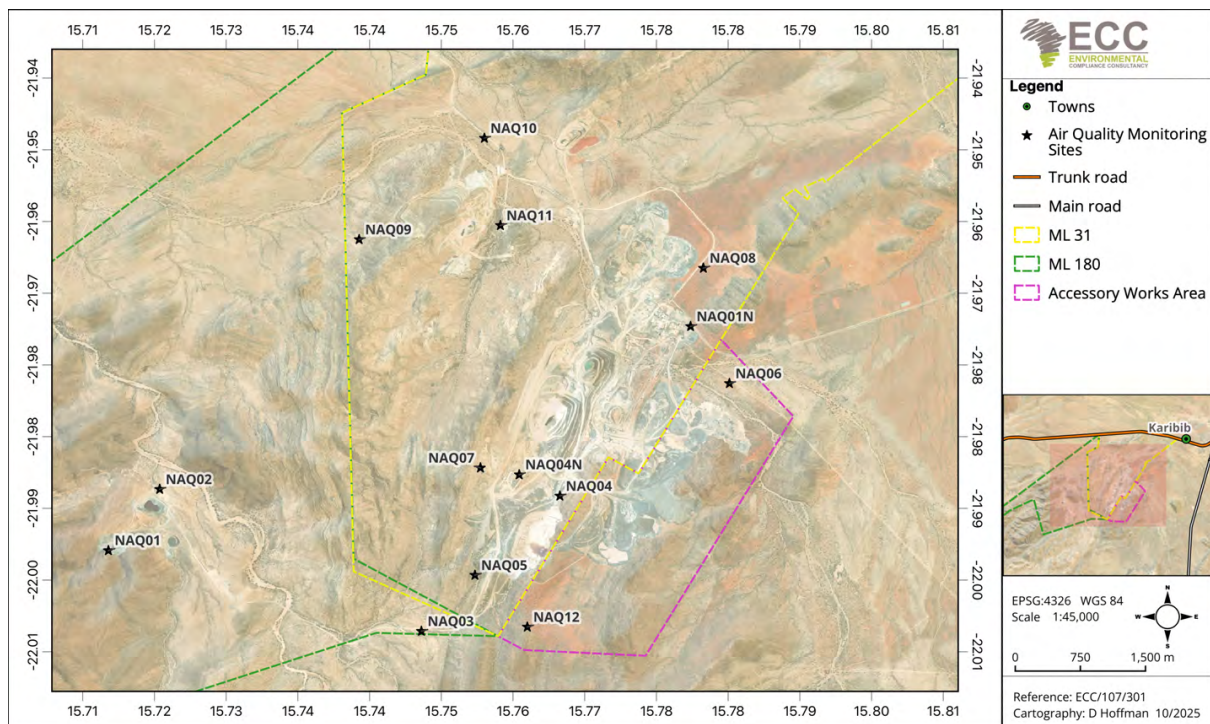


Figure 29 - Navachab Gold Mine dust bucket monitoring network

5.4 GEOLOGICAL SETTING

Most of Namibia's valuable mineral resources have been found in the western part of Namibia, where the oldest rocks are exposed to the surface, i.e., the Damara Supergroup, where the mine is situated (Mendelsohn *et al.*, 2002). Most of these formations (of various ages and compositions) are exposed in the west as rugged landscapes of mountains, hills, valleys and plains with sparse vegetation, shown in Figure 30.

The regional geology of this area consists mainly of the Swakop Group, where the main rock types are schists and dolomites. The Swakop Group is part of the Damara Supergroup and Gariep Complex (Bubenzer, 2002). The Swakop group is further divided into the Navachab and Usakos subgroups, which are then even further divided into different formations and members shown in Figure 30 (Wulff *et al.*, 2017). The area contains numerous quartz-vein-hosted gold prospects, reflecting the influence of an extensive hydrothermal system (Creus, Pieter Koenraad, MSc Thesis, 2011–12). The local geology lies within the Navachab synform and is predominantly composed of dolomitic marble.

According to Wulff *et al.* (2017), the Navachab gold deposit is situated in the Southern Central Zone (SCZ) of the Pan-African Damara Belt in Namibia (Figure 31). The SCZ consists of Neoproterozoic, shelf-type metasedimentary rocks metamorphosed under high temperature /low pressure (HT/LP) conditions. The metamorphism was accompanied by large granite magmatism (Wulff *et al.*, 2017).

A vein swarm extends across the entire northwest portion of the Karibib Dome, spanning an area of 5×3 km, and hosts the Navachab gold deposit. Additionally, high-grade mineralisation can be found in replacement bodies near the base of the Okawayo Member that are skarn-style and sulphide-rich.

In the areas where veins crosscut metapelites, calc-silicate rocks and marbles (of the Arandis formation at the periphery of the anticline) it tends to be mineralised with gold (Wulff *et al.* 2017). In contrast, where veins crosscut diamictites of the Chuos formation and continental quartzites and arkoses of the Etusis formation, gold is usually absent. This is possibly a result of marine units containing accessory graphite, which aided a favourable reducing environment for the precipitation of gold (Wulff *et al.*, 2017).

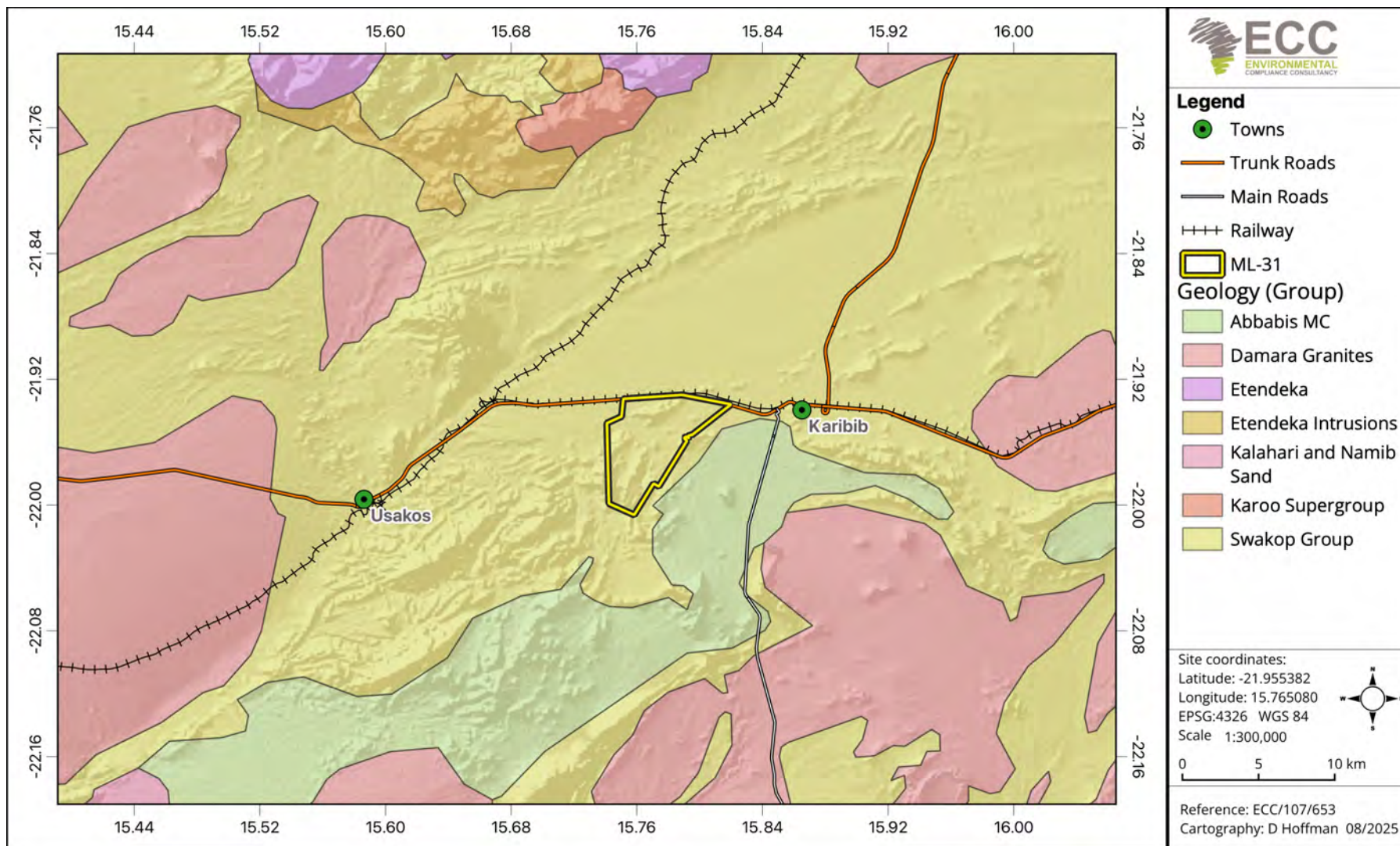


Figure 30 - Regional geology of the Project area and the general Karibib area

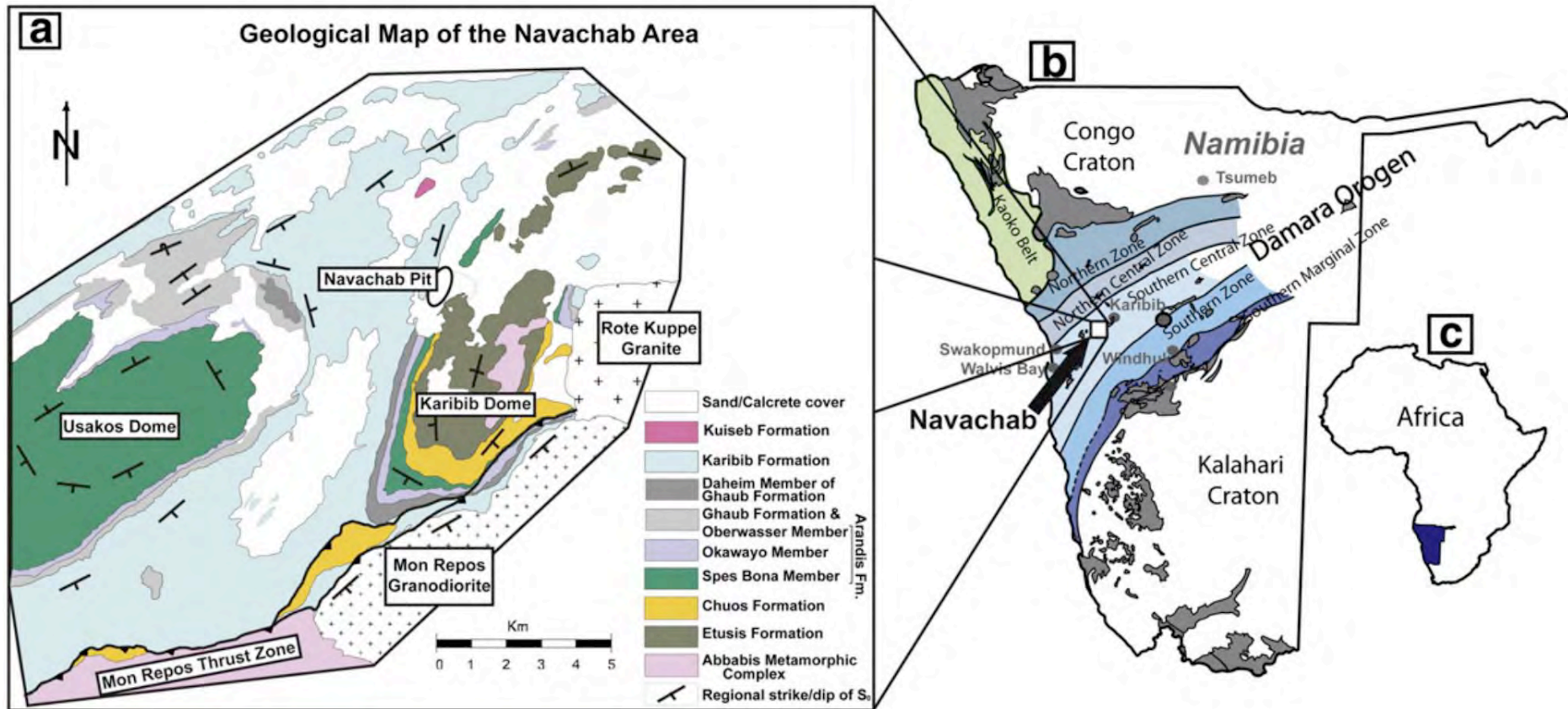


Figure 31 - Regional geology of the Project area and the general Karibib area

5.5 TOPOGRAPHY AND SOILS

The Project area elevation gradually decreases but varies between just below 1100 m above sea level (north-western corner) to just below 1300 m above sea level (1287 m hills) from the south-eastern side of the mine site towards the north-western side. The current existing explosive magazines can be seen from neighbouring farms to the southeast of ML 31 up to 10 km away from ML 31, from an elevation of 1200 m and above as shown in Figure 32.

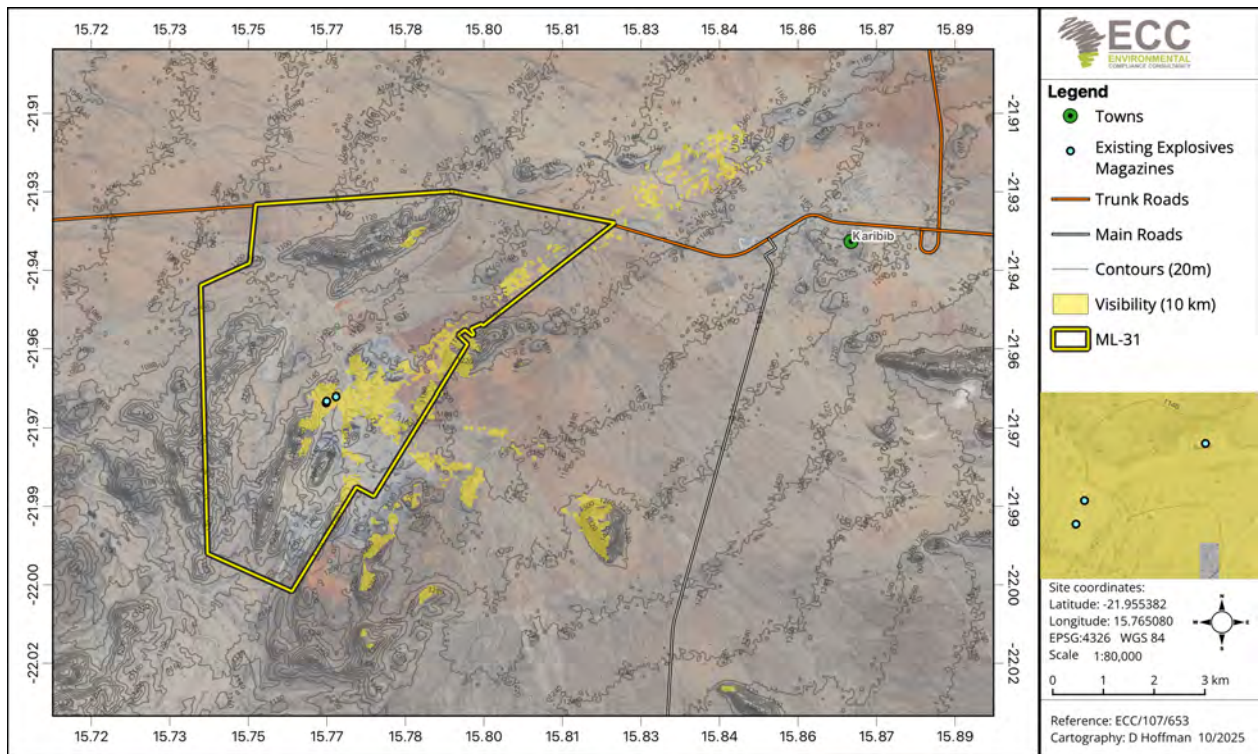


Figure 32 - Viewshed map of existing explosives magazines

With the addition of the proposed third explosive magazine, these structures would be visible from nearby farms located to the east of the ML and from the B2 road, up to 10 km away from an elevation of 1200 m, this is shown in Figure 33.

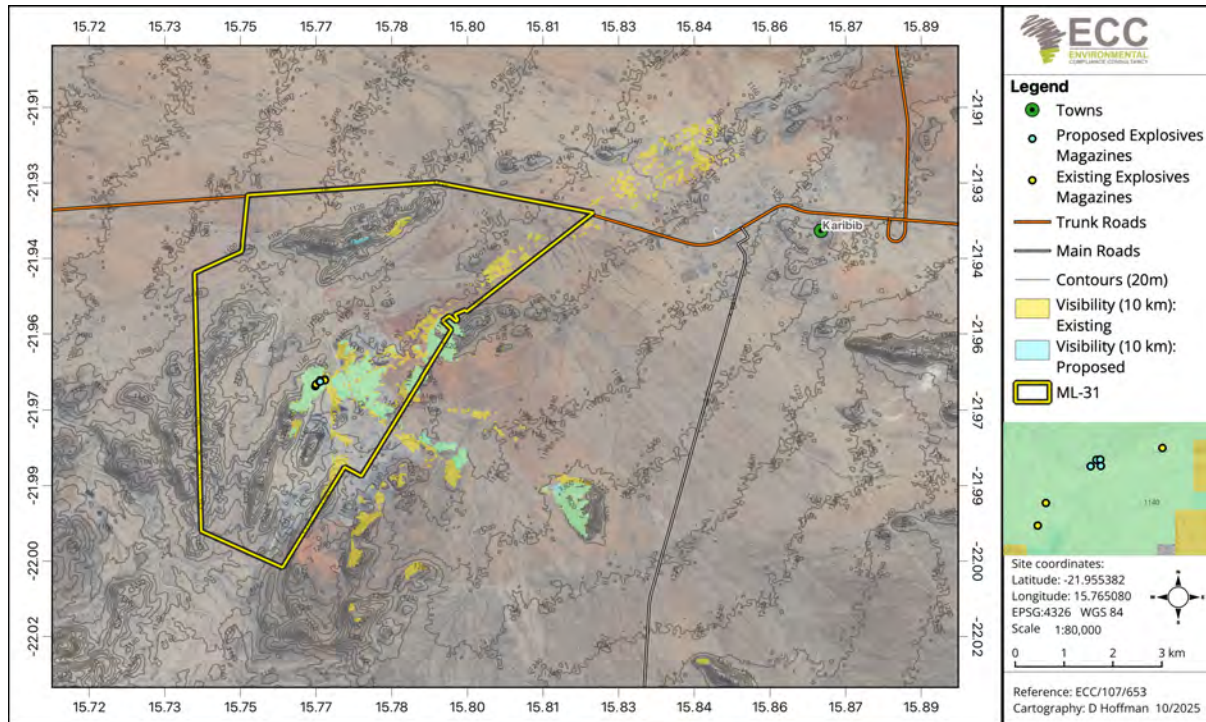


Figure 33 - The viewshed of the proposed and existing explosives magazines

The mine area is largely covered by rocky outcrops and small sections of the north-western and north-eastern areas of the ML are covered by petric Calcisols, as shown in Figure 34. Petric Calcisols represent a distinctive soil group within the Calcisol classification under the World Reference Base for Soil Resources (WRB). Namibian soils vary a great deal, variations occur on a broad scale, but there is even a great deal of variability at a local level. Petric refers to the strongly cemented carbonate horizon that significantly influences soil properties. A typical Petric Calcisol profile includes a sandy to loamy surface horizon underlain by a prominent carbonate accumulation, often forming a barrier that restricts water infiltration and root penetration (IUSS Working Group WRB, 2022).

Petric Calcisols are strongly influenced by the presence of calcium carbonate (CaCO_3). The high levels of CaCO_3 result in alkaline conditions, with pH values typically above 7.5 (Brady & Weil, 2017). This alkaline environment affects nutrient solubility, often reducing the availability of micronutrients such as iron, manganese and zinc, and consequently limiting crop productivity. Nutrient levels may vary depending on the depth and quality of the upper horizon, but the carbonate layer generally imposes constraints on soil fertility (Hafez, Zhang, Younis, Abdelhamid, & Rashad, 2025). This makes them poorly suited for intensive agriculture. However, they can still support certain forms of dryland farming, rangelands or grazing systems that are adapted to their physical and chemical limitations (FAO, 2006). Navachab Gold Mine, located on ML 31, has been in operation for 35 years since its official opening in 1990 (Attridge, 1991). Given the long history of mining activity and the already highly disturbed state of the area, farming activities are not foreseen. Hence, the area is suitable for an underground mine.

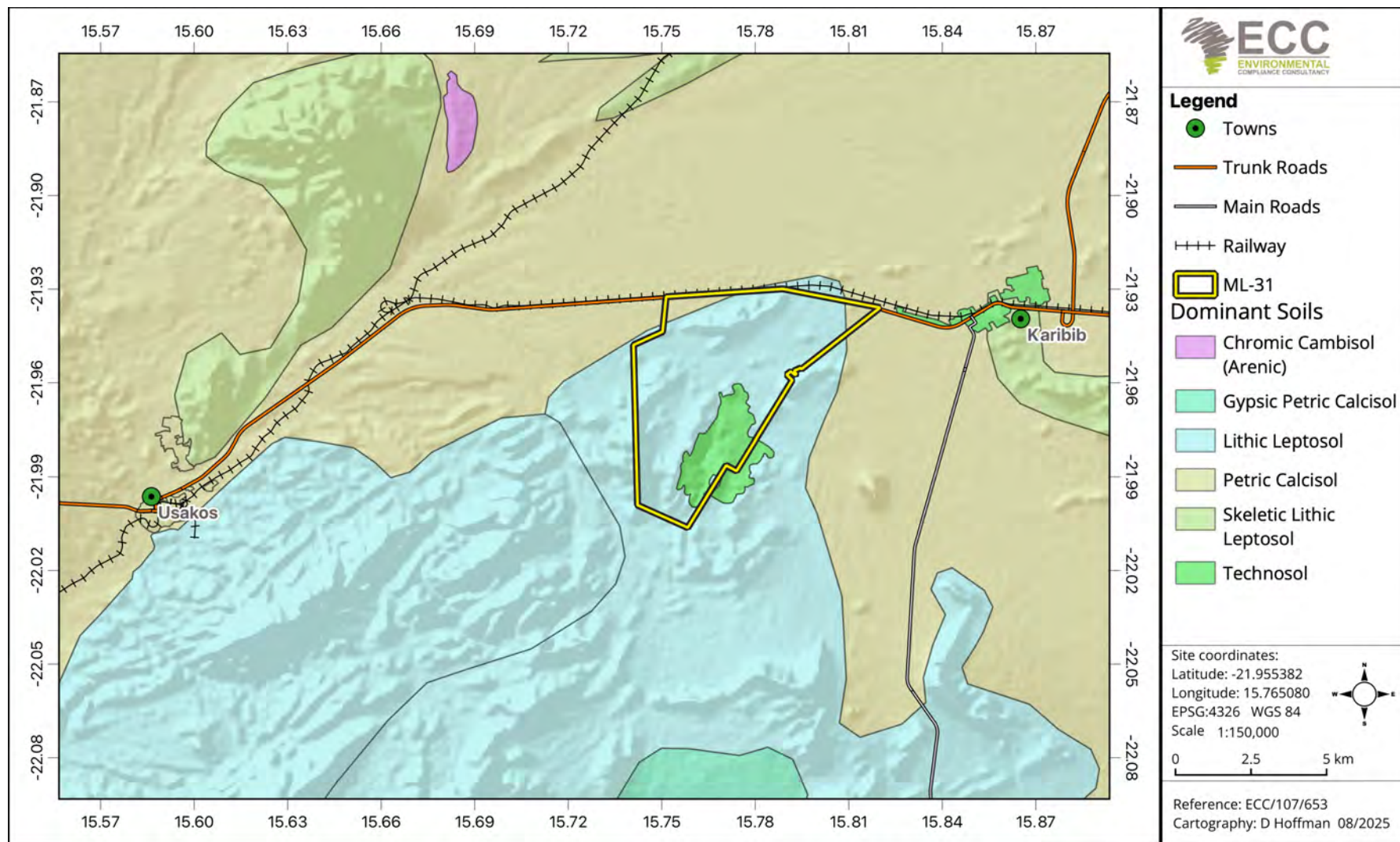


Figure 34 - Soil characteristics of the Project area

5.6 HYDROLOGY

Navachab Gold Mine is situated within a structurally and lithological complex geological environment dominated by the Karibib Formation (dolomitic marble), which forms the principal aquifer unit in the area. This formation is bounded and interbedded with other lithological units, namely upper schist (US), marble and dolomitic marble (MDM), marble-calc-silicate (MC), and lower schist (LS). Groundwater occurrence in this setting is controlled almost entirely by secondary permeability features, such as fractures, shear zones and lithological contacts, rather than by the intrinsic porosity of the intact rock. The hydrology of the area is shown in Figure 35.

The Karibib Formation aquifer exhibits heterogeneity in both hydraulic properties and storage potential. While the intact dolomitic marble and associated lithologies have very low primary porosity, fractures, faults and lithological contacts locally enhance transmissivity. Isolated karst pockets are present, but the lack of widespread, high-yield karst systems suggests limited regional aquifer storage capacity.

Connectivity between the contorted marble (CM), MDM and MC units is likely in certain areas, particularly via fractures. This may result in preferential recharge or inflow pathways into mining areas when underground workings intersect such structures.

SRK Consulting (2021) (Appendix D) conducted packer testing and a preliminary groundwater investigation, which consisted of drilling boreholes using the down-hole-percussion method, with the aim that where appreciable volumes of groundwater were encountered, pump tests would be conducted to estimate bulk hydraulic parameters within the formation. To assist with the site selection for the drilling positions, a geophysical survey was conducted. See Figure 36 for the borehole monitoring network. The assessment sought to evaluate groundwater occurrence in relation to underground operations, focusing on the potential for geological structures to channel water into the workings.

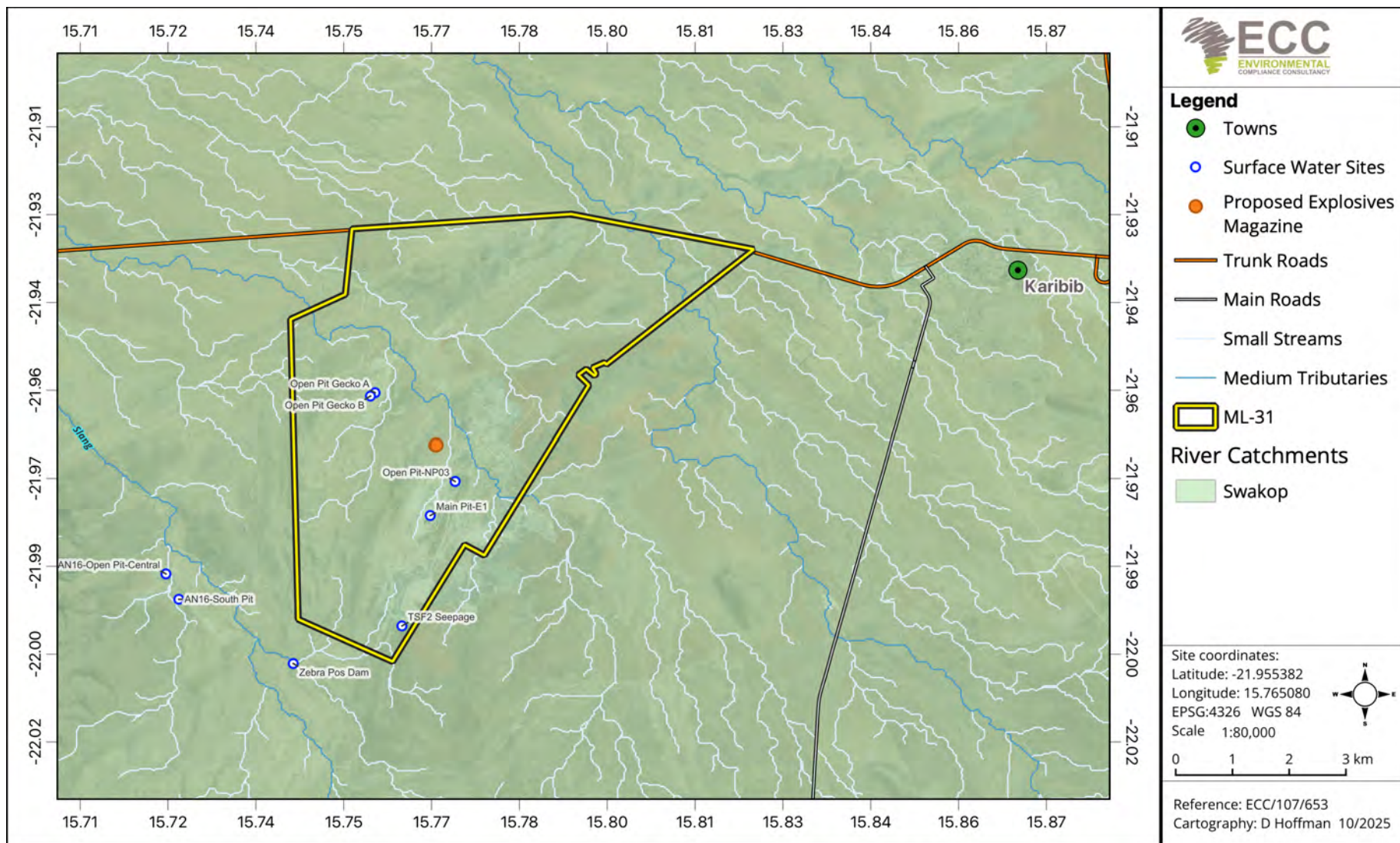


Figure 35 - Hydrology of the area and the proposed location of the third explosive magazine

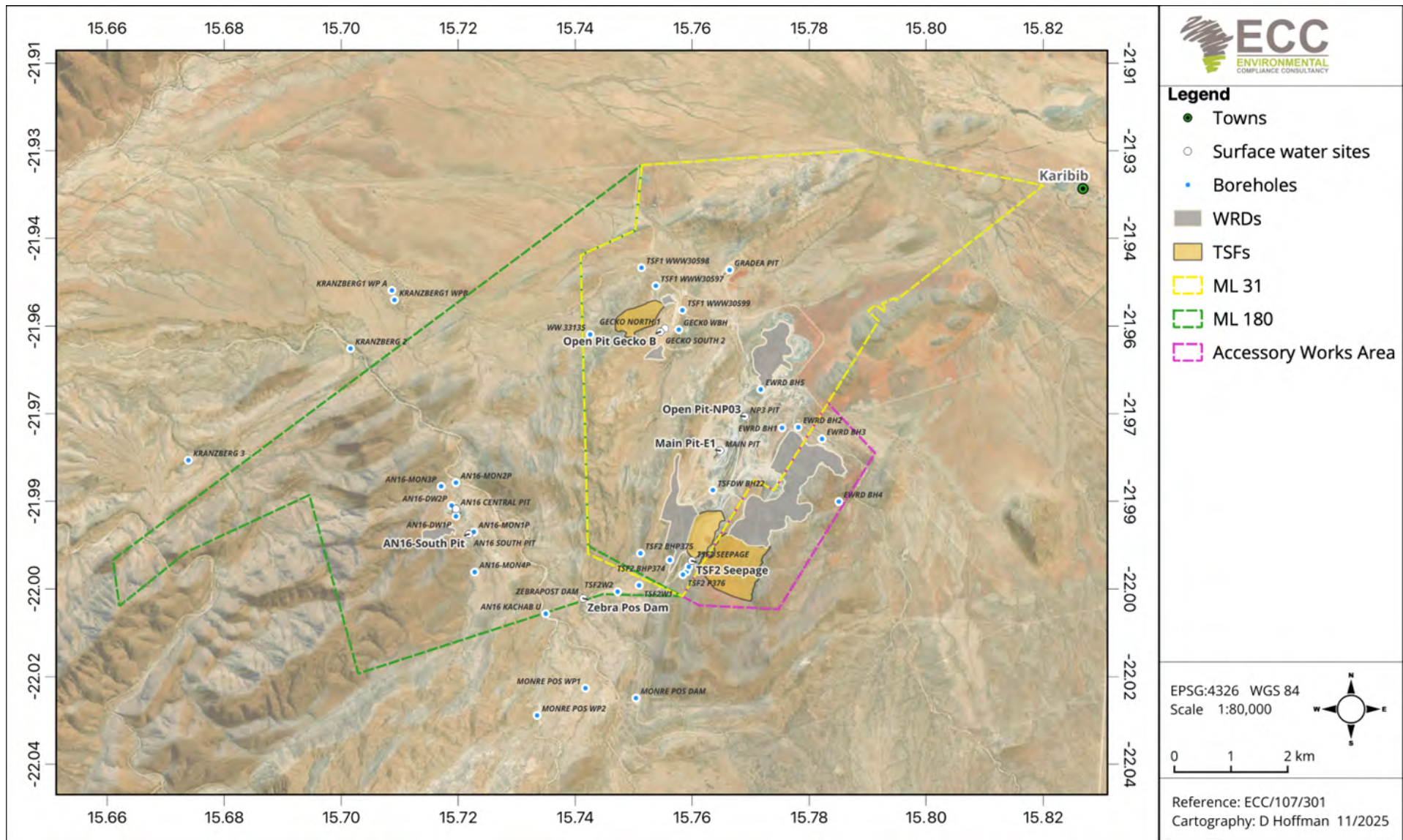


Figure 36 - Groundwater monitoring borehole network

Packer testing results confirm that hydraulic conductivity is typically in the range of 1×10^{-2} to 1×10^{-1} m/day, indicating low to moderate transmissivity. A locally elevated hydraulic conductivity of 6.6×10^{-1} m/day was measured in a sheared fault zone intersected at borehole NGT22, where artesian pressures were observed. This demonstrates the potential for structurally controlled zones to yield higher inflows than the surrounding rock mass.

Groundwater levels across the mine area are generally encountered at 45 mbgl – 60 mbgl (meters below ground level). Construction of a piezometric surface from monitoring borehole data shows a depression in groundwater levels in the northwest of the pit, interpreted to be caused by a northwest (NW) – southeast (SE) trending geological structure that acts as a preferential flow path. Seepage associated with the MDM unit in this area is likely contributing to the observed depressurisation.

The resistivity survey, conducted by Geophysics LDA was used to identify potential structures and karst features within the Karibib formation. The survey was limited because of the pushback to the west of the North Pit and waste rock dumps to the north and northeast. However, anomalies were identified, indicated by low resistivity zones, which were interpreted to be potential zones of weakness in the contorted marble (CM) where groundwater could occur.

Three boreholes were drilled, namely DW 23R, DW24R and DW25R. Static water level for DW23R was found at 44.7 mbgl. Borehole DW24R was drilled to a depth of 200 m and was dry on completion. DW25R was drilled on an inferred low resistivity anomaly with several fractures and partially oxidised zones. Groundwater was found deeper during drilling (59 m), but when the borehole was left alone, the water level rose higher than where it was found. This means the water is under pressure, likely because it's trapped under an impermeable layer.

Groundwater samples were taken of DW23R and DW25R, north face seepage and a surface water sample from the open pit. Groundwater in the mine area ranges from brackish to saline in character, with total dissolved solids (TDS) concentrations between 1 222 milligram per litre (mg/L) and 3 912 mg/L, which is typical of arid environments with low and erratic recharge rates. Hydro chemical analysis shows spatial variability linked to geological setting:

- DW23 (MDM): sodium-chloride/sulphate type water.
- DW25 (CM): calcium-bicarbonate/sulphate type water.
- Pit sump water: elevated sulphate due to oxidation of sulphide minerals.

The elevated salinity may present corrosion risks to mine infrastructure. Isotope analysis indicates that groundwater originates as precipitation, with some samples (pit sump and north face seepage) displaying an evaporative enrichment signal.

A small drainage line is visible next to the road, running in front of the proposed area for the third magazine to be constructed. The water channel runs from multiple directions. A section

flows from the left (west) of the future magazine (Figure 37), continuing and passing along the front towards the right (east), where the channel is met by a second drainage line flowing across the road (Figure 38).



Figure 37 - Water channel flowing from the left (west) to the front of the third magazine



Figure 38 - Second water channel flowing across the road

5.7 BIODIVERSITY BASELINE

Namibia is perceived as one of the world's biodiversity hotspots, despite it being the driest country in sub-Saharan Africa. Its biodiversity is strongly shaped by arid and semi-arid ecosystems, large-scale protected areas, and unique coastal and desert environments (Convention on Biological Diversity, 2025). The underground mining on ML 31 is located within the Western Highland area (Figure 39). This broad area is largely formed by erosion cutting back into higher ground and carving out the catchment areas of several major rivers. Much of the area lies between 500 and 100 m above sea level and consists of metamorphic rocks that were forced up out of the sea during the formation of the Gondwana continent some 550 million years ago (Mendelsohn, Jarvis, Roberts, & Robertson, 2002).

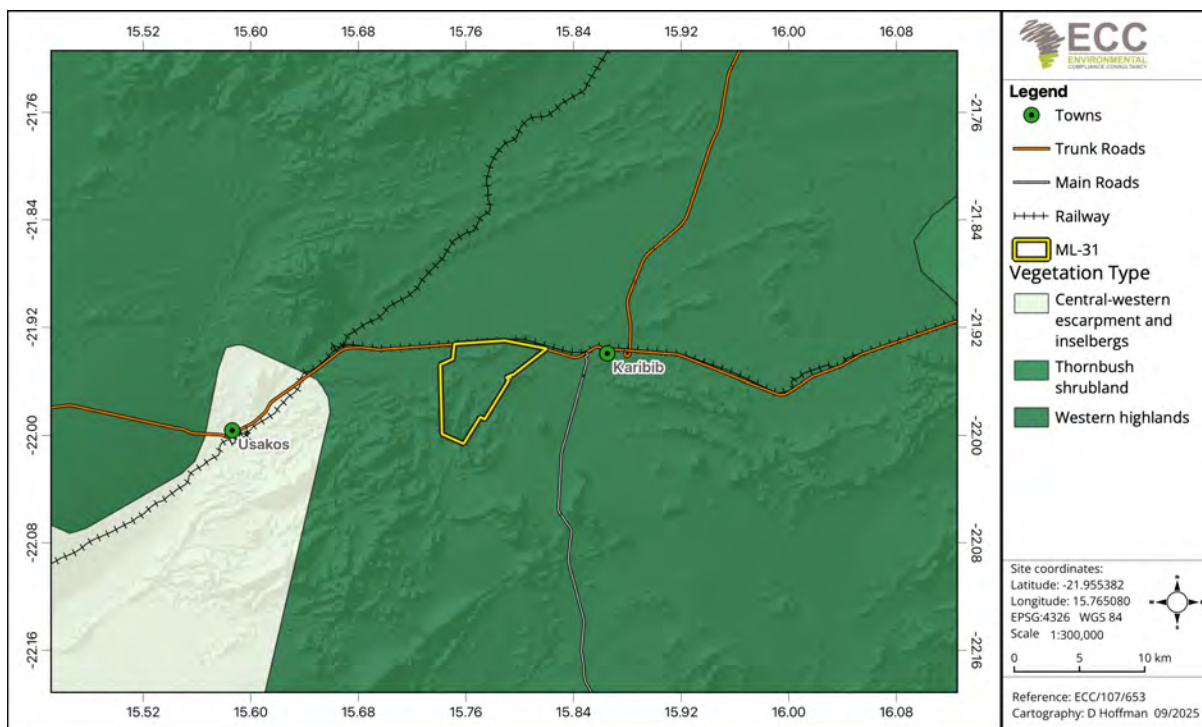


Figure 39 - Vegetation map of ML 31

Majority of the information under this section was extracted from a baseline study centred around the vertebrate fauna and flora associated with the QKR Navachab Gold Mine TSF 3 Project in the Karibib area conducted by Dr. Peter Cunningham in May 2022.

5.7.1 FLORA

It is expected that eight species of trees and shrubs (7.9%) occur in the general Karibib area and are classified as endemic, 4 species as near endemic (4%), 21 species (20.8%) are protected by the Forest Act, No 12. of 2001, 5 species (5%) are protected under the Nature Conservation Ordinance, No. 4 of 1975 and while 6 species (5.9%) are classified as CITES Appendix 2 species. All the trees with some kind of conservation and/or protected status are viewed as important in the general Karibib area. The most important species are viewed as *Commiphora dinteri*, *Commiphora saxicola*, *Commiphora virgata*, *Cyphostemma bainesii*, *Cyphostemma currorii* and *Erythrina decora*. An overview of the area can be found in Figure 40.



Figure 40 - Overview of flora growing in the third magazine location

5.7.2 FAUNA

5.7.2.1 Reptiles

The overall reptile diversity and endemism in the general Karibib area is estimated at between 41 - 70 species and 21 - 28 species, respectively. At least 75 species of reptiles are expected to occur in the Karibib area with 34 species being endemic, i.e. 45.3% endemic. The most important species expected to occur in the general area are viewed as the tortoises *Stigmochelys pardalis* and *Psammobates oculiferus*; pythons *P. anchietae* and *P. natalensis*; Namibian wolf snake (*Lycophidion namibianum*); *Varanus albigularis* and some of the endemic and little-known gecko species, e.g. *Pachydactylus* species. Tortoises, snakes and monitor lizards are routinely killed for food or as perceived threats. Other important species are those viewed as “rare”, i.e. *Rhinotyphlops lalandei*, *Mehelya vernayi* and *Afroedura africana* – although very little is known about these species.

5.7.2.2 Amphibians

The overall frog diversity in the general Karibib area is estimated at between 4 - 7 species (Mendelsohn, Jarvis, Roberts, & Robertson, 2002). At least 7 species of amphibians are expected to occur in suitable habitat in the Karibib area. The area is underrepresented, with 2 toads and 1 species each for rubber, puddle, bullfrog, sand and platanna known and/or expected (i.e. potentially could be found in the area) to occur in the area. Of these, 2 species are endemic

(*Poyntonophrynus (Bufo) hoeschi* and *Phrynomantis annectens*) and 1 species is classified as “near threatened” (*Pyxicephalus adspersus*) i.e. high level (42.9%) of amphibians of conservation value from the general area.

5.7.2.3 Mammals

The overall terrestrial diversity and endemism are considered moderate to high with approximately 5 - 6 species and abundance of large herbivorous mammals is high in the general area with kudu, mountain zebra and oryx having the highest densities of the larger species (Mendelsohn, Jarvis, Roberts, & Robertson, 2002). The overall abundance and diversity of large carnivorous mammals is moderate (4 species) in the general Karibib area with leopard and cheetah having the highest densities of the larger species.

Of the 87 species of mammals known and/or expected to occur in the general Karibib area, 9 species (10.3%) are classified as endemic. Rodents (of which 5 species 18.5% are endemic) and bats (of which 1 species is classified as rare) are the groups least studied. Species of greatest concern in the general area are those viewed as rare in Namibia, i.e. Namibian wing-gland bat and Southern African hedgehog and species classified as vulnerable (cheetah, leopard, Hartmann’s Mountain zebra, giraffe) and near threatened (African straw-coloured fruit bat, Commerson’s roundleaf bat, striped leaf-nosed bat, brown hyena).

5.7.2.4 Avian

Bird diversity and endemism is viewed as high in the general Karibib area with 171 - 200 species. Bird species observed and/or confirmed from the Navachab Gold Mine area included 85 species. Twelve of the 14 Namibian endemics are expected to occur in the general Karibib area (85.7% of all Namibian endemic species or 5.6% of all the species expected to occur in the area). Eight species are classified as endangered (violet wood-hoopoe, Ludwig’s bustard, white-backed vulture, black harrier, tawny eagle, booted eagle, martial eagle, black stork), 2 species as vulnerable (lappet-faced vulture, secretary bird) and 5 species as near threatened (Rüppel’s parrot, kori bustard, Verreaux’s eagle, peregrine falcon, marabou stork).

5.8 SOCIAL AND SOCIO-ECONOMIC BASELINE

5.8.1 GOVERNANCE

After gaining independence in 1990, Namibia has been governed by a stable, democratically elected government. In 2015, it ranked among the top five of 54 African countries on the Ibrahim Index of African Governance, excelling in areas such as governance quality, government support for human development, sustainable economic opportunities, adherence to the rule of law and human rights and the development of smart information and communication technologies to facilitate socio-economic growth.

Erongo Region is governed by the Erongo Regional Council as a statutory body promulgated under the Regional Act, Act No. 22 of 1922 and headed by a Governor, who is appointed by the President of Namibia. The current Governor of Erongo Region is Natalia |Goagoses. The Erongo

Regional Council is responsible for the planning and development of the region in a sustainable manner for the benefit of its inhabitants by establishing, managing and controlling settlement areas and focusing on core services. The council is accountable for an area of 63 586 km² or approximately 7.7 % of the total area of Namibia (Erongo Regional Council, 2015). The underground mine on ML 31 is located in the Karibib constituency of the Erongo Region.

5.8.2 POPULATION AND GROWTH RATE

In 1991, Namibia's population was recorded at 1.4 million. According to the preliminary results of the 2023 Population and Housing Census, the population has more than doubled over the past 32 years, reaching 3,022,401 people, of which 240 206 reside in the Erongo Region. A notable population increase was first observed in 1994, following the reintegration of Walvis Bay from South Africa. The significant growth between 2001 and 2011 is largely linked to increased mining activity and industrial expansion in the coastal towns. Today, Erongo is the fifth most populous region in Namibia, with a population density of 3.8 people per km². The region's average household size stands at 3.1 persons, below the national average of 3.8 (Namibia Statistics Agency, 2024).

In the 2023 Population and Housing Census, it was reported that Karibib's population increased from 5 132 in 2011 to 8 434 in 2023, resulting in an annual growth rate of approximately 4.1%.

5.8.3 POVERTY AND UNEMPLOYMENT

The unemployment rate is widely regarded as one of the key labour market indicators and a good measure for employment creation and participation in economic activities in the country. A low unemployment rate indicates that the economy has the capacity to absorb a greater share of the working-age population, whereas a high unemployment rate reflects limited absorption capacity. The industries in which most Namibian citizens are employed are agriculture, forestry and fishing, wholesale and retail trade and manufacturing administration and support services (Namibia Statistics Agency, 2025). Namibia's mining sector has demonstrated resilience and growth in 2024, adding more than 2 600 new jobs. The mining industry's direct employment figures rose to 20 843 in 2024, marking a 14.6% increase from the previous year's 18 189 jobs. This growth highlights the sector's vital contribution to employment, especially in a context where youth unemployment continues to be a major challenge (Chamber of Mines of Namibia, 2025). The Erongo Region ranks among the regions with the lowest unemployment rates in Namibia (Namibia Statistics Agency, 2019).

Although Erongo records the second-lowest poverty headcount nationally, significant poverty persists in constituencies such as Daures, Karibib and Omaruru (National Planning Commission, 2015). In Karibib, unemployment remains relatively high, though slightly below the national average, due to opportunities in the mining and transport sectors. However, employment is largely concentrated among individuals with mining-related skills, limiting broader job absorption. Additionally, social concerns have emerged, including a reported increase in alcohol and drug abuse among residents. (New Era, 2021).

5.8.4 ECONOMIC DEVELOPMENT

5.8.4.1 *Mining*

Navachab Gold Mine, located outside Karibib, is the oldest open pit mine in Namibia and has been the town's largest employer for decades. At the end of 2023, Navachab reported 652 permanent employees, 137 temporary employees and 317 contractors. By the end 2024 all these values increased with 717 permanent employees, 341 temporary employees and 428 contractors (Chamber of Mines of Namibia, 2023, 2024). The most recent Chamber of Mines of Namibia annual review also reported N\$ 1.702 billion in profit, N\$ 486.1 million in wages and salaries and N\$ 7 million expenditures on training, skills and development (Chamber of Mines of Namibia, 2025).

5.8.4.2 *Road infrastructure and transport*

Karibib is situated on the B2 national road, linking Windhoek to the central Namibian coast (Walvis Bay and Swakopmund), making it a key transit town. This generally allows efficient transport of equipment and goods to NamPort (Namibia Port Authority (Pty) Ltd) (export hub of Namibia) and mines in the Erongo Region, enhancing national trade and logistics. Furthermore, TransNamib, the national rail services operator is conducting an extensive rail rehabilitation and upgrade to become a regional logistics hub by modernising infrastructure and expanding the network (Energy Capital & Power, 2024).

5.8.5 PUBLIC HEALTH

Namibia's healthcare system consists of two main sectors: the private sector, which serves approximately 18% of the population with medical aid and the public sector, which provides care for the remaining 82% (Christians, 2020). Public health services fall under the mandate of the Ministry of Health and Social Services (MoHSS), which manages a four-tiered system comprising primary healthcare (PHC) facilities, district hospitals, intermediate hospitals and a national referral hospital (Christians, 2020). Karibib relies mainly on one public health centre and a few clinics, with referrals made to larger hospitals in Omaruru, Swakopmund or Windhoek. This leads to overburdened local facilities and long travel distances for specialised care (MoHSS, 2018). Furthermore, public facilities tend to be understaffed and shortages in equipment and facilities raises concerns (Christians, 2020).

It has been reported that Namibia has one of the highest estimated incidence rates of tuberculosis (TB) in the world, ranking ninth in the latest WHO report. In 2020, the country reported 6 137 drug-susceptible TB cases and 218 drug-resistant TB cases. Almost all (99%) of TB patients had a known human immunodeficiency virus/ acquired immunodeficiency syndrome (HIV/AIDS) status, of whom 31% were HIV/AIDS positive and all were put on antiretroviral therapy. It should be noted that for all forms of TB, five regions (Erongo, Kunene, Omaheke, Otjozondjupa and Zambezi) achieved a treatment success rate above 90%, which is the WHO's set target (New Era, 2022).

Reports indicate growing alcohol and drug abuse, particularly among youth and unemployed individuals in Karibib, which is linked to growing unemployment, poverty and limited mental health support services, leading to increased gender-based violence (GBV) and other acts of violence.

5.9 CULTURAL HERITAGE

An archaeological and historical assessment () for Navachab was conducted in 2009 by Dr John Kinahan and seventeen archaeological sites were recorded. These sites ranged in age from the Late Pleistocene to the colonial period. The sites were of generally low archaeological significance. During 2022 for the TSF 3 assessment, an additional survey was conducted, and three additional sites were determined (Kinahan, 2022). Heritage sites within the broader Project area have been mapped and will be avoided during the underground mining Project shown in Figure 41.

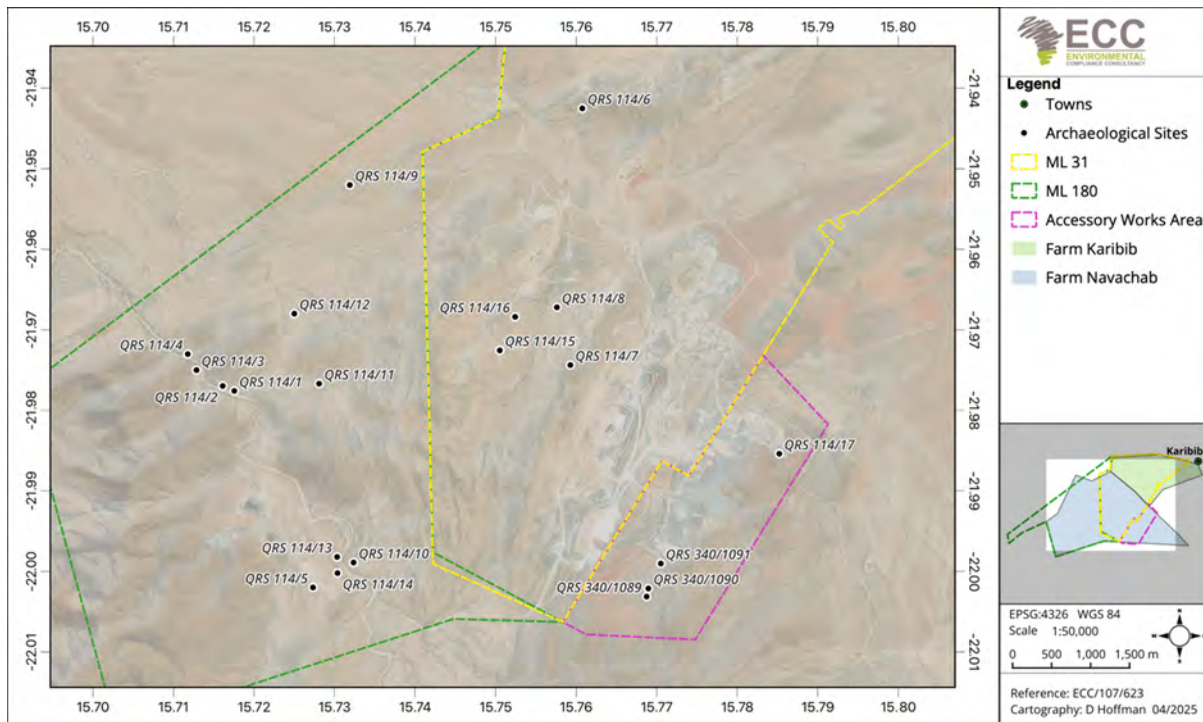


Figure 41 - Archaeological sites (known) located on Navachab Gold Mine

During the 2009 assessment (Appendix H) four archaeological heritage sites near where the third explosive magazine is proposed to be built was identified, situated on ML 31, shown in Figure 42. These sites are less than 3 km from the proposed construction and operation of the third explosives magazine, which is in a direct path of risk should any of the explosive magazines accidentally detonate. This potential impact is assessed in detail in chapter 7.

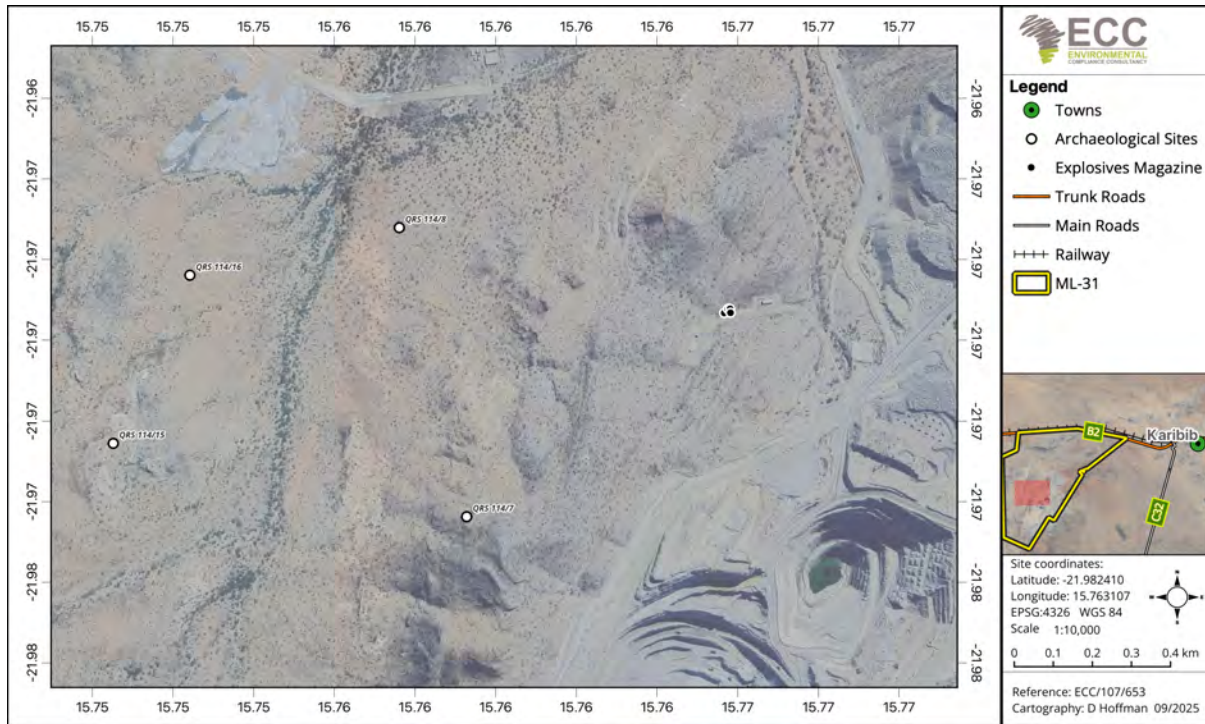


Figure 42 - Archaeological/heritage sites in proximity (less than 3 km) to the proposed site for the construction and operation of the third explosives magazine

These points contain the following heritage sites or artifacts:

- QRS 114/7 (1.2 km away from proposed site) which is a possible remnant of winch anchor (Figure 43);
- QRS 114/8 (1.25 km away from proposed site) which is a possible iron wagon tyre quenching bath (Figure 44);
- QRS114/15 (2.3 km away from proposed site) which is a MSA scatter; and
- QRS114/16 (2 km away from proposed site) which has seed diggings, five within 100 m radius.



Figure 43 - QRS114/7 A possible remnant of winch anchor (Kinahan, 2009)



Figure 44 - QRS 114/8 Possible iron wagon tyre quenching bath (Kinahan, 2009)

During that 2022 assessment of TSF 3 (Kinahan, 2022), three minor archaeological sites were identified namely being a dispersed stone feature, possible burial site (which was confirmed with underground penetrating radar in 2023), two small stone hut circle features 2.2 m

diameter, associated with surface scatter of quartz flaking debris and two spoil heaps approximately 2 m diameter and 1.5 m in height comprising rubble from the possible excavation of a small well located on a fracture containing haematite and quartz conglomerate. These findings have no material influence on the underground mining activities or the construction and operation of the third explosives magazine.

5.10 VISUAL – SENSE OF PLACE

Given the existing mining activities on ML 31, along with the presence of the TSF and WRD facilities, the development of an underground mine is unlikely to introduce entirely new impacts from a visual perspective. However, it may contribute to increased dust generation from above ground activities associated with underground mining activities, such as hauling, stockpiling, magazine activities, blasting and burning of explosive packaging material, additional industrial lighting and thus have a cumulative effect on the nearest sensitive receptors and overall environment. These potential impacts are assessed in chapter 7 of this report.

5.11 NOISE

Airshed Professional Planning (Pty) Ltd (Airshed) conducted a noise survey of five locations on site, making use of IFC best practice guidelines in the absence of Namibian legislation (Airshed, 2022). Another guideline useful for estimating a community response to an increase in ambient noise level caused by intrusive noise is SANS 10103.

Generally, noise is defined as unwanted sound transmitted through a medium such as air. Sound, on the other hand, can be defined as any pressure that the ear can detect. Human response to noise is complex and varies because it's subjective, not objective. Sound pressure levels are measured using a linear scale in Pascal (Pa) but because the human ear recognises sound logarithmically rather than linearly, it's more efficient to represent these values as a logarithmic ratio comparing the measured sound pressure to a reference level. This ratio, known as decibel (dB), simplifies a wide-ranging linear scale into a manageable range-from 0 dB at the threshold of hearing (20 μ Pa) to ~ 130 dB at the threshold of pain (roughly 100 Pa) (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

Sound is defined as any pressure variation that can be detected by the human ear. The number of pressure variations per second is referred to as the frequency of sound and is measured in hertz (Hz). The hearing frequency of a young, healthy person ranges between 20 Hz and 20 000 Hz. In terms of LP, audible sound ranges from the threshold of hearing at 0 dB to the pain threshold of 130 dB and above. Even though an increase in sound pressure level of 6 dB represents a doubling in sound pressure, an increase of 8 to 10 dB is required before the sound subjectively appears to be significantly louder. Similarly, the smallest perceptible change is about 1 dB (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

As human hearing does not respond equally to all frequencies, a filter known as the A-weighting filter was developed to mimic the way people perceive sound. This filter reflects the human

ear's reduced sensitivity to low-frequency sounds compared to high frequencies. The term "dBA" refers to a unit expressing ten times the logarithmic ratio of sound pressure levels that have been adjusted using the A-weighting filter. Table 16 provides an overview for the typical rating levels for outdoor noise perceived during the day versus during the night by the human ear.

Table 16 - Typical rating levels for outdoor noise

Type of district	Equivalent Continuous Rating Level ($L_{Req,T}$) for Outdoor Noise		
	Day/night $L_{R,dn}^{(a)}$ (dBA)	Daytime $L_{Req,d}^{(b)}$ (dBA)	Night-time $L_{Req,n}^{(c)}$ (dBA)
Rural district	45	45	35
Suburban district with little road traffic	50	50	40
Urban district	55	55	45
Urban district with one or more of the following: business premises and main roads.	60	60	50
Central business district	65	65	55
Industrial districts	70	70	60

- a) $L_{R,dn}$ = The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the period of a day and night
- b) $L_{Req,d}$ = The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the day-time period
- c) $L_{Req,n}$ = The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the night-time period

As discussed earlier in this section, Airshed identified five survey sites in 2022 to measure baseline noise levels that could influence noise sensitive receptors (NSRs). These results reflect the current noise levels (Figure 45) on the Navachab site.

Baseline noise levels (LAeq) ranged between 30 dBA to 54 dBA during the day and nighttime noise levels ranged between 31 dBA to 56 dBA (Table 17). As stated in SANS 10103:2008, noise levels for rural districts during the day and night should be lower than 45 dBA and 35 dBA, respectively, to be acceptable. Noise levels detected at Site 1, Site 2 and Site 3 were below the rural area guidelines for the daytime measurements. Noise levels detected at Site 1, Site 2 and Site 5 were below the rural area guidelines for the nighttime measurements. Note no nighttime measurements were available for Site 3. The gold processing plant recorded the highest noise levels (Site 4) and exceeded the required standard for both day and night-time measurements. Recent noise level measurements were taken by ECC in May 2025 and will continue to be measured biannually (six-monthly) to further monitor environmental ambient noise levels and mitigation activities on site. As the site is an active mining area, noise emissions from

underground operations, construction and operations of the new magazine are less likely to propagate to NSRs. Areas closer to the magazines are the active open pit and haul roads, which already creates a large amount of noise, making it less likely that the construction and magazine will have a large impact. These impacts are further assessed and discussed in chapter 7.

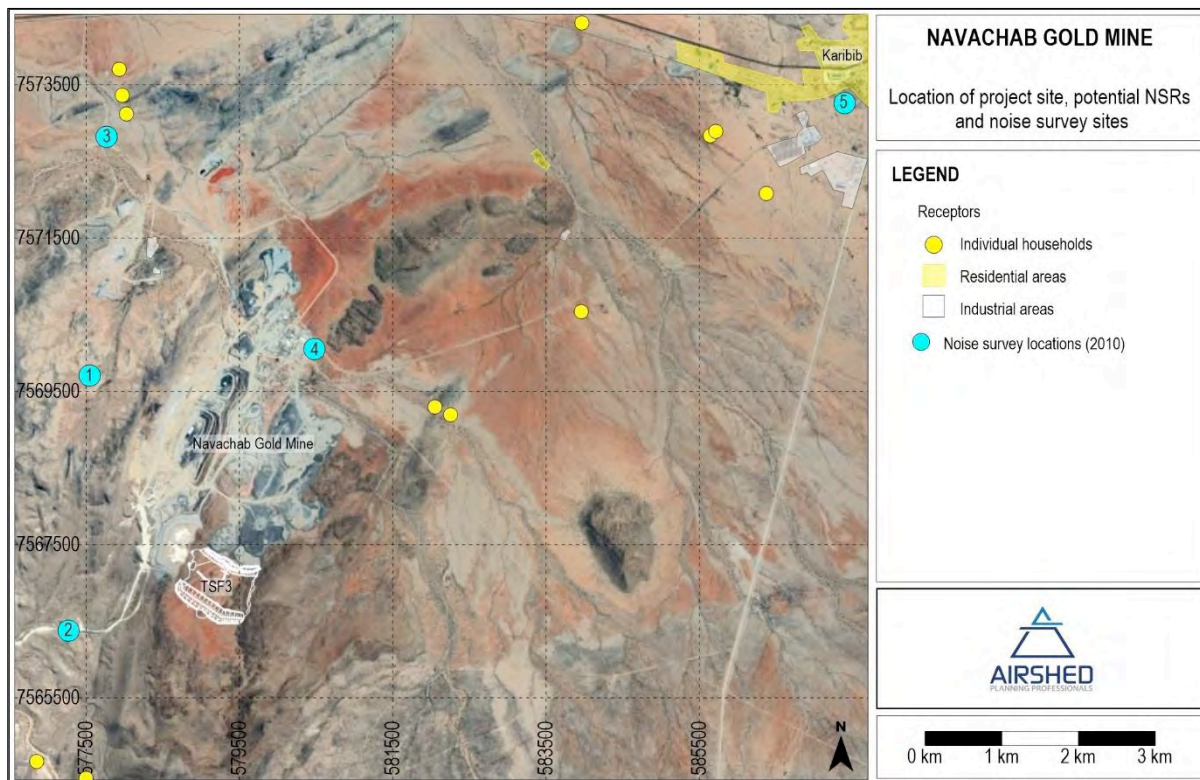


Figure 45 - Potential noise sensitive receptors and noise survey locations within the study area (Airshed, 2022)

Table 17 - Baseline noise measurements for the survey conducted in 2010 for the area

Location	Date and time	Duration	L _{Aeq} (dB)	L _{AFmax} (dB)	L _{AFmin} (dB)	L _{AF10} (dB)	L _{AF90} (dB)
Night-time measurements							
Site 1	09-Feb-10 23:18:06	00:20:00	31.8	45.2	26.8	35.5	27.5
Site 2	09-Feb-10 23:58:27	00:20:00	32.4	55.5	27.5	34.8	29.0
Site 3	-	-	-	-	-	-	-
Site 4	11-Feb-10 01:01:27	00:15:00	56.1	58.9	53.9	56.8	55.2
Site 5	11-Feb-10 01:31:06	00:15:00	34.0	46.5	28.6	35.3	30.2
Day-time measurements							
Site 1	10-Feb-10 12:34:53	00:20:00	32.4	54.6	27.1	35.0	27.7

Location	Date and time	Duration	L _{Aeq} (dB)	L _{AFmax} (dB)	L _{AFmin} (dB)	L _{AF10} (dB)	L _{AF90} (dB)
Site 2	10 Feb 10 11:56:05	00:20:00	30.1	48.3	26.9	31.9	27.4
Site 3	10 Feb 10 10:05:58	00:20:00	34.6	57.0	27.0	33.8	27.5
Site 4	10 Feb 10 14:12:15	00:15:00	53.9	68.1	47.5	54.8	50.0
Site 5	10 Feb 10 14:37:32	00:15:00	46.6	66.7	31.8	47.8	33.3

6 IDENTIFICATION AND EVALUATION OF IMPACT METHODOLOGY

6.1 INTRODUCTION

This chapter outlines ECC's method to identify and evaluate impacts arising from the proposed Project. The findings of the assessment are presented in chapter 7.

The evaluation and identification of the environmental and social impacts require the assessment of the Project characteristics against the baseline characteristics, ensuring all potentially significant impacts are identified and assessed.

This chapter provides the following:

- Details on the assessment guidance used to assess impacts;
- Limitations, uncertainties and assumptions regarding the assessment methodology;
- How impacts were identified and evaluated, and how the level of significance was derived;
- Details how mitigation was applied in the assessment and how additional mitigation was identified; and
- The cumulative impact assessment (CIA) method used

6.2 ASSESSMENT GUIDANCE

The following principal documents were used to inform the assessment method:

- The current assessment will be built on the methodology and findings of the previous environmental clearance amendment assessment conducted for the pilot underground mine phase (ECC, November 2020);
- International Finance Corporation standards and models, in particular performance standard 1: Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2012 and 2017);
- International Finance Corporation Cumulative Impact Assessment (CIA) and Management Good Practice Handbook (International Finance Corporation, 2013); and
- Namibian Draft Procedures and Guidance for EIA and E[S]MP (Republic of Namibia, 2008).

6.3 LIMITATIONS, UNCERTAINTIES AND ASSUMPTIONS

The following limitations and uncertainties associated with the assessment methodology were considered in the assessment phase:

- Topic-specific assessment guidance has not been developed in Namibia. A generic assessment methodology will be applied to all topics using IFC guidance and professional judgement; and

- Guidance for CIA has not been developed in Namibia, but a single accepted state of global practice has been established. The IFC's guidance document (International Finance Corporation, 2013) will be used for the CIA.

6.4 ASSESSMENT METHODOLOGY

The ESIA amendment methodology applied to this assessment has been developed by ECC using the International Finance Corporation (IFC) standards and models, in particular performance standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2017); Namibian Draft Procedures and Guidance for EIA and E[S]MP (Republic of Namibia, 2008); international and national best practice; and over 25 years of combined ESIA experience. The methodology is set out in Figure 46 and Figure 47, respectively.

The assessment undertaken for the current scope of the Project will draw from the findings of the prior ML 31 environmental clearance amendment scoping report, with impact assessment, for the pilot underground mine (ECC, November 2025). The evaluation and identification of the environmental and social impacts require the assessment of the Project characteristics against the baseline characteristics, ensuring that all potentially significant impacts are identified and assessed. The significance of an impact is determined by taking into consideration the combination of the sensitivity and importance/value of environmental and social receptors that may be affected by the proposed Project, the nature and characteristics of the impact, and the magnitude of any potential change. The magnitude of change (the impact) is the identifiable changes to the existing environment that may be negligible, low, minor, moderate, high, or very high; temporary/short-term, long-term, or permanent; and either beneficial or adverse.

Cumulative impacts will also be assessed and can be classified as intraspecific or interspecific. Intraspecific cumulative impacts occur when multiple activities on the same project interact over time or space, leading to intensified effects e.g., dust, noise, and traffic from one mine collectively affecting nearby communities. In contrast, interspecific cumulative impacts arise from the interaction of different types of projects or sectors, within the same area that have a combined effect, thus creating new or amplified impacts (e.g., the combined pressures of agriculture, mining, and urban development contributing to habitat loss and reduced biodiversity). This distinction ensures that this assessment captures both the internal and cross-sectoral nature of cumulative impacts.

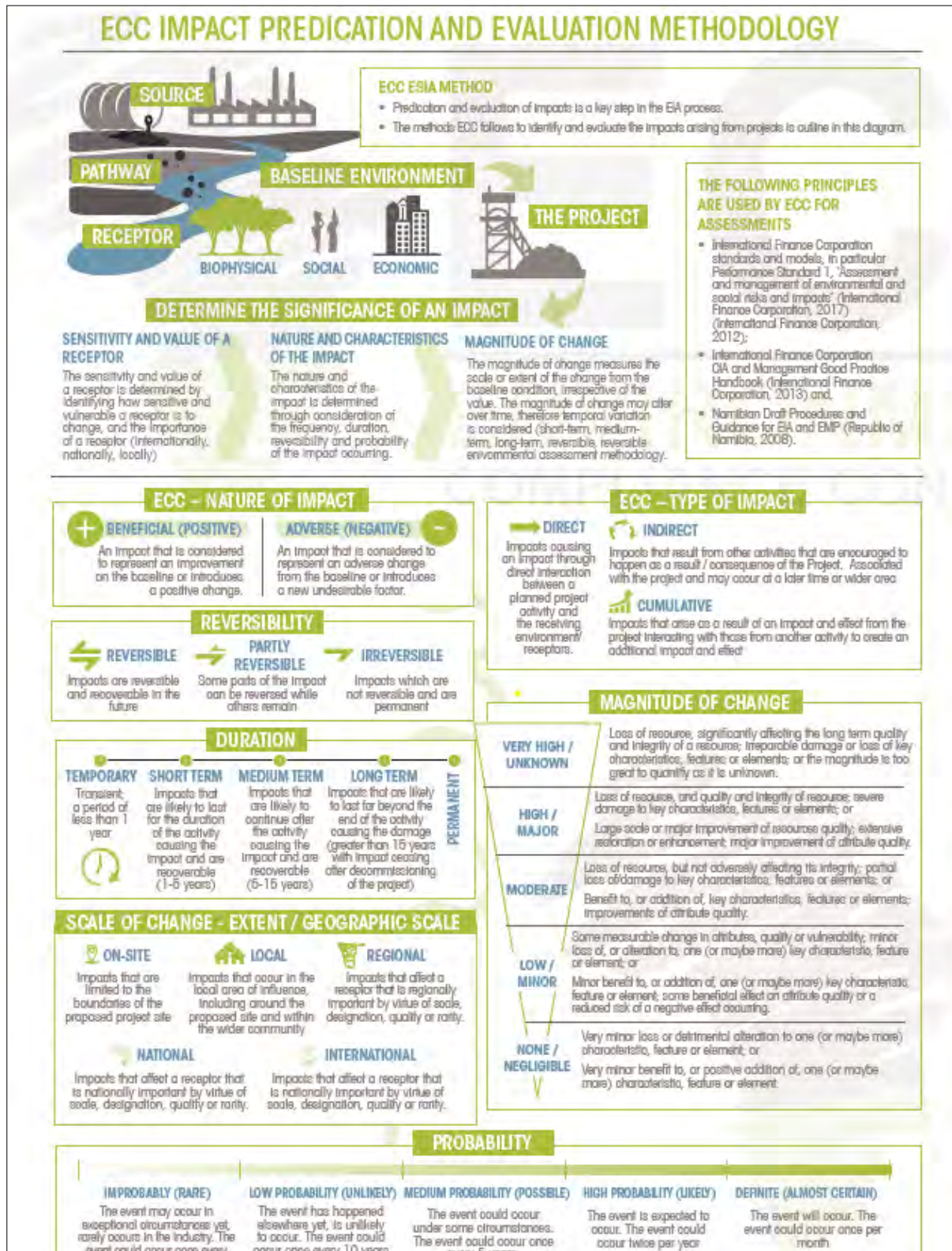


Figure 46 - ECC ESIA methodology based on IFC standards

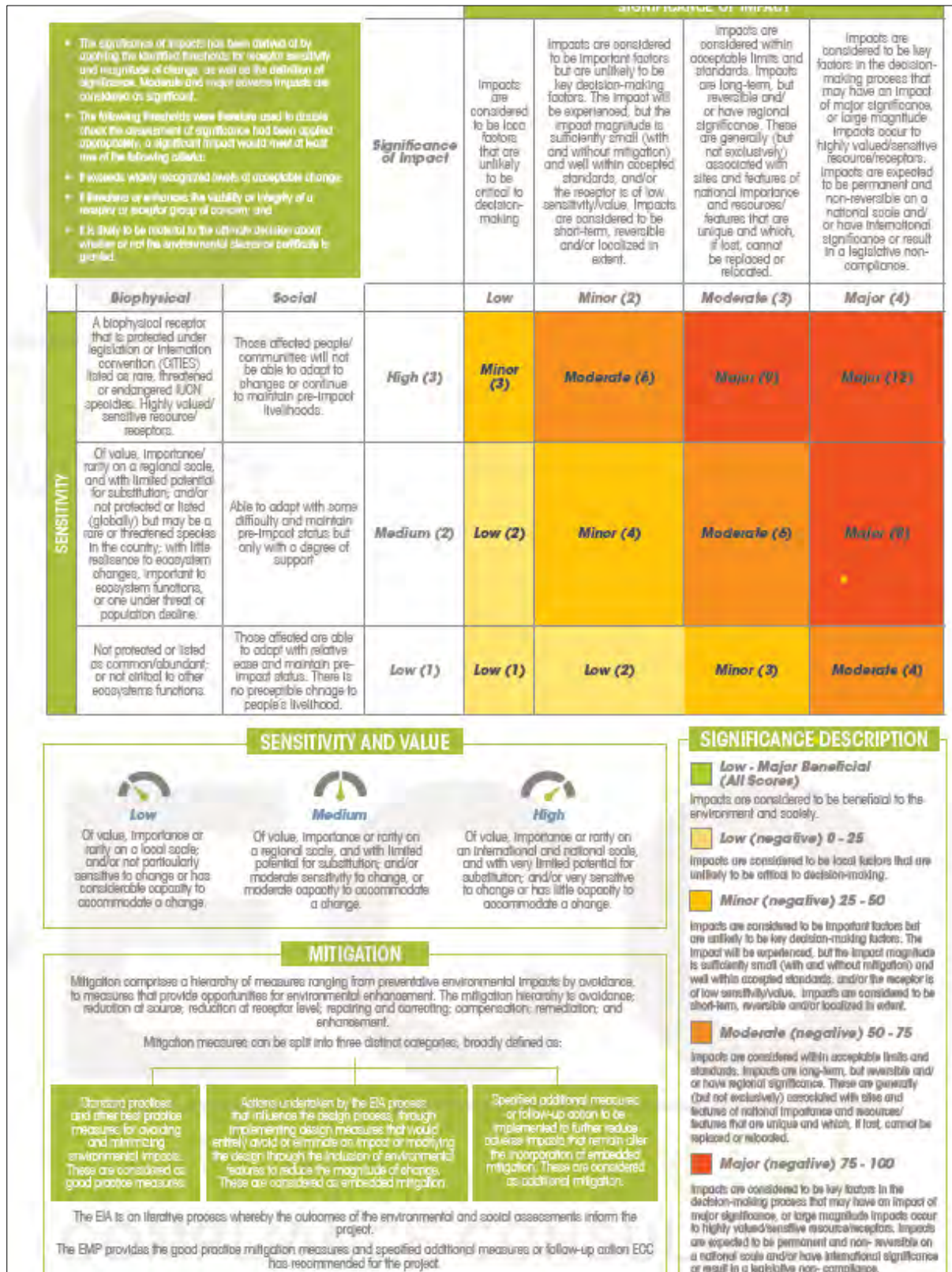


Figure 47 - ECC ESIA methodology based on IFC standards

6.5 MITIGATION

Impacts that are identified throughout the amendment assessment process will be subjected to a process of impact mitigation, which is inherent in all aspects of the ESIA system. Embedded

mitigation and good practice mitigation will be considered in the amended assessment. Additional mitigation measures will be identified when the significance of an impact requires it and causes the impact to be further reduced.

The principle of impact mitigation comprises a hierarchy of measures ranging from preventative environmental impacts by avoidance, to measures that provide opportunities for environmental enhancement, and will be applied to all impacts associated with the Project. The mitigation hierarchy is avoidance; reduction at source; reduction at receptor level; repairing and correcting; compensation; remediation; and enhancement. The OEMP (Appendix B) for the Project provides the good practice measures of impact mitigation and specifies additional measures or follow-up action where required.

Mitigation measures can be split into three distinct categories, broadly defined as:

1. Actions undertaken by the ESIA process influence the design process, through implementing design measures that would entirely avoid or eliminate an impact or modifying the design through the inclusion of environmental features to reduce the magnitude of change. These are considered embedded mitigation.
2. Standard practices and other best practice measures for avoiding and minimising environmental impacts. These are considered good practice measures.
3. Specified additional measures or follow-up action to be implemented, to further reduce adverse impacts that remain after the incorporation of embedded mitigation. These are considered additional mitigation.

Where additional mitigation is identified, a final assessment of the significance of impacts (residual impacts) will be carried out, taking into consideration the additional mitigation.

7 IMPACT ASSESSMENT FINDINGS AND PROPOSED MITIGATION MANAGEMENT MEASURES

7.1 PROJECT OVERVIEW

This chapter presents the findings of the scoping report, with impact assessment, for the proposed Project as per the ESIA process, scope and methodology set out in chapter 2 and chapter 6, respectively. A range of potential impacts have been identified that may arise because of the proposed project. The aim of this EIA report is to focus on the significant impacts that may arise because of the proposed project. This chapter therefore only considers the significant impacts and or those that may have specific interest to the community and stakeholders. A summary of impacts that are not considered significant is discussed in section 7.2.

Impacts that are considered significant or are of interest to the community and stakeholders are as follows:

- Social environment: air quality (dust, gases and odours), noise impacting employees, employment, skills development, socio-economic benefits, visual (magazine) and heritage (magazine);
- Bio-physical environment: ground and surface water, soil, fauna and flora and waste management; and
- Cumulative impacts.

For each potential significant or sensitive impact, a summary is provided which includes the activity that would cause an impact; the potential impacts; embedded or best practice mitigation (stated where required / available); the sensitivity of receptor that would be impacted; the severity, duration and probability of impacts; the significance of impacts before mitigation and after mitigation measures (where applicable) are applied.

7.2 IMPACTS NOT CONSIDERED AS SIGNIFICANT

As a result of an iterative development process, mitigation has been incorporated and embedded into the Project, thereby designing out potential environmental and social impacts or reducing the potential impact so that it is not significant. Best practice has also played a role in avoiding or reducing potential impacts. The OEMP provides best practice measures, management and monitoring for all impacts.

Impacts that have been assessed as not being significant are summarised in

Table 18 and thus not discussed further.

Table 18 - Potential impacts not considered significant

Environment or social topic	Potential impact	Summary of assessment findings
– Noise from underground mining activities impacting third party receptors	Potential for vibrations from underground to follow fault paths and cause vibration on surface and distance. Noise impacts to neighbours.	The potential for the underground mine to generate noise that will impact neighbours is extremely unlikely given the distance from the underground operations to the nearest sensitive receptor. Underground mining operations are quieter than open pit mining and therefore the addition of the underground mining method is unlikely to cause any noise concern for neighbours.
– Blast and vibration impact from underground mining activities impacting third party receptors		Vibrations from underground mining are orders of magnitude smaller than open pit mining, furthermore the vibration pattern and methods for underground blasting are such that smaller blasts are required. As with open pit mining there is the potential for vibration to follow fault lines and sometimes vibrations can be felt some distance away from the operation. The site will continue to monitor vibrations and ensure vibrations are below allowable limits. Negligible change to current operations.
– Safety impacts or risks for underground mining activities	Occupational health and safety impacts.	This will be addressed directly by the Proponent in a site-specific safety management plan
– Biodiversity and visual impacts for underground mining	Loss and destruction of biodiversity (fauna and flora) and loss of aesthetics and sense of place (visual).	The underground mining activities falls within the main active and disturbed open pit, and no flora or fauna will be disturbed because of the mining activities.
– Heritage and culture for underground mining activities	Disturbance and destruction of archaeological artifacts due to underground mining operations	The area is already an open pit mine and no flora or fauna will be disturbed because of the underground mining.

7.3 SOCIO-ECONOMIC ENVIRONMENT: SOCIAL

7.3.1 AIR QUALITY (DUST, GASES AND ODOURS)

Mining operations including the construction and operation of an additional explosive's magazine can contribute to a deterioration in air quality at every stage of the process and have significant impacts on the health of both those working at the sites and those living in surrounding communities (Clarity Movement Co., 2023). The confined nature of an underground mine limits natural ventilation, leading to the accumulation of airborne contaminants such as dust and harmful gases, as well as odours. Pollutants released pose serious health risks to employees and surrounding communities.

The impacts before mitigation measures are presented in Figure 48, for illustrative purposes only. The air quality related impact ratings are summarised in Table 19. The potential adverse impacts are discussed further in the sections below.

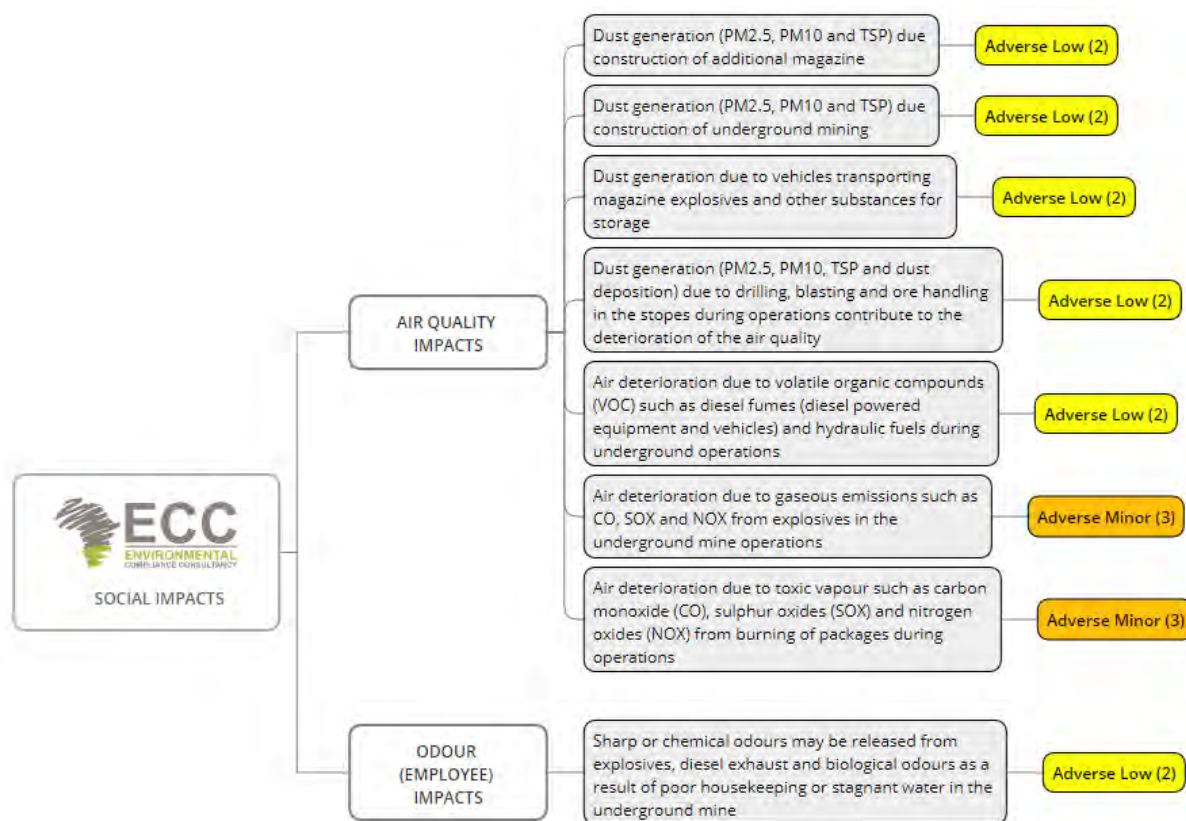


Figure 48 - Social impacts (air quality)

7.3.1.1 Dust generation (PM_{2.5}, PM₁₀ and TSP) due construction of additional explosive magazine

During Construction, activities that generate dust Particulate Matter 2.5 (PM_{2.5}), Particulate Matter 10 (PM₁₀) and total suspended particulates (TSP) include site clearing, site preparation,

loading and handling of material and vehicle movement. Particles that are 2.5 microns or less in diameter ($PM_{2.5}$) are released from combustion of gasoline, oil and diesel fuel, while particles with a diameter of 10 microns (PM_{10}) are released from construction sites, landfills and agriculture, wildfires and brush/waste burning, industrial sources, wind-blown dust from open lands, pollen and fragments of bacteria (California Air Resource Board, 2024). TSP is mostly generated by bulk earthworks, handling of coarse materials, and road dust.

The nature of the impact is adverse, direct and reversible post construction. The impact is likely to occur over a short term during the construction phase (<2 years). The dust generated and subsequently deposited may affect employees working within the mining licence area; therefore, the impact is considered to occur on site. The impact is likely due to vehicle and machinery used during the mining process.

The magnitude of the impact is rated minor. Employees are identified as the main sensitive receptors; however, the use of appropriate PPE and compliance with standard operating procedures (SOPs) are expected to mitigate potential health impacts from air quality. The sensitivity of the impact is low, as the impact is confined to the mining site. The overall significance of the impact prior to mitigation measures is rated low. Mitigation measures are outlined in the Navachab OEMP under Domain 4 (Appendix B).

7.3.1.2 Dust generation ($PM_{2.5}$, PM_{10} and TSP) due construction of underground mining

Normal underground mining construction activities, such as mucking, hauling and excavation generate dust that affect air quality within the workings. The nature of the impact is adverse, direct and reversible after construction. The impact is likely to occur over a short term during the construction phase (<2 years). The dust generated and subsequently deposited may affect employees working within the mining licence area; therefore, the impact is considered to occur on site. The impact is likely due to vehicle and machinery used during the mining process.

The magnitude of the impact is rated minor. Employees are identified as the main sensitive receptors; however, the use of appropriate PPE and compliance with standard operating procedures (SOPs) are expected to mitigate potential health impacts from air quality. The sensitivity of the impact is low, as the impact is confined to the mining site. The overall significance of the impact prior to mitigation measures is rated low. Mitigation measures are outlined in the Navachab OEMP under Domain 4 (Appendix B).

7.3.1.3 Dust generation due to drilling, blasting and ore handling in the stopes contribute to the deterioration of the air quality

During underground mining activities, activities involved include drilling, blasting and ore handling (loading and hauling) in the stopes, as well as crushing and grinding the ore. Important dust emissions generated are TSP, PM_{10} and $PM_{2.5}$. TSP refers to the total mass of all airborne particles suspended in the atmosphere, regardless of their size. This includes a mix of fine, coarse and larger particles typically generated by mining activities such as blasting, crushing,

haulage and stockpiling (Envirosuite, 2025). PM10 are inhalable dust particles with diameters of 10 micrometres or less, which can penetrate the upper respiratory tract and settle in the lungs, posing health risks, especially to site workers and nearby communities. PM2.5 comprises fine particles with a diameter of 2.5 micrometres or less. Due to their size, these particles can reach the deepest parts of the lungs and even enter the bloodstream, increasing risk of cardiovascular and respiratory disease (Envirosuite, 2025). Dust deposition is essentially the process of dust in the atmosphere settling on surfaces.

The nature of the impact is adverse, direct and reversible as ventilation is provided. The impact is likely to occur over a short term due to the life of mine (LoM), which is expected to be ~5 years. The dust generated and subsequently deposited may affect employees working within the mining licence area; therefore, the impact is considered to occur on site. The impact is likely due to vehicle and machinery used during the mining process.

The magnitude of the impact is rated minor, as the expansion of the trial underground mine during phase II operations includes a surface bored ventilation raise of 170 m, allowing sufficient ventilation. Additionally, dust suppression activities will be continued, and employees will wear the appropriate PPE. The sensitivity of the impact is low due to the on-site scale. The overall significance of the impact prior to mitigation measures is rated low. Mitigation measures are detailed in the Navachab OEMP under Domain 4 (Appendix B).

7.3.1.4 Dust generation due to vehicles transporting magazine explosives and other substances for storage

The transportation of explosives and other materials to and from the magazine area is expected to generate dust emissions primarily from vehicle movement along unpaved access roads within the mining licence area. The level of dust generation will depend on factors such as road surface conditions, vehicle speed, traffic frequency, and prevailing weather conditions specifically wind speed and moisture content. The nature of the impact is adverse, direct and reversible as dust suppression mitigations are applied. The impact is likely to be temporary depending on meteorological factors and dust suppression applied on site. The main sensitive receptors are mine employees working in proximity to haul routes on site. The impact is likely as the use of heavy vehicles will occur for transportation purposes.

The magnitude of the impact is rated minor, as employees are required to wear appropriate PPE and follow standard operating procedures (SOPs). Regular watering of haul roads and enforcement of speed limits will further minimise dust generation. The sensitivity of the impact is low due to the on-site scale. The overall significance of the impact prior to mitigation measures is rated low. Mitigation measures are detailed in the Navachab OEMP under Domain 4 (Appendix B).

7.3.1.5 *Air deterioration due to volatile organic compounds (VOC) during underground operations*

Volatile organic compounds (VOCs) are carbon-containing chemicals that readily evaporate into the air at normal temperatures. In underground mines, VOCs are mainly released from diesel engine exhausts and hydraulic fluid evaporation/leakage, but may also come from lubricants, explosives and maintenance chemicals (WHO, 2021). Health hazards because of VOC exposure includes acute effects such as eye, nose and throat irritation, headaches, dizziness and nausea, while chronic effects are potentially liver, kidney and nervous system damage (International Agency for Research on Cancer (IARC), 2014).

The impact is adverse, direct and reversible due to the ventilation that will be incorporated. The impact is likely to occur over a short term due to the life of mine (LoM) which is expected to be ~5 years. The VOCs released may affect employees on site only and not third-party receptors. The impact is likely due to vehicle and machinery used during the mining process. The magnitude of the impact is rated minor, due to the surface bored ventilation raise of 170 m included in the underground mining activities, allowing sufficient ventilation. Additionally, employees will wear the appropriate PPE. The sensitivity of the on-site impact is low. The overall significance of the impact prior to mitigation measures is rated low. Mitigation measures are outlined in the Navachab OEMP under Domain 4 (Appendix B).

7.3.1.6 *Air deterioration due to gaseous emissions such as carbon monoxide (CO), sulphur oxides (SOX) and nitrogen oxides (NOX) from explosives in the underground mine*

Air pollution may occur due to gaseous emissions such as CO, SO_x and NO_x from explosives during blasting in the underground mine and machinery operations. Post-blast fumes are composed of toxic gases (including oxides of nitrogen) which can be released into the atmosphere in significant quantities from blasting operations. Exposure to even quite low concentrations can pose a serious health risk (Resources Safety & Health Queensland, 2011). Additionally, packaging contaminated by explosive residues may release SO_x, NO_x and hydrogen cyanide (HCN) during routine burning activities in the designated burn pit.

The impact is adverse, directly impacting receptors and reversible due to foreseen ventilation. The impact is likely to occur over a short term due to the life of mine (LoM) which is expected to be ~5 years. Harmful gases released during mining operations may impact on-site employees and potential broader communities in certain cases. These emissions are primarily associated with blasting activities, vehicles and heavy machinery and equipment handling. The magnitude of the impact is considered minor, as the 170 m surface-bored ventilation raise incorporated into the underground mining design provides adequate air circulation. Additionally, employees will wear the appropriate PPE. The sensitivity of the impact is rated low, given its on-site extent. Overall, the significance of the impact prior to mitigation measures is assessed as low with mitigation actions detailed in the Navachab OEMP under Domain 4 (Appendix B).

7.3.1.7 *Air deterioration due to toxic vapour such as carbon monoxide (CO), sulphur oxides (SOX) and nitrogen oxides (NOX) from burning of packages*

The burning of packaging materials associated with explosive magazines as a controlled disposal method is generally done in a designated burn area to destroy any remaining explosive residues safely. This could lead to the release of toxic gases such as carbon monoxide (CO), sulphur oxides (SO_x), and nitrogen oxides (NO_x). The release of these gases could lead to several health risks such as respiratory irritation and lead to the formation of secondary pollutants such as ozone and acid aerosols.

The impact is adverse, directly impacting employees and potential communities and reversible particularly if burning is conducted without adequate control measures or under unfavourable meteorological conditions. The impact is likely to be temporary, as burning activities are typically infrequent, small-scale, and conducted under supervision following strict safety protocols. The magnitude of the impact is considered moderate and due to the acute exposure, the gases can cause respiratory irritation, headaches, and reduced oxygen absorption, while prolonged inhalation of particulate matter can aggravate respiratory conditions. The sensitivity of the impact is rated low, due to local scale. Overall, the significance of the impact prior to mitigation measures is rated as minor. Mitigation measures are discussed in the Navachab OEMP as Domain 4 (Appendix B).

7.3.1.8 *Sharp or chemical odours may be released from explosives, diesel exhausts and biological odours in the underground mine*

The sharp, acidic odour associated with explosives used during blasting activities and the smoky smell associated with diesel fumes could cause headaches and nausea should the smells persist (Safe Work Australia, 2015) and appropriate PPE not utilised. Additionally, biological odours (hydrogen sulphide) could result from water in sumps or low-lying areas, combined with organic matter this could be favourable for the bacterial growth. Hydrogen sulphide may also be found in trace amounts in mines (Chart Industries, 2023).

The impact is adverse, directly impacting receptors and reversible due to the planned ventilation. The impact is likely to occur over a short term due to the life of mine (LoM) which is expected to be ~5 years. Prolonged exposure to various odours may cause discomfort and pose potential health risks to employees. The magnitude of the impact is considered minor, due to the 170 m surface-bored ventilation raise within the underground mine, which ensures sufficient air circulation. The sensitivity of the impact is rated low, due to on-site release. Overall, the significance of the impact prior to mitigation measures is rated as low. Mitigation measures are discussed in the Navachab OEMP as Domain 4 (Appendix B).

Table 19 - Air quality related impacts affecting employees

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Construction activities	Air quality	Dust generation (PM _{2.5} , PM ₁₀ and TSP) due to construction of additional magazine	Adverse Direct Reversible Short term On-site Likely	Low	Minor	Low (2)
		Dust generation (PM _{2.5} , PM ₁₀ and TSP) due to construction of underground mining	Adverse Direct Reversible Short term On-site Likely	Low	Minor	Low (2)
Underground mining operation		Dust generation due to vehicles transporting magazine explosives and other substances for storage	Adverse Direct Reversible Temporary On-site Likely	Low	Minor	Low (2)
		Dust generation (PM _{2.5} , PM ₁₀ , TSP and dust deposition) due to drilling, blasting	Adverse Direct Reversible Short term On-site Likely	Low	Minor	Low (2)

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		and ore handling in the stopes contribute to the deterioration of the air quality				
		Air deterioration due to volatile organic compounds (VOC) such as diesel fumes (diesel powered equipment and vehicles) and hydraulic fuels during underground operations	Adverse Direct Reversible Short term On-site Likely	Low	Minor	Low (2)

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		Air deterioration due to gaseous emissions such as CO, SO _x and NO _x from explosives in the underground mine	Adverse Direct Reversible Short term Local Likely	Low	Minor	Minor (3)
		Air deterioration due to toxic vapour such as carbon monoxide (CO), sulphur oxides (SO _x) and nitrogen oxides (NO _x) from burning of packages	Adverse Direct Reversible Temporary Local Likely	Low	Moderate	Minor (3)
	Odour (employee)	Sharp or chemical odours may be released from explosives, diesel	Adverse Direct Reversible Short term On-site Likely	Low	Minor	Low (2)

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		exhaust and biological odours as a result of poor housekeeping or stagnant water in the underground mine				

7.3.2 VISUAL IMPACTS

This section assesses the potential visual impacts associated with the proposed addition of a third explosives magazine at Navachab Gold Mine on mining licence (ML) 31. Visual impacts refer to changes in the landscape's character and scenic quality as perceived by observers, including local residents, land users and travellers along nearby roads. Considering the Project site's proximity to the B2 trunk road, district roads and nearby farms, certain elements of the mine infrastructure, including the proposed explosives magazine, are likely to be visible within a localised 10 km viewshed, as shown in Figure 49 and Figure 50, respectively. This assessment considers both the direct visual effects of the new explosive's magazine and its contribution to the cumulative visual presence of existing mine infrastructure.

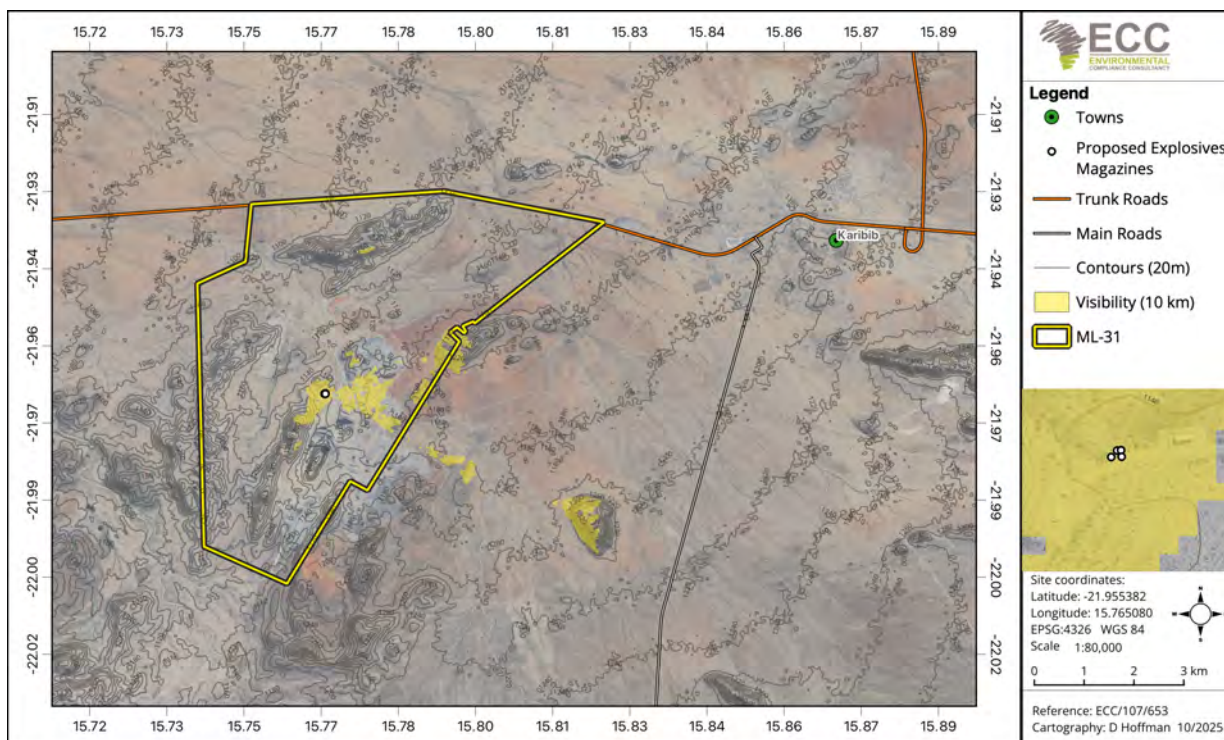


Figure 49 - Viewshed of the proposed explosives magazine with a visibility of 10 km from the magazine

The potential visual impacts identified are assessed in the sections below. An overview of significant impacts before mitigation is displayed in Figure 50 and the impact assessment ratings are detailed in Table 20.

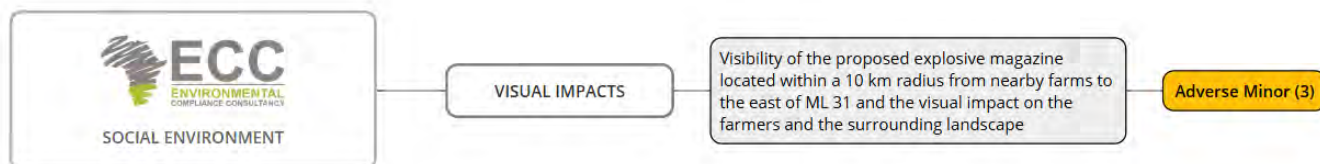


Figure 50 - Visual impact assessment for the explosive's magazine

7.3.2.1 *Visibility of the third explosives magazine located within a 10 km radius from nearby farms to the east of ml 31 and the visual impact on the farmers and the surrounding landscape*

The Project area surrounding the Navachab Gold Mine/ML 31 exhibits gently undulating terrain, with elevations ranging from just below 1 300 m above sea level (masl) on the south-eastern (SE) side, to approximately 1 100 masl in the north-western (NW) corner. This gradual decrease in elevation, combined with the presence of isolated hills and ridges reaching up to 1 287 m, plays a significant role in determining visibility patterns across the landscape. The higher lying SE sections offer wider and more elevated viewing points, potentially allowing observers from these areas, including nearby farms to have a clear line of sight toward sections of the mine, the proposed explosives magazine and the already existing explosives magazines. In contrast, the lower NW areas are more visually contained, with the terrain and intervening ridges offering natural screening that can partially obscure infrastructure from view.

Considering this topographic variation, the visual exposure of the proposed Project infrastructure will not be uniform across the landscape. The SE high ground is more sensitive to visual intrusion, as it overlooks much of the mining lease area, while the NW plains are less affected due to reduced visibility and distance attenuation. The relatively open and sparsely vegetated desert terrain around Navachab further increases visibility, as limited vegetation cover offers minimal natural screening. Consequently, residents, land users located on elevated terrain or along ridges within the 10 km viewshed may experience visual disturbance, particularly during daylight hours when contrasts between natural and industrial elements are more noticeable.

The impact is considered adverse as the mine infrastructure, including the additional explosives magazine, will be visible from elevated areas and open terrain, resulting in a disruption of the natural and rural landscape character. The sparse vegetation offers little screening, making industrial structures visually prominent. This reduces the overall scenic quality for nearby farms and stakeholders within a 10 km radius. The impact is considered direct as the impact arises from the Project's physical infrastructure, specifically the explosives magazine and other mine facilities. The impact is rated as partly reversible because visual intrusion can be reduced over time through progressive rehabilitation or the removal of infrastructure following mine closure. However, some alterations to the natural landscape may remain permanent, particularly for adjacent receptors (e.g. nearby farms and motorists travelling on the B2 trunk road). The magnitude of change is considered low as the visual impact from the explosive's magazine causes only a minor alteration to the landscape's overall characteristics. Although some noticeable visual disturbance may occur, it is limited to specific viewpoints or sections of the landscape and does not significantly alter its broader visual quality or integrity.

The duration of the impact is deemed long term because the explosives magazine and associated mine infrastructure will remain visible for the duration of the underground mining operations and potential for future use in the above mining operations (>5 years). The extent of the impact is deemed local as the visual receptors are expected to be those located in the immediate surroundings of the mine, including nearby farms and farms/stakeholders within the approximate 10 km viewshed. The probability of the impact is assessed as definite as the explosives magazine and associated mine infrastructure will be physically constructed and remain visible within the landscape throughout the Project operational phase. Additionally, the visibility of the explosive's magazine from a 10 km radius is certain due to the limited natural screening in the area. However, the sensitivity of the impact is rated low as the landscape itself is already disturbed by other land users, current ML 31 and ML 180 operational activities and is not particularly rare or highly valued for its aesthetic qualities. Additionally, the environment has some capacity to accommodate changes, as natural features such as hills, vegetation and ridges will block or reduce visibility of the explosive magazine from certain viewpoints (partial screening effect). Overall, the impact has been rated adverse minor, before mitigation (Table

20). The proposed mitigation measures are detailed further in the OEMP Domain 8 (Appendix B).

Table 20 - Visual impacts associated with the construction of a third explosives magazine at Navachab Gold Mine on ML 31

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
The construction and operation of a third explosives magazine	Nearby farms and farms located within a 10 km radius of ML 31	Visibility from nearby to farms and farmers within a 10 km radius of the proposed construction and operation explosives magazine	Adverse Direct Partly reversible Long term Local Definite	Low	Low	Adverse Minor (3)

7.3.3 HERITAGE/ARCHAEOLOGICAL IMPACTS

The archaeological and historical assessment for the Navachab Project (Kinahan, 2009) identified in total 17 heritage sites covering mining licence (ML 31) (5 sites), ML 31 accessory works area (1 site) and ML 180 (11 sites). A further 3 sites were recorded in the TSF 3 area in the 2022 assessment (Kinahan, 2022), bring the total sites discovered on Navachab Gold Mine to 20. These heritage site locations are mapped in section 5.9 (Figure 41). Therefore, the proposed construction of the third explosive magazine poses a direct risk to four specific sites:

- QRS 114/7 (1.2 km away from proposed site) (ML 31 accessory works area) which is a possible remnant of winch anchor (Figure 43);
- QRS 114/8 (1.25 km away from proposed site) (ML 31) which is a possible iron wagon tyre quenching bath (Figure 44);
- QRS114/15 (2.3 km away from proposed site) (ML 31) which is a MSA scatter); and
- QRS114/16 (2 km away from proposed site) (ML 31) which are seed diggings, five within 100 m radius.

These sites are susceptible to adverse impacts from operational activities and accidental detonation (ground vibration, air blasts and fly rock). Furthermore, site preparation and clearing for the explosive's magazine construction carry the potential for direct physical impact and the unearthing of previously unrecorded archaeological artifacts (chance finds).

The potential significant archaeological impacts are identified and assessed below, and the pre-mitigation impacts are visually summarised in Figure 51 and detailed in Table 21.

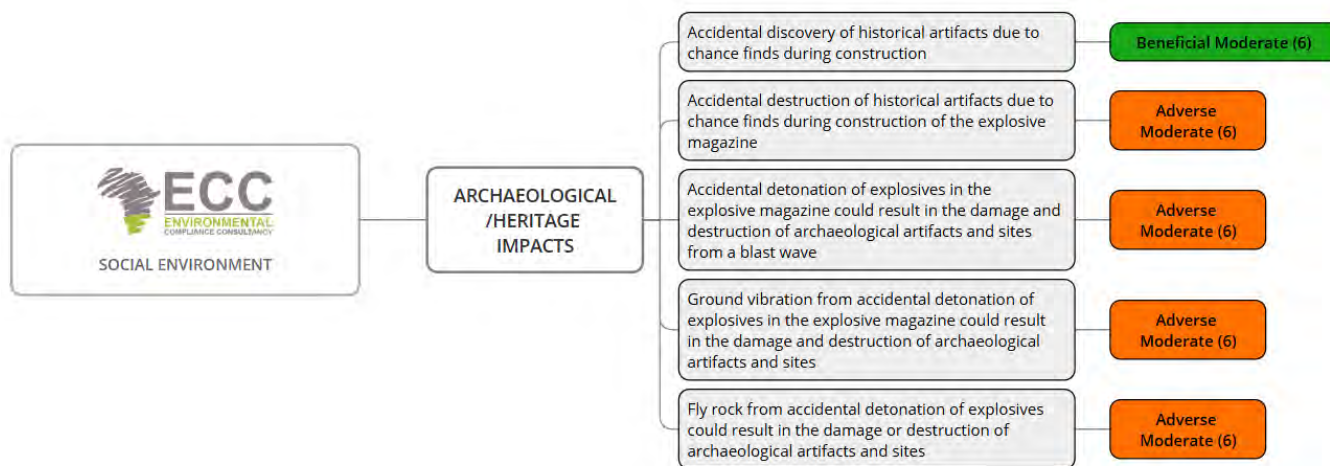


Figure 51 - Illustrated summarised impacts of the construction and operations of an explosive's magazine on heritage artifacts within a 3 km radius from the explosive magazine

7.3.3.1 *Accidental discovery of historical artefacts due to chance finds during construction*

Earthworks, site-preparation work and civils during construction present an opportunity to increase our understanding of the area's cultural heritage. This is because ground-disturbing activities (earthmoving, grading, utility trenching and foundation excavation) could reveal previously unrecorded artifacts, lithic scatters or buried features not captured in the 2009 and 2022 inventory of recorded heritage sites. As such chance finds are often fragile, it is important to manage construction activities so that any discoveries are protected and recorded promptly. With a clear chance find procedure, trained supervision and immediate mitigation measures in place, there can be an advance in archaeological knowledge, ensuring compliance with the protection objectives of the National Heritage Act, No. 27 of 2004, avoiding irreversible loss of potential archaeological discoveries.

The nature of this impact is beneficial as the discovery of new archaeological artifacts enriches the country's historical knowledge, strengthens cultural identity, supports historical research and promotes heritage preservation. The type of impact is indirect because the construction activities themselves do not directly aim to discover cultural heritage but rather creates conditions that could unintentionally lead to new archaeological discoveries. However, earthworks may incidentally reveal artifacts that were previously unknown. This impact is irreversible because once an archaeological site has been discovered, archaeological records are permanently altered. The duration of this impact is permanent because the knowledge of the site, its stratigraphy, spatial relationship and cultural significance can neither be altered or replaced. The magnitude of change is moderate because discovering new artifacts adds valuable heritage information and improves knowledge quality. The extent of the impact is national as it contributes to Namibia's overall cultural heritage, enhancing the countries historical records, research and public knowledge.

The probability of this impact occurring is possible because the area already has 20 documented heritage sites and ground disturbance for the construction of the magazine

creates conditions where chance finds can occur. Furthermore, other archaeological artifacts have been found within 1 kilometre of where the construction of the additional explosive's magazine is to happen. The sensitivity of the impact is high because archaeological artifacts are nationally important, irreplaceable and highly vulnerable to disturbance, with little capacity to accommodate change. Therefore, this impact has been rated beneficial moderate as shown in Table 21. The requirements and implementation of the chance finds procedure is detailed Domain 8 of the OEMP (Appendix B).

7.3.3.2 Accidental destruction of historical artifacts due to chance finds during construction of the explosive's magazine

Construction and site preparation activities carry an unavoidable risk of direct, irreversible physical impact to surface and sub-surface heritage features. Although the 2009 assessment inventoried 5 sites on ML 31, ground-disturbing activities (such as earthmoving, grading, trenching for utilities and foundation excavation) may unearth previously unrecorded artifacts, lithic scatters, or buried features. These chance finds are often highly vulnerable to destruction without immediate mitigation. The subsequent loss of artifacts, context, and stratigraphy constitutes a permanent depletion of the non-renewable archaeological record, directly contravening the protection mandate of the National Heritage Act, No. 27 of 2004.

The nature of this impact is adverse because earthworks may permanently destroy unknown heritage features and their destruction diminishes the historical and scientific significance of the site, depleting a non-renewable cultural resource. The impact is direct because construction and excavation activities physically interact with and disturb heritage material, causing damage to surface and subsurface archaeological features. The impact is irreversible because any damage or loss of these heritage features such as artifacts or buried remains cannot be undone or replaced. Once destroyed or damaged their historical, cultural and scientific value is partially or permanently lost, making recovery or restoration impossible or difficult. The duration of the impact is permanent because the destruction or disturbance of these potential heritage features is a lasting loss of cultural and archaeological artifacts, that cannot be regenerated or replaced, entailing the consequence of the impact persists indefinitely and permanently after construction has ended. The extent of the impact is national because the heritage features at risk are protected under the National Heritage Act, No. 27 of 2004 and are considered significant to Namibia as a whole. Damage or loss of these archaeological features affects the country's collective historical and cultural record, not just the local area. The magnitude of change of the impact is high because construction activities could result in the loss of archaeological artifacts and severely damage key characteristics and features of these artifacts. Chance finds, buried artifacts or stratigraphic layers may be irreversibly destroyed, permanently compromising the quality, integrity and historical value of the sites. The scale of the potential damage, even if localised, affects the essential and non-substitutable attributes of the heritage resource.

The probability of the impact occurring is possible because while construction activities have the potential to disturb heritage artifacts, it is not certain that damage will occur. However, the

risk cannot be ruled out, so there is a real but not inevitable likelihood that heritage features will be affected. Furthermore, the chances of the construction unearthing archaeological artifacts is also possible because there are several other archaeological sites that have been identified within 1 - 2 km of the proposed construction site. The sensitivity of the impact is high because the heritage artifacts at risk are of national importance and irreplaceable. Artifacts buried structures and stratigraphic contexts are rare and non-substitutable, and they are highly vulnerable to disturbance. Even minor ground-disturbing activities can permanently alter or destroy these artifacts, which have very limited capacity to accommodate change. Therefore, the significance of this impact has been rated adverse minor (Table 21), and the mitigation measures have been included in Domain 8 of the OEMP.

7.3.3.3 Accidental detonation of explosives in the explosives magazine could result in the damage and destruction of archaeological artifacts and sites from a blast wave (air blast)

The proximity of QRS 114/7 and QRS 114/8, ~ 1 km from the proposed explosives magazine places these sites within the high-risk zone for blast overpressure damage from an accidental air blast. The winch anchor (QRS 114/7) and possible iron wagon tyre quenching bath (QRS 114/8) are constructed from fragile, dry-stacked or weathered materials, are highly sensitive to the transient dynamic loading imposed by the shockwave. Potential impacts include the disintegration and collapse of rock structures, and the dispersal of surface artifact scatters. This physical displacement destroys the spatial integrity and contextual information of the site, rendering the remaining archaeological data scientifically useless. Generally, the safe zone for planned blasting is 500 m but could extend without control of the detonation due to the increased volume of explosives stored at the magazine.

The nature of the impact is adverse because an unplanned blast could destroy fragile heritage structures and disperse artifacts, permanently damaging the site's integrity, context and scientific value. The impact is direct because it results from the immediate physical effect of the explosive shockwave on the nearby heritage sites. The transient dynamic loading from the blast acts directly on the structures and artifacts, causing collapse, disintegration and dispersal without any intermediate steps or indirect processes. The impact is irreversible because the blast would destroy fragile structures and scatter artifacts, permanently erasing the original arrangement and context of the site. Since the spatial relationships and material integrity of archaeological artifacts are critical for scientific interpretation, once they are lost or displaced, they cannot be reconstructed or recovered, making the damage irreversible. The duration of the impact is permanent because the damage destroys the physical structures and displaces artifacts, irreversibly altering the site's spatial integrity and contextual information. Once these heritage elements are collapsed, broken, or scattered, they cannot be restored to their original state, making the loss long-lasting and irreversible.

The scale of the impact is national because the affected heritage sites (QRS 114/7 and QRS 114/8) are of significance to the country. Their destruction would represent a loss of cultural and scientific value that extends beyond the local area, affecting Namibia's national heritage,

archaeological record and collective historical knowledge. The impact is therefore not just local but of importance at the national level. The magnitude of change is high because the impact would cause the loss of the heritage resources and severely damage its key characteristics and features. The fragile structures and artifacts could disintegrate or collapse, and the spatial integrity and contextual information would be destroyed, eliminating the scientific and cultural value of the site. This represents severe damage to critical elements of the artifacts. The probability is rare, although the consequences of a detonation would be severe, strict safety protocols, magazine design standards, regulatory controls, handling procedures and security measures will be in place to prevent accidental high-order explosions. These preventative measures, such as controlled storage distances, blast-proof construction, restricted access and rigorous operational procedures significantly reduce the likelihood of an accidental detonation, making the event improbable even though its potential consequences are extreme. The sensitivity of the impact is high because the heritage sites are of national significance, rare, and irreplaceable. The fragile structures and artifacts are very sensitive to change and have little to no capacity to withstand or accommodate the blast, meaning any damage would result in an irretrievable loss of cultural and scientific value. Therefore, this impact has been rated adverse minor (Table 21) and the mitigation measures have been included in Domain 8 of the OEMP.

7.3.3.4 Ground vibration from accidental detonation of explosives in the explosives magazine could result in the damage and destruction of archaeological artifacts and sites

The local geology, dominated by hard, metamorphosed rocks such as dolomitic marble and schists of the Swakop Group, facilitates the efficient transmission of seismic energy, allowing vibrations to propagate across long distances with minimal attenuation. In the event of an accidental detonation, the resulting shockwave would generate high peak particle velocities (PPV) at surrounding heritage sites. Since the winch anchor (QRS 114/7) and possible iron wagon tyre quenching bath (QRS 114/8) are fragile requiring PPV limits well below 5 mm/s to avoid damage, even moderate ground motion poses a serious risk. The vibrational energy could induce internal micro-fracturing within stone or rock features of QRS 114/7 cause subtle destabilisation of the underlying substrates and potentially lead to partial or complete disintegration of the site. Structural discontinuities in the geology, such as faults, veins and foliation planes, may further amplify or channel seismic energy, intensifying localised ground motion. Consequently, the combination of a vibration-prone geological environment and the fragility of heritage materials represent a significant threat to the long-term preservation of these culturally valuable sites.

The nature of this impact is adverse because accidental detonations could generate ground vibrations that exceed the very low tolerance of fragile heritage structures, causing micro-fractures, destabilisation or partial/complete destruction. The hard geology amplifies and transmits seismic energy over long distances, increasing the risk of loss of culturally and historically valuable sites. The impact is direct because it results immediately from the accidental detonation at the source. The vibration generated by the explosion travel through the surrounding geology and directly affect the heritage structures (e.g., winch anchor, iron

wagon tyre quenching bath) without any intermediate steps or mediating processes. In other words, the damage is an immediate physical consequence of the detonation rather than an indirect or secondary effect. The impact is irreversible because any damage to the heritage structures, such as micro-fracturing, destabilisation or partial/complete disintegration, cannot be fully repaired or restored to their original condition. These sites are unique, culturally and historically valuable and non-substitutable, so once structural or material integrity is lost, it represents a permanent loss of heritage that cannot be replaced. The duration of the impact is permanent because the damages to the heritage structures, such as micro-fractures, destabilisation or collapse, cannot naturally recover over time. Once the physical integrity of these irreplaceable sites is compromised, the loss is lasting and the sites' cultural, historical and scientific value is permanently diminished.

The heritage sites affected, such as the winch anchor (QRS 114/7) and the iron wagon tyre quenching bath (QRS 114/8), are of significance at a national scale. Their cultural, historical and educational value is recognised beyond the local community, meaning damage to these sites would be a loss to the entire nation, not just the immediate area. The magnitude of change is high because an accidental detonation could cause severe damage to these heritage sites, resulting in the loss of structural integrity, key features and cultural value. The affected elements, such as the winch anchor and quenching bath are fragile and cannot withstand even moderate vibrations, meaning the resource would be extensively degraded or partially destroyed, representing a major negative change to their quality and characteristics. The probability is rare, although the consequences of a detonation would be severe, strict safety protocols, magazine design standards, regulatory controls, handling procedures and security measures will be in place to prevent accidental high-order explosions. These preventative measures, such as controlled storage distances, blast-proof construction, restricted access and rigorous operational procedures significantly reduce the likelihood of an accidental detonation, making the event improbable even though its potential consequences are extreme. The sensitivity of the impact is high because the heritage sites are of national importance and irreplaceable, with unique cultural, historical and structural features. They have very limited potential for substitution, and their fragile nature means they are extremely vulnerable to even minor vibrations, with little or no capacity to accommodate or recover from damage. Any alteration would significantly compromise their value. Therefore, this impact has been rated adverse minor (Table 21), and the mitigation measures have been included in Domain 8 of the OEMP.

7.3.3.5 Fly rock from accidental detonation of explosives could result in the damage or destruction of archaeological artifacts and sites

While the sites are located at ~1.2 km to 1.25 km, a large unconfined explosion can eject high-velocity fragments over large distances and outside the normal 500 m-controlled blast safe zone. Any fly rock reaching the heritage sites would result in direct, high-energy impact damage, causing the physical smashing of artifacts, obliteration of surface features such as the winch anchor (QRS 114/7) and possible iron wagon tyre quenching bath (QRS 114/8), and creation of impact craters that permanently obscure the archaeological context.

The nature of the impact is adverse because high-velocity fragments from an explosion could irreversibly destroy artifacts and surface features, permanently damaging the heritage and archaeological value of the sites. The impact is direct because the high-velocity fragments (fly rock) would physically reach the heritage sites themselves, causing immediate damage to artifacts and surface features without involving any intermediate processes or indirect pathways. In other words, the source of harm (the explosion) acts directly on the heritage artifacts. The impact is irreversible because the physical destruction of artifacts, surface features and archaeological context cannot be undone or restored. Once objects are smashed, features obliterated or spatial arrangements disturbed by fly rock and impact craters, the cultural, historical and scientific value of the heritage sites is permanently lost. The duration of the impact is permanent because the damage caused, such as smashed artifacts, destroyed surface features and disrupted archaeological context cannot naturally regenerate or be restored. The loss of cultural, historical and scientific information remains for the long term, making the effects enduring and lasting.

The extent of the impact is national because the affected heritage sites are of significance beyond the local area, holding value for Namibia as a whole. Damage to these sites would represent a loss of nationally important cultural and historical assets, not just localised features, affecting the country's collective heritage and identity. The magnitude of change is high because an unconfined explosion could cause severe damage to key characteristics and features of the heritage sites, including smashing artifacts, obliterating surface features and creating impact craters that destroy the archaeological context. This represents a loss of both the resource and its integrity. The probability is rare, although the consequences of a detonation would be severe, strict safety protocols, magazine design standards, regulatory controls, handling procedures and security measures will be in place to prevent accidental high-order explosions. These preventative measures, such as controlled storage distances, blast-proof construction, restricted access and rigorous operational procedures significantly reduce the likelihood of an accidental detonation, making the event improbable even though its potential consequences are extreme. The sensitivity of the impact is high because the heritage sites are of national significance, representing irreplaceable cultural and archaeological value with limited or no potential for substitution. Additionally, the sites are very sensitive to physical disturbance, and any damage, such as smashed artifacts or disrupted archaeological context cannot be accommodated or reversed, making them highly vulnerable to change. Therefore, the significance of the impact is adverse minor (Table 21) and the mitigation measures have been included in Domain 8 of the OEMP.

Table 21 - Impact of the construction and operation of the additional explosive magazine on known and potential heritage sites and archaeological artifacts

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Groundwork and		Accidental discovery of	Beneficial Indirect	High	Moderate	Beneficial Moderate

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
construction of an explosive magazine	Undiscovered archaeological artifacts	historical artifacts due to chance finds during construction	Irreversible Permanent National Possible			
		Accidental destruction of historical artifacts due to chance finds during construction of the proposed explosives magazine	Adverse Direct Irreversible Permanent National Possible	High	High	Adverse minor (3)
Operation of the explosive magazine	Winch anchor (QRS 114/7) and possible iron wagon tyre quenching bath (QRS 114/8)	Accidental detonation of explosives in the explosives magazine could result in the damage and destruction of archaeological artifacts and sites from a blast wave	Adverse Direct Irreversible Permanent National Possible	High	High	Adverse minor (3)
		Ground vibration from accidental detonation of explosives in the explosives magazine could result in the damage and destruction of archaeological artifacts and sites	Adverse Direct Irreversible Permanent National Possible	High	High	Adverse minor (3)
		Fly rock from accidental detonation of	Adverse Direct Irreversible	High	High	Adverse minor (3)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		explosives could result in the damage or destruction of archaeological artifacts and sites	Permanent National Unlikely			

7.3.4 NOISE IMPACTS

Noise monitoring at Navachab Gold Mine on ML 31 is conducted biannually in accordance with the South African National Standard (SANS) 10103 to ensure occupational health protection, regulatory compliance and assess noise levels at the surrounding sensitive receptors (NSRs). The first noise dataset was recorded in May 2025 and serves as the baseline acoustic data for the Project. The dataset serves as a tool for ongoing comparison to future noise measurements throughout operations to assess the level of compliance to the SANS (10103:2008) daytime and nighttime noise guidelines (thresholds) for rural districts, which is 45dBA during the day and 35 dBA during the night (this is also in line with IFC requirements). The noise monitoring program aims to establish effective control measures to ensure key noise generating activities such as drilling, blasting, ore crushing and haulage operations are properly managed to minimise noise impacts on mine personnel and off-site receptors. Furthermore, future noise monitoring measurements will aid in trends analysis to ensure effective noise mitigation, management and control measures are implemented to ensure the noise levels remain within acceptable limits, for both mine personnel and offsite receptors. Overall, the noise monitoring program aims to ensure effective environmental management, maintain good community relations and promote continuous site improvement in occupational health and safety.

This section assesses the potential noise and vibration impacts associated with the construction and operations of the additional explosive's magazine on mine personnel and off-site NSRs (i.e. nearby farmers to the southeast (SE) of the Project/ML 31).

The potential noise impacts on the ambient environment and third parties/stakeholders from underground drilling, blasting, ore extraction and haulage are considered non-significant and are not discussed further in this assessment. These activities occur below the surface, where the surrounding rock effectively absorbs and muffles most of the sound energy. As a result, minimal noise propagates to the surface or surrounding environment. Any vibrations or low-frequency sounds that do propagate to the surface would typically be intermittent, infrequent and well below thresholds that could disrupt nearby receptors. Furthermore, underground blasting will take place within an already active open pit. It is not expected that it will cause a significant increase in existing baseline noise levels or those generated by routine blasting operations in the open pit. Moreover, blasting is usually planned and scheduled within regulatory limits and monitored to ensure compliance, further reducing the likelihood of

significant noise impacts. However, noise related occupational health and safety impacts produced during underground mining on employees and contractors will be assessed.

A detailed log of noise measurements across a network of noise survey locations is in place and will be maintained to support subsequent data analysis and validation against guideline limits. The outdoor noise threshold bands are summarised in Table 22. The survey results for the campaign undertaken on 13 and 14 May 2025 are summarised in Table 23. Noise monitoring locations were identified close to the depositional dust fallout stations (NAQ01N, NAQ03, NAQ04N, NAQ05, NAQ09 and NAQ12) and are shown Figure 52.

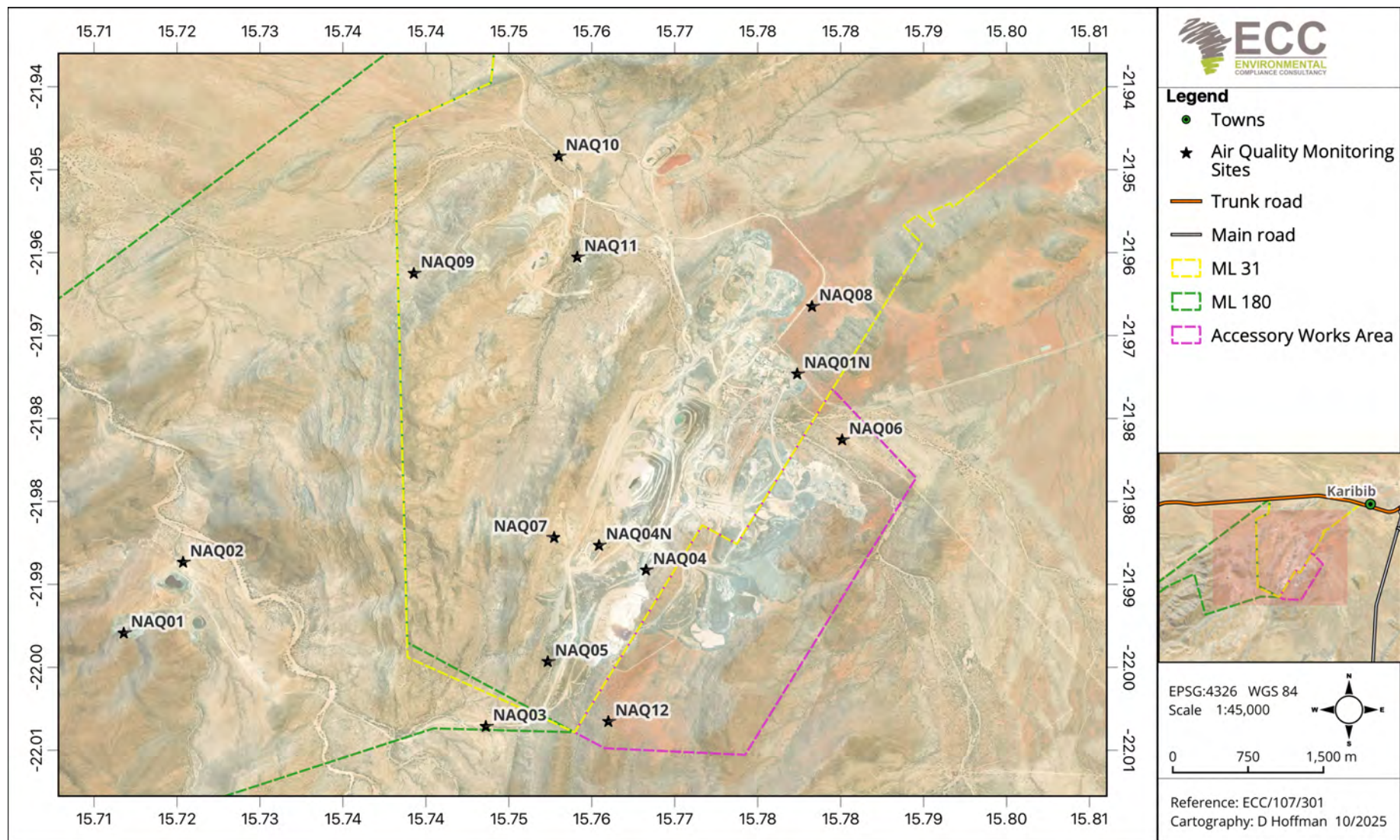


Figure 52 - Noise monitoring locations based on current position of depositional dust monitoring stations

Table 22 - Typical rating levels for outdoor noise as per SANS and IFC requirements

Type of district	Equivalent Continuous Rating Level ($L_{Req,T}$) for Outdoor Noise		
	Day/night $L_{R,dn}^{(a)}$ (dBA)	Daytime $L_{Req,d}^{(b)}$ (dBA)	Night-time $L_{Req,n}^{(c)}$ (dBA)
Rural district	45	45	35
Suburban district with little road traffic	50	50	40
Urban district	55	55	45
Urban district with one or more of the following: business premises and main roads.	60	60	50
Central business district	65	65	55
Industrial districts	70	70	60

- a) $L_{R,dn}$ = The LA_{eq} rated for impulsive sound and tonality in accordance with SANS 10103 for the period of a day and night.
- b) $L_{Req,d}$ = The LA_{eq} rated for impulsive sound and tonality in accordance with SANS 10103 for the day-time period.
- c) $L_{Req,n}$ = The LA_{eq} rated for impulsive sound and tonality in accordance with SANS 10103 for the night-time period.

Table 23 - Nighttime and daytime noise measurements recorded at noise survey locations at the Project site

Sampling point	Visual and acoustic observation	General weather conditions	Start date and time	Duration	LAF max (dBA)	LAF min (dBA)	LA_{eq} (dBA)
NAQ01N-Daytime	CIP plant generators, moving vehicles, vehicle reverse beeps and birds chirping.	Wind gusts	13/05/2025 11:49:46	00:23:33	62.3	45.2	52.1
NAQ01N-Nighttime			13/05/2025 10:00:37	00:22:50	63.2	49.6	52.8
NAQ03-Daytime	Vehicles cracking, vehicle movement on the B2 road.	Wind gusts	13/05/2025 10:50:14	00:23:07	57.3	29.5	41.2
NAQ03-Nighttime			14/05/2025 01:20:21	00:23:27	59.5	35.9	41.3
NAQ04N-Daytime	Dumping from haul trucks. Reverse beepers,	Wind gusts	13/05/2025 02:45:01	00:23:07	57.3	29.5	86.8
NAQ04N-Nighttime			14/05/2025 12:05:37 am	00:23:39	59.6	44.6	50.6

Sampling point	Visual and acoustic observation	General weather conditions	Start date and time	Duration	LAF max (dBA)	LAF min (dBA)	LA _{eq} (dBA)
	rock falling, birds chirping and insects.						
NAQ05-Daytime	Haul trucks movement, dumping, vehicle movement, reverse beepers and birds chirping.	Wind gusts	13/05/2025 09:57:15	00:22:58	57.8	24.8	38.9
NAQ05-Nighttime		Wind gusts	14/05/2025 12:05:37	00:22:58	57.8	24.8	38.9
NAQ09-Daytime	Haul truck movement,	Wind gust	13/05/2025 12:43:44	00:23:10	62.4	26.2	41.1
NAQ09-Nighttime	loading, dumping, falling rocks and birds chirping.		13/5/2025 11:07:12	00:23:21	65.5	26.5	35.7
NAQ12-Daytime	Excavation, dumping,	Wind gusts	13/05/2025 02:04:06	00:23:21	65.3	36.5	48.3
NAQ12-Nighttime	haul truck movement, haul truck dumping, hooting, rock rolling and birds chirping.		14/05/2025 02:07:57	00:23:30	53.9	38.5	44.6

NAQ01N exceeded the rural threshold for both day and nighttime noise limits, the monitoring location is next to the processing plant, and this is expected and like the results obtained by Airshed (2022) and discussed in chapter 5. NAQ03 daytime noise levels are within the required threshold, and the nighttime noise levels are also within the threshold. NAQ04N daytime noise levels are within the required threshold but the nighttime noise levels are not. This station is located at pit control and therefore within the mining operational area. NAQ05 greatly exceeded the threshold levels during the daytime and exceeded during the nighttime. During the monitoring activities active hauling and dumping activities were observed, location is behind TSF 2 and a lot of insect activity. NAQ09 did not exceed the daytime threshold but did exceed the nighttime threshold. NAQ09 is located behind the decommissioned TSF 1 and the B2 national road is to the north of the station. NAQ12 exceeded both the daytime and nighttime thresholds and levels were noted to be very similar. This location is by the newly constructed TSF 3, which is currently under construction and partially operational. Based on these interim

May 2025 results, the noise related potential impacts as a result of the proposed construction and operational activities of the Project should not have a major influence on the current ambient daytime and nighttime and related thresholds, especially taking into consideration the closest monitoring locations to the east (NAQ01N), to the south (NAQ4N) and to the north (NAQ09).

The potential noise and ground vibration impact(s) associated with the construction and operations of the explosive's magazine on construction and operational employees; contractors and third parties/stakeholders are assessed in the sections below. An overview of the impact is visually summarised in Figure 53 and the impact assessment ratings are detailed in Table 24, before mitigation, unless otherwise specified.

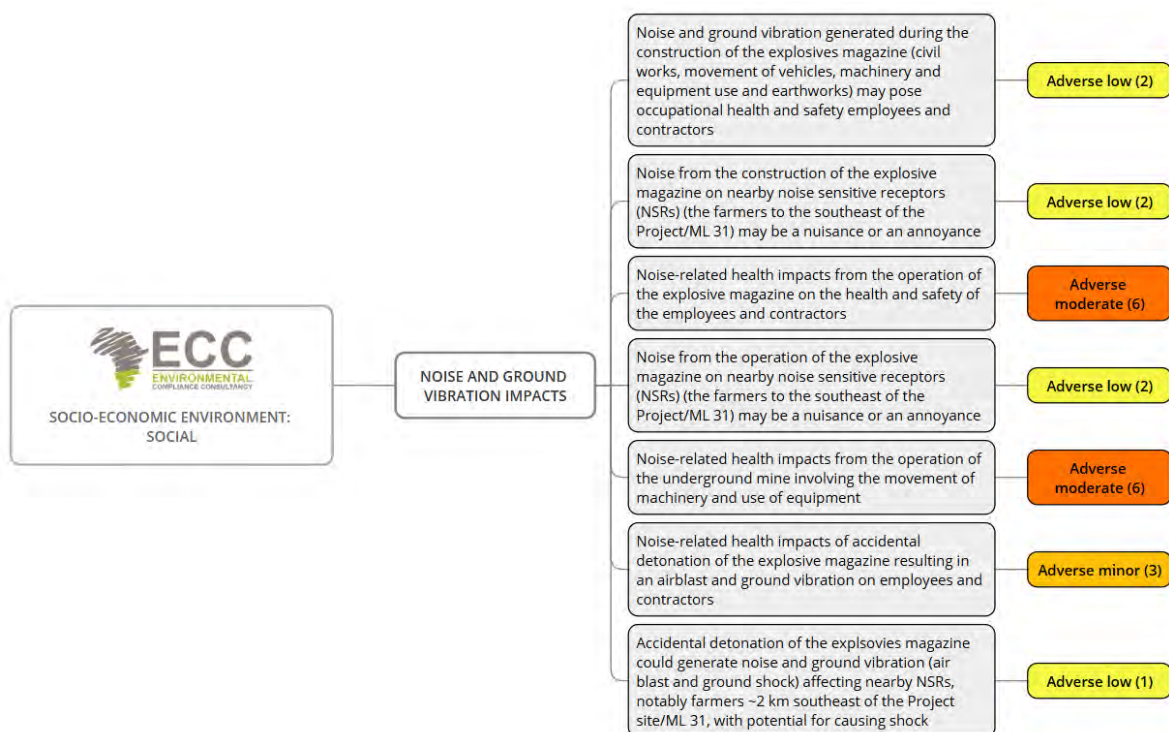


Figure 53 - Illustration of the impacts of noise and vibration from the construction and operations of the explosive's magazine on the health employees, contractors and third parties

7.3.4.1 *Noise and ground vibration generated during the construction of the explosive's magazine (civil works, movement of vehicles, machinery and equipment use and earthworks) may pose occupational health and safety risks to employees and contractors*

During the construction of the explosive's magazine, activities such as the operation of heavy machinery, vehicle movement, equipment use, civil works and earthworks will generate elevated noise levels that can adversely affect construction workers. Prolonged or repeated exposure to these noise levels may cause noise-induced hearing loss, tinnitus and temporary auditory fatigue, while also induces physiological and psychological stress responses such as

increased heart rate, elevated blood pressure, fatigue, reduced concentration and irritability. The severity of these impacts depends on the intensity, frequency and duration of noise exposure. The proximity of workers to noise sources and the use of personal protective equipment (PPE) also determines the severity of noise impacts. Workers operating or working near heavy machinery and earthworks are particularly vulnerable due to higher cumulative noise exposure.

This impact is assessed post mitigation, on the basis that the implementation of noise control measures, use of appropriate personal protective equipment (PPE), routine risk assessments and adherence to occupational health and safety procedures are legal requirements under national labour and safety regulations. These measures are therefore considered an integral part of the construction process and are expected to be enforced throughout the construction phase.

The nature of the impact is considered adverse as the construction noise generated by machinery, equipment, vehicle movement and earthworks can negatively affect the health and well-being of the construction workers/contractors. The impact is also considered direct as noise will be generated by construction activities that occurs at the construction site. The impact is deemed partly reversible because temporary effects such as auditory fatigue, stress and reduced concentration can recover once noise exposure is reduced or mitigated through PPE and rest, whereas prolonged or repeated exposure can cause permanent hearing damage or tinnitus (irreversible impact in the worse-case scenario). The duration of the impact is long term as some effects of noise exposure, particularly permanent hearing loss and chronic tinnitus, can persist for the lifetime of the worker. Even after construction activities cease, these irreversible auditory effects remain, while repeated or cumulative exposure over the duration of the construction period can lead to lasting physiological and psychological stress impacts. The extent of the impact is on-site as the noise generated by construction activities will directly affect only those workers present at the construction site.

The magnitude of change is moderate as construction noise affects workers' health and well-being (key elements of the workforce resource), although it does not permanently compromise the integrity of the workforce. While temporary auditory fatigue, stress and reduced concentration represent a partial loss or impairment of worker functionality, only prolonged or repeated exposure could cause permanent hearing damage, the construction of the explosive's magazine will be completed within less than (<) one year. Therefore, the impact could cause noticeable but not complete or irreversible loss of key characteristics. The probability of the impact occurring is unlikely as occupational health and safety protocols will be enforced, therefore, most workers will unlikely experience significant or lasting health effects. The sensitivity of the impact is rated low as construction workers are not inherently sensitive to temporary noise exposure and they have a considerable capacity to adapt to noise by using appropriate PPE. Additionally, the effects of short-term exposure (fatigue, stress, reduced concentration) do not permanently compromise their health or functionality. Overall, the

significance of this impact is rated adverse low, post mitigation (Table 24). Mitigation measures have been included under Domain 8 of the OEMP (Appendix B).

7.3.4.2 Noise and ground vibration generated during the construction of the explosive's magazine by civil works, movement of vehicles, machinery and equipment use, and earthworks may be a nuisance to nearby sensitive receptors (the farmers to the southeast of the project/ML 31)

Based on the baseline acoustic data collected during the May 2025 campaign, the noise levels (LAeq) at daytime ranged mostly between 38.9 dBA and 86.8 dBA, while nighttime levels ranged from 35.7 dBA to 52.8 dBA. Compared to the SANS 10103 guideline limit for rural districts, these results show that while some locations are within compliance, certain activities, particularly at NAQ4 (86.8 dBA), already exceed acceptable thresholds. Given this baseline, the construction of the explosive's magazine (involving earthworks, civil works, heavy machinery, equipment use, and vehicle movement) is expected to temporarily elevate ambient noise due to high-intensity, intermittent sound peaks ($L_{max} > 80$ dBA) and continuous low-mid frequency components from diesel engines and machinery. These sound waves can propagate beyond the immediate construction area, particularly during periods of wind gusts observed in the baseline survey, which enhance noise transmission toward the southeast of the ML towards the NSRs. Consequently, nearby sensitive receptors, such as the farmers southeast of ML 31, may experience short-term nuisance effects, including audible construction noise and disturbance to livestock, particularly during early mornings or evenings when background levels are lower (35 – 45 dBA).

The nature of the impact is adverse because construction of the explosive's magazine will add new sources of noise and vibration to the area, potentially exceeding the required guidelines and disturbing nearby receptors such as the farmer and livestock to the southeast of ML 31. The high noise levels from machinery, vehicles and earthworks may cause a nuisance and annoyance, especially during calm weather when sound travels further. The impact is direct because the noise and vibration generated from construction activities, such as machinery operation, vehicle movement and earthworks may directly affect nearby receptors. The impact is reversible because the noise generated during the construction of the explosive's magazine will cease once construction activities stop. The duration of the impact is temporary because the impact will only occur during the construction phase of the explosive's magazine (which is less than a year) and will end once the associated activities, such as earthworks, vehicle movement and machinery operations are completed. The extent of the impact is local because the noise generated during construction will not be confined to the immediate Project area but will be heard in its nearby surroundings (neighbouring farmers to the southeast of the Project site/ML 31), however it may dissipate rapidly with distance from the source, dependent on terrain and metrological conditions. The magnitude of change is negligible because the noise increase is short-term, localised and affects only one aspect (ambient noise), causing very minor, reversible disturbance without permanent harm. The probability of the impact occurring is possible because the construction activities, earthworks, machinery use and vehicle movement can generate elevated noise levels, but whether sensitive receptors (like the farmer

to the southeast) experience nuisance depends on variable factors such as wind direction, time of day and the intensity of specific activities. The sensitivity of the impact is low because the affected receptor is of local importance and is not particularly sensitive to temporary increases in noise. The receptors (humans and livestock) have a considerable capacity to accommodate short-term, intermittent noise, and the impact does not threaten rare or highly valuable features. Therefore, this impact has been rated adverse low pre mitigation (Table 24). Mitigation measures have been included under Domain 8 of the OEMP (Appendix B).

7.3.4.3 The impact of noise from the operations of the explosive's magazine on the health and safety of the employees and contractors

Employees and contractors working at an active mine, particularly those operating or working near an explosive's magazine, are exposed to elevated levels of occupational noise, which can have significant health and safety implications. Prolonged exposure to high-intensity noise generated by blasting, heavy machinery, vehicle movements and other mining operations can result in noise-induced hearing loss (NIHL), a permanent and irreversible condition, as well as tinnitus, which manifests as persistent ringing or buzzing in the ears. Elevated noise levels can also contribute to physiological stress responses, including increased heart rate and blood pressure, and may lead to fatigue, irritability and reduced concentration, potentially compromising the ability of employees and contractors to perform tasks safely. High ambient noise can mask warning signals and hinder effective communication, reducing situational awareness and increasing the likelihood of accidents, particularly during the handling, transport or storage of explosives. Sudden or unexpected loud noises, such as detonations, can provoke startle responses, further elevating the risk of operational errors. Additionally, chronic exposure to noise can have psychological effects, including stress, anxiety, and reduced job satisfaction, which may indirectly affect safety performance.

The nature of this impact is adverse because it negatively affects psychological well-being and overall safety, making it harmful to workers' health and operational performance. The impact is direct because noise from blasting, machinery, vehicle movements and equipment operations directly can affect workers' hearing, physiological state, concentration and safety without requiring any intermediate processes or external factors. The impact is partly reversible because some effects of noise exposure can be mitigated or recovered if addressed promptly, while others are permanent. For example, temporary hearing fatigue, stress, and reduced concentration may improve once noise exposure is reduced or controlled, and physiological or psychological effects can often be alleviated with rest, hearing protection, or administrative controls. However, noise-induced hearing loss (NIHL) is irreversible, meaning that once permanent damage to the inner ear occurs, it cannot be fully restored.

The duration of the impact is long-term because noise exposure in a mining environment occurs repeatedly over extended periods (there are still 5+ years of LoM), often throughout the employees and contractors' entire employment at the site. Continuous or frequent exposure to high noise levels can lead to effects, such as permanent hearing loss and chronic stress-related health issues, which persist even after the exposure has ended. The extent of the impact is on-

site because the noise generated by machinery operation, vehicle movement and activities associated with the operations of the explosive magazine operations, primarily affects employees and contractors within the Project site/ML 31. The magnitude of change is high because long term noise exposure can cause permanent hearing loss and severe health or safety impacts, representing significant damage to key human health and safety components. The probability of the impact occurring is unlikely because, engineering and mechanical controls, administrative measures and personal protective equipment (PPE); such as hearing protection, noise barriers and controlled operational procedures, are in place to reduce employee exposure to harmful noise levels. The sensitivity of the impact has been rated high because workers' hearing and safety are highly valuable and critical resources on a local scale, and they are very sensitive to change, as prolonged exposure to high noise levels can cause permanent hearing loss and increase accident risk. Unlike environmental features that may naturally absorb minor changes, human health and safety have limited capacity to accommodate harmful noise without protective measures. Therefore, this impact has been rated adverse moderate (before mitigation) as shown in Table 24. The mitigation measures have been included in Domain 8 of the OEMP (Appendix B) and are discussed further below.

The following mitigation measures should be implemented:

- Maintain and service machinery to reduce noise;
- Rotate shifts and schedule tasks to limit exposure time;
- Provide noise awareness training and clear signage for high-noise zones;
- Use visual alarms where required;
- Require earplugs or earmuffs; use dual protection for extreme noise;
- Ensure proper fit and training on correct use;
- Conduct baseline and periodic hearing tests;
- Monitor stress and cardiovascular health; provide quiet rest areas;
- Train workers on safe responses to unplanned detonations;
- Use visual alarms or radios for communication in noisy areas; and
- Implement regular noise monitoring and feedback systems.

7.3.4.4 The impact of noise from the operations of the explosive magazine on nearby noise sensitive receptors (NSRs), the farmers southeast of the project/ML 31

The operations of the explosive's magazine at the Project site on ML 31, located ~2 km from the farmers on ML31 to the southeast, is expected to generate low-level noise primarily from vehicle movements, loading/unloading activities, maintenance, and standby generators. Given the distance, sound levels from these sources will attenuate significantly, with geometric spreading and additional atmospheric and vegetative attenuation reducing noise to levels likely below typical rural ambient conditions (~30–40 dB(A)). Short-term events such as truck pass-byes or intermittent maintenance may cause minor and temporary nuisance, particularly during quiet periods, but are unlikely to result in measurable loss of amenity, sleep disturbance or long-term impacts.

The nature of the impact is adverse because any noise heard from the operation of the explosive magazine may be a nuisance or annoyance to nearby farmers. The impact will be direct because it results from activities that occur on-site at the explosives magazine and immediately affect the nearby receptors. The impact is reversible because once vehicle movements, maintenance or generator operations ends, the acoustic environment returns to its baseline condition, and the farmers experience no lasting change. Even repeated or intermittent noise events are reversible, as the receptors' environment and amenity fully recover between events. The duration of the impact is long term because the mine operations are still expected to continue for 5 or more years until end of LoM projected in 2033. The extent of the impact is local because the receptor affected resides beyond the boundaries of the Project. The magnitude of change is negligible because the noise from the operations and use of the explosive magazine at ~2 km would result in a very minor alteration to the acoustic environment of the nearby farmers. At this distance, sound levels from vehicle movements, maintenance, and generators are strongly attenuated and are likely below or just at the level of the existing background noise, causing no measurable loss of amenity or significant disruption to daily activities. Therefore, the probability of this impact occurring is unlikely because the sources of noise; vehicle movements, loading/unloading, maintenance and generator operation, are infrequent and intermittent, rather than continuous and is also unlikely to be heard over the other louder activities conducted at the mine. Furthermore, the sensitivity of the impact is low because the impact is on a local scale, and the farm households are not particularly sensitive to occasional, low-level noise compared to the current baseline noise levels. The rural environment can naturally accommodate minor variations in background noise without significant disruption to daily activities or well-being. Therefore, this impact has been rated adverse low (after mitigation) as shown in Table 24. The mitigation measures have been included in Domain 8 of the OEMP (Appendix B).

7.3.4.5 The impact of noise generated from the operations of the underground mine on the noise-related occupational health and safety of the employees and contractors

The operations of underground mining machinery and equipment generate significant noise levels that can directly affect the hearing, comfort and overall safety of employees and contractors working in the underground environment. Sources include loaders, haul trucks, drilling rigs, conveyors, ventilation fans and auxiliary equipment, all operating within confined underground tunnels where sound reverberates and attenuation is limited. Prolonged exposure to high noise levels can result in noise-induced hearing loss (NIHL), tinnitus, increased stress, fatigue and reduced concentration. These health effects can also increase the likelihood of accidents, as impaired communication, difficulty hearing warning signals, or diminished alertness compromise the ability to respond safely to hazards.

The nature of the impact is adverse because occupational noise exposure in underground mining has a negative effect on the health, safety and well-being of employees and contractors. The impact is direct, as noise exposure occurs at the workplace where employees and contractors are present. The impact is partly reversible because some of the negative effects of

noise exposure can be mitigated or eliminated, but others may be permanent. For example, temporary effects such as fatigue, stress or reduced concentration are reversible once the exposure stops or is reduced. However, prolonged or repeated exposure to high noise levels can cause permanent hearing damage (noise-induced hearing loss), which is irreversible. The duration of the impact is long term because the impact is likely to last long after underground mining has ceased and the extent of the impact is on site because the noise generated by underground mining machinery and equipment affects only the employees and contractors working within the underground workings or immediate operational areas.

The magnitude of change is high because prolonged exposure to noise from underground mining machinery can result in severe and permanent damage to a key human health resource, workers' hearing. Noise-induced hearing loss represents a loss of the integrity and quality of the auditory system, which is critical for communication, safety and overall well-being. Additionally, noise can cause fatigue, stress and reduced concentration, compromising the functionality and safety of workers, which are key characteristics of the occupational environment. The probability of this impact occurring is likely because employees and contractors are routinely exposed to machinery and equipment noise during their shifts. Furthermore, the sensitivity of the impact is high because workers' hearing and safety are highly valuable and critical resources on a local scale, and they are very sensitive to change, as prolonged exposure to high noise levels can cause permanent hearing loss and increase accident risk. Unlike environmental features that may naturally absorb minor changes, human health and safety have limited capacity to accommodate harmful noise without protective measures. Therefore, this impact has been rated adverse moderate (before mitigation) as shown in Table 24. The mitigation measures have been included in Domain 4 of the OEMP (Appendix B).

The following mitigation measures should be implemented:

- Use modern, low-noise machinery and ensure regular maintenance to prevent excessive noise from worn or malfunctioning components;
- Fit machines with mufflers, acoustic enclosures or vibration isolators to reduce emitted noise;
- Optimise tunnel layouts and ventilation systems to minimise sound reverberation and allow noise dispersion;
- Limit the duration employees spend in high-noise areas through shift rotations, ensuring cumulative noise exposure stays within safe limits;
- Conduct regular noise surveys and personal dosimetry to identify areas or tasks exceeding occupational exposure limits;
- Clearly mark high-noise zones and provide visual or vibration-based warning signals for critical alerts where auditory communication may be impaired;
- Educate workers on the risks of noise exposure, safe work practices and proper use of hearing protection devices;

- Provide appropriate PPE such as earplugs or earmuffs, with sufficient attenuation to reduce noise exposure below permissible limits;
- Ensure PPE is correctly fitted, maintained, and replaced as necessary to maintain effectiveness;
- Implement routine hearing tests to detect early signs of noise-induced hearing loss and adjust exposure or protective measures accordingly;
- Monitor worker fatigue and stress levels to mitigate indirect safety risks caused by noise exposure;
- Ensure communication systems remain effective in noisy environments, using visual or electronic alerts when auditory signals may be compromised; and
- Use findings from incidents to continuously improve noise control strategies.

7.3.4.6 Noise-related health impacts of accidental detonation of the explosives magazine resulting in an air blast and ground vibration on employees and contractors

The accidental detonation of the explosive's magazine would generate an intense air blast and substantial ground vibration, with immediate implications for the auditory and physiological health of employees and contractors. Typical high-order detonations in mining operations can produce peak sound pressure levels (SPLs) exceeding 160–180 dB at close range, which far surpasses the threshold for instantaneous auditory injury, including tympanic membrane rupture, temporary threshold shifts (TTS), permanent threshold shifts (PTS) and acute tinnitus. Infrasound components (<20 Hz) associated with such detonations can induce vestibular disturbances, nausea and disorientation. Ground vibrations from the blast, commonly expressed in terms of peak particle velocity (PPV), may reach 10–50 mm/s in proximity to the magazine, capable of causing whole-body vibration effects such as musculoskeletal strain, postural instability and exacerbation of pre-existing conditions. Exposure to the combination of air blast and ground vibration can also provoke acute stress responses, including transient elevations in heart rate and blood pressure and in rare cases, cardiovascular events in sensitive individuals. The confined nature of mining operations amplifies these effects, as reflections of the air blast from nearby structures can increase SPLs locally, and resonance phenomena may magnify vibration impacts on equipment and personnel. Regulatory occupational exposure limits, such as the 85 dB(A) 8-hour time-weighted average (TWA), are exceeded by several orders of magnitude, indicating that even brief exposure could result in immediate and long-term auditory and vestibular damage.

The nature of this impact is adverse because it directly threatens the health, safety and well-being of employees and contractors. The accidental detonation would produce extremely high-intensity air blast and ground vibration levels that far exceed safe occupational thresholds, leading to immediate physiological harm and potentially long-term health effects. The impact is direct because it results from the immediate physical processes of the detonation itself. The high-intensity air blast and ground vibration act directly on employees and contractors in the vicinity of the explosive magazine. The impact is irreversible because the detonation can cause

permanent auditory, vestibular and physiological damage (even death) to employees and contractors that cannot be undone. The duration of the impact is permanent because the health effects it causes, such as permanent hearing loss, chronic tinnitus, vestibular dysfunction, lasting musculoskeletal injuries persist for the lifetime of the affected individuals or even death, meaning the harm does not naturally diminish or recover over time. The extent of the impact is onsite because employees and contractors exposed to these forces are located within the mine site, and the intensity of the blast rapidly diminishes with distance, so significant effects do not extend beyond the boundaries of the Project site/ML 31.

The magnitude of change is high because an accidental detonation would cause severe, immediate damage to key human health characteristics, including permanent hearing loss, vestibular dysfunction, musculoskeletal injury acute stress responses or even death. These effects represent a substantial loss of health and integrity of the affected individuals. The probability of the impact occurring is rare because accidental detonations of properly stored and managed explosives are rare events. Mining operations implement strict safety protocols, regulatory controls and handling procedures to prevent unplanned detonations, meaning that while the consequences would be severe, the chance of such an event happening is low. Furthermore, the sensitivity of the impact is high because the health and safety of employees and contractors are of critical importance at both national and international standards, with no substitute for human life or irreversible injury. Human receptors are extremely sensitive to high-intensity blasts and ground vibrations, with very limited capacity to tolerate or recover from such severe exposures. Therefore, this impact has been rated adverse minor (before mitigation) as shown in Table 24. The mitigation measures have been included in Domain 8 of the OEMP (Appendix B).

7.3.4.7 Accidental detonation of the explosive's magazine could generate noise and ground vibrations (air blast and ground shock) affecting nearby noise-sensitive receptors, notably farmers ~2 km southeast of the project site/ml 31, with potential for causing shock

The accidental detonation of the explosives magazine at Navachab Gold Mine/ML 31 would result in a sudden and intense release of energy, producing both an air blast and ground vibration. The air blast would propagate as a high-pressure shock wave through the atmosphere, potentially generating noise levels significantly above the typical background levels recorded in the area (38–55 dBA during daytime, based on baseline monitoring). Ground vibrations would radiate through the substratum, with peak particle velocities depending on the explosive charge, distance and geotechnical properties of the soil and bedrock. Noise-sensitive receptors, including farmers located approximately 2 km southeast of the Project site, may experience perceptible auditory disturbance, potential startle effects and minor structural vibrations. Although the distance provides some attenuation of both air blast overpressure and ground vibration, the event would be acute, sudden and could exceed thresholds for human perception of vibration (typically ~0.5–1 mm/s for continuous exposure, but lower for instantaneous shock events).

The nature of the impact is adverse because it would cause human discomfort or distress for nearby farmers due to loud noise and vibration. The impact is direct because it results immediately from the source, the accidental detonation of the explosives magazine and directly affects nearby noise-sensitive receptors (farmers ~2 km SE of ML 31). The impact is reversible because any disturbances caused by the accidental detonation, such as noise and vibration, would cease once the event has passed. No permanent changes to the environment, infrastructure or human health are expected and normal conditions would return over time without long-lasting damage. The duration of the impact is temporary because the effects of an accidental detonation, air blast, ground vibration, noise disturbance and human reaction occur only during and immediately after the event. Once the explosion has occurred, these effects dissipate rapidly and normal environmental and human conditions are quickly restored, typically within minutes to hours.

The extent of the impact is local because the air blast and ground vibrations from an accidental detonation attenuate rapidly with distance, meaning only receptors in the immediate vicinity, such as the farmers located ~2 km southeast of the site will be affected. However, beyond this range, the energy dissipates, and there are no measurable effects on more distant areas. The magnitude of change is negligible because, although the accidental detonation would produce a measurable noise and vibration event, the effect would involve only a very minor alteration to one or a few characteristics, such as temporary disturbance to farmers without causing lasting damage, significant loss, or permanent change to the environment or receptors. The probability of this occurring is rare because strict safety protocols, magazine design standards, handling procedures and regulatory controls are in place to prevent accidental detonations. Furthermore, the sensitivity of the impact is low because the affected receptors (local farmers), while important on a local scale, are not particularly vulnerable to a single, short-term noise and vibration event and can readily accommodate or recover from such a temporary disturbance without long-term consequences. Therefore, this impact has been rated adverse low (after mitigation) as shown in Table 24. Mitigation measures are provided in the OEMP Domain 8 (Appendix B).

Table 24 - Noise and vibration related impacts related to the construction and operations of the explosive's magazine on employees, contractors and third parties

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
The construction of the explosive's magazine, vehicle movements, equipment and	Employees and contractors	Occupational noise related health impacts e.g. hearing loss, tinnitus and temporary audio fatigue	Adverse Direct Partly reversible Long term On-site Unlikely	Low	Moderate	Adverse Low (2)
	Nearby sensitive	Noise generated from the	Adverse Direct	Low	Negligible	Adverse Low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
machinery use, civil works and earthworks	receptors (NSRs) – Farmers southeast of ML 31	construction of the explosive magazine may become a nuisance or annoyance to the farmers southeast of ML 31	Reversible Temporary Local Possible			
Operation of the explosive's magazine including the movement of vehicles to and from the magazine and the noise associated with the blasting in the underground mining activities	Employees and contractors	Occupational noise related health impacts e.g. hearing loss, tinnitus and temporary audio fatigue	Adverse Direct Partly Reversible Long term On site Possible	High	High	Adverse moderate (6)
	Noise-related sensitive receptors – farmers southeast of the mine/ML 31	Noise generated from the operation of the explosive magazine may become a nuisance or annoyance to the farmers southeast of ML 31	Adverse Direct Reversible Temporary Local Unlikely	Low	Negligible	Adverse low (2)
Operation of the underground mine and movement of machinery and use of equipment in the underground mine	Employees and contractors	Occupational noise related health impacts e.g. hearing loss, tinnitus and temporary audio fatigue	Adverse Direct Partly Reversible Long term On-site Likely	High	High	Adverse moderate (6)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Accidental detonation during the operation of the explosive's magazine	Employees and contractors	Noise and ground vibration related health impacts e.g. hearing loss, tinnitus and temporary audio fatigue	Adverse Direct Irreversible Permanent On-site Rare	High	High	Adverse minor (3)
	Noise-related sensitive receptors – farmers southeast of the mine	Noise and ground vibration generated from the accidental detonation of the explosive magazine may be a shock to the farmers southeast of ML 31	Adverse Direct Reversible Local Rare	Low	Negligible	Adverse low (1)

7.3.5 BUILT ENVIRONMENT IMPACTS

The construction and operation of the proposed explosives magazine within ML 31 will potentially pose several environmental, health, safety and operational impacts due to its proximity to existing mine infrastructure and sensitive receptors. The explosives magazine will be located approximately 145 – 903 metres (m) from key operational areas such as the Steenbok Drives, Steenbok satellite pit and PB5/PB6 Pit limits, the geology camp and the future proposed solar power station (not part of this amendment report as the location is not yet defined and will form part of a separate environmental clearance certificate application). Additional nearby facilities such as power lines and HME workshop are located approximately 88.7 m and 793.6 m from explosives magazine 1, respectively. Figure 54 summarises the measured distances from the proposed and existing magazines to various mine operational infrastructure and areas.

DISTANCES:	
Proposed Magazine to Steenbok Drives = 333.739m	
Proposed Magazine to Steenbok Pit limit = 336.268m	
Proposed Magazine to Geology Camp = 902.955m	
Proposed Magazine to PB5 Pit = 731.047m	
Proposed Magazine to PB6 Pit limit = 500.115m	
Proposed Magazine to Solay power station = 145.649m	
Magazine 1 to nearest Power line = 88.745m	
Magazine 1 to PB5 Pit = 720.628m	
Magazine 1 to PB6 Pit limit = 518.902m	
Magazine 1 to HME Workshop = 793.565	
Magazine 1 to Solar Power station = 181.212m	
Magazine 1 to proposed Magazine = 91.428m	
Magazine 2 to PB5 Pit = 683.709m	
Magazine 2 to PB6 Pit limit = 426.858m	
Magazine 2 to Solar Power station = 123.357m	
Magazine 2 to proposed Magazine = 94.881m	

Figure 54 - Distances between the proposed and existing magazines and key site infrastructure and operational areas (Source: QKR Namibia Navachab Gold Mine, 2025)

The storage and handling of large quantities of ANFO and detonators present significant safety risks such as accidental detonation which would result in ground vibration and blast overpressure (air blasts). Secondary environmental impacts such as noise, dust, contamination and restricted land use may also arise. The following section summarises the potential impacts anticipated during the operational phase proposed explosives magazine on built infrastructure. The underground mining activities do not pose potential significant impacts on built infrastructure due to its location with the existing open pit and is not further assessed.

These potential impacts are assessed and discussed in the section below, before mitigation. An overview of the impacts is visually summarised in Figure 55 and the impact assessment ratings are detailed in Table 25.

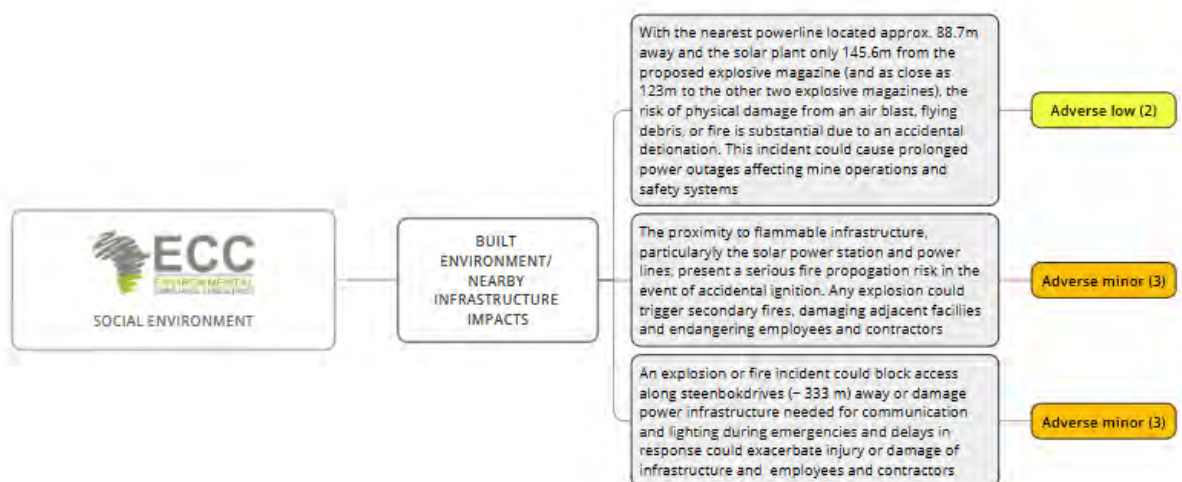


Figure 55 - Impact of the operation of the explosive magazine on nearby built infrastructure

- 7.3.5.1 *An overhead power line is located approximately 88.7 m away from the explosive's magazine 1 the risk of physical damage from an air blast, flying debris, or fire is substantial in the event of an accidental detonation. This impact could cause prolonged power outages and significant operational, safety and financial consequences*

The proximity of high-value electrical infrastructure, with the nearest overhead powerline at ~88.7 m from the explosive magazine 1 creates a credible pathway for blast-related energy and debris to directly compromise electrical supply and distribution assets. An explosive overpressure wave is capable of mechanically deforming tower and pole structures, shearing insulators and conductors and causing collapse or misalignment of support members. Simultaneously, high-velocity fragments and fly rock can sever conductors, resulting in short circuits, grounding faults and sustained arcing that could ignite combustible components.

The damages to power supply infrastructure could result in both production and momentary losses. Interruptions to the mine's primary and backup power can disable critical safety systems (ventilation fans, dewatering pumps, compressed-air systems, emergency lighting, communications and control systems), halt hoisting and conveyor operations, and impede emergency response actions. This increases the risk of personnel being trapped underground or in isolated locations.

Repair timelines for high-voltage structures typically span between days and weeks, depending on the availability of spare-parts and site access. An incident could lead to prolonged outages, extensive production losses, costly repairs costs and increased safety risks, unless robust separation, physical shielding, redundant feeds and rapid isolation/protection schemes are implemented.

The nature of the impact is considered adverse as an explosion would cause significant damages to critical electrical infrastructure, leading to power outages, fires and system failures that disrupt mine operations and emergency response. These effects pose serious safety, operational and financial risks. Additionally, this impact is considered direct as damage from an explosion will result in the destruction of the powerline leading to secondary failures, fires and equipment degradation. These interconnected effects would compound operational and safety risks, resulting in progressively worsening impacts rather than a one-time event. Although an explosion could disrupt power supply and damage electrical infrastructure, the impact is considered reversible as the affected systems can be repaired, replaced and restored to full functionality. With proper cleanup, equipment replacement, and reinstallation of damaged components, the mine's power and communication networks can return to normal operation over time.

The magnitude of change is rated high as an explosion near the electrical infrastructure would cause severe physical damage to essential components such as powerlines and transformers. This would result in a loss of functionality, quality and structural integrity of these critical

resources. The blast, debris and fires could destroy or deform key infrastructure elements, disrupt power supply and impair systems vital to mine safety and operations. Although an explosion would cause immediate and severe damage to infrastructure, the affected systems, such as powerlines and transformers can be repaired or replaced relatively quickly (typically within days to weeks, depending on spare parts and site access). It is expected that the mine will promptly implement the necessary corrective measures to ensure the Project resumes with operations. Therefore, the duration of impact is considered temporary because they have backup generators on site and once repairs are completed, operations and functionality can resume to normal levels, meaning the disruption, while intense, does not persist indefinitely and the impact does not extend beyond the repair and recovery period. The extent of the impact is on-site as the explosion and its direct impacts, such as structural damage, flying debris, fires and electrical faults are confined to the immediate area around the explosive's magazine and adjacent infrastructure. The blast primarily affects the mine's own electrical network and nearby operational facilities. It is anticipated that no off-site areas, communities or the broader environment will be significantly impacted.

The probability of the impact occurring is considered rare as the explosives magazines are typically designed, located and managed with strict safety protocols, including controlled access, separation distances, robust containment and handling procedures. These measures greatly reduce the chance of an accidental detonation. The sensitivity of the impact is rated low as power supply infrastructure is not rare or exceptionally valuable on a broader scale and is designed to tolerate certain stresses or damage. Additionally, the power supply spare parts are locally available in the local market, therefore operations can be restored. Power supply backup systems such as diesel generators, routine inspections and maintenance practices would also reduce both the likelihood and ensure operations remain uninterrupted. Overall, the significance of the impact is rated as adverse low (before mitigation) as shown in Table 25. The mitigation measures are provided in Domain 8 of the OEMP (Appendix B).

7.3.5.2 The proposed explosives magazine proximity to flammable infrastructure, particularly the power lines present a serious fire propagation risk in the event of accidental ignition. Any explosion could trigger secondary fires that could damage adjacent facilities and endanger employees and contractors.

The proximity of the proposed explosive magazine to flammable infrastructure, most notably the overhead power lines (~88.7 m) pose a significant fire propagation hazard in the event of accidental ignition or detonation. A high-energy blast can emit intense thermal radiation and expel burning debris or molten materials capable of igniting combustible elements such as cable insulation and junction boxes. The resulting secondary fires can rapidly spread through electrical conduits, trenching systems and vegetation corridors, particularly under dry and windy site conditions. Power lines pose an additional hazard due to potential arcing from displaced conductors or collapsed poles, which can ignite surrounding materials and propagate fire across a broad area. Moreover, damaged electrical systems can feed back energy into the fire zone, intensifying combustion and increasing the risk of electrocution for emergency responders. The simultaneous loss of power transmission capacity and fire-induced damage to

adjacent infrastructure could disable mine-wide electrical supply, suppress ventilation and water-pumping systems, and disrupt emergency communication networks. Collectively, these mechanisms create a cascading hazard scenario where a single ignition event at the magazine may escalate into a multi-source fire and power failure incident and consequently endangering employees, contractors, and high-value operational assets unless robust separation distances, firebreaks, non-combustible construction materials and automatic isolation systems are incorporated into the facility design.

The impact is considered adverse as accidental detonation of the proposed magazine could trigger fires and electrical failures that threaten human safety, damage critical infrastructure and disrupt mine operations. The impact is considered direct because an accidental explosion would result in damage of the powerline, consequently resulting in secondary fires from these infrastructures. An ignition or blast at the explosives magazine would not occur in isolation; it could interact with the other two existing magazines, flammable infrastructure, power lines, vegetation and operational systems, leading to escalated fires, cascading equipment failures and overall operational disruptions beyond the immediate vicinity of the proposed explosives magazine. This combination of multiple impacts over space and time makes the impact cumulative. The impact is deemed irreversible as a detonation or fire at the explosives magazine could cause permanent loss or destruction of critical mine infrastructure and high-value assets, such as overhead power lines and electrical systems. These losses cannot be fully restored to their original condition, even if damaged components are replaced, the original materials, configurations and historical integrity of the infrastructure are permanently altered. Additionally, the potential loss of life or severe injury is inherently irreversible. The magnitude of change is rated high as an accidental detonation or resulting fire could cause severe damage to critical mine infrastructure and operational assets that could pose a financial burden on the Proponent to ensure corrective measures are timely implemented to restore site operations. This represents a loss of both the resource and its functional integrity, as key characteristics, such as the structural, electrical and safety features of these facilities would be severely compromised or destroyed, fundamentally altering their condition and value.

The duration of the impact is deemed permanent as the damage caused by a detonation or subsequent fire would result in long-lasting or irreversible loss of critical infrastructure, operational systems and possibly human life, in the worse-case scenario. Although repairs efforts are implemented, the original condition, integrity and historical value of the affected assets cannot be fully restored, meaning the effects persist indefinitely. The extent of the impact is considered on site as the potential damage from an accidental detonation or fire is largely confined to the immediate vicinity of the explosives magazine and infrastructure in adjacent areas. This includes the overhead power lines and other mine operational systems. While the effects may cascade locally, they are contained within the mine site boundary and do not extend to off-site areas or the wider environment. The probability of the impact occurring is deemed rare as the mine enforces strict safety protocols and regulatory controls will be in place to ensure fire hazards are identified and promptly addressed. These include robust

separation distances, non-combustible construction, automatic isolation systems and controlled handling procedures. When these measures are properly applied and maintained, the chance of an accidental detonation or fire is low, even though the consequences would be severe if fire event occur. Furthermore, the sensitivity of the impact is rated high as the affected infrastructure and employees and contractors' lives, overhead power lines, and mine electrical systems are critical to operational functions of the mine. These assets have potential for substitution, but not employees' lives, meaning that any loss or degradation would have serious consequences. Overall, the significance of this impact is rated adverse low (before mitigation) as shown in Table 25. The mitigation measures are included in Domain 8 of the OEMP (Appendix B).

7.3.5.3 An explosion or fire event has the potential to damage power supply infrastructure that supports site communications and lighting systems. Additionally, debris and structural collapse may obstruct roadways and critical access routes, potentially delaying emergency response deployment and hindering evacuation or rescue operations

An explosion or fire incident occurring at the proposed magazine site poses a serious threat to critical access and emergency response infrastructure, particularly given the proximity of Steenbok Drives (~333 m away) and the dependence of mine operations on the adjacent electrical network for power, communications and lighting. A high-energy detonation could scatter debris, create craters or cause secondary collapses that may obstruct access routes. This may cause delays in the dispatch of firefighting, medical and rescue teams. Thermal radiation and blast overpressure could simultaneously compromise the structural integrity of nearby road surfaces, culverts, and retaining walls and as a result rendering them unsafe or impassable.

The potential destruction or de-energisation of power lines, substations and transformers in the vicinity would further exacerbate the situation by disabling essential communication systems, emergency alarms and lighting within underground and surface areas. This loss of power would critically impair coordination, situational awareness and evacuation efforts, particularly at night or within confined underground environments where visibility and ventilation depend entirely on electrical supply.

Prolonged communication blackouts could prevent accurate incident reporting, delay hazard isolation and increase the likelihood of secondary accidents or injuries among responding personnel. In addition, disrupted power may halt critical life-support systems such as ventilation fans, dewatering pumps, compressed-air systems, intensifying risks for workers trapped underground or in adjacent work areas. Consequently, the interaction between blocked access, loss of power and delayed emergency response represents a high-severity cascading hazard capable of amplifying both human and asset losses, unless redundant access routes, autonomous lighting systems and emergency power backup measures are integrated into the mine operational recovery framework/plan.

The impact is considered adverse as an explosion or fire at the proposed magazine could block access routes, damage critical power and communication infrastructure and delay emergency responses. This combination threatens human safety, disrupts essential mine operations and creates cascading hazards that could amplify injuries, fatalities and asset losses. The impact is considered direct as an explosion or fire affects power supply, communications and access to critical work areas and emergency response units. The impact is partly reversible considering that some consequences can be repaired or restored, such as rebuilding damaged roads, replacing electrical infrastructure, and restoring communications to allow operations to resume. However, other effects, such as the loss of life, injuries or permanent cannot be recovered. The magnitude of change is rated high as an explosion or fire event at the explosives magazine site would cause severe damage to critical infrastructure and operational systems, including roads, power lines, ventilation systems and communication networks. These could impose financial burdens on the Proponent. This represents a significant loss of resource and a reduction in the quality and integrity of these essential facilities. Furthermore, the potential loss of life is irreversible and is a permanent loss of resource.

The duration of the impact is deemed permanent as the effects of an explosion or fire event, such as destroyed infrastructure, damaged roads, power lines and other structural elements, cannot be fully restored to their original state immediately. Some consequences, particularly loss of life, injuries and irreversible structural damage, are long-lasting or permanent in nature, meaning the impact persists beyond the operational or repair timeframe. The extent of the impact is on site as the explosion or fire event at the proposed explosives magazine site will primarily affects infrastructure, access routes and operational areas located within the mine site itself. The physical damage to auxiliary infrastructure, power outages and blocked access are confined to the mine's boundaries. Therefore, the impact is not expected to impact off-site areas. The probability of the impact occurring is rare as explosive magazines are typically designed, sited and managed in accordance with strict safety standards, regulatory compliance and operational procedures to prevent accidental detonation or fire events. Although the consequences would be severe if an incident occurred, the combination of engineering controls, monitoring, handling protocols, and emergency preparedness reduced the likelihood of the event occurring to improbable. The sensitivity of the impact is rated high as the affected infrastructure and operational systems are critical to mine safety and continuity, with no immediate viable substitutes in the event of failure. The loss or compromise of critical work areas and failure to timely implement emergency response measures would have serious consequences on the mine's reputation. Overall, the significance of the impact is considered adverse minor (before mitigation) as shown in Table 25.

Table 25 - Impact of the operation of the three magazines near other infrastructure

Activity	Receptor	Impact	Nature of the impact	Sensitivity	Magnitude of change	Significance of impact
Operation of the explosives	Nearby powerline infrastructure	Power outages affecting mine	Adverse Direct Reversible	Medium	High	Adverse Low (2)

Activity	Receptor	Impact	Nature of the impact	Sensitivity	Magnitude of change	Significance of impact
magazine resulting in the accidental detonation of the explosive magazines, resulting in air blasts, flying debris or fire		operations and safety systems	Short term On-site Rare			
Operation of the explosives magazine resulting in the accidental ignition of explosives resulting in an explosion, causing secondary fires	Nearby infrastructure and employees and contractors	Fires may damage adjacent infrastructure and endanger employees and contractors	Adverse Direct Irreversible Permanent On-site Rare	High	High	Adverse minor (3)
Operation of the explosives magazine resulting in accidental detonation of the magazine or fire incident at the explosives magazine	Power infrastructure, critical work areas of the mine, employees and contractors	Damage of power infrastructure needed for communication and lighting during emergencies, delaying the dispatch of emergency responses to injured	Adverse Direct Partly reversible Permanent On site Rare	High	High	Adverse minor (3)

Activity	Receptor	Impact	Nature of the impact	Sensitivity	Magnitude of change	Significance of impact
		employees and contractors				

7.3.6 WASTE IMPACTS

Inadequate waste management for the Project can have direct and indirect impacts on human health, safety and the surrounding community. Volatile compounds, dust and fumes from solvents, paints, and explosive residues can degrade air quality, while the accumulation of waste and debris can cause visual intrusion and reduce the aesthetic quality of the area. Exposure to hazardous materials, unsanitary effluent, decaying organic food and potential fire or explosion hazards also threatens worker safety and public health. Furthermore, visible contamination or leachate entering local watercourses can affect community confidence, livelihoods and overall well-being, highlighting the need for stringent social and occupational health safeguards alongside environmental management.

These potential waste impacts (pre-mitigation) are identified and assessed in the sections below and are visually summarised in Figure 56 and the impact assessment ratings are detailed in Table 26.

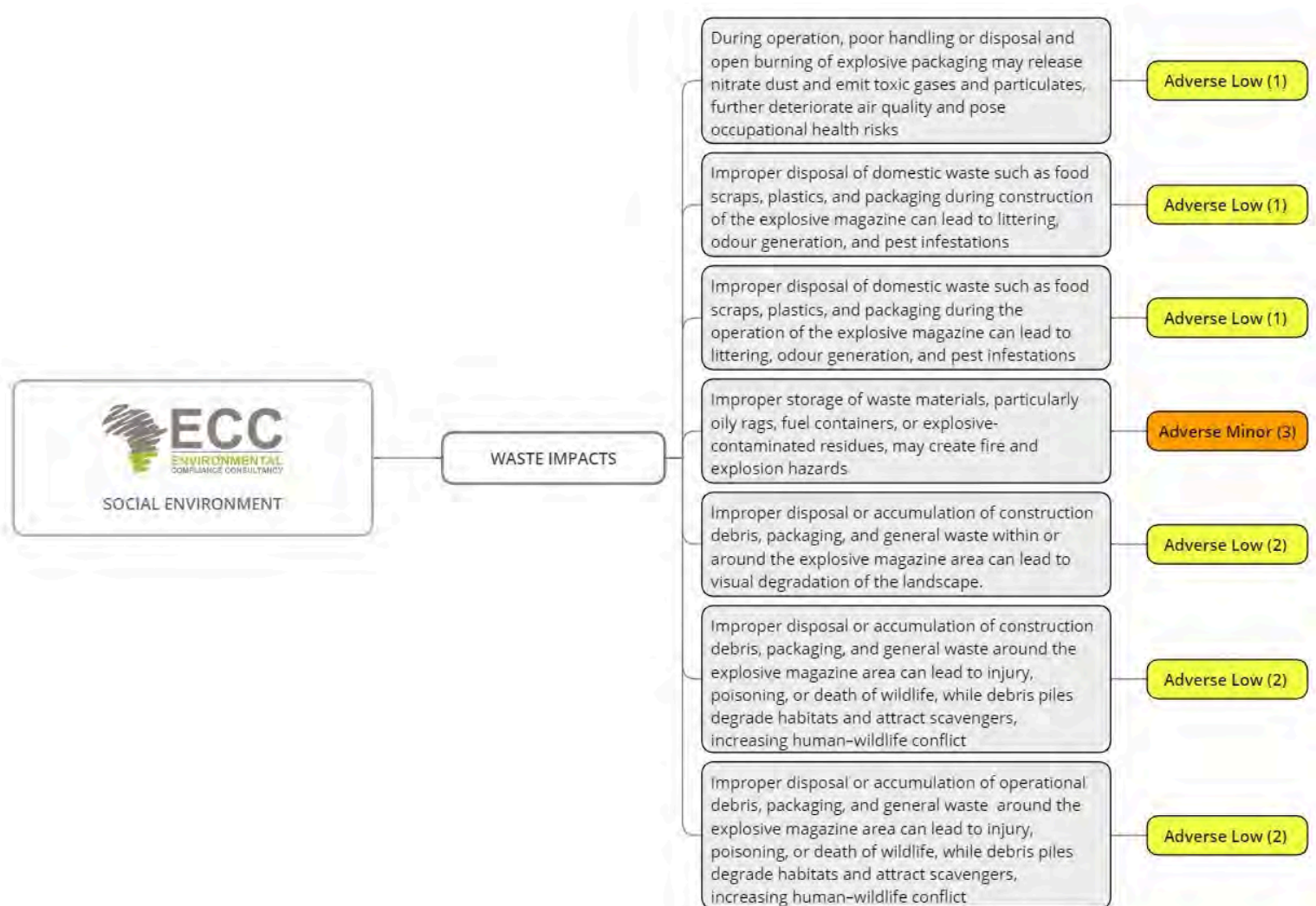


Figure 56 - The impacts of improper waste management on the receiving social environment

7.3.6.1 *During operations, poor handling or disposal and open burning of explosives packaging may release nitrate dust and emit toxic gases and particulates that deteriorate air quality and pose occupational health risks.*

The potential for the poor handling or disposal of explosives packaging to release nitrate dust or solvent vapours into the air during operation is a critical atmospheric risk directly tied to the confirmed use of explosives. The source of the contamination is the packaging material, which is saturated with residues like nitrate dust (from ANFO) and solvent vapours. The primary mechanism for the release of these pollutants is the explicit and documented activity of burning explosives packaging material as part of above-ground activities associated with underground mining. This practice converts solid and volatile residues into a pervasive atmospheric plume, which will be transported according to the prevailing east-northeast (ENE) winds. The resulting release of particulate nitrate dust and chemical solvent vapours will contribute to the general air quality degradation and create a cumulative effect alongside existing operational dust generation (e.g., from hauling, stockpiling, drilling and blasting). This new input of airborne contaminants increases the burden on an already stressed airshed, which has a documented history of severe threshold exceedances for dust fallout (e.g., up to 4 781 mg/m²/day) (South African National Air Quality Standard (SANAS)). This suggests the local atmosphere has a low tolerance for additional pollutant loads, making the control of emissions from packaging disposal essential to protect the nearest sensitive receptors.

The nature of this impact is considered adverse as burning explosives packaging releases nitrate dust and solvent vapours, worsening air quality in an area that already has frequent air quality threshold exceedances and posing risks to nearby communities and the environment. Additionally, this impact is considered direct as it results directly from the burning of explosives packaging during mining operations. The impact is deemed reversible because the effects on air quality and pollutant levels are temporary and will diminish once the source of pollution (burning explosives packaging) is controlled or stopped. Nitrate dust and solvent vapours disperse and degrade over time in the atmosphere depending on various meteorological conditions, so the environment can recover naturally, provided no simultaneous emissions occur. The duration of the impact is deemed temporary due to the transient and dissipate over a relatively short period. Once the activity ceases, the airborne pollutants gradually disperse or settle, and this allows eventual restoration of air quality to baseline conditions. The environment is not permanently altered as the air quality deterioration only exists during and shortly after the emission events. The extent of the impact is local as the release of nitrate dust and solvent vapours from burning explosives packaging primarily affects the immediate area around the controlled area or burn pit. While wind can disperse some pollutants from the sources, their concentration and effect diminish rapidly with distance. Therefore, the impact is confined to nearby surroundings, including the mine site and nearby sensitive receptors. The magnitude of change is rated low as the release of nitrate dust and solvent vapours causes only a minor, temporary alteration to air quality in the immediate area. It does not lead to the loss or severe degradation of any key environmental feature.

The probability of the impact occurring is rated (medium) possible because burning explosive packaging containing nitrate residues and solvent vapours is a planned operational practice and it is not expected that it will be conducted every day. The sensitivity of the impact is rated low as the local atmosphere, although affected by the release of nitrate dust and solvent vapours, has a relatively high capacity to disperse and dilute these pollutants. The affected receptors (air and nearby surroundings) are not particularly rare or highly sensitive. Overall, the significance of the impact is rated adverse low, before mitigation (Table 26). Mitigation measures are included in Doman 8 of the OEMP (Appendix B).

7.3.6.2 Improper disposal of domestic and recyclable waste such as food scraps, plastics and packaging can lead to littering, odours and pest infestations during construction of the explosive's magazine

Improper disposal of domestic and recyclable waste introduces significant environmental challenges. Specifically, the unmanaged accumulation of food scraps (putrescible organic waste) provides a substrate rich in biodegradable carbon and nitrogen. These materials undergo rapid anaerobic and aerobic decomposition by microbial communities, leading to the generation of noxious gases, most notably hydrogen sulfide (H₂S) and various volatile organic compounds (VOCs) such as amines and short-chain fatty acids that result in pervasive odour generation. Furthermore, the accessible food source and protective habitat created by mixed waste, particularly in packaging materials and poorly contained refuse, critically enhance the reproductive success and population density of various pest species such as rodents and synanthropic insects (e.g., *Musca domestica*, *Periplanar americana*). These organisms act as mechanical vectors for numerous pathogens (e.g., *Salmonella*, *Escherichia coli*), escalating public health risks through the potential contamination of water sources. Additionally, lightweight and durable materials such as plastics and non-biodegradable packaging, generate during construction activities are readily windblown and transported by stormwater runoff. This leads to widespread litter that degrades the aesthetic quality and introduces macro- and microplastic pollution into terrestrial and aquatic ecosystems. Furthermore, this disrupts biogeochemical cycles and impact wildlife through ingestion and entanglement.

The nature of the impact is considered adverse as improper disposal of domestic waste disposal alters the visual landscape, generates odours and toxic gases that attract vermin, promote pest-borne diseases and increases the risk of contamination of water sources, if surface runoffs are not effectively monitored. The impact is deemed direct as improper waste disposal causes odours, pest proliferation and pollution on site. However, the impact is considered reversible as proper waste management, cleanup and pest control can restore the environment and reduce health risks. These are the responsibility of the mine environmental section and contractors; therefore, it is expected that these efforts will be enforced throughout the life of mine (LoM). The duration of the impact is considered temporary considering that improperly disposed waste, odours, pest infestations and pollution persist only during the period of construction of the explosive's magazine, which will be less than a year. Once the waste is removed, the impacts subside and the environment recovers over time. The extent of the impact is considered on site as improperly disposed domestic waste, odours, pest

proliferation and litter primarily occur on-site and can also affect nearby farms, residents and regarding odour can affect nearby farmers and Karibib residents depending on wind direction and strength and users of the B2 road as they pass the mine before planned offsite disposal by the registered waste management contractor.

The magnitude of change is deemed negligible as the improper waste disposal causes only very minor or barely detectable alterations to the social environmental or health characteristics of the local area. Any loss or damage affects a limited element (e.g., small patches of soil contamination or minor aesthetic degradation) without significantly altering the overall integrity or function of the environment. Nevertheless, the probability of the impact occurring is considered possible (medium) as the impact may only occur under certain conditions (e.g., accumulation of waste, warm, baboon interference and moist conditions favouring decomposition or lack of pest control). The sensitivity of the impact is rated low considering that precautionary measures will be implemented by the environmental section as best practice for sustainable mining. Overall, the significance of the impact is rated adverse low, before mitigation (Table 26). The mitigation measures are provided in the OEMP under Domain 8 (Appendix B)

7.3.6.3 Improper storage of waste materials, particularly oily rags, fuel containers, or explosive-contaminated residues may create fire and explosion hazards during operations

The improper storage of certain waste materials constitutes a significant fire and explosion hazard due to their inherent properties, chemical and reactive behaviours. Oily rags, often saturated with unsaturated fatty acid esters from oils (e.g., linseed oil and cooking oils), undergo exothermic oxidation when exposed to atmospheric oxygen. When these rags are crumpled or stored in bulk, their low thermal conductivity prevents effective heat dissipation, resulting in an adiabatic rise in temperature. When the internal temperature reaches the autoignition temperature of the oil, the material spontaneously combusts, a phenomenon known as spontaneous combustion. Similarly, improperly sealed or vented fuel containers (holding volatile liquids like gasoline or solvents) continuously release flammable vapours that are heavier than air. These vapours can accumulate in low-lying areas, creating an explosive atmosphere within the flammability limits (or explosive limits). The introduction of a low-energy ignition source (e.g., static electricity, a spark from a tool, or pilot light) can trigger a flash fire. Furthermore, explosive-contaminated residues, even in minute quantities, can contain energetic materials that are sensitive to thermal, mechanical (impact or friction), or electrostatic stimuli, posing an immediate risk of detonation or deflagration, if not managed according to stringent regulatory protocols for acutely hazardous waste.

The nature of the impact is considered adverse as improper storage of reactive or flammable waste creates significant fire, explosion and detonation hazards that pose immediate risks to human safety, property and the environment. The impact is considered direct as the hazardous effects, fires, explosions, or detonations, would occur immediately as a direct result of the improper storage of waste. The impact is deemed partly reversible as certain damages (e.g. to

the environment) can be remediated, while others such as the loss of life or permanent material destruction cannot be fully remediated. The impact is considered short term as hazardous events such as fires, explosions or chemical reactions occur rapidly and are of limited duration, typically ceasing once the fire is extinguished. The effects occur rapidly rather than persisting continuously over an extended period and the resulting impact can be typically remediated within one (1) to five (5) years. The extent of the impact is on-site as the hazards such as fires, explosions or chemical releases, primarily affect the immediate area where the waste is improperly stored. The potential risks are primarily confined to the storage site, with impacts rarely extending beyond it, except in cases of secondary events such as fire spread. The magnitude of change is rated high as improper storage of reactive or flammable waste can trigger fires, explosions or detonations that cause severe damage to resources. Such events can compromise the quality and integrity of materials, structures, equipment and other critical site components.

Furthermore, the probability of the impact occurring is considered possible (medium) as fires or explosions may arise when reactive or flammable wastes accumulate, vapours concentrate, ignition sources are present, or materials are mishandled. The risk is further elevated conditions such as warm temperatures, poor ventilation, confined spaces and improper handling (accidental dropping or friction). Although fires can cause significant damage to the mine infrastructure and result in costly repairs, the sensitivity of the impact is rated low as the mine is expected to strictly enforce precautionary measures such as SOPs for the proper handling of hazardous substances and chemicals and routine inspections/audits. These control measures will minimise the likelihood of the fires or explosions and to mitigate associated risks to the greatest extent possible. Overall, the impact is rated adverse minor, before mitigation (Table 26). Mitigation measures are included in the OEMP under Domain 8 (Appendix B).

7.3.6.4 Improper disposal or accumulation of construction debris, packaging and general waste within or around the explosive's magazine area can lead to visual degradation of the landscape

Improper management and accumulation of construction debris, packaging and general waste within or proximate to the explosives magazine area result in significant visual degradation by introducing anthropogenic clutter and sharp textural contrasts to the surrounding environment. This debris, which often comprises of shattered concrete, wooden forms, plastic sheeting and discarded metal components creates an aesthetically incoherent and untidy landscape.

The nature of the impact is considered adverse as the accumulation of construction debris around the explosive's magazine diminishes the visual quality and coherence of the landscape, create an untidy and aesthetically degraded environment. Additionally, the impact is considered direct as it results directly from the construction activities, in this case, the improper management and accumulation of construction debris and waste directly within or next to the explosives magazine area. The impact is deemed reversible as the visual degradation caused by the debris can be remedied through proper cleanup and site management. When the

accumulated waste, packaging and construction materials are removed, the area is restored, and the landscape regain its original aesthetic quality. The duration of the impact is deemed temporary as the visual degradation from the debris only persists while the waste remains unmanaged. The extent of the impact is on-site any potential improper disposal of general waste would not be able to be seen by people off-site and windblown waste will remain in the immediate area. The magnitude of change is rated negligible as the accumulation of construction debris causes only a very minor alteration to the visual quality of the area. It only affects the aesthetics or visual coherence of the area, without significantly damaging other features, resources or ecological elements. The probability of the impact occurring is rated possible (medium) as there is a chance that construction debris and waste could accumulate around the explosives magazine, if not properly managed. Although not anticipated to occur in every instance, the fast-paced working environment could result in materials mishandling and consequently visual degradation. The sensitivity of the impact is rated low because the area designated for the explosives magazine is within an existing and active mining environment, with an open pit and other mining infrastructure. The landscape can readily accommodate or recover from minor visual alterations, such as temporary debris accumulation, without significant loss of overall environmental quality or functional integrity. Overall, the significance of the impact is rated adverse low, before mitigation (Table 26). The mitigation measures are provided in the OEMP under Domain 8 (Appendix B).

7.3.6.5 Improper disposal and accumulation of construction debris, packaging and general waste within or around the explosives magazine area could be ingested by wildlife could result in injury, poisoning, or death, while debris piles degrade habitats and attract scavengers, increasing human–wildlife conflict

Improper disposal or accumulation of construction debris, packaging materials and general waste within or around the explosive's magazine area poses a significant threat to local wildlife and surrounding habitats. Animals attracted to waste may ingest plastics, paper or food-contaminated materials, leading to internal injuries, digestive blockages, chemical poisoning, or even death. Sharp metal fragments, glass, and other hazardous items can cause external wounds or internal damage if ingested. Waste piles often attract scavengers such as jackals or vultures increasing their presence near operational areas and thereby heightening the potential for human–wildlife conflict. Such interactions not only endanger animals but can also compromise the safety and security of the explosive's magazine through fence damage or burrowing. If left unmanaged, these impacts can persist over the long term, as non-biodegradable materials like plastics remain in the environment for decades, continuing to harm wildlife and impede habitat recovery.

Therefore, the nature of the impact is adverse due to its significant negative effects on local wildlife, habitats and operational safety. The impact is direct because it arises immediately from construction activities and directly affects wildlife, habitats and operational safety. The impact is irreversible because non-biodegradable materials, including plastics, metals and glass, can persist in the environment for decades, continuously posing hazards to wildlife and degrading habitats, while some fauna may die or become permanent injured from the ingestion

or entrapment by the waste. Collectively, these effects demonstrate that certain changes caused by the accumulation of construction waste are lasting, cannot be fully reversed by natural processes. The nature of the impact is high because the impact is a profound and lasting disturbance that fundamentally compromises the resource's value, function, and ecological resilience. As such, the changes are extensive and severe.

The duration of the impact is permanent and is unlikely to be naturally reversed within a meaningful ecological or management timeframe. Severe damage to sensitive habitats or the loss of vulnerable species can lead to permanent alteration of ecosystem structure or even local extinctions, with no realistic prospect of recovery without intensive intervention. The extent of the impact is on site because the effects are largely confined to the immediate area where the waste is generated and accumulated, specifically, within and around the explosive's magazine. The adverse consequences, such as ingestion of waste by local wildlife, physical injuries from sharp objects, soil contamination from leachates, habitat degradation and increased human-wildlife interactions, are mostly restricted to this location. The probability of the impact occurring is possible because improper waste handling could allow wildlife to access debris, leading to ingestion, injury or contamination. The sensitivity of the impact is low because the area has some capacity to recover from disturbances such as waste accumulation if proper management occurs. Therefore, this impact has been rated adverse minor (before mitigation). The mitigation measures have been included in Domain 8 of the OEMP (Appendix B).

7.3.6.6 *Improper disposal of accumulation of operational debris, packaging and general waste within or around the explosives magazine area could be ingested by wildlife could result in injury, poisoning, or death, while debris piles degrade habitats and attract scavengers, increasing human-wildlife conflict*

Improper disposal and accumulation of operational debris, packaging and general waste in or around an explosive's magazine creates a multifaceted threat to local wildlife and ecosystems. Animals may scavenge through piles of refuse and ingest plastic, metal, treated wood, or contaminated packaging, causing internal injury, gastrointestinal blockage, choking, and long-term malnutrition; sharp fragments and fasteners can produce lacerations or internal perforations that lead to infection or death. By concentrating food-like waste in one location, preferably away outside of the fence of the explosives magazine, these piles attract opportunistic species (scavenging birds, mammals, and rodents), unnaturally increasing local densities and drawing predators closer to human infrastructure, a dynamic that elevates the risk of human-wildlife encounters, vehicle collisions, and the spread of zoonotic disease. Over time these impacts can cascade through the food web, altering species composition and ecosystem functions, and may trigger regulatory, community and reputational consequences for the operation.

The nature of the impact is adverse as the impact results in negative environmental consequences such as physical injury, poisoning and habitat degradation for local fauna. It disrupts ecosystem balance by promoting bioaccumulation of toxins, altering species composition, and increasing human-wildlife conflict. The impact is direct because animals

come into direct contact with the waste through ingestion, inhalation, or physical interaction, leading to injuries, poisoning, or habitat disturbance. The impact is irreversible because ecological damage caused by improper disposal and accumulation of operational waste leads to long-term or permanent alterations in ecosystem structure and function that cannot be restored to their original state, even after the waste is removed. Wildlife fatalities from ingestion, poisoning, or injury are permanent losses to local populations, particularly if affected species have slow reproductive rates or limited ranges. Toxic residues and bioaccumulated contaminants can persist in soils and food chains for years, continuing to affect flora and fauna long after the initial exposure. The magnitude of change is high because wildlife injury and mortality, represents a severe disruption to key ecological functions and species interactions.

The duration of the impact is long term because environmental degradation caused by the improper disposal and accumulation of operational waste persists well beyond the operational phase and may take many years to recover, if at all (>5 years). Toxic substances from paints, solvents, and fuel residues can remain in soils and sediments for extended periods, continuing to affect wildlife through ongoing exposure and bioaccumulation. Additionally, declines in wildlife populations from poisoning, injury, or reproductive failure can take multiple generations to stabilize. These persistent and slow-to-recover effects make the impact's duration long term. The extent of the impact on site the improper disposal and accumulation of operational debris and waste occur around the explosive's magazine area, meaning the effects are spatially confined to the project footprint. The probability of the impact occurring is possible because during operational activities around the explosive's magazine, waste such as packaging materials, contaminated containers or food containers may unintentionally be left on-site or improperly segregated. The sensitivity of the impact is low because the affected environment and species around the explosive's magazine is of local ecological value. The habitats near the operational area likely consist of wildlife species with relatively high adaptability to human activity and environmental change. Therefore, the significance of this adverse minor (before mitigation). The mitigation measures have been included in Domain 8 of the OEMP.

Table 26 - The impacts of improper waste management on the receiving social environment

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Poor handling or disposal and open burning of explosive packaging during the operation	Air quality	Improper disposal and burning of explosive packaging may release nitrate dust and emit toxic gases and	Adverse Direct Reversible Temporary Local Possible	Low	Low	Adverse Low (1)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
of the explosive magazine		particulates, further deteriorate air quality and pose occupational health risks.				
Improper disposal of domestic waste such as food scraps, plastics, and packaging during the construction of the explosive magazine	Employee occupational health and safety and nearby sensitive receptors (farmers to the SE of ML 31)	Odour generation, and pest infestations	Adverse Direct Reversible Temporary Local Possible	Low	Low	Adverse Low (1)
Improper disposal of domestic waste such as food scraps, plastics, and packaging	Employee occupational health and safety and nearby sensitive receptors (farmers to the SE of ML 31)	Odour generation, and pest infestations	Adverse Direct Reversible Temporary Local Possible	Low	Low	Adverse Low (1)
Improper storage of waste materials, particularly oily rags,	Employee occupational health and safety	Fire and explosion hazards	Adverse Direct Partly reversible Short term On-site	Low	High	Adverse Minor (3)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
fuel containers , or explosive-contaminated residues during underground mining operations			Possible			
Improper disposal or accumulation of construction debris, packaging, and general waste within or around the explosive magazine area	Visual aesthetics	Visual degradation of the landscape	Adverse Direct Reversible Temporary On site Possible	Low	Negligible	Adverse Low (2)
Improper disposal and accumulation of construction debris, packaging and general	Wildlife	Injury, poisoning, or death of wildlife, while debris piles degrade habitats and attract scavengers,	Adverse Direct Irreversible Temporary On site Possible	Low	High	Adverse Low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
waste within and around the explosive's magazine construction area		increasing human-wildlife conflict				
Improper disposal and accumulation of operational debris, packaging and general waste within and around the explosive magazine operational area	Wildlife	Injury, poisoning, or death of wildlife, while debris piles degrade habitats and attract scavengers, increasing human-wildlife conflict	Adverse Direct Irreversible Long term On site Possible	Low	High	Adverse Low (2)

7.4 SOCIO-ECONOMIC ENVIRONMENT: ECONOMIC

The underground expansion aims to extend the operational lifespan of the mine, enhance ore extraction efficiency and sustain local economic benefits through the employment of approximately 150 additional personnel. In parallel, the Project requires the construction of an additional explosives magazine to support increased underground operations, which will engage several contractors during the construction phase.

These potential socio-economic impacts are identified and assessed below before mitigation are visually summarised in Figure 57 and detailed in Table 27.

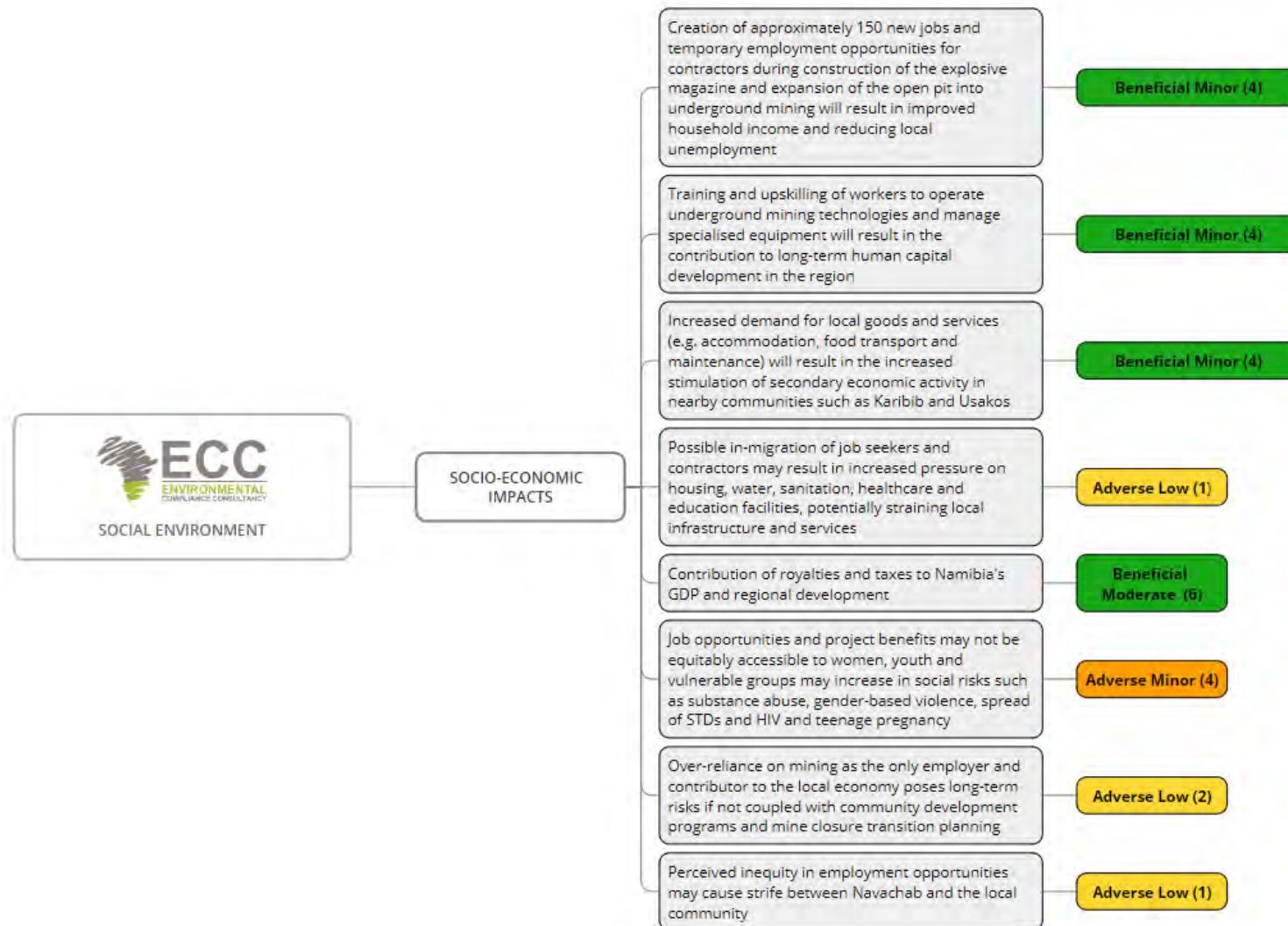


Figure 57 - Socio-economic impacts from the construction of the explosive's magazine and the underground expansion of the mine

7.4.1 CREATION OF APPROXIMATELY 150 NEW JOBS AND TEMPORARY EMPLOYMENT OPPORTUNITIES FOR CONTRACTORS DURING CONSTRUCTION, IMPROVING HOUSEHOLD INCOME AND REDUCING LOCAL UNEMPLOYMENT

As stated in section 5.8.3, in Karibib unemployment remains relatively high, though slightly below the national average, due to opportunities in the mining and transport sectors. However, employment is largely concentrated among individuals with mining-related skills, limiting broader job absorption. The proposed underground expansion of the Navachab Gold Mine and the construction of an additional explosive's magazine are expected to significantly boost local employment and income levels. The creation of about 150 permanent jobs and temporary construction opportunities will provide stable and well-paying employment, improve household livelihoods and reduce poverty in nearby communities. Increased wages and local procurement will stimulate small business growth and create indirect jobs in sectors such as transport, catering and accommodation, producing a positive ripple effect throughout the local economy. By prioritising local recruitment, the Project will also help to reduce unemployment, particularly among youth, minimise outward migration, and strengthen the socio-economic resilience of communities in the Erongo Region.

The nature of the impact is beneficial because the Project will strengthen the socio-economic resilience of communities in the Erongo Region, through job creation. The impact is direct because it results immediately from the Project's activities. Specifically, the underground expansion and construction of the additional explosive's magazine will directly create jobs, increase wages and boost local procurement. These effects occur as a direct consequence of the Project's operations, without relying on intermediary factors or secondary processes. The impact is reversible because the socio-economic benefits, such as employment, income and local business growth, depend on the ongoing operation of the mine. If the mine closes, downsizes, or stops these activities, jobs, wages and economic stimulation provided to the community would cease and households and businesses could return to their pre-Project conditions. The magnitude of change is moderate because the Project provides measurable improvements to key socio-economic characteristics of the local communities, such as employment, income levels and business opportunities. While these improvements enhance the quality of livelihoods and strengthen local economic resilience, they do not completely transform the community or create large-scale systemic changes. The duration of the impact is short-term because the socio-economic benefits, such as employment from construction and temporary opportunities related to the expansion, will only last for the period of the specific Project activities (e.g., construction and early operational phases). These benefits are recoverable in the sense that if the activity ends or the mine closes, the jobs and associated income will cease, typically within a 1–5-year timeframe. The extent of the impact is regional because the benefits of the Project, such as employment opportunities, increased incomes and stimulation of local businesses, primarily affect communities within the Erongo Region, including Karibib and surrounding areas. While some economic ripple effects may reach

beyond the immediate vicinity, the direct and significant socio-economic improvements are concentrated within this specific region, rather than affecting the entire country or multiple regions.

The probability of the impact is certain because the Project activities, such as the underground expansion and construction of the explosive's magazine, will inevitably create jobs, generate income and stimulate local businesses. These outcomes are a direct and unavoidable consequence of the Project's implementation, assuming the activities proceed as planned. The sensitivity of the impact is medium because the socio-economic benefits, such as employment, income generation and local business stimulation, are valuable and important at the regional scale (Erongo Region), but they are not unique or irreplaceable. The community has a moderate capacity to adapt if the mine were to close or reduce operations, for example by seeking alternative employment or business opportunities elsewhere. Therefore, this impact has been rated beneficial minor as shown in Table 27.

7.4.2 TRAINING AND UPSKILLING OF WORKERS TO OPERATE UNDERGROUND MINING TECHNOLOGIES AND MANAGE SPECIALISED EQUIPMENT, CONTRIBUTING TO LONG TERM HUMAN CAPITAL DEVELOPMENT IN THE REGION

The training and upskilling of workers to operate underground mining technologies and manage specialised equipment are expected to contribute significantly to long-term human capital development in the region. By providing employees with advanced technical skills and practical experience in modern underground mining operations, the initiative will enhance workforce competence, productivity and safety standards. These skills not only improve individual career prospects but also increase the employability of workers within the broader mining sector and other technical industries. Over time, the development of a highly skilled local workforce can attract additional investment, support the growth of local businesses and foster innovation in the region. Furthermore, the emphasis on continuous learning and professional development will strengthen community capacity, empower youth and women through targeted training programs and contribute to sustainable socio-economic development by building a durable pool of technical expertise in the Erongo Region.

The nature of this impact is beneficial because it builds a skilled local workforce, enhances career prospects, boosts employability, attracts investment, supports local business growth, empowers communities, especially youth and women and contributes to sustainable socio-economic development in the Erongo Region. This impact is direct because the training and upskilling activities are an immediate and intentional outcome of the mining expansion Project. The mine's initiative to provide technical skills, hands-on experience, and professional development directly affects the workers who participate, without relying on secondary or indirect processes. This impact is irreversible because once workers acquire advanced technical skills and experience, these capabilities become permanent personal assets that cannot be undone. The knowledge and expertise gained remain with the individuals even if they leave the mine or the Project ends, making the improvement in human capital lasting and enduring in

the long term. The magnitude of change is moderate because the training and upskilling activities provide noticeable improvements to the workforce's skills, competence and productivity, but they do not completely transform the entire workforce or create entirely new industries. The initiative enhances key characteristics, such as technical expertise, employability and safety awareness, representing a meaningful addition to existing capabilities, but the change is not extreme or overwhelming.

The duration of the impact is permanent because the skills, knowledge and experience gained by workers through training and upskilling are long-lasting. Once acquired, these competencies remain with individuals for the rest of their careers and can be applied in future roles within the mining sector or other technical industries. Unlike temporary benefits that fade after the Project ends, this human capital development creates a lasting change in the workforce and the region's socio-economic capacity. The extent of the impact is regional because the benefits of the training and upskilling extend beyond individual workers to the wider Erongo Region. As workers apply their enhanced skills, the improvements in workforce competence, productivity and safety standards positively affect local businesses, other mining operations and related technical industries across the region. The probability of the impact is likely because the training and upskilling programs are planned, structured and actively implemented as part of the mine's expansion Project. Since the Project directly provides access to technical training, hands-on experience and professional development, it is highly probable that workers will acquire the intended skills and knowledge. The sensitivity of the impact is medium because the development of a skilled workforce is valuable and important at the regional scale, it strengthens human capital, supports local industries and enhances socio-economic development but it is not unique or irreplaceable. While the workforce's skills are significant, other training programs or opportunities in the region could partially substitute for them if necessary. Additionally, the workforce and regional systems have a moderate capacity to accommodate and build on these changes, meaning the impact is meaningful but not so critical that the region cannot adapt without it. Therefore, this impact has been rated beneficial minor as shown in Table 27.

7.4.3 INCREASED DEMAND FOR LOCAL GOODS AND SERVICES (E.G. ACCOMMODATION, FOOD, TRANSPORT AND MAINTENANCE SERVICES), STIMULATING THE LOCAL ECONOMY IN NEARBY COMMUNITIES SUCH AS KARIBIB AND USAKOS

The expansion of Navachab Gold Mine is expected to increase demand for local goods and services, including accommodation, food, transport and maintenance, thereby stimulating secondary economic activities within the surrounding communities. Local suppliers and small businesses are likely to benefit from the higher demand, leading to increased revenue, job creation and a positive multiplier effect in the regional economy. However, this surge in economic activity may also place additional pressure on local infrastructure and public services, such as roads, water supply, waste management and healthcare facilities, potentially leading to congestion, overuse, or service delays if not properly managed. While the increased economic

activity supports local livelihoods and business growth, careful planning and investment in infrastructure and service provision will be necessary to ensure that the benefits are sustainable and that the local community can adequately accommodate the heightened demand.

The nature of the impact is beneficial because the mine's expansion stimulates the local economy, creates jobs, increases revenue for businesses and generates a positive multiplier effect in the region, while requiring careful planning to manage pressures on infrastructure and services. The impact is indirect because it does not result directly from the mining activities themselves but arises from the secondary effects of the expansion, such as increased demand for local goods and services, job creation in supporting businesses and the wider economic benefits in the community. These effects occur because of the mine's operations, rather than being an immediate or direct output of the mining process. The impact is reversible because the economic benefits, such as increased demand for goods and services, job creation and higher local business revenue, depend on the ongoing operation of the mine. If mining activity decreases or stops, these benefits could decline or disappear, meaning the community could return to its previous economic conditions. The magnitude of change is low because the benefits of the mine's expansion, such as increased demand for local goods and services and some job creation, represent only minor additions to the local economy. These effects improve certain aspects of community or business activity but do not significantly transform the overall economic structure or create major, widespread changes.

The duration of the impact is short term because the economic benefits, such as increased demand for goods and services and temporary job opportunities, are tied to the period of active mining expansion and associated construction or operational activities. Once these activities end or reduce, the heightened economic activity is likely to diminish, typically within 1–5 years, making the impact temporary and recoverable. The extent of the impact is regional because the economic benefits, such as increased demand for goods and services, job creation, and revenue for local businesses, affect not just the immediate mine site or town but the wider surrounding communities and towns that supply or support the mine. The probability of the impact is likely because the mine's expansion is expected to increase demand for local goods and services and create job opportunities, which are highly probable outcomes based on the planned operations and historical patterns from similar mining activities. The sensitivity of the impact is medium because the economic benefits, such as increased revenue for local businesses and job opportunities, are of value and importance at a regional scale, but the local economy has some capacity to adapt or accommodate these changes. Therefore, this impact has been rated beneficial minor as shown in Table 27.

7.4.4 POSSIBLE INWARD MIGRATION OF JOB SEEKERS AND CONTRACTORS' MAY PLACE PRESSURE ON HOUSING, WATER, SANITATION, HEALTHCARE AND EDUCATION FACILITIES, POTENTIALLY STRAINING LOCAL INFRASTRUCTURE AND SERVICES

As stated in section 5.8.5 Karibib relies mainly on one public health centre and a few clinics, with referrals made to larger hospitals in Omaruru, Swakopmund or Windhoek. This leads to overburdened local facilities and long travel distances for specialised care (MoHSS, 2018). Furthermore, public facilities tend to be understaffed and shortages in equipment and facilities raises concerns (Christians, 2020). The potential inward migration of job seekers and contractors to support the Navachab Gold Mine expansion may place additional pressure on local housing, water, sanitation, healthcare and education facilities. An influx of workers and their families could lead to increased demand for accommodation, utilities and public services, potentially straining existing infrastructure and reducing service quality for both new and existing residents.

The nature of this impact is adverse because the influx of workers could strain housing, utilities, healthcare and education, leading to overcrowding, reduced service quality, and competition for resources, potentially lowering community well-being if not properly managed. This impact is indirect because it is not caused directly by the mining activities themselves, but rather by the secondary effects of those activities, specifically, the inward migration of workers and their families. The mine expansion creates jobs, which then triggers increased demand for housing, utilities and public services, placing pressure on local infrastructure. The impact is reversible because pressures on infrastructure and services can be alleviated through upgrades, management or a reduction in inward migration, allowing the community to recover. Additionally, this pressure may also decrease post mine closure when people/families emigrate from the town in search of other jobs and opportunities.

The magnitude of change is low because the impact would cause only a minor alteration or loss of one or a few key characteristics or features, rather than a major or widespread change. It is noticeable but limited in scale or significance. The duration of the impact is short term because it is expected to last only for the period of the activity causing it (e.g., the influx of workers during the mine expansion) and is recoverable within a few years once the activity ends. The extent of the impact is local because the Project affects only the immediate community or area surrounding the mine, such as housing, utilities and public services in Karibib, rather than spreading across a wider region or nationally. The probability of the impact is possible because the inward migration of workers may occur because of the mine expansion, but it is not certain, it depends on factors like recruitment patterns, housing availability and the level of local versus non-local employment. The sensitivity of the impact is low because the Project affects services that are only of limited value or importance on a local scale, and the community and infrastructure have considerable capacity to accommodate the change without long-term harm. Therefore, this impact has been rated adverse low as shown in Table 27.

While the arrival of new workers can bring economic benefits through increased spending and business opportunities, without proper planning and investment, local facilities may become overburdened, leading to challenges such as overcrowding, reduced access to essential services, and increased competition for resources. Proactive measures, including infrastructure upgrades and coordinated service provision, will be essential to manage these impacts and ensure that community well-being is maintained while supporting economic growth. The mitigation measures are included in the OEMP (Appendix B).

7.4.5 JOB OPPORTUNITIES AND PROJECT BENEFITS MAY NOT BE EQUITABLE ACCESSIBLE TO WOMEN, YOUTH AND VULNERABLE GROUPS, INADVERTENTLY INCREASING SOCIAL RISKS E.G SUBSTANCE ABUSE AND DOMESTIC VIOLENCE

Job opportunities and benefits arising from the Navachab Gold Mine expansion may not be equitably accessible to women, youth and other vulnerable groups, potentially exacerbating existing social inequalities. Limited access to employment, skills development and economic opportunities for these groups could inadvertently increase gender-based violence and social risks (such as increased substance abuse, teenage pregnancies and the spread of sexually transmitted diseases (STDs) and/or particularly human immunodeficiency virus (HIV)). As stated in section 5.8.3, employment is largely concentrated among individuals with mining-related skills, limiting broader job absorption social concerns have emerged, including a reported increase in alcohol and drug abuse among residents (New Era, 2021). Further impacts of inequitable access to job opportunities includes income disparities, marginalization and reduced participation in decision-making processes. While the Project can generate significant economic and social benefits, without targeted inclusion measures, certain segments of the population may be excluded from these opportunities.

The nature of the impact is adverse because the mine expansion may exclude women, youth and vulnerable groups from employment and economic benefits, potentially worsening social inequalities, income disparities and social risks such as gender-based violence, teenage pregnancies and the spread of HIV/STDs. The impact is direct because it results immediately from the mine expansion activities, specifically the way jobs and benefits are allocated. The exclusion of women, youth and vulnerable groups from employment, skills development and economic opportunities is a direct consequence of the Project's employment and procurement practices, rather than arising indirectly through secondary or long-term social processes. The impact is partly reversible because targeted measures can restore access to jobs and opportunities, but some longer-term social effects, like income disparities and health risks, may persist and require ongoing intervention. The magnitude of change has been rated high because the impact could cause severe disruption to regional social cohesion and well-being. Excluding vulnerable groups from employment and economic opportunities can significantly undermine community relationships, trust and participation, leading to social fragmentation. In addition, the associated social risks, such as increased gender-based violence, teenage pregnancies, substance abuse and the spread of HIV/STDs, represent a major deterioration in public health and social stability.

The duration of the impact is long term because the social inequalities, health risks and disruptions to community cohesion caused by exclusion from employment and economic opportunities are not immediately resolved. Even if mitigation measures are implemented, entrenched income disparities, marginalisation and social behaviours (e.g., substance abuse or teenage pregnancies) can persist for many years long after the Project has ended. The extent of the impact is regional because the social and health consequences, such as exclusion from employment, income disparities, gender-based violence, teenage pregnancies, substance abuse and the spread of HIV/STDs, affect multiple communities around the mine, not just a single town or household as the employees of the mine come from several towns within the Region and may leave behind their wives and children then resulting in this impact. The probability is rated as possible because there is a realistic likelihood that unequal access to employment and economic opportunities could occur, especially if targeted inclusion and gender-sensitive measures are not effectively implemented. The sensitivity is medium because regional communities have some capacity to adapt to change, but limited alternative opportunities make them moderately vulnerable to social and economic exclusion. Therefore, this impact has been rated adverse minor as shown in Table 27.

Mitigation measures for this impact have been included in section 2.4 of the OEMP (Appendix B).

7.4.6 THE UNDERGROUND MINING EXPANSION WILL CONTRIBUTE TO NAMIBIA'S GDP AND REGIONAL DEVELOPMENT

The N\$ 4-billion-dollar underground expansion is expected to make a substantial contribution to Namibia's GDP and regional development over the next four years and create over 150 employment opportunities (Namibia Mining & Energy, 2025). By boosting gold production, creating employment and increasing demand for local goods and services, the Project will stimulate economic activity both nationally and within the Erongo Region. At current gold prices, approximately N\$44 650 per ounce, the in-situ value of the mine's resources exceeds N\$60 billion; however, this represents the theoretical gross value, as actual economic returns will depend on factors such as recovery rates, operational costs and long-term market conditions. By mid-2025, the mine had already contributed around N\$750 million in taxes and royalties to the Namibian government, highlighting its role in supporting national revenue. Additional benefits from wages, procurement and business opportunities are expected to drive local enterprise growth and provide resources for reinvestment in public infrastructure and social services. The expansion is also likely to attract further investment, strengthen regional supply chains and promote broader industrial and community development. Overall, the project is poised to support sustained economic growth, enhance livelihoods, and contribute to long-term socio-economic development in Namibia.

The nature of this impact is beneficial as the Navachab Gold Mine expansion promotes economic growth, employment and regional development. It increases Namibia's GDP,

generates substantial government revenue through taxes and royalties, and stimulates local business activity in the Erongo Region. The Project also attracts further investment, strengthens supply chains and supports community development. Overall, it contributes to sustained socio-economic growth and improved livelihoods at both national and regional levels. This impact is direct because the economic benefits, such as increased GDP, employment, government revenue and local business activity, arise immediately from the mine's operations. However, the impact is reversible because the economic and social benefits depend on the ongoing operations of the mine. If mining activities were to cease or scale down, employment, local procurement and government revenue would decline or stop, and the associated economic growth and regional development gains could be lost or reduced. Essentially, the positive effects exist only while the mine is active. The magnitude of change is high because the Navachab Gold Mine expansion produces a large-scale improvement in economic and social resources. It substantially boosts GDP, government revenue, employment and local business opportunities, representing a major enhancement of regional and national economic attributes.

The duration of the impact, however, is short term because the Project's contribution to the GDP lasts only for the duration of the mine's active operations or specific expansion activities (construction and operations). Benefits like employment, local procurement and increased revenue are directly tied to ongoing mining activity and would diminish or disappear once the Project ends or if operations are paused. The extent of the impact is national because the extent of the impact is national because the economic benefits, such as increased GDP, government revenue from taxes and royalties and overall contribution to Namibia's economic growth, affect the entire country, not just the local or regional area. While local communities benefit directly, the financial flows and economic stimulation reach a national scale, influencing development across Namibia. While the probability of this impact is occurring is almost certain because the benefits, such as increased gold production, employment and government revenue, will occur if the mine operates as planned. These outcomes are direct, measurable and tied to the mine's established activities, making their occurrence almost guaranteed. Furthermore, the sensitivity of the impact is high because the economic and social benefits from the Navachab Gold Mine, such as national revenue, employment and contributions to GDP, are of significant value and importance at both the national and international level. These benefits have limited potential for substitution, meaning other activities or projects could not easily replace them if lost. Additionally, the economy and regional development have little capacity to absorb the loss of these contributions without experiencing substantial negative effects. Therefore, this impact has been rated beneficial moderate as shown in Table 27.

7.4.7 OVER-RELIANCE ON MINING COULD POSE LONG-TERM RISKS IF NOT COUPLED WITH COMMUNITY DEVELOPMENT PROGRAMMS AND MINE CLOSURE TRANSITION PLANNING

As stated in section 5.8.4.1, Navachab Gold Mine, located outside Karibib, is the oldest open pit mine in Namibia and has been the town's largest employer for decades. Over-reliance on

mining as a primary economic driver in the Karibib area could pose significant long-term risks if not accompanied by community development programs and mine-closure transition planning. While the mine generates employment, income and business opportunities during its operational phase, these benefits are finite, as mineral resources will eventually be depleted and current LoM will end in 2033. Without proactive planning, local communities may face economic decline, high unemployment and reduced household incomes once mining activities cease, potentially leading to social instability and outward migration.

The nature of this impact is adverse because mining provides temporary jobs and income, these benefits are finite and are limited to LoM. The impact is directly related to mine closure because the risk of economic decline, unemployment and social instability after closure arises directly from the finite nature of mining. There's a clear, cause-and-effect relationship between the mine's activities and the socio-economic consequences. The impact is reversible because its negative effects can be alleviated through measures like community development, retraining, economic diversification and mine-closure planning, allowing the community to recover and regain economic stability. The magnitude of change of the impact is high because over-reliance on mining threatens the integrity and long-term sustainability of the local economy and community well-being, which are key resources. The potential economic decline, unemployment and social instability represent severe damage to essential socio-economic characteristics and functions of the area.

The duration of the impact will be long term because the negative socio-economic consequences of over-reliance on mining, such as economic decline, unemployment and social instability, can persist well beyond the operational life of the mine and mine closure. The extent of the impact is it primarily local as it affects the Karibib and Usakos areas and its immediate surrounding communities where the mine operates. The economic dependency, potential unemployment and social risks are confined to the communities directly linked to the mine, rather than spreading across a wider regional or national scale. Furthermore, the probability of the impact occurring is likely as stated in section 5.8.3 employment in the town is mostly reliant on employees of the mine therefore, it is highly probable that negative socio-economic consequences, such as unemployment, income loss and social instability, will materialise once mining operations decline or cease. However, the sensitivity of the impact is low because the socio-economic environment affected, such as local employment and income are important primarily at the local scale and the community has some capacity to adapt. For example, through alternative livelihoods, retraining, or local business initiatives, the community can partially accommodate or recover from the negative effects, making the system less sensitive to change. Therefore, this impact has been rated adverse low as shown in Table 27. Mitigation measures have been included in the OEMP (Appendix B).

It is essential to implement community development initiatives that enhance skills, support local entrepreneurship and diversify economic activities beyond mining. Mine-closure transition planning should include retraining programs, the promotion of alternative

livelihoods, environmental rehabilitation and the establishment of financial mechanisms such as local development or trust funds to sustain post-closure socio-economic activities. By integrating these measures, the long-term benefits of mining can be maximised, ensuring that local communities remain resilient and economically stable even after the mine's closure.

7.4.8 PERCEIVED INEQUITY IN EMPLOYMENT OPPORTUNITIES MAY CAUSE STRIFE BETWEEN NAVACHAB AND THE LOCAL COMMUNITY

The community may become dissatisfied if the Navachab Gold Mine employs contractors from outside Karibib or prioritises expatriates over local residents, leading to feelings of exclusion and social tension. Such perceptions can undermine trust in the mine, damage its reputation and potentially provoke protests or conflict.

The nature of this impact is adverse because prioritising non-locals or expatriates over locals can cause community dissatisfaction, social tension and loss of trust in the mine, potentially leading to protests or conflict. This is an indirect impact as it does not result from the mine's physical operations or immediate actions (like noise, dust or land use), but rather from the social and perception-based consequences of its employment and contractor decisions. However, this impact is reversible by reducing the number of non-local hires and can be corrected through the correct procedures, local hiring, skills development and transparent communication.

To address this risk, the mine should prioritise local recruitment, implement transparent hiring and contractor selection processes, and provide targeted skills development programs to enable locals to qualify for specialized roles. Clear communication about employment policies and regular reporting on local hiring can further build trust and demonstrate the mine's commitment to inclusive community benefits. The magnitude of change of this impact is negligible because the impact causes only a very minor loss or alteration to one or a few aspects of the community, such as slight dissatisfaction or limited social tension, without significantly affecting overall social cohesion or well-being.

The duration of the impact is short term any community dissatisfaction or social tension is likely to last only for the period of the specific employment or contractor decisions and can be resolved relatively quickly through corrective measures like local hiring, skills development and transparent communication. While the extent of the impact will only be local because it primarily affects the community immediately surrounding the Navachab Gold Mine, such as residents of Karibib. The social dissatisfaction and tension are confined to this specific area and do not significantly influence other towns, regions, or national-level social dynamics. The probability of this impact occurring is unlikely because the mine mainly hires from Karibib and other town near the mine, furthermore, the mine already has positive community engagement strategies in place and has existing trust from the local community. While the sensitivity from the impact is low because the affected community, while locally important, is not rare, and has a considerable capacity to adapt to changes in employment or contractor decisions. Minor

dissatisfaction or social tension can be absorbed and corrected without causing lasting damage to the community's social structure or well-being. Therefore, this impact has been rated adverse low as shown in Table 27. Mitigation measures have been included in the OEMP (Appendix B).

Table 27 - The social: socio-economic impacts of the construction of the explosive magazine and the underground expansion of Navachab Gold Mine

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Creation of approximately 150 new jobs and temporary employment opportunities for contractors during construction of the explosive magazine and expansion of the open pit into underground mining	Employment and job creation	Improved household income and reducing local unemployment	Beneficial Direct Reversible Short term Regional Definite	Medium	Moderate	Beneficial Minor (4)
Training and upskilling of workers to operate underground mining technologies and manage specialised equipment	Employees - Skills transfer	Increased contribution to long-term human capital development in the region	Beneficial Direct Irreversible Permanent Regional Likely	Medium	Moderate	Beneficial Minor (4)
Increased demand for local goods and services (e.g. accommodation, food transport and maintenance)	Local and Regional economy - Goods and service providers	Increased stimulation of secondary economic activity in nearby communities such as Karibib and Usakos	Beneficial Indirect Reversible Short term Regional Likely	Medium	Low	Beneficial Minor (4)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Possible in-migration of job seekers and contractors	Karibib residents and local services and infrastructure	Increased pressure on housing, water, sanitation, healthcare and education facilities, potentially straining local infrastructure and services	Adverse Indirect Reversible Short term Local Possible	Low	Low	Adverse Low (1)
Job opportunities and project benefits may not be equitably accessible to women, youth and vulnerable groups	Women, youth and vulnerable groups (disabled and previously disadvantaged)	Increase in social risks such as substance abuse, gender-based violence, spread of STDs and HIV and teenage pregnancy	Adverse Direct Partly reversible Long term Regional Possible	Medium	High	Adverse Minor (4)
Payment of royalties and taxes	National and regional economy	Contribution of royalties and taxes to Namibia's GDP and regional development	Beneficial Direct Reversible Short term National Definite	High	High	Beneficial moderate (6)
Over-reliance on mining as the only employer and contributor to the local economy	Jobs and the local economy	Over reliance on mining poses long-term risks if not coupled with community development programs and mine closure transition planning	Adverse Direct Reversible Long term Local Likely	Low	High	Adverse Low (2)
Perceived inequity in	Local community	Strife between Navachab and	Adverse Indirect	Low	Negligible	Adverse Low (1)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
employment opportunities		the local community	Reversible Short term Local Unlikely			

7.5 BIOPHYSICAL ENVIRONMENT

7.5.1 SOIL IMPACTS

Soils within the mining licence 31 area are largely shallow, stony Petric Calcisols, particularly in the north-western and north-eastern portions of the site. These soils are strongly influenced by calcium carbonate, resulting in alkaline conditions, low fertility, limited water retention, and poor natural regenerative capacity. Given their physical and chemical constraints, Petric Calcisols are highly susceptible to erosion and contamination when disturbed. The construction and operation of the explosive's magazine, including vegetation clearance, excavation and the introduction of impervious surfaces (e.g. concrete, steel rebar etc), has the potential to exacerbate soil erosion, sedimentation and contamination, therefore changing soil properties, from accidental spills of explosives (ANFO), hydrocarbons or other hazardous chemical substances. This section assesses these potential soil and land impacts, evaluating their nature, magnitude, duration and significance within the context of the site's sensitive soil environment. Figure 58 illustrates the impacts on soil from the construction and operation of the required explosives magazine before mitigation and Table 28 summarises the impact details further.

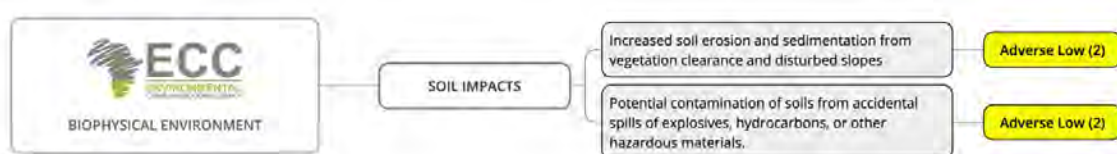


Figure 58 - Impact of the construction and operation of the explosive magazine (No. 3) for required for underground mining activities

7.5.1.1 Increased soil erosion and sedimentation from vegetation clearance and disturbed slopes

The Project soils are characterised by high calcium carbonate content, low fertility, and poor water retention, are highly susceptible to erosion when disturbed and have limited capacity for natural regeneration. The construction and operation of the explosive's magazine will require localised vegetation clearance and excavation for foundations. The introduction of impervious surfaces, such as concrete flooring and access roads, may exacerbate runoff and sediment transport during rainfall events. Given the inherent instability and slow recovery of Petric

Calcisols, soil stripping and compaction from heavy vehicle movement could significantly degrade soil structure and increase sedimentation downslope.

Therefore, the nature of the impact is adverse, direct and reversible, while the magnitude of change is low as there will be a loss of resources, along with its quality and integrity. The duration of the impact is medium term as the impact is likely to continue after the activity causing the impact for 5 - 15 years after the end of the activity. Underground mining activities at present is expected to operate for 5 years, extending the LOM to 2035 for Navachab operations and the magazine is only expected to be decommissioned at end of life of mine. The extent of the impact is onsite limited to the boundaries of the proposed Project site. The probability of this impact occurring is possible as the event could occur under some circumstance and the sensitivity of this impact is low as the impact is only on a local scale, and the significance of the impact is minor, therefore this impact has been rated low (Table 28). Mitigation measures are further detailed in the Navachab OEMP under Domain 4 (Appendix B).

7.5.1.2 Potential contamination of soils from accidental spills of explosives, hydrocarbons, or other hazardous materials

The shallow, stony Petric Calcisols at the site have low organic content and poor contaminant retention, making them highly vulnerable to pollution from accidental spills of explosives (ANFO), hydrocarbons and other hazardous chemical materials during the construction and operation of the third explosive's magazine. Spilled ammonium nitrate from explosives can cause nitrate buildup, while hydrocarbons can create hydrophobic layers that reduce infiltration, hinder vegetation regrowth and destabilise soils. The site's rugged terrain increases the risk of contaminants spreading downslope through runoff, leading to long-term soil degradation and off-site impacts if not properly managed.

Therefore, the nature of the impact is adverse, direct and reversible, while the magnitude of change is moderate, as there will be a loss of resource but will not severely affect the quality of the resource. The duration of the impact is medium term as the impact is likely to continue after the activity has ceased, causing the impact for 5 - 15 years after the end of the activity, and the extent of the impact is onsite as it does not extend beyond the boundaries of the proposed Project site. The probability of this impact occurring is possible as the event could occur under some circumstance. The sensitivity of this impact is low as the impact is on a local scale, and the significance of the impact is minor, therefore this impact has been rated low (Table 28). Mitigation measures are further detailed in the Navachab OEMP under Domain 4 (Appendix B).

Table 28 - Impact of the construction and operation of an additional explosive magazine on soils

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Construction and operation of	Soils	Increased soil erosion and sedimentation	Direct Reversible Medium-term	Low	High	Low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
an explosive magazine		on from vegetation clearance and disturbed slopes	On-site Possible			
		Potential contamination of soils from accidental spills of explosives, hydrocarbons, or other hazardous materials	Direct Reversible medium-term On-site Possible	Low	Moderate	Low (2)

7.5.2 BIODIVERSITY IMPACTS: FAUNA AND FLORA

The proposed development of an additional explosives magazine on-site will require the removal of existing vegetation during earthworks and site preparation and disturbance of the underlying soil, within the designated construction footprint. The proposed explosives magazine occurs within a semi-arid environment characterised by sparse shrubs, grasses and drought-tolerant plant species that provide critical habitat for a range of reptiles and small mammal species. Figure 59 provides an overview of the anticipated impacts before mitigation, which are discussed in detail in the sections below and shown in Table 29.

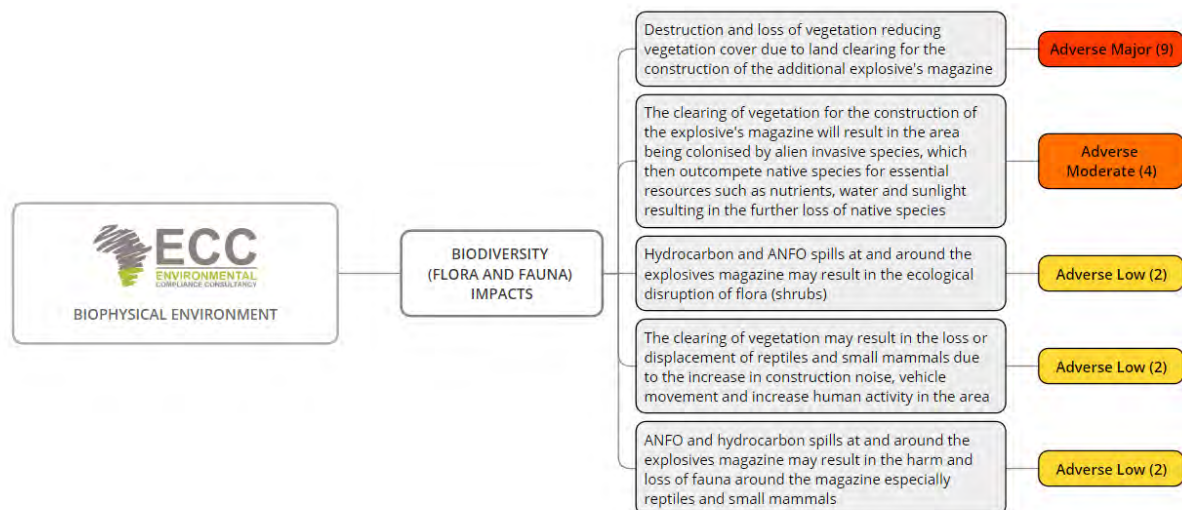


Figure 59 - Impacts on biodiversity from the construction and operation of an explosive's magazine

7.5.2.1 Flora

7.5.2.1.1 Destruction and loss of flora due to the construction of the explosive's magazine

As already described in chapter 5 the overall regional area is characterised by roughly eight (8) different species of trees and shrubs, with 4% of those species being near endemic, 20% of those species being protected and 6% classified by CITES Appendix species. Bush thickening (encroachment) is viewed as problematic with *Acacia reficiens* (red-bark Acacia) the dominant problem species. A detailed biodiversity assessment was not undertaken for the specific area earmarked for vegetation clearing. However, based on the visual interpretation presented in Figure 40 (section 5.7.1) the vegetation within the proposed clearance footprint predominantly comprises herbaceous grass species, mixed shrubs and scattered individuals of *Vachellia* and *Senegalia* species. In accordance with the Proponent's tree harvesting and land clearing permit application requirements, a representative from the DEAF, Omaruru office, will conduct a site verification to identify the potential occurrence of any protected or endangered floral species within the proposed clearance area. Should any protected species be encountered, the Proponent will be obligated to implement the procedures stipulated in the tree harvesting permit, OEMP (Appendix B) and the approved Navachab rehabilitation plan to ensure adequate conservation of the area. Based on the vegetation baseline these are the potential species of grasses and shrubs that can be expected in the area that may be removed: *Commiphora dinteri*, *Commiphora saxicola*, *Commiphora virgata*, *Cyphostemma bainesii*, *Cyphostemma currorii* and *Erythrina decora*.

The removal and loss of flora within the designated magazine area will not significantly reduce overall plant cover as the area being cleared is minuscule compared to the entire vegetation of ML 31 (~2.76 m²). However, woody plant species present in this semi-arid environment serve critical ecological functions, particularly in soil stabilisation through their root networks (Joubert *et al.*, 2008). Their removal may leave soils exposed and highly vulnerable to both wind and

water erosion (González-Botello & Bullock, 2012). In turn, this can generate increased dust emissions such as PM₁₀ and PM_{2.5}, which may reduce air quality and as dust lands on nearby shrubs and grasses it will hinder photosynthetic processes in nearby vegetation (Kameswaran *et al.*, 2019).

Water erosion during rainfall events may further mobilise loose sediments, leading to the siltation of nearby ephemeral drainage lines and downstream watercourses. Such sedimentation can alter hydrological flows, reduce water quality, and negatively affect riparian habitats (Hartsch & Singh, 2019).

The proposed Project activity, vegetation clearing, is anticipated to have a direct and adverse impact on the environment. This impact is a direct result of the interaction between the Project's activities and the natural surroundings, specifically leading to vegetation loss, potential loss of protected species on ML 31 and soil erosion.

The impact is partly - reversible, given that it is difficult to restore the soil's previous productivity and rehabilitate the area once the vegetation has been cleared and the topsoil is lost. However, it is not impossible and recolonisation can occur if all requirements for rehabilitation are correctly planned and implemented (e.g. topsoil conservation). The duration of the impact is medium-term, as the effects are expected to persist after the activity ceases but are not expected to last more than 15 years.

Although the area to be cleared is relatively small (approximately 2.760 m², comprising a 60 m × 46 m footprint with an additional 10 m offset and a 5 m clearance around the fence line) compared to the overall ML 31 footprint, the magnitude of the ecological change is considered high. This is due to the potential removal of protected plant species, which could alter the local species composition, density and abundance within the affected area. Furthermore, the increased dust from the clearing may affect nearby vegetation life by covering their leaves and reducing their photosynthetic ability, which in turn could degrade the overall quality of the vegetation in that area. Thus, there will be a very minor loss or detrimental alteration to one element of the vegetation in that area.

The extent of the impact is on-site, as it will be confined to the specific Project site where the clearing occurs. The probability of this impact occurring is likely, based on observations from similar projects where vegetation has been removed.

The sensitivity of the biophysical environment for this impact is assessed as high, given that the removal of protected species from their natural habitat, without assurance of successful rehabilitation or re-establishment, represents a matter of national ecological importance. Furthermore, the potential loss of these species is significant. Therefore, the significance of this impact has been rated adverse major (before mitigation) (Table 29). Mitigation measures are described below and are also included in the Navachab OEMP: Domain 8 (Appendix B). With the

required mitigation measures adopted, the significance of the impact will be reduced to adverse moderate.

Proposed mitigation measures to be implemented:

- Protected tree species to be identified, demarcated clearly and uprooting of trees to be avoided, where possible;
- Seed and sample collection to be done for future rehabilitation purposes;
- Permits to be acquired from MEFT if protected trees are to be removed and/or relocated;
- No unauthorised removal of vegetation is allowed;
- Flora incidents to be reported and recorded as per the incident management procedure;
- Prevent and discourage the collecting of firewood as dead wood has an important ecological role – especially during the development phase(s). Such collecting of firewood, especially for economic reasons, often leads to abuses – e.g. chopping down of live and/or protected tree species such as *Vachellia erioloba*, etc. which are good quality wood.
- Educate/inform contractors and staff on protected species to avoid and the consequences of illegal collection of such species;
- Protected vegetation will be identified and avoided;
- Relocation of important fauna and flora species to be conducted before clearing commences, with the support of a specialist, if required;
- Topsoil to be removed and stockpiled as per the rehabilitation plan;
- Stockpiles will be managed in such a way to ensure they are not impacted upon, are not susceptible to erosion and designed in such a manner to promote the survival of the seed banks;
- Sensitive areas (e.g. protected vegetation) to be demarcated with appropriate demarcation tape;
- Disturbance to be restricted to approved areas only;
- Where areas have been unnecessarily disturbed, these will be immediately rehabilitated
- Re-seed bund walls with seeds from sacrificed protected tree species – i.e. collect seeds from *Vachellia erioloba*, *Moringa ovalifolia*, *Sterculia africana*, etc. and re-seed after covered with soil;
- Consider the importance of preserving wildlife and ecology throughout this Project clearing phase, by ensuring that all precautions are taken into consideration and have as little harmful impacts as possible;
- Any identified flora species are to be relocated to the nursery before construction activities commence;
- If required, relocate fauna of concern (e.g. borrows) before construction activities commence;
- Where required, the Project area is to be rehabilitated before being handed over for operations

- A close-out inspection must be conducted with the contractor, domain manager and OHSE department on Project completion; and
- Rehabilitate cleared or disturbed areas promptly using indigenous plant species to stabilise soils and reduce colonisation opportunities, especially the protected species e.g. *Moringa ovalifolia* because indigenous species require less water and overall maintenance

7.5.2.1.2 *Land clearing and vegetation loss may result in the colonisation of the area by alien invasive plant species*

As mentioned in section 5.7, the area is characterised by bush thickening (encroachment) and the removal of natural vegetation exposes bare soil, increasing vulnerability to colonisation by alien invasive plant species (Bethune *et al.*, 2004). These species may be introduced unintentionally by seeds on the wheels of construction vehicles, equipment workers (ICMM, n.d.) or through imported construction soils. Invasive plants establish rapidly due to fast growth rates and effective reproduction, outcompeting slow-growing indigenous shrubs and grasses (Montesinos, 2021). Dense infestations compete for sunlight, soil nutrients and limited water resources, intensifying water scarcity among plant species. This suppresses native plant growth and could lead to the loss of local shrubland (Funk, 2013). A decline in shrubland habitat would have secondary impacts on dependent flora and fauna species.

The introduction of invasive alien species poses an adverse and direct impact on the on-site terrestrial ecosystem. These species negatively affect the composition and structure of the local environment by outcompeting native flora and fauna. The magnitude of change is high, as the presence of these species can lead to a loss of resources and degrade the overall quality and integrity of the ecosystem and its microclimates. The duration of the impact is medium-term, likely to last between 5 to 15 years after the Project's operation ends. However, this impact is considered reversible, provided that effective measures are implemented to remove the species and prevent their spread to the wider ecosystem. The extent of the impact is localised to the Project site, if the presence of the invasive species is actively monitored and controlled. The probability of this occurring is likely, given the rapid growth and effective reproductive rates of alien invasive species.

The sensitivity of the biophysical environment to this impact is low, as its value and importance are considered low if the issue is contained within the Project area. Consequently, the overall significance of this impact is rated as adverse moderate (before mitigation) (Table 29).

Mitigation measures include and are described in the Navachab OEMP under Domain 8 (Appendix B):

- Develop and implement an invasive species management plan outlining prevention, early detection and control procedures for alien species during construction and operations;

- Conduct a pre-construction survey to identify existing invasive species and sensitive native vegetation to inform site-specific management actions;
- Strip, store, and re-use topsoil separately to prevent contamination with invasive plant material or seeds;
- Ensure that imported construction materials (e.g., soil, sand, gravel) are certified free of alien plant seeds and propagules;
- Require all vehicles, machinery and equipment entering or leaving the site to be cleaned to remove soil, plant material, and seeds;
- Conduct environmental induction sessions to educate workers on identifying invasive species and the importance of preventing their spread;
- Limit vegetation clearing strictly to designated areas to minimise soil exposure and disturbance;
- Rehabilitate cleared or disturbed areas promptly using indigenous plant species to stabilise soils and reduce colonisation opportunities, especially the protected species e.g. *Moringa ovalifolia* because indigenous species require less water and overall maintenance
- Prevent the planting of potentially invasive alien plant species (e.g. *Tecoma stans*, *Pennisetum setaceum*, etc.)
- Re-seed bund walls with seeds from sacrificed protected tree species – i.e. collect seeds from *Vachellia erioloba*, *Moringa ovalifolia*, *Sterculia africana*, etc. and re-seed after covered with soil.
- Implement erosion control measures such as mulching, sediment barriers and watering to reduce seed dispersal through wind and runoff;
- Manually remove or chemically treat invasive species before they seed or spread.
- Dispose of plant material safely (e.g., offsite incineration or deep burial);
- Keep detailed records of infestations, removal actions, and monitoring results. Review and adjust control measures annually based on effectiveness; and
- Continue invasive species monitoring for at least 3 – 5 years after Project closure to ensure long-term ecosystem recovery.

7.5.2.1.3 Hydrocarbon spills may result in the ecological disruption of flora

Hydrocarbon spills from construction and operational equipment and vehicles and ANFO can have severe and lasting effects on shrubs and grasses, primarily by contaminating the soil with toxic chemicals, which disrupt root function and nutrient uptake (Correa *et al.*, 2022). The ammonium nitrate component can acidify the soil, further stressing the plants (Arnall, 2024). Airborne toxins and physical damage from accidental fires at the magazine can harm foliage and hinder photosynthesis, while spills can also disrupt soil microbial communities, affecting nutrient cycling. Over time, toxic chemicals can accumulate in plant tissues, affecting the broader food chain and potentially reducing biodiversity in the local ecosystem (Dehkordi *et al.*, 2024).

The nature of this impact is adverse as the impact may result in soil contamination, thus disrupting root function and affecting nutrient uptake. The type of impact is direct as the impact will occur from direct interaction between the activity and the receptors being the shrubs and grasses. This impact is considered reversible, as the habitat and ecosystems can be restored, with the same vegetation types and species if the area is adequately rehabilitated, if the impacted individuals are lost. Proper use of spill kits will help contain and prevent the spread of hydrocarbons, thereby minimising further impacts on surrounding vegetation. The duration is medium term as the impact will last 5 - 15 years after the construction, operation and decommissioning of the explosives magazine as these plants will be permanently damaged. The magnitude of change is moderate as vegetation will be lost; however, the entire local ecosystem will not be affected, thus, resulting in only partial damage to the surrounding habitat. The extent of the impact will be on site as the impact will only affect those plants immediately affected by the spill and are contained within the boundaries of ML 31. The probability of the impact occurring is possible as the impact could occur as hydrocarbon spills have occurred on this Project site and other similar sites. The sensitivity of the impact is low as the impact is valued only on a local scale and can be rehabilitated and has capacity to accommodate change, therefore the significance of the impact has been rated adverse low (before mitigation) (Table 29). Mitigation measures are described in the Navachab OEMP: Domain 8 (Appendix B).

7.5.2.2 Fauna

7.5.2.2.1 *Increased construction noise, vehicle movement and human activity may result in loss of habitat and displacement of reptiles and small mammals*

At least 75 species of reptiles are expected to occur in the Karibib area with 34 species being endemic – i.e. 45.3% endemic. While at least 87 species of mammals are known and/or expected to occur in the general Karibib area of which 10 species (11.5%) are classified as endemic. At least 31% (27 species) of the mammalian fauna that occur or are expected to occur in the general Karibib area are represented by rodents of which 5 species (18.5%) are endemic.

The removal of shrubs and other vegetation may remove the providing habitat for small mammals, reptiles and invertebrates, as clearing reduces available shelter, nesting sites and foraging grounds (Day *et al.*, 2003). Removal of shrubs and grasses eliminate microclimates such as shade, that smaller species depend on (Thomas *et al.*, 2018). During land clearing smaller less mobile species such as reptiles and burrowing mammals may be killed during vegetation removal and soil excavation (Finn & Stephens, 2017). Furthermore, construction noise, vehicle movement and increased human activity in the area may lead to the temporary or permanent displacement of reptiles and mammals (Wildlife Trusts Wales, n.d.).

The construction and operation of the explosive magazine will have a direct and adverse impact on local terrestrial fauna. This is due to the potential loss or displacement of reptiles and small mammals in the Project area, which will reduce the abundance, diversity and species richness of the ecosystem.

The magnitude of this change is moderate because the loss of these animals will directly affect the integrity and quality of the local ecosystem. However, the impact is considered reversible, as these animals are likely to return to the area once human activity and disturbance decreases, additionally there is already vehicle movement and human activity in the area as the proposed location of the additional magazine is between two other existing explosive magazines. Therefore, fauna in the area have already moved away from the area or have assimilated to the vehicle and human movement.

The duration of the impact is short-term, as it is expected to last only for the duration of the construction and operation phases (5 years). The extent of the impact is on-site, meaning it is confined to the specific area of the magazine's construction and operation.

The probability of this impact occurring is likely, given that it is improbable for reptiles and small mammals to remain in an area with excessive noise and movement. The sensitivity of the biophysical environment to this impact is low, if the impact remains within the Project area. Consequently, the overall significance of this impact has been rated as adversely low (before mitigation) (Table 29). Mitigation measures are described in the Navachab OEMP: Domain 8 (Appendix B).

7.5.2.2.2 *Toxicological and habitat Impacts of ANFO spills on small reptiles and mammals*

Hydrocarbon spills from construction and operational vehicles and equipment and ANFO can pose serious threats to small reptiles and mammals through direct toxicity, habitat degradation and food chain disruption. Contact with contaminated soil or inhalation of toxic vapours can cause skin irritation, respiratory issues, neurological damage or death. These animals may also ingest harmful substances through grooming or feeding on contaminated prey or plants. The destruction of vegetation and ground cover removes critical shelter and nesting areas, increasing exposure to predators and environmental stress. Additionally, spills can harm insects and plant populations that small reptiles and mammals rely on for food, leading to starvation or forced migration. Over time, bioaccumulation of toxins in body tissues can affect reproduction and lead to population decline, with broader consequences for the ecosystem (Spill Prevention, 2019).

The nature of this impact is adverse and direct as a hydrocarbon spill(s) could negatively affect reptiles and small mammals who encounter the spill(s). The impact is partly reversible as the area can be rehabilitated through immediate in situ bioremediation and decommissioning activities restoring their habitat. The magnitude of change is moderate as it could result in the loss of reptiles and small mammals in the area and could also be affected by the loss of their habitat and a decline in foraging due to the spill(s). The duration of the impact is temporary as it will only affect the fauna that come into immediate contact with the spill(s) and the spill(s) is /are likely to be contained and treated within a week, thus not further affecting any of the other animals in the area after that. The extent of the impact is on-site as the spill(s) will not spread beyond the Project area or ML 31 boundary and thus would not affect any fauna outside of this

area if the correct control measures are in place to contain the spill(s) from spreading to other habitat or drainage line(s). The probability of this impact occurring is possible as hydrocarbon spills have occurred on this Project site and similar sites however the frequency of occurrence is reduced by adequate mitigation and management measures to be implemented as per their OEMP. The sensitivity of the impact is low as the toxicological and habitat Impacts of ANFO spills on small reptiles and mammals are confined to onsite. Therefore, the significance of the impact has been rated adversely low (before mitigation) (Table 29). Mitigation measures are described in the Navachab OEMP: Domain 8 (Appendix B).

Table 29 - Impact of the construction and operation of an explosive magazine on biodiversity (flora and fauna)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Land clearing of the area required for the construction of the explosive's magazine	Terrestrial biodiversity and ecosystem	Destruction and loss of flora, reducing vegetation cover	Adverse Direct Medium-term Partly reversible On-site Likely	High	High	Major (9)
Land clearing of the area required for the construction of the explosive's magazine	Terrestrial biodiversity and ecosystem	Colonization of the cleared area by alien invasive plant species	Adverse Direct Medium-term Reversible On-site Likely	Low	High	Moderate (4)
ANFO spill from the explosive magazine	Terrestrial biodiversity and ecosystem	Hydrocarbon spills may result in the ecological disruption of flora (shrubs and grasses)	Adverse Direct Reversible Medium term On-site Possible	Low	Moderate	Low (2)
Increased noise, vehicle movement and human activity during the	Terrestrial biodiversity and ecosystem	Loss and displacement of reptiles and small mammals	Adverse Direct Short-term Reversible On-site Likely	Low	Low	Low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
construction and operation of the explosive's magazine						
ANFO spill from the explosive magazine	Terrestrial biodiversity and ecosystem	Hydrocarbon spill may result in the harm and loss of fauna specific reptiles and small mammals	Adverse Direct Temporary Partly reversible On-site Possible	Low	Moderate	Low (2)

7.5.3 SURFACE WATER IMPACTS

The surface water environment of the Project area is characteristic of an arid to semi-arid climate, where water resources are limited and highly variable. The region's hydrology is dominated by ephemeral river systems that only flow in direct response to infrequent rainfall events. The primary drainage feature in the area is the Khan River, which, while being a major catchment, is typically dry for most of the year. The mine is within the greater catchment of the Aroab River, which is located to the north of the site. Within the site, no defined rivers are present. The sporadic and intense nature of precipitation can lead to flash floods, making the presence of surface water a transient phenomenon. The construction and operation of the explosive magazine will have several impacts on nearby surface water drainage lines, tributaries, the Slang River and other surface water bodies (e.g. the open pits) on ML 31 shown in Figure 35 in section 5.6. The surface water impacts are illustrated in Figure 60, before mitigation and are further summarised in Table 30.

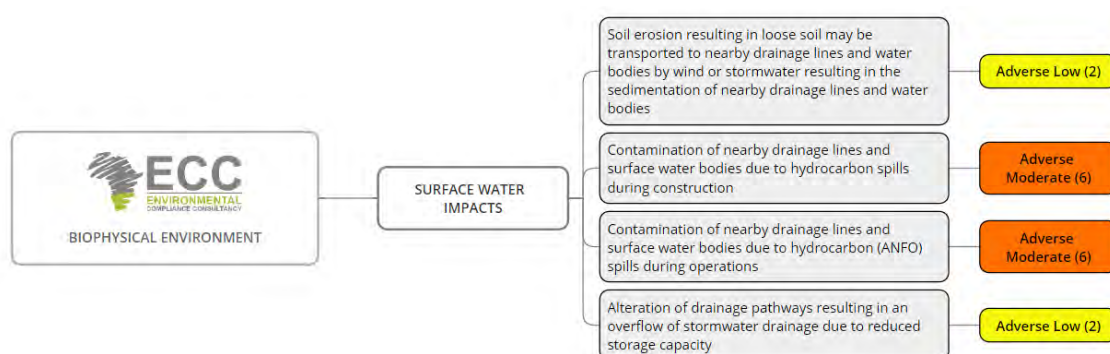


Figure 60 - Surface water impacts from the construction and operation of an explosive magazine

7.5.3.1 *The development of the explosive magazine site may result in erosion leading to sedimentation of nearby drainage lines*

Land clearing, vegetation removal and earthworks activities undertaken to establish the magazine footprint will increase soil exposure and susceptibility to erosion, especially on the sandy to gravelly substrates typical of the Navachab area. During high-intensity rainfall events, these exposed soils are prone to significant sediment mobilization, leading to elevated levels of total suspended solids (TSS) in surface runoff. Sediments act as vectors for adsorbed pollutants such as heavy metals, fuel hydrocarbons and undissolved explosive particles, facilitating their transport to ephemeral streams and storage reservoirs. Elevated levels of TSS reduce light penetration, impair aquatic productivity, clog channel beds and smother benthic habitats. Furthermore, erosion can compromise the stability of constructed berms and diversion channels, increasing the risk of structural failure and the uncontrolled release of potentially contaminated stormwater.

The nature of this impact is adverse and cumulative as sedimentation of nearby drainage lines will adversely affect surface water quality from all three (3) magazines. This impact is reversible; however, the extent of recovery depends on the volume of sediment accumulation. Light sediment deposits can typically be removed through routine maintenance, whereas heavier or long-term sedimentation may require more intensive interventions such as mechanical removal (excavation, flushing, vacuum trucks), reshaping the drainage channels to restore flow capacity or installation of sediment traps to intercept sediments upstream before they reach main drainage lines. The magnitude of change is considered low as the area to be cleared is relatively small (approximately 2 760 m², measuring 60m x 4 6m with 10 m offset and 5 m clearance around the fence). As a small portion of land will be disturbed, this will result in a minimal risk of erosion-induced sedimentation. Therefore, no significant or lasting changes to key characteristics of surface water are expected.

The duration of the impact is considered temporary as erosions are expected to occur primarily during the construction phase, which would typically last one to two months, and only if construction coincides with the rainy season (October to April) or the windy season (August). With appropriate control measures in place, the impact can be effectively managed prior to the onset of the next rainy season, and before sediment reaches major drainage lines. This will reduce the duration of impact to less than a year. The extent of the impact is local as sedimentation can be controlled within the Project site, however there is still a possibility for sedimentation and the spread of pollutants to downstream drainage lines and water bodies spreading beyond the Project area, particularly during intense stormwater events and heavy rainfall events. The probability of this impact occurring is rated as possible (medium). The sensitivity of the impact is low as the drainage lines and water bodies that may be affected are of local importance (for their hydrological functions which include the conveyance of runoff and the temporary retention and infiltration of stormwater). The sensitivity of the impact is rated low due to low probability of the event occurring as the magazine footprint is relatively small. The impact is expected to induce manageable environmental disturbances. Overall, the

significance of the impact is rated as adversely low, before mitigation measures (Table 30). Mitigation measures are included in the Navachab OEMP under Domain 8.

7.5.3.2 Hydrocarbon spills at the explosive magazine may contaminate nearby surface water in nearby drainage lines during construction

During the construction phase, the primary risk of hydrocarbon and chemical spills associated with the explosive's magazine arises from the handling, storage, and transfer of fuels, lubricants, and other hazardous substances required for construction activities. These risks are mainly linked to the operation and refuelling of construction vehicles, generators, and equipment, as well as the temporary storage of hydrocarbons on-site. Accidental leaks or spills may occur during fuel transfer, because of damaged containers, overfilling, or inadequate bunding and containment measures. In addition, poor housekeeping practices or the improper disposal of oily rags, used oils, and chemical containers can increase the likelihood of contamination. If not properly managed, spilled substances can be transported by stormwater runoff into surrounding soils, drainage lines, or nearby surface water bodies, potentially resulting in surface water pollution. Therefore, strict adherence to hazardous material handling procedures and implementation of spill prevention and containment measures are essential to mitigate these risks.

The nature of this impact is adverse as it involves the potential pollution of nearby drainage lines and surface water bodies, directly affecting water quality. The impact is direct as pollutants will originate from hydrocarbon spills used in equipment during construction. The impact is considered partially reversible, depending on the scale and response time. Small spills and leaks can typically be addressed through prompt remediation measures. However, if clean up actions are delayed or inadequate, long-term contamination may occur. The duration of the impact is assessed as short-term as pollutants may remain in the environment (soils and geological substrates) for up to 1–5 years, following cessation of construction activities.

The extent of the impact is considered regional as the pollution of drainage lines, Aroab River, the Slang River and other surface water bodies can be transported beyond the Project boundaries. The magnitude of change is rated high due to the potential deterioration of surface water which could limit water usage. Furthermore, as stated above these drainage channels concentrate the flow of contaminants during heavy storm flow events, which may result in polluted drainage lines and surface water bodies, which then continue to wash contaminants to other downstream drainage lines and surface water bodies. The likelihood of the impact is rated as medium (possible), at an estimated frequency of one (1) event every ten (10) years, particularly if stormwater management infrastructure, diversion channels and containments are not properly or adequately maintained. The sensitivity of the impact is rated as medium as surface water resources are valuable, and the quality of water will ensure unrestricted usage. Overall, the significance of the impact has been rated adverse moderate, before mitigation (Table 30).

The following mitigation measures should be applied and are included under Domain 8:

- Ensure proper storage, use and management of hydrocarbons and chemicals on site are implemented;
- Spill kits and spill absorbent treatment material to be present for quick reaction times to handle small and large spills;
- Incident reports to be compiled for each spill event as per the incident management procedure;
- Should a temporary satellite refuelling bay be needed for construction of the third explosive magazine established near the construction site to position the fuel tank in order to facilitate quick refuelling of equipment and machinery whilst construction is ongoing;
- The satellite refuelling bay should be properly bunded to reduce the risk of fuel discharged to the environment;
- Traces and spills of hydrocarbons observed from daily inspections should be cleaned up and be removed immediately;
- Soils to be treated in situ and where this is not possible, soils to be removed to the bioremediation facility for further treatment.

7.5.3.3 *Hydrocarbon spills at the explosive magazine may contaminate nearby surface water in nearby drainage lines during operations*

The primary risk of hydrocarbon spills from the explosive's magazine arises from the potential release of explosive compounds such as NH_4NO_3 , nitro-glycerine, TNT by-products, and hydrocarbon-based emulsifiers or fuel containers. These substances are highly soluble and mobile in water. Furthermore, nitrate ions are conservative tracers in hydrological systems and can rapidly migrate with surface runoff, leading to eutrophication of downstream water bodies and elevated nutrient loading in non-perennial channels. Hydrocarbons, on the other hand, exhibit lower solubility but can form persistent surface films, decrease dissolved oxygen and impair aquatic habitat quality. In semi-arid systems like Navachab, where ephemeral channels concentrate flow during high-intensity storm events, even small spills may result in high-concentration pulses that exceed water quality guidelines for nitrates ($>10 \text{ mg/l NO}_3^- \text{-N}$).

The nature of this impact is adverse as the impact will result in the pollution of nearby drainage lines and nearby water bodies. The impact will directly affect the water quality of surface water in the affected drainage lines and water bodies. The impact is partially reversible, depending on the volume of spill. Small spills and leaks can be addressed through immediate remediation measures, however, if clean up measures are not promptly initiated, long term contamination may occur. Large-scale spillage would trigger immediate emergency response actions, and if not implemented promptly or effectively, the full extent of the spillage may not be fully recovered. The primary concern is ammonium nitrate, which is highly soluble in water and readily leaches into surface drainage lines. This can lead to eutrophication and consequently disrupting natural nutrient balances in aquatic ecosystems. The duration of the impact is considered short-term, as pollutants may persist in the environment for up to 1–5 years after operational activities have ceased, depending on site conditions and the effectiveness of mitigation efforts.

The extent of the impact is considered regional as the pollution of drainage lines, Aroab River, the Slang River and other surface water bodies can be transported to regional drainage lines and water bodies beyond the Project boundaries. The magnitude of change is rated high as there will be deterioration of water quality, which limits usage. However, these drainage channels also concentrate and convey contaminants during intense storm flow events, often transporting pollutants from surrounding areas. This can result in short-duration, high-concentration pulses that exceed water quality guidelines for nitrates. The impact may occur approximately once every ten years if stormwater management systems, containment dams and diversion channels are not properly and adequately maintained. The sensitivity of the impact is medium as surface water resources are important on a regional scale and there is limited potential to accommodate change. Any remediation measures may also be costly. Overall, the significance of the impact is rated as adverse moderate, before mitigation measures (Table 30).

The following mitigation measures should be applied and are included in the Navachab OEMP under Domain 4:

- Implement the requirements outlined in the stormwater management plan and in the OEMP;
- Construct the magazine with impermeable flooring, bunding, and sumps to contain spills;
- Maintain separation of clean and dirty stormwater and regularly inspect containment systems;
- Implement strict handling and storage procedures for explosives and hydrocarbons;
- Keep spill kits on-site and train staff in immediate spill response and cleanup;
- Monitor water quality (nitrates, ammonia, hydrocarbons) in nearby drainage lines;
- Ensure routine inspections and maintenance of drainage and containment structures;
- Dispose of contaminated materials adequately; and
- Rehabilitate affected areas and review management plans after any incident.

7.5.3.4 *The construction of the explosives magazine may cause an alteration of drainage pathways, resulting in an overflow of stormwater drainage due to reduced storage capacity*

Construction of the explosive magazine can modify natural hydrological connectivity, divert ephemeral surface flows and increase the probability of hydraulic mixing between clean and contaminated runoff. The site is characterised by flash runoff responses due to sparse vegetation and steep slopes. Intense storm events can generate high peak discharges (design basis: 1:100-year, 24-hour storm). Should clean-water diversion berms fail, contaminated water volumes could increase significantly and overwhelm dirty water containment systems. Furthermore, pollution control dams (PCDs) and informal storage areas behind waste dumps have finite freeboard and may overtop during extreme rainfall or operational mismanagement. Overtopping events can cause rapid downstream pollutant transport, while seepage from

unlined PCDs introduces the risk of vertical migration of contaminants into aquifers, later re-emerging as baseflow in surface channels. The requirements of the stormwater management plan are still to be implemented.

The nature of this impact is adverse as the impact will alter drainage lines, water flow regimes and patterns. Additionally, there is a potential risk of clean water mixing with contaminated water on-site, which could further degrade surface water quality. The impact will directly affect stormwater drainage systems and may divert into other areas of the mine. The impact is assessed as reversible, particularly if proactive measures such as the construction of dedicated dirty water drainage lines to manage and redirect contaminated surface runoffs around the explosive magazine. The duration of the impact is temporary as the impact is only expected to occur during the rainy season, which is a period from October to April (less than a year). The extent of the impact is on-site as the impact will only affect the flow of water in the immediate explosive magazine area (not expected to beyond the Project site/ML 31 boundary). The magnitude of change is low as surface runoffs will be altered and there is a potential risk of contact between clean and dirty water. The likelihood of this impact is rated as possible (medium), as flash flood events have been recorded on-site within the past five (5) years. If the stormwater management measures outlined in the management plan are not properly implemented, the risk of occurrence increases significantly. The sensitivity of the impact is rated low as surface runoff and flow regimes beyond the Project sites are not expected to be impacted. Overall, the significance of the impact is rated as adverse low, before mitigation (Table 30). The mitigation measures provided in the Navachab OEMP under Domain 4.

Table 30 - Surface water impacts from the construction and operation of an explosive magazine

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Construction of the explosive magazine	Surface water quality and drainage line capacity	Soil erosion resulting in loose soil may be transported to nearby drainage lines and water bodies by wind or stormwater resulting in the sedimentation of nearby drainage	Adverse Direct Reversible Temporary Local Possible	Low	Low	Adverse Low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		lines and water bodies				
Construction of the explosive magazine and accidental hydrocarbons (ANFO) spill at the explosive magazine	Surface water quality	Contamination of nearby drainage lines and surface water bodies due to hydrocarbon spills during construction	Adverse Direct Partly reversible Short term Regional Possible	Medium	High	Adverse Moderate (6)
Operation of the explosive magazine and accidental hydrocarbons (ANFO) spill at the explosive magazine		Contamination of nearby drainage lines and surface water bodies due to hydrocarbon (ANFO) spills	Adverse Direct Partly reversible Short term Regional Possible	Medium	High	Adverse Moderate (6)
Construction of explosive magazine	Nearby drainage lines and pathways	Alteration of drainage pathways resulting in an overflow of stormwater drainage due to reduced storage capacity	Adverse Direct Reversible Temporary On-site Possible	Low	Low	Adverse Low (1)

7.5.4 GROUNDWATER IMPACTS: UNDERGROUND MINING

Navachab commissioned SRK Consulting in 2021 to undertake a site-specific hydrogeological assessment aimed at understanding the prevailing hydrogeological conditions at Navachab. The study aimed at understanding groundwater characteristics and associated risks and impacts to guide the planning and design of the trial underground mining activities (an initial step in Navachab's underground mining program). The hydrogeological report is presented in Appendix D.

The underground mining operations at Navachab Gold Mine presents a range of potential impacts on the groundwater regime that require careful evaluation. As mining progresses below the surface, changes to the hydrogeological environment such as drawdown, dewatering and potential contamination may arise. This impact assessment refers to available hydrogeological data, predictive models and relevant baseline studies to inform management strategies that ensure sustainable underground mining, long-term groundwater management and preservation and regulatory compliance. An overview of the hydrogeological impacts is presented in Figure 61 before mitigation, for illustration purposes only. The impacts are discussed in detail in the sections below. A summary of the impacts is detailed in Table 31.

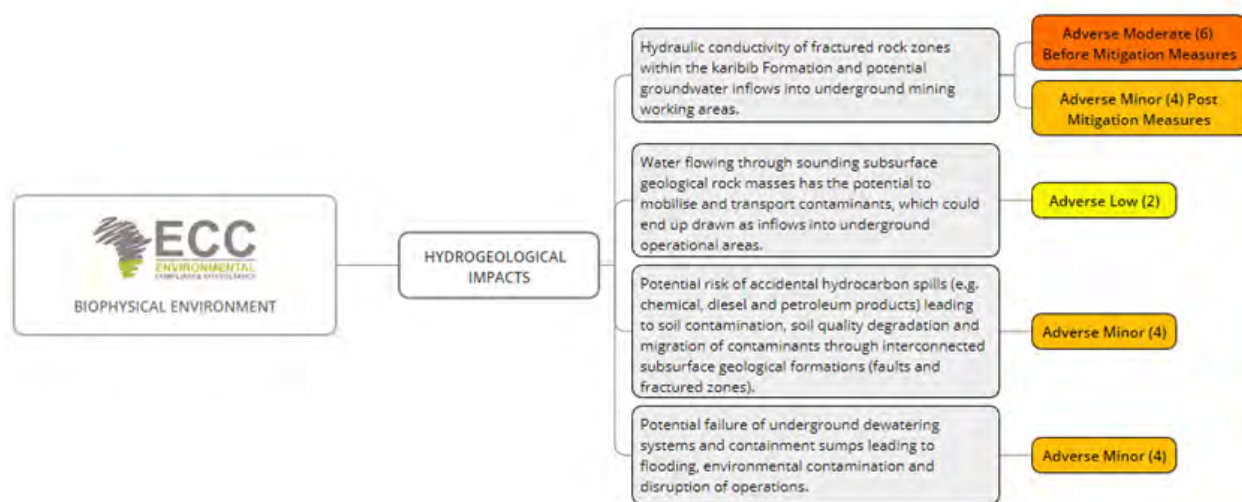


Figure 61 - An overview of the hydrogeological impacts

7.5.4.1 *Hydraulic conductivity of fractured rock zones within the Karibib Formation and potential groundwater inflows into underground mining working areas*

The proposed underground mining operations has the potential to interact with water in several ways. These interactions may involve groundwater inflows, groundwater intercepted in fractured rock zones, water-bearing sediments, perched water bodies and potential inrush events. Once intercepted, dewatering may be required to ensure safe and dry mining.

The groundwater investigation conducted by SRK Consulting in 2021 within the Karibib Formation focused on five (5) coreholes (NGT20, NGT21, NGT22, NGT23 and NGT24). The results indicate that fractured contact and shears exhibit hydraulic conductivity values ranging between 1×10^{-2} m/d and 1×10^{-1} metre per day (m/d). Notably, a high hydraulic conductivity

of 1.6×10^{-1} m/d was recorded in corehole NGT22, located northwest of the north pit of the main open pit, within the sheared fault. Artesian conditions were encountered at this location during drilling, suggesting elevated groundwater pressure. It is important to note that fractures with hydraulic conductivity values between 0.1 to 1 m/d have the capacity to transmit significant volumes of water to underground working areas, while moderate inflows are likely from zones with conductivities between 0.01 and 0.1 m/d zones. These results are presented in Figure 62.

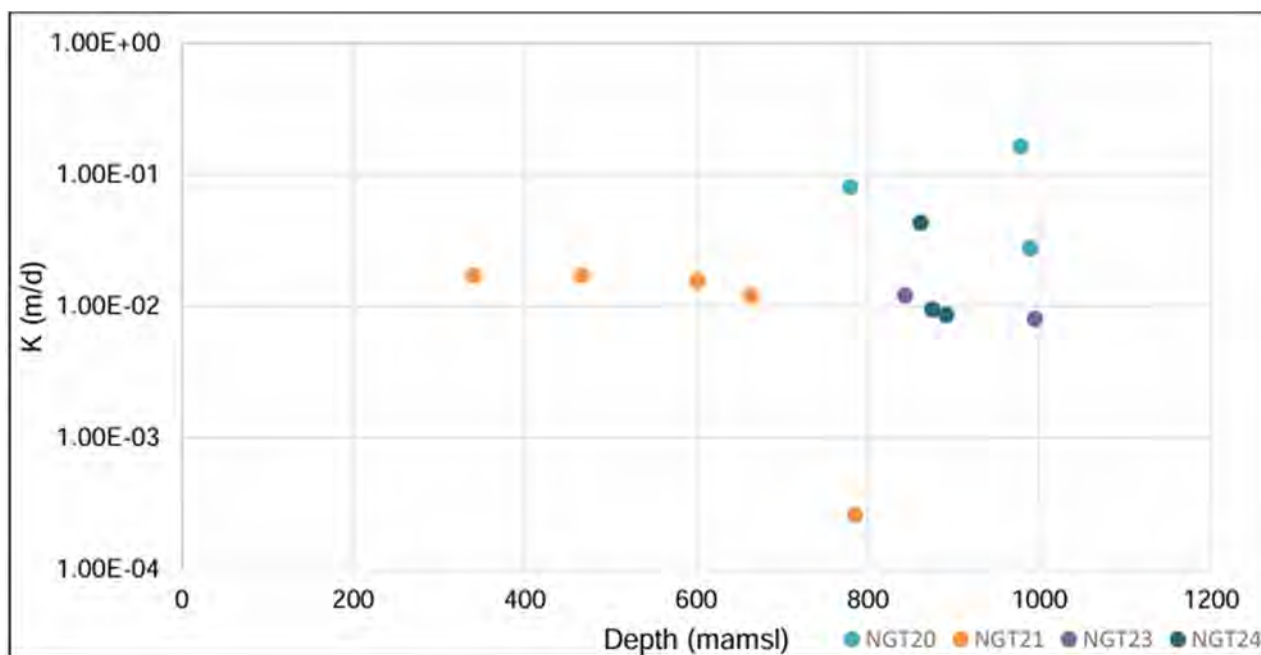


Figure 62 - Results of hydraulic conductivity testing conducted on five (5) coreholes (SRK Consulting, 2021)

The findings of the groundwater investigation as shown in Figure 63 suggests that fractured and faulted zones within the Karibib Formation have the potential to contribute moderate to significant groundwater inflows into the proposed underground mining areas. NGT22, located in the sheared fault zone exhibit both elevated hydraulic conductivity and artesian conditions, which indicate the potential for substantial localised inflows if intersected.

The hydraulic conductivity values obtained from the investigation were further incorporated into the groundwater inflow model. The model predicts that inflows into underground working areas will range between 199 and 1 260 cubic metre per day (m^3/d) (refer to Figure 63), depending on the specific mining level. However, inflows into the shallower sections are expected to decrease over time as mining progresses to deeper levels. This reduction is attributed to the gradual depletion of aquifer storage and depressurisation of the surrounding rock mass in response to tunnelling activities.

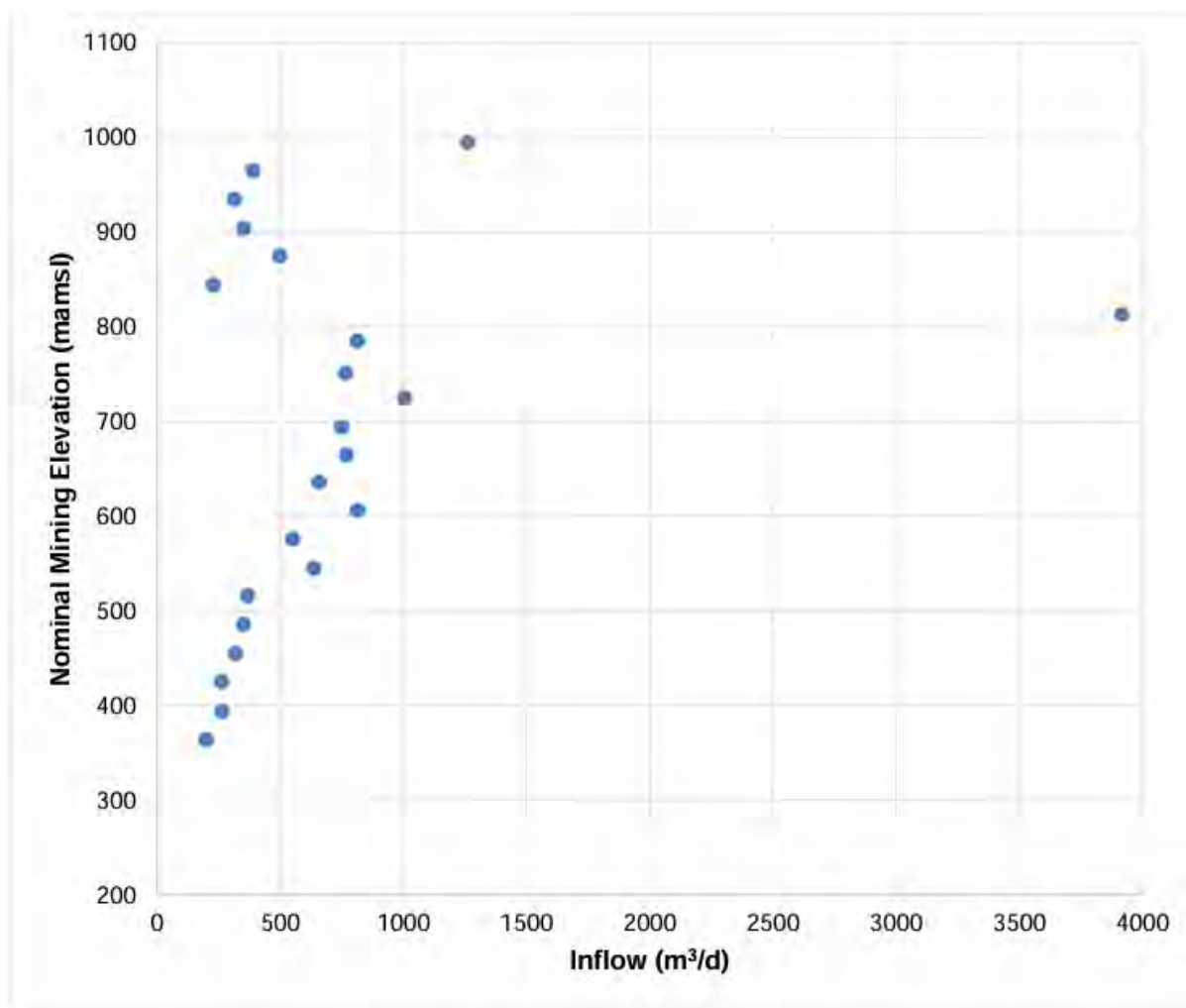


Figure 63 - Estimated groundwater inflows of each mining level (SRK Consulting, 2021)

Groundwater inflows during underground mining pose several operational and environmental challenges. Excess water entering working areas can hinder access, disrupt production and increase safety risks such as flooding or rock instability. Additionally, managing these inflows requires extensive dewatering infrastructure efforts (managing the cone of depression), raise operational costs and energy use.

The potential risk for adverse, direct and irreversible impacts from excessive inflows and dewatering exists in theory. However, based on the groundwater inflow model, significant inflows are not expected to occur. The predicted inflows are minimal and suggest that the Karibib Formation is not a major groundwater reservoir. Therefore, the probability of the impact is rated medium as inflows may occur under certain conditions (e.g. intersection of highly saturated faults or fractured zones and occurrence of rainfall causing groundwater recharge and leachate). The magnitude of impact is rated moderate, and the sensitivity of impact is rated medium due to the risks and challenges associated with groundwater inflows into mining areas. Overall, the significance of impact is rated adverse moderate (before mitigation) (Table 31)

In the event that groundwater inflows into operational areas lead to gradual accumulation, the following mitigation measures must be implemented (Theu & Mohamed, 2021):

- Temporary collection sumps should be constructed for accumulated groundwater to be managed with haulage drains (ensure the dewatering program is followed and monitoring and reporting on the dewatering plan is undertaken);
- Measure groundwater inflow volumes into the working areas so that any required adjustments to groundwater management can be implemented to ensure safe and dry mining;
- During cover drilling in areas with poor ground conditions, the presence of groundwater and the volume of its flows should be monitored and recorded;
- Ensure emergency response procedures are in place in the event of an inrush event;
- Ensure adequate pumping capacity with back up pumps as critical spares are kept on site;
- Maintain documentation of groundwater occurrence depths together with descriptions of the geological structures associated with it; and
- Maintain the groundwater monitoring program for the Project and establish additional groundwater monitoring piezometers around the northern pit.

These mitigation measures have also been included in the OEMP under Domain 4 (Appendix B).

7.5.4.2 *Water flowing through surrounding subsurface geological rock masses has the potential to mobilise and transport contaminants, which could end up drawn as inflows into underground operational areas*

Water flowing through surrounding rock masses has the potential to mobilise and transport geochemical constituents, those naturally occurring or mining related contaminants (i.e. contaminants from the tailings storage facilities (TSF) and waste rock dumps (WRD)). Where hydraulic connectivity exists between rock masses, such contaminants flow into underground mine working areas.

The predictive models in the hydrogeology report by SRK Consulting (2021) (Appendix D) have been used in this assessment to understand groundwater behaviour within the Karibib Formation, particularly in the vicinity of the main open pit. The models and results indicate that the rock mass in the vicinity of the pit, although generally dense with low primary permeability, may exhibit hydraulic connectivity in certain areas due to structurally controlled secondary permeability. These zones include fractures, joints, bedding planes, dyke contacts and shear zones, which may interconnect to form continuous flow pathways. Where continuous hydraulic connectivity exists, groundwater can move more freely through the rock masses and drawn to underground mining operational areas. Such inflows pose environmental compliance challenges and may contribute to equipment corrosion.

This impact is adverse, irreversible and will result from direct intersection of highly fractured or faulted zones. This impact is likely to arise only under specific conditions, such as when highly

fractured or faulted zone are intersected during drilling or during intense rainfall events that result in rapid groundwater recharge and leachate generation. Therefore, the probability of this impact is rated as medium. However, overall groundwater inflows are expected to remain relatively low (as per the groundwater inflows predictive model and discussion in section 7.5.4.1). Significant inflows are not anticipated over time, and no major environmental impacts are expected. Any inflows that occur are likely to be manageable within the planned mine water control and dewatering processes. As such, both magnitude of change and sensitivity of impact are rated as low. The significance of impact is rated adverse low, (before mitigation) (Table 31). Mitigation measures are included in the Navachab OEMP under Domain 4 (Appendix B).

7.5.4.3 *Potential risk of accidental hydrocarbon spills (e.g. chemicals, diesel and petroleum products) leading to soil contamination and quality degradation and migration of such contaminants through interconnected subsurface geological formations*

Underground mining operations present a risk of soil and groundwater contamination resulting from handling, storage and the use of various hazardous materials, such as hydrocarbons (e.g., diesel, petroleum, lubricants) and blasting explosives (e.g., ammonium nitrate-based products). Additionally, continuous vibrations may destabilise chemical storage containers. These substances can enter the subsurface environment through accidental spills, leaks or improper disposal, particularly in areas where fractured rocks or fault zones provide pathways for contaminant transport. Once introduced, contaminants may dissolve and be transported via groundwater flow, potentially affecting water quality both within and beyond the mining area.

The contamination of soil and groundwater sources is considered an adverse environmental impact. Such contamination results directly from underground mining activities and, if not addressed promptly through appropriate remediation measures can persist in the long-term. Without timely remediation, such contamination can become unmanageable if contaminants migrate through interconnected subsurface rock masses. Once contaminants enter these pathways, containment and remediation could prove challenging. As a result, this impact is considered irreversible, with a high moderate of change (due to risks of changes to the geochemistry of other groundwater sources, should there be significant contaminant transport via interconnected faults and fractures). The sensitivity of the impact is rated as medium, due to the regional scale of potential environmental impacts and the challenges associated with the implementing effective remediation measures. The likelihood of the impact is rated as medium (possible), with no mitigation or precautionary measures implemented. However, the likelihood of the impact is rated low as proactive risk management strategies will be in place. These include workforce induction on hydrocarbon spill prevention, awareness on principal hazards, implementation of critical remediation measures, training in emergency response, preparedness and incident reporting and investigation. These measures are outlined in Navachab's safety, environment, quality and training management plan (SEQT) (Appendix B) and are included in the Navachab OEMP under Domain 4. Overall, the significance of impact is rated as adverse minor (before mitigation) (Table 31).

7.5.4.4 *Potential failure of underground dewatering systems and containment sumps leading to flooding, environmental contamination and operational disruption*

Underground mining operations typically require continuous dewatering to manage groundwater ingress and maintain safe working conditions. Water extracted from underground operational areas will be directed to surface via a network of pumping systems and temporarily stored in containment sumps before reuse in the processing plant for reuse in the processing circuit. However, the failure of these critical systems, whether through mechanical malfunction, structural compromise, or operational oversight presents a significant environmental impact and operational risk.

The impact is considered adverse as failure in pumping systems could lead to water accumulation within underground working areas, which could pose risks to workers safety, cause infrastructure damage and operational delays. In addition, a breach or overflow of containment sumps could release large volumes of contaminated or sediment-laden water into the surrounding environment (localised impact as soil, surface water quality and downstream ecosystems may be impacted). The severity of the impact depends on the concentration and composition of nutrients and other water quality parameters present in the discharged water. The impact is considered partly reversible as remediation measures can be implemented, although complete containment and recovery of contaminants may not be achievable in some cases. The likelihood of impact is assessed as low. Although equipment failures are an inherent risk in mining operations and can occur at any phase of the Project, operations, equipment will be closely monitored (e.g. routine pre-start checks on equipment and machinery). The magnitude of change is rated moderate, and the sensitivity is rated as medium as the impact can be managed and mitigated, especially if detected early, although they may require considerable resources and time to address. Overall, the significance of impact is rated adverse minor (before mitigation) (Table 31). Mitigation measures are included in the Navachab OEMP under Domain 4 (Appendix B).

Table 31 - Groundwater impact assessment ratings, before mitigation measures

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Underground mining activities	Water availability	Potential for groundwater inflows into underground mining areas	Adverse Direct Irreversible Long-term Local Possible (Medium)	Medium	Moderate	Adverse Moderate (6)

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
	Groundwater quality	Potential for contaminants featured within different subsurface geological rock masses to dissolve into groundwater flowing through them and interconnected faults and fractured networks and drawn into underground mining operational areas	Adverse Direct Irreversible Long-term On-site Possible (Medium)	Low	Low	Adverse Low (2)
	Soil quality and groundwater quality	Potential risk of accidental hydrocarbon spills (diesel, petroleum etc.) leading to soil contamination, soil quality degradation and migration of such contaminants through interconnected subsurface geological formations (faults and	Adverse Direct Irreversible Long-term Unlikely On-site	Medium	High	Adverse Minor (4)

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
		fractured zones).				
	Soil, surface water quality and downstream ecosystems	Potential failure of underground dewatering systems and containment dams leading to flooding, environmental contamination and operational disruption.	Adverse Direct Partly reversible Local Low probability Long-term	Medium	Moderate	Adverse Minor (4)

7.5.5 GROUNDWATER IMPACTS: CONSTRUCTION AND OPERATION OF THE ADDITIONAL (THIRD) EXPLOSIVE MAGAZINE

The baseline hydrogeological conditions at Navachab indicate several vulnerabilities that heighten the potential impacts associated with the construction and operation of an ammonium nitrate fuel oil (ANFO) explosives magazine. Although groundwater generally occurs at depths of 45 – 60 metres below ground level (mbgl), the fractured and fault-controlled nature of the aquifer significantly reduces the natural protection typically offered by the vadose zone. Zones of elevated hydraulic conductivity, such as the fault intersected at borehole NGT22, demonstrate the capacity for contaminants to be transmitted rapidly through structural pathways.

Furthermore, isolated karst pockets present a unique risk. These features can act as short-term sinks for nitrate-rich water, storing contaminants until hydraulic conditions change, at which point stored pollutants may be released as a “slug load.” Similarly, the depressurisation associated with the northwest (NW) – southeast (SE) trending fault structure increases the likelihood that any contamination would be drawn toward the main open pit.

The impacts assessed are illustrated in Figure 64 below, before mitigation measures and are discussed in detail in the sections thereafter. The impact assessment ratings are summarised in Table 32.

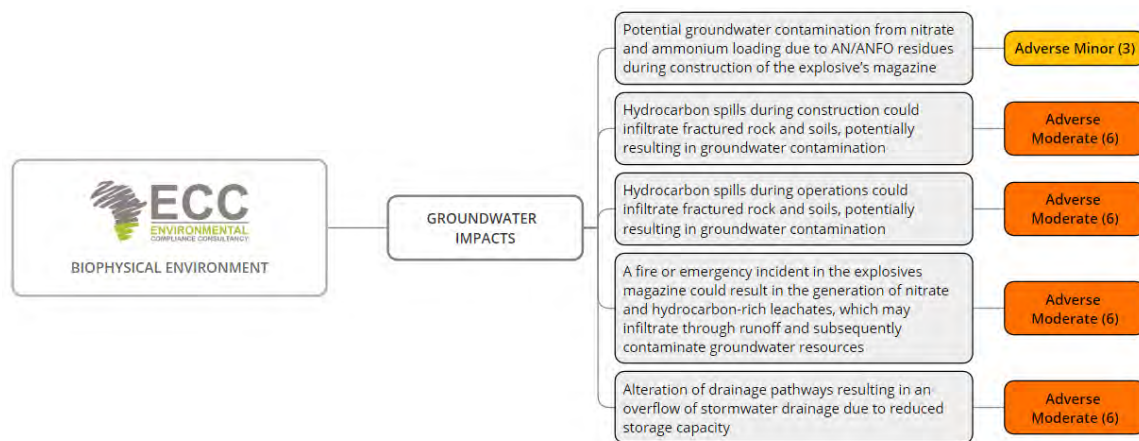


Figure 64 - Groundwater impacts from the construction and operation of an explosive's magazine

7.5.5.1 *Potential groundwater contamination from nitrate and ammonium loading due to AN/ANFO residues during construction of the explosive's magazine*

Ammonium nitrate is highly soluble, and even small amounts of spillage, drill dust or contaminated wastewater can leach rapidly through fractures and faults into the aquifer system. Given the structurally controlled nature of groundwater occurrence in the Karibib Formation, such contamination could preferentially migrate along fault zones or low-resistivity anomalies within the contorted marble (CM) and marble-dolomitic marble (MDM) units. The preferential NW – SE trending geological structure, already associated with a depression in groundwater levels, may act as a capture pathway, directing nitrate-rich water toward the open pit sump. Although this reduces the risk of contamination spreading off-site, it concentrates the load within the mine's dewatering system.

The nature of the impact is adverse and direct as the spill would result in contamination of the underlying aquifer system (groundwater resources). The impact is partially reversible as the contamination can be managed through remediation efforts. Remediation methods include biological remediation using microorganisms, chemical remediation using reactive chemicals or physical remediation using a pump and treat method. The duration of the impact will be long-term lasting between 5 - 15 years, without remediation but is recoverable through remediation. The extent of the impact is local as the underlying aquifer extend beyond the boundaries of ML 31, therefore third-party receptors that are reliant on the same groundwater resource are at risk of contamination. The probability of this impact occurring is possible, however rigorous mitigation measures have been included in the Project's OEMP to reduce the likelihood of this impact. The magnitude of change of the impact is moderate because there is a potential risk of groundwater quality deterioration, which could impact the supply and suitability to the users. The sensitivity of the impact is low as the groundwater resource is only of importance on a local scale and no regional impacts are anticipated. Therefore, this impact has been rated adverse minor (before mitigation) (Table 32). Mitigation measures are detailed in the Navachab OEMP under Domain 8.

7.5.5.2 *Hydrocarbon and ANFO spills during construction could infiltrate fractured rock and soils, potentially resulting in groundwater contamination*

Diesel fuel oil used during the construction of the explosive's magazine could be spilled during storage, transfer or use. As a light non-aqueous phase liquid (LNAPL), fuel oil (FO) could persist in the vadose zone but also migrate downwards via fractures. Spills of more than 200 L would result in regional groundwater contamination and soil quality deterioration, with long-term persistence if not remediated. Possible remediation methods include biological using microorganisms, chemical using reactive chemicals or physical using a pump and treat method.

This impact has been rated adverse and direct as it will pollute the underlying groundwater resource. The nature of the impact is partly reversible as the impact, if caught early and if not more than 200 L, can be remediated immediately in situ and would not require informing MIME, MEFT and DWA and could be handled internally. The duration of this impact would be long-term if not remediated and the extent of the impact is regional, spreading beyond the immediate boundaries of ML 31 and affecting local users, affecting nearby farmers and the Karibib community and the wider region. The magnitude of change is moderate because there will be a loss of groundwater quality thus also affecting the supply of groundwater to the users, but the aquifer's integrity will not be harmed. The probability of this impact occurring is likely as hydrocarbon spills have occurred on this Project site and other similar sites on a frequent basis. The sensitivity of the impact is medium as this groundwater resource is of importance on a regional scale. Therefore, the significance of this impact is rated adverse moderate, (before mitigation) (Table 32). Mitigation measures are detailed in the Navachab OEMP under Domain 8.

7.5.5.3 *Hydrocarbon and ANFO spills during operations could infiltrate fractured rock and soils, potentially resulting in groundwater contamination*

Diesel fuel oil (FO) is required in ANFO preparation and could be spilled during storage, transfer or use. As a light non-aqueous phase liquid (LNAPL), fuel oil (FO) could persist in the vadose zone but also migrate downwards via fractures. Spills of more than 200 litres (L) would result in local groundwater contamination and soil quality deterioration, with long-term persistence if not remediated. In the event of such contaminations, appropriate remediation methods and engineering control measures should be implemented. This may include biological treatments using microorganisms, chemical treatments with reactive compounds or physical methods such as pump-and-treat systems.

This impact is rated as adverse and direct as it will pollute the underlying groundwater resource. The nature of the impact is partly reversible as the impact if detected early and not more than 200 L can be remediated immediately in situ without requiring notification to the Ministry of Mines, Industries and Energy (MIME), Ministry of Environment, Forestry and Tourism (MEFT) or Department of Water Affairs (DWA). The duration of this impact would be long-term if not remediated and the extent of the impact is local as contaminants would spread beyond the immediate boundaries of ML 31, affecting local users and nearby farmers. The magnitude of change is moderate because the groundwater quality will be deteriorated. The likelihood of the

impact is deemed possible (medium) as hydrocarbon spills have been reported on-site and other similar underground mining operations. Additionally, accidental hydrocarbon spillages can also occur (worse-case scenario). The sensitivity of the impact is rated medium as the groundwater resource is of importance on a regional scale. Overall, the significance of this impact is rated adverse moderate, before mitigation measures (Table 32). Mitigation measures are further detailed in the Navachab OEMP under Domain 8.

7.5.5.4 *A fire or emergency incident in the explosives magazine could result in the generation of nitrate and hydrocarbon-rich leachates, which may infiltrate through runoff and subsequently contaminate groundwater resources*

A particularly high-consequence scenario would be a fire or emergency event in the magazine. Fire suppression, particularly with water, could generate large volumes of nitrate- and hydrocarbon-laden runoff. Given the measured hydraulic conductivities (up to 6.6×10^{-1} m/day in fault zones) and artesian conditions observed in boreholes such as DW25R, there is potential for such contaminated water to infiltrate rapidly and migrate under pressure through the fractured aquifer system.

This impact is rated adverse and direct as it will pollute the underlying groundwater resource. The nature of the impact is irreversible as it will have long lasting effects on riparian systems, especially downstream. The duration of this impact would be long-term, and the extent of the impact is regional, spreading beyond the boundaries of ML 31 and affecting local users, nearby farmers and the Karibib community, potentially along with downstream users in the wider Erongo Region (i.e. downstream communities that are dependent on the same groundwater resource). The magnitude of change is rated high as the groundwater quality will be deteriorated, and this would affect water supply and suitability to the mine, local users, riparian ecology. The impact would also pollute downstream drainage lines and surface water bodies. The probability of this impact occurring is possible (medium) as such incidences have been reported elsewhere and may likely occur under certain conditions. The sensitivity of the impact is medium due to the quantifiable nature and magnitude of the impact and its risks to regional groundwater resources. Overall, the impact has been rated adverse moderate, before mitigation (Table 32).

The following mitigation measures should be applied and have been included in the Navachab OEMP under Domain 8:

- Safe storage and handling: store explosives at regulated safe distances from emulsions;
- Prohibit un-authorised electronic devices near explosives;
- Ensure only trained and competent personnel handle explosives and respond to spillages;
- Fire prevention and control: construct the magazine with non-combustible, fire-resistant materials, proper ventilation, and compliant design; install automatic fire detection and alarm systems;
- Use dry chemical or foam-based suppression (not water); and maintain portable extinguishers;

- Implement and regularly update a site-specific emergency response plan (ERP) covering fire, runoff, and groundwater protection and provision for regular fire and spill drills;
- Maintain an on-site emergency response team with suitable equipment;
- Install impermeable flooring, bunding, low-permeability liners, and sealed drainage systems with shut-off valves; direct runoff to containment sumps; and use spill berms, hydrocarbon traps, and absorbents in high-risk areas;
- Conduct routine inspections, groundwater quality and hydrogeological monitoring, and maintain incident logs; treat contaminated water before disposal; and promptly report incidents to relevant authorities (MIME, MEFT and DWA); and
- Perform contamination assessments, apply appropriate remediation (e.g., pump-and-treat or bioremediation), rehabilitate affected ecosystems, and review and update emergency and stormwater management plans, when necessary.

7.5.5.5 Potential stormwater contamination from flooding of the ANFO explosives magazine, which then seeps underground thus polluting groundwater resources

Runoff originating from the magazine yard, particularly when combined with spilled prills or their residues, could transport high concentrations of nitrates and sulphates into adjacent surface depressions. This poses significant concerns as the local groundwater is already saline, with total dissolved solids (TDS) ranging between 1 222 to 3 912 mg/l (milligrams per litre). The addition of nitrates and sulphates will further degrade groundwater quality by increasing salinity and corrosivity.

Severe rainfall events, such as the design basis 100-year, 24-hour storm, have the potential to cause significant operational and environmental challenges. In the event of failure of clean-water diversion berms, larger volume of clean water could become contaminated/polluted. This could easily overwhelm the dirty water containment systems and pollution control dams (PCDs), which are required to be properly designed and constructed. These dams and other dirty water containment storage areas located at waste dumps (WRDs), have limited capacity and may overflow during extreme storm events or in cases of inadequate operational management. An overflow event would quickly spread pollutants downstream.

This impact is rated adverse and direct as it will pollute the underlying groundwater resources. The nature of the impact is irreversible due to its potential to cause long-term degradation of riparian systems and downstream users. The duration of the impact is deemed long-term, and the extent of the impact is regional, as the contaminants would spread beyond the boundaries of ML 31 and affect local users, nearby farmers and the broader Karibib community. The magnitude of change is rated high due to the risk and deterioration of groundwater quality, which would affect water supply to downstream communities that are dependent on the same water supply source. The probability of this impact occurring is possible (medium), however, the Proponent developed a stormwater management plan. This plan will mitigate and manage this risk (although currently not implemented yet). The sensitivity of the impact is medium as this impact is on a regional scale and water resources (groundwater and surface water) have limited potential for substitution and little capacity to accommodate change. Therefore, the

significance of the impact has been rated adverse moderate, before mitigation measures (Table 32).

The following mitigation measures should be applied and have been included in the Navachab OEMP under Domain 4:

- Implement the recommendations outlined in the stormwater management plan and the OEMP;
- Conduct regular inspection and maintenance of stormwater diversion berms and drainage systems to ensure their continued effectiveness in managing extreme rainfall events;
- Line or seal pollution control dams (PCDs) and containment ponds to prevent seepage and overflow;
- Increase storage capacity and provide emergency overflow containment for large storms;
- Maintain strict housekeeping in the magazine yard to prevent spillage of prills or residues;
- Conduct regular water quality monitoring for nitrates, sulphates and TDS in groundwater and surface water;
- Update and implement an emergency response plan with overflow and containment procedures;
- Train staff in response and emergency containment;
- Implement immediate cleanup, sampling and remediation following any overflow or contamination incident; and
- Ensure pollution incidents are promptly reported to MIME, MEFT and DWA

Table 32 - Impact of the construction and operation of an explosive magazine on groundwater

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Construction of the explosive magazine	Groundwater	Potential groundwater contamination from nitrate and ammonium loading due to AN/ANFO residues during construction of the explosive's magazine	Adverse Direct Partly reversible Long term Local Possible	Low	Moderate	Adverse Minor (3)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		Hydrocarbon spills during construction could infiltrate fractured rock and soils, potentially resulting in groundwater contamination	Adverse Direct Reversible Long-term Regional Likely	Medium	Moderate	Adverse Moderate (6)
Operation of the explosive magazine		Hydrocarbon spills during operations could infiltrate fractured rock and soils, potentially resulting in groundwater contamination	Adverse Direct Reversible Long-term Regional Possible	Medium	Moderate	Adverse Moderate (6)
		A fire or emergency incident in the explosives magazine could result in the generation of nitrate and hydrocarbon-rich leachates, which may infiltrate through runoff and subsequently contaminate groundwater resources	Adverse Direct Irreversible Long-term Regional Possible	Medium	High	Adverse Moderate (6)
	Groundwater and surface	Potential Stormwater	Adverse Direct	Medium	High	Adverse Moderate (6)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
	water drainage lines	Contamination from Flooding of the ANFO Explosives Magazine	Irreversible Long-term Regional Possible			

7.5.6 NOISE IMPACTS

The potential noise impacts from the construction and operations of the explosives magazine on wildlife are assessed in the sections below (pre-mitigation). An overview of the impact is visually summarised in Figure 65 and the impact assessment ratings are detailed in

Table 33.

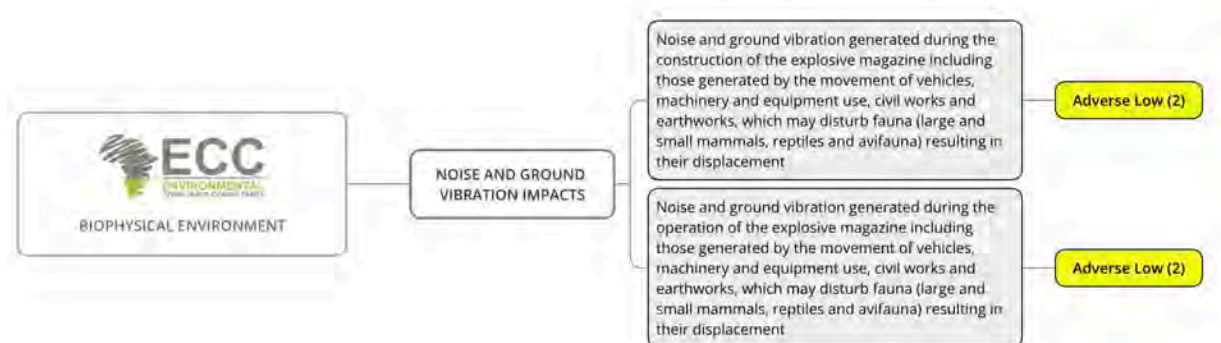


Figure 65 - Illustration of the impact of noise from the construction and operations of the explosive's magazine on local wildlife

7.5.6.1 *Noise generated during the construction of the explosives magazine including those generated by the movement of vehicles, machinery and equipment use, civil works and earthworks may temporarily disturb wildlife (large and small mammals, reptiles and avifauna) and result in their temporary displacement*

During the construction of the explosive's magazine, noise generated by earthmoving, machinery, vehicles and equipment operations is expected to temporarily elevate ambient sound levels, producing both airborne and ground-borne vibrations. These noise emissions, characterised by intermittent high peaks (Lmax) and continuous broadband components, dominated by low to mid frequencies, have the potential to disturb local wildlife, including avifauna, small and large mammals and reptiles. Birds are particularly sensitive to mid-high frequency noise, which can mask communication, disrupt foraging and induce nest abandonment, while small-bodied mammals may respond to low-frequency sounds and vibrations by temporarily avoiding the area. This alters their movement and foraging patterns and displaces them from their established home ranges. Large-bodied mammals are perceived to be more tolerant to noise disturbances and may adapt to the modified environment over time. Reptiles, though less sensitive to airborne noise, may be affected by ground-borne vibrations, especially in burrowing species. The disturbance is expected to be localised to the immediate construction zone and temporary, coinciding with active operations, with recovery likely expected once work ceases. The ecological consequences primarily include short-term behavioural disruption, temporary displacement and potential stress responses, with long-term habitat impacts minimal, if noise management are implemented and work is scheduled to avoid sensitive periods.

The nature of the impact is adverse as the construction noise generated by machinery can negatively affect and induce behavioural changes in wildlife. Birds may experience communication masking, foraging interference, or nest abandonment, while some small-bodied mammals may abandon their home ranges and burrowing reptiles may respond to ground-borne vibration. The impact is considered direct as noise will be generated by construction activities at the construction site and will elicit a response from birds, mammals and reptiles in the vicinity. Additionally, construction activities, machinery use and increased

human activity create acute disturbances that exceed the animal's tolerance threshold and cause stress to animals.

The impact is deemed reversible as noise and vibration only disturb animals while operations are ongoing. Once construction ceases, wildlife may return to the area and resume normal behaviour. The duration of the impact is considered temporary and will last for the duration of construction phase of the explosive magazine (< 1 year). The extent of the impact is on-site because the noise and vibration generated by construction are strongest in the immediate vicinity of the construction site. Wildlife populations beyond this area are unlikely to be affected, as the intensity of sound and ground-borne vibrations diminishes rapidly with distance.

The magnitude of change is considered negligible as the noise and vibration from construction activities causes very minor, temporary disturbances to wildlife behaviours. No disturbances to habitats or key ecological features are expected. Although there may be temporarily alteration of wildlife movements and foraging patterns, these effects do not result in lasting harm or loss of ecological integrity. The overall alteration to the environment is minimal and barely perceptible. The probability of the impact occurring is possible because there will be a slight change in baseline environment due to the increased levels of construction noise and vibration, which may result in slight altered behaviour of these species during the period of construction moving away or staying clear of the site. However, the anthropogenic noise and activity from ongoing mining operations reduces the likelihood of significant additional or sustained ecological disturbance. The sensitivity of the impact has been rated low because the species present have a considerable capacity to tolerate temporary noise and vibration and can return to the area once construction ceases. Thus, the ecosystem can accommodate the temporary change without long-term damage or loss of ecological integrity. Overall, the impact significance of the impact is rated adverse low, (before mitigation) as shown in

Table 33. The mitigation measures have been included under Domain 8 in the OEMP (Appendix B).

7.5.6.2 Noise generated during the operations of the explosives magazine including those generated by the movement of vehicles, drilling and blasting may temporarily disturb wildlife (large and small mammals, reptiles and avifauna) and result in their temporary displacement

Recorded daytime LAeq values ranged from 38.9 dBA to 86.8 dBA, with peak LAF max levels reaching 113.9 dBA near the most active operational areas, primarily associated with haul truck movement and material dumping. Nighttime noise levels were generally lower, ranging from 35.7 dBA to 52.8 dBA, but still included intermittent peaks from vehicle movement. Small and large mammals are likely to temporarily retreat from high-noise zones, while birds may abandon foraging or nesting areas during peak operational periods. Reptiles, though less mobile, may seek refuge in burrows or shaded areas in response to sudden noise or vibration. The disturbance is expected to be temporary and localised, with wildlife returning to affected areas once operations cease or noise levels subside, especially since this is already a disturbed area where wildlife have become accustomed to the current baseline noise environment. Overall, the mine's daily operational noise constitutes a short-term behavioural disturbance rather than a permanent habitat modification, primarily affecting species near active operational points.

The nature of the impact is adverse because operational noise temporarily disrupts the natural behaviour and habitat use of mammals, birds and reptiles, causing stress, displacement and interference with ecological functions. The impact is direct because the noise from mine operations immediately affects wildlife in the areas where the activities occur, causing instantaneous disturbance or displacement. The impact is reversible because wildlife temporarily displaced by operational noise can return to their habitats once the disturbance ceases. The duration of the impact is long term because it will last for the LoM, which is until 2033. The extent of the impact is on-site because the noise disturbance is largely confined to areas immediately surrounding the mine's operational activities. The magnitude of change is low because the noise causes only minor, temporary alterations to wildlife behaviour, such as brief displacement or short-term disturbance, without resulting in permanent loss or significant degradation of their habitat or key ecological functions. The probability of the impact occurring is possible because operational noise is intermittent and varies with activity, meaning that wildlife may or may not be disturbed depending on their proximity, sensitivity and timing of exposure, but there is a possibility that some disturbance will occur. The sensitivity of the impact is low because the affected wildlife species are of local importance, are not particularly rare or highly sensitive to noise and can temporarily avoid or adapt to operational disturbances without long-term harm. Therefore, this impact has been rated adverse low (after mitigation) as shown in

Table 33. Mitigation measures are detailed in the OEMP Domain 8 (Appendix B).

Table 33 - Noise impact of construction and operational activities on the biophysical environment

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
The construction of the explosive magazine including vehicle movement, equipment uses, machinery movement and earthworks	Small and large mammals, avifauna, reptiles	Movement of wildlife away from the construction area	Adverse Direct Reversible Temporary On-site Possible	Low	Negligible	Adverse low (2)
The operation of the explosive magazine and other daily operational activities	Small and large mammals, avifauna, reptiles	Movement of wildlife away from the operational areas	Adverse Direct Reversible Temporary On-site Possible	Low	Negligible	Adverse low (2)

7.5.7 WASTE IMPACTS

The underground operations at Navachab Gold Mine will generate a diverse range of waste streams, including mineral, industrial, domestic and hazardous waste. If these wastes are not managed properly, they pose significant environmental impacts, particularly to soil, water and biodiversity. Specifically, waste from the construction and operation of the explosive's magazine, such as hazardous solvents, explosive residues and sanitary effluent and can adversely affect soil, water and ecosystems. Poorly contained or improperly disposed waste has the potential to contaminate soils, leach into groundwater and disrupt ecological functions. Reactive or combustible materials increase the risk of fires or explosions that could damage biophysical resources.

These potential waste impacts are identified and assessed in the section below, before mitigation. An overview of the impacts is visually summarised in Figure 66 and the impact assessment ratings are detailed in Table 34.

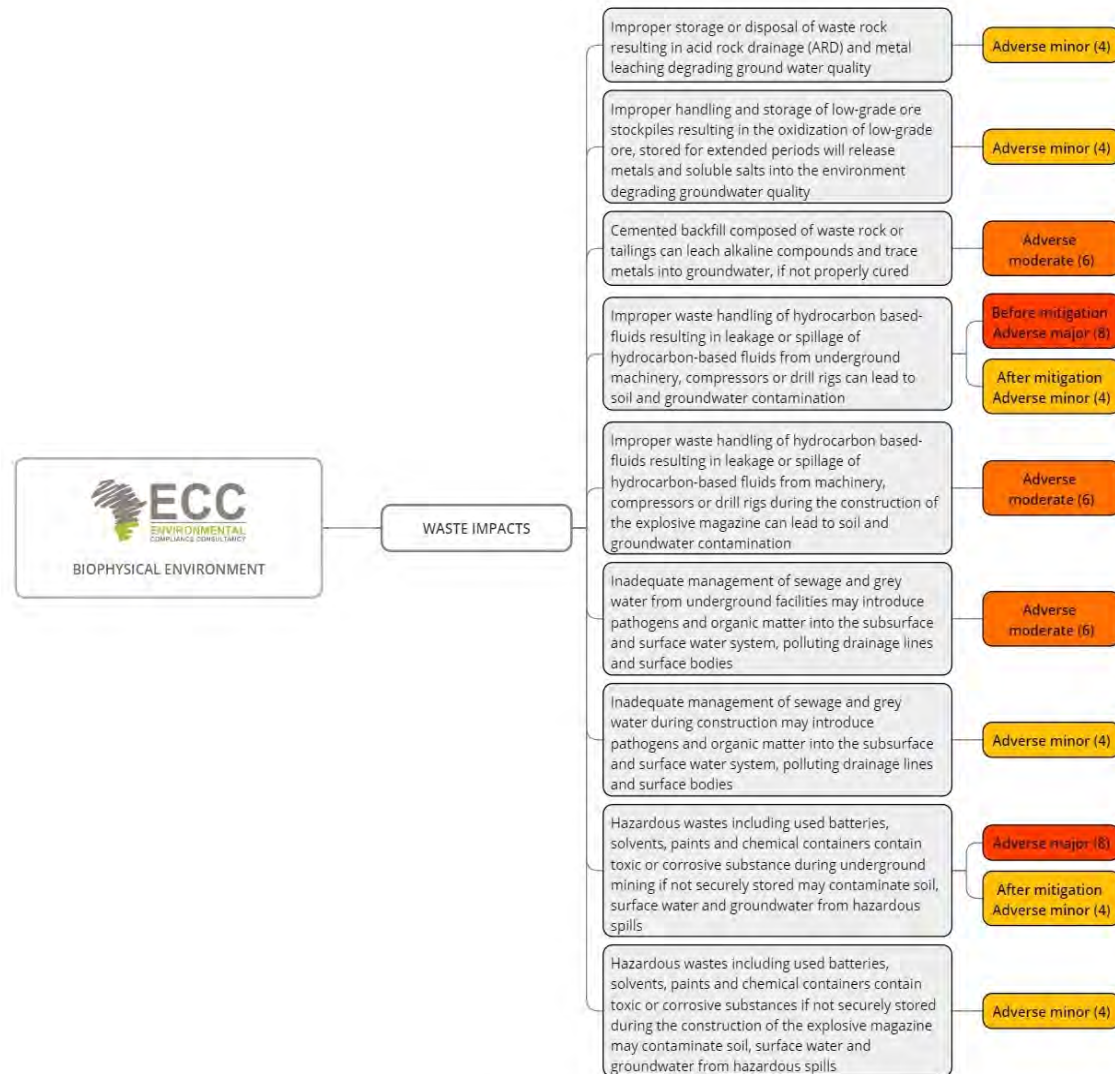


Figure 66 - Impacts from improper waste management from underground mining activities and the construction and operations of the explosives magazine

7.5.7.1 *Improper storage or disposal of waste rock may result in acid rock drainage (ARD) and metal leaching*

The potential for acid rock drainage (ARD) and metal leaching from improper waste rock storage at the Navachab Gold Mine is directly linked to the site's geology and hydrogeology. The local geology, which lies within the Pan-African Damara Belt and consists predominantly of dolomitic marble, contains sulphide-rich mineralisation, specifically described as skarn-style and sulphide-rich replacement bodies. The essential precursor for ARD, the oxidation of sulphide minerals, is already confirmed by the hydro chemical analysis of the pit sump water, which shows elevated sulphate (SO_4^{2-}) levels. When sulphide-bearing waste rock is exposed to atmospheric oxygen and water, it can generate sulfuric acid (H_2SO_4), which then mobilises metals into leachate. However, a significant potential mitigating factor is the presence of dolomitic marble and Petric Calcisols in the area, which contain calcium carbonate (CaCO_3) and contribute to an alkaline environment, offering a degree of acid neutralisation or buffering capacity. Despite the arid to semi-arid climate, which is characterised by low rainfall and high evaporation, the generated acidic and metal-rich leachate poses a risk to the principal aquifer unit in the Karibib Formation. Groundwater occurrence is controlled by secondary permeability features like fractures and shear zones, which can act as preferential flow paths for contaminants. If ARD is not effectively managed through containment or neutralisation with alkaline materials, the resultant brackish to saline groundwater, which already shows variability in chemical composition would further degrade/deteriorate.

The nature of the impact is considered adverse as the potential for ARD and metal leaching from sulphide-rich waste rock at Navachab Gold Mine poses a risk to groundwater quality and the surrounding environment. The impact is direct as the generation of ARD and metal leaching occurs as an immediate consequence of mining activities, specifically the exposure of sulphide-rich waste rock to air and water. This process directly mobilises metals into leachate, which can migrate through fractures in the Karibib Formation to groundwater. The impact is deemed irreversible because once ARD and metal leaching occur, the resulting acidification and metal contamination of groundwater and soils cannot be fully remediated or remediation will require a long-term rehabilitation strategy, that might not be successful. Sulphide oxidation permanently alters the geochemical balance, and contaminated groundwater can persist for decades due to the slow rate of natural attenuation under the area's semi-arid conditions. Even with remediation efforts, the ecosystem and water resources may remain degraded, making the effects long-lasting and permanent. The duration of the impact is regarded as permanent as the chemical and geochemical changes caused by ARD and metal leaching can persist for decades. The extent of the impact is regional as contaminants from acid rock drainage (ARD) and metal leaching can migrate beyond the mine site through fractures and shear zones in the Karibib Formation, potentially affecting groundwater, soils and ecosystems over a wider area. Surface runoff or seepage from waste rock storage may also disperse acidic and metal-laden leachate to surrounding lands. Although the source is localised, the mobility of contaminants and hydrogeological connectivity extend the effects to the surrounding and broader region. The magnitude of change is rated high as ARD and metal leaching from waste rock can severely

degrade the quality and integrity of groundwater resources. The chemical composition of groundwater resources such as pH, electrical conduction (EC) and composition of major ions (anions and cations) may be altered and limit its usability by livestock and humans.. The contamination represents a substantial and measurable degradation of the aquifer and surrounding environment.

The probability of this impact occurring is considered unlikely, as natural buffering from dolomitic marble and calcareous soils, combined with the area's arid to semi-arid climate, limits acid generation and metal mobilisation. Additionally, proper waste management measures such as containment and neutralising with alkaline materials in their waste rock dumps (WRD) further reduce the potential for ARD and groundwater contamination. This reduces the probability of the impact to improbable. The sensitivity of the impact is medium as the groundwater resource is of regional importance for ecosystems, agriculture, and potential human use. There are limited feasible alternative options. At the same time, the system has a moderate capacity to accommodate change, due to natural buffering from dolomitic marble and calcareous soils, which can partially neutralise acidity and limit metal mobilisation. Overall, the significance of the impact is rated adverse minor, before mitigation (Table 34). Mitigation measures are included in Domain 4: Underground mining and Domain 6: Stockpiles of the OEMP (Appendix B).

7.5.7.2 Low-grade ore from underground mining activities, when stored for extended periods, may undergo oxidation and release metals and soluble salts into the environment

The low-grade stockpile ore at the Navachab Gold Mine has a high potential for oxidation and the subsequent release of metals and soluble salts due to the deposit's inherent geochemistry and the prevailing semi-arid climate. Geologically, mineralisation is described as sulphide-rich, with the essential ARD-generating process already confirmed by hydro chemical analysis showing elevated SO_4^{2-} in the pit sump water because of sulphide mineral oxidation. When low-grade ore stockpiles are exposed, this oxidation reaction generates soluble salts and metals. This release is critically amplified by the semi-desert climate, where the high potential evaporation (2 240 mm/year – 2 380 mm/year) vastly exceeds the average annual rainfall (105 mm/year), leading to the concentration of leached contaminants as water evaporates from the stockpiles. Mobilisation of these contaminants poses a risk to the Karibib Formation aquifer, as water percolating through the ore may enter the secondary permeability features (fractures and shear zones) that control groundwater flow. As a result, any influx of dissolved solids from the ore would further degrade the existing brackish to saline groundwater (total dissolved solids up to 3 972 mg/l).

The nature of this impact is considered adverse as the oxidation of sulphide-rich low-grade ore in the Navachab Gold Mine stockpiles releases metals and soluble salts, which degrade soil and water quality. The impact is considered direct as it results from the Project's activities, specifically, the placement and exposure of low-grade ore stockpiles from underground mining activities. The impact is considered irreversible as certain changes caused by the oxidation of

sulphide-rich ore and the release of metals and salts cannot be fully remediated. Once contaminants infiltrate groundwater or accumulate in soils, natural processes in the semi-arid environment are too slow to restore the original water quality or soil chemistry, and certain metals may remain permanently bound in sediments or aquifers. Even with remediation, the pre-existing conditions of the Karibib Formation aquifer or surrounding soils cannot be completely restored, meaning the impact has a lasting or permanent impact. The duration of the impact is deemed permanent as the processes causing contamination, oxidation of sulphide-rich ore and leaching of metals and salts, can persist for decades or even centuries as long as stockpiles exist or residues remain in the environment. Although mitigation measures could be implemented to minimise the severity of the impact, alteration in groundwater quality and soil chemistry can persist over the long- term, making the impact permanent.

The magnitude of change is rated high as the impact results in a significant loss of both the quality and integrity of key environmental resources, namely the groundwater in the Karibib Formation and surrounding soils. The oxidation of sulphide-rich ore releases metals and soluble salts that severely degrade water quality, increasing salinity and contaminant levels beyond natural conditions. This process severely affects the key characteristics of the aquifer, including its chemical composition and usability. The extent of the impact is regional as the contaminants from the oxidising ore stockpiles have the potential to migrate downstream and affect a broad area beyond the immediate mine site. Water percolating through the stockpiles can enter secondary permeability features such as fractures and shear zones in the Karibib Formation, which control groundwater flow over a wide area. As a result, the degraded water quality could impact multiple wells, boreholes and connected ecosystems across the region. Although the ore is sulphide-rich and has the potential to generate acid rock drainage, the probability of the impact occurring is unlikely as the actual mobilisation of metals and salts depends on several specific conditions aligning simultaneously. These include sufficient water percolation through stockpiles, connectivity to permeable fractures in the aquifer and mitigation measures failing. If effective management, containment and monitoring measures are in place, the chance of significant contamination reaching the regional groundwater is low, making the impact unlikely to occur under normal operational conditions. The sensitivity of the impact is considered medium as the Karibib Formation aquifer is of regional importance as a water resource, and there is limited potential for substitution (feasible alternative options) given the semi-arid environment. While the aquifer is valuable, it has a moderate capacity to accommodate some changes in water quality without complete functional loss, and the surrounding environment may buffer minor contaminant inputs. Overall, the significance of the impact is rated adverse minor, before mitigation (Table 34). Mitigation measures are included in Domain 6: Stockpiles of the OEMP (Appendix B).

7.5.7.3 *Cemented backfill composed of waste rock or tailings from underground mining activities can potentially leach alkaline compounds or trace metals into groundwater, if not properly cured.*

The potential for cemented backfill to leach alkaline compounds or trace metals is a significant risk driven by both the engineered material and the site's natural setting. Leaching of alkaline

compounds is supported by the highly alkaline local environment, where the geology is predominantly dolomitic marble and soils are Petric Calcisols, both characterised by high calcium carbonate (CaCO_3) content and pH values typically above 7.5. If the backfill, which incorporates cementitious material, is not properly cured or contains natural alkaline waste rock/tailings, it could introduce excess alkalinity that further alters the water chemistry of the already brackish to saline groundwater. Conversely, the potential for trace metal leaching stems from the deposit's sulphide-rich mineralisation, with the precursor to this issue confirmed by the presence of elevated sulphate in the pit sump water due to sulphide mineral oxidation. If the cement binder fails to adequately encapsulate the sulphide minerals or is improperly cured, it exposes these reactive materials to water. The leached metals and salts could then rapidly enter the Karibib Formation aquifer via secondary permeability features such as fractures, faults, and shear zones, which serve as preferential flow paths and increase the existing corrosion risks to mine infrastructure.

The nature of the impact is considered adverse as the potential leaching of alkaline compounds and trace metals from cemented backfill could negatively alter the chemical composition of the already brackish to saline groundwater in the Karibib Formation aquifer. The impact is considered direct as it results immediately from the Project's own activities, specifically the placement and curing of cemented backfill within the underground mine. The leaching of alkaline compounds and trace metals occurs as a direct consequence of the backfill interacting with groundwater, without requiring any intermediate actions or external factors. The impact is considered irreversible as the chemical changes to the groundwater and potential contamination of the Karibib Formation aquifer cannot be easily remediated. Once alkaline compounds or trace metals leach into the aquifer, they may persist for long periods due to the slow natural flushing and limited dilution capacity of the groundwater system. Additionally, contamination of fractures, faults and shear zones could spread beyond the immediate backfill area, making remediation difficult or unfeasible. The duration of the impact is deemed permanent because once alkaline compounds and trace metals from the cemented backfill enter the Karibib Formation aquifer, they can persist in the groundwater for extended periods due to slow natural flushing, limited dilution and ongoing chemical interactions with the surrounding geology. The extent of the impact is regional as the leached alkaline compounds and trace metals have the potential to migrate beyond the immediate mine site through the Karibib Formation aquifer, which extends over a broader area. Secondary permeability features such as fractures, faults and shear zones provide pathways for contaminants to travel significant distances, potentially affecting groundwater quality across multiple properties, farms and downstream users as a shared water resource. The magnitude of change is considered high considering that the leaching of alkaline compounds and trace metals from the cemented backfill could cause a significant loss in both the quality and integrity of the groundwater resource. The chemical alteration would constitute severe damage to key characteristics of the Karibib Formation aquifer, including its natural chemistry, suitability for use and ecological function.

The probability of the impact occurring is rated possible (medium) as the conditions for leaching, such as the presence of cementitious backfill, reactive sulphide minerals, and naturally alkaline geology exist, along with hydrogeological pathways like fractures, faults and shear zones that could allow contaminants to migrate. The sensitivity of the impact is considered medium as the Karibib Formation aquifer is a valuable regional water resource with limited potential for substitution, meaning that contamination could affect water availability and quality over a wider area. However, the aquifer and the surrounding environment have a moderate capacity to accommodate changes, as some natural buffering and dilution may occur, although these processes are not sufficient to fully neutralise the effects of leached alkalinity or trace metals. Overall, the significance of the impact is rated adverse moderate, before mitigation (Table 34).

The following mitigation measures must be implemented and are also included in Domain 4: Underground mining of the OEMP (Appendix B):

- Use low-cement mixes and replace part of the cement with pozzolanic materials (e.g ash, slag) to reduce alkalinity;
- Test and characterised all backfill materials for sulphide and metal content before use;
- Ensure proper encapsulation and curing of sulphide-rich materials to prevent exposure to water;
- Maintain strict quality control (QA/QC) records for each batch (mix ratios, curing time, pH checks);
- Enforce minimum curing times before contact with groundwater;
- Avoid placing uncured backfill near fractures or faults;
- Grout or seal fractures and faults near backfill zones to block contaminant pathways;
- Install drainage and collection systems to capture any seepage before it reaches the aquifer;
- Use hydraulic cut-offs or barriers (e.g., slurry walls) to contain leachate;
- Establish baseline groundwater quality and install piezometers up- and down-gradient;
- Monitor pH, electricidal conductivity, sulphate, metals monthly (more often during placement);
- Set trigger levels for pH or metal increases and define response actions (e.g., stop placement, investigate and treat seepage);
- Treat collected leachate using lime precipitation, ion exchange, or reverse osmosis;
- Consider passive systems like permeable reactive barriers to capture down-gradient metals;
- Maintain post-closure monitoring and update hydrogeological models with new data.
- Keep a contingency fund for emergency treatment; and
- Engage local stakeholders and report monitoring results transparently.

7.5.7.4 *Leakage or spillage of hydrocarbon-based fluids from underground machinery, compressors drill rigs due to improper waste handling can lead to groundwater contamination*

The potential for leakage or spillage of hydrocarbon-based fluids from underground machinery, compressors or drill rigs to cause soil and groundwater contamination is high due to the mine's adverse hydrogeological setting. The underground mining activities are situated within the Karibib Formation aquifer, where groundwater flow and occurrence are governed not by intrinsic rock porosity but by secondary permeability features such as fractures, shear zones, and lithological contacts. These structural weaknesses serve as preferential flow paths, enabling the rapid and deep migration of non-aqueous phase liquids (NAPLs) like hydrocarbons through the unsaturated zone and into the groundwater system. Groundwater is relatively shallow, typically encountered between 45 meters below ground level (mbgl) - 60 mbgl. Highly conductive zones, such as a sheared fault that measured a locally elevated hydraulic conductivity of 6.6×10^{-1} m/day, would facilitate rapid contaminant transport. Considering that the groundwater resource is already naturally brackish to saline (TDS up to 3 912 mg/l), the introduction of hydrocarbons would severely degrade water quality, posing a significant risk to the integrity of the aquifer.

The nature of the impact is considered adverse as hydrocarbon leakage or spillage from underground mining machinery poses a significant risk of soil and groundwater contamination. The impact is considered direct as the impact would arise because of the Project's underground mining activities (i.e. hydrocarbon leakage or spillage from underground machinery, compressors, or drilling rigs directly entering the soil and groundwater). The impact is considered partly reversible as some remediation measures can reduce or remove hydrocarbon contamination from soil and groundwater. However, full restoration of the aquifer to its original condition is unlikely. Hydrocarbons are persistent and can bind to soil or penetrate fractures in the aquifer, making complete removal practically unfeasible. The duration of the impact is deemed permanent as hydrocarbon contamination of soil and groundwater persists over extended periods. Hydrocarbons are chemically stable and resistant to natural degradation, and once they infiltrate the aquifer, especially through fractures and high-permeability zones, they can remain in the environment for years or even decades. The extent of the impact is regional as the contaminants have the potential to migrate beyond the immediate mine site due to the hydrogeological characteristics of the Karibib Formation aquifer. Secondary permeability features such as fractures, shear zones and lithological contacts act as preferential flow paths, allowing hydrocarbons to migrate over a broad area. High hydraulic conductivity zones further facilitate rapid movement of contaminants through the groundwater system, meaning that soil and water quality could be affected across multiple properties, surrounding farms and potentially connected water users, rather than being confined to the mine site itself. The magnitude of change is rated high considering that hydrocarbon contamination would result in a significant loss of groundwater quality and compromise the integrity of the aquifer for downstream communities. The introduction of persistent contaminants like hydrocarbons can irreversibly alter the physical and chemical

properties of the soil and groundwater, representing a major degradation of the groundwater resource that is difficult or impossible to fully restore.

The likelihood of the impact occurring is rated high (likely) as this impact has occurred on site before during open pit mining operation and therefore it is likely that hydrocarbon leakage or spillage from underground machinery, compressors or drill rigs could occur during underground mining operations. The sensitivity of the impact is considered medium as the groundwater resource, although important and valuable on a regional scale, has a moderate capacity to accommodate change. The aquifer provides water that supports local ecosystems and potentially regional users. Overall, the significance of the impact is rated adverse major, before mitigation (Table 34).

These mitigation measures must be implemented and are included in Domain 4: Underground mining of the OEMP (Appendix B):

- Use well-maintained, leak-proof machinery and sealed fuel systems;
- Conduct regular inspections and maintenance of hoses, seals and fittings;
- Restrict refueling and servicing to designated, lined containment areas underground;
- Use double-walled tanks or bunded fuel storage with automatic shut-off valves;
- Install (high-density polyethylene) HDPE or concrete liners under refueling and maintenance areas;
- Equip all underground zones with spill kits, absorbent pads, and drip trays;
- Fit oil-water separators and hydrocarbon traps in sumps and drainage systems;
- Ensure contaminated water is collected and treated before discharge;
- Implement a hydrocarbon management plan with clear standard operating procedures (SOPs).
- Conduct daily equipment leak checks and keep a fuel inventory log;
- Install groundwater monitoring boreholes to detect early contamination (TPH, BTEX);
- Train workers in spill prevention and emergency response;
- Treat contaminated water using oil-water separators or activated carbon filters;
- Remove contaminated rock for bioremediation or lined disposal;
- Use biodegradable hydraulic fluids to reduce long-term impacts;
- Maintain post-closure groundwater monitoring; and
- Seal and backfill fuel storage areas at closure.

7.5.7.5 Leakage or spillage of hydrocarbon-based fluids from machinery or compressors during the construction of the explosive magazine due to improper waste handling can lead to groundwater contamination

Leakage or spillage of hydrocarbon-based fluids from construction machinery or compressors during the development of the explosives magazine poses a significant risk to the underlying Karibib Formation aquifer system, which is the principal groundwater unit in the Navachab area. Given that groundwater occurrence within this formation is primarily controlled by secondary permeability features such as fractures, shear zones, and lithological contacts, even small hydrocarbon releases can rapidly migrate through these preferential pathways,

bypassing the limited attenuation capacity of the overlying Petric Calcisols. These soils, characterised by a cemented carbonate horizon, have low infiltration and limited adsorption capacity, which reduces their ability to immobilise hydrocarbons, thereby facilitating vertical migration through fractures or weathered rock zones. Once hydrocarbons infiltrate the subsurface, light non-aqueous phase liquids (LNAPLs) such as diesel or lubricating oil can spread laterally along the water table, while dissolved aromatic hydrocarbons (e.g., benzene, toluene, ethylbenzene, and xylenes) may form contaminant plumes within the groundwater system. This can lead to localised deterioration in groundwater quality, with elevated Total Petroleum Hydrocarbons (TPH), Chemical Oxygen Demand (COD), and volatile organic compound (VOC) concentrations. Such contamination may also alter the hydro chemical balance of the aquifer, increase salinity or reduce redox potential, which can mobilise trace metals. Given the mine's complex hydrogeological regime, with hydraulic connectivity between the MDM, CM, and MC units and locally elevated hydraulic conductivities (up to 6.6×10^{-1} m/day), the potential exists for pollutants to migrate into active or dewatered mine workings, pit sumps, or downgradient boreholes. This contamination would compromise water quality for operational reuse, pose corrosion risks to underground infrastructure, and require costly remediation through pump-and-treat or in-situ bioremediation methods. Therefore, robust fuel management, secondary containment, spill response protocols, and regular groundwater quality monitoring are critical to prevent and detect hydrocarbon ingress into the aquifer system.

The nature of the impact is adverse because the hydrocarbon leakage or spillage introduces harmful contaminants into a sensitive and interconnected groundwater system, resulting in direct degradation of environmental quality and posing risks to mine operations and water resources. The release of petroleum hydrocarbons, including volatile and dissolved organic compounds, can alter the physical and chemical properties of groundwater, leading to long-term deterioration of water quality and potential ecosystem toxicity. The impact is direct because hydrocarbon leaks or spills from construction machinery immediately contaminate soil and groundwater. The pollution results directly from project activities, leading to immediate degradation of groundwater quality and posing risks to the regional hydrogeological system. The impact is partly reversible because natural attenuation processes such as volatilisation, biodegradation, dilution, and adsorption can gradually reduce the concentration of certain hydrocarbons in the subsurface over time. Light hydrocarbons like diesel or lubricating oil may partially degrade through microbial activity or evaporate from the soil surface, and dissolved contaminants can be dispersed or diluted within the groundwater flow system. The magnitude of change is high because hydrocarbon contamination would cause a significant loss in the quality and integrity of the groundwater resource, which serves as a key hydrogeological unit in the Navachab area. The infiltration of petroleum hydrocarbons and volatile organic compounds into the Karibib Formation aquifer could severely degrade its chemical composition, elevating concentrations of Total Petroleum Hydrocarbons (TPH), VOCs, and other pollutants. This contamination would compromise the aquifer's natural characteristics, such as its potability, suitability for operational reuse, and overall hydro chemical balance, while

potentially mobilising trace metals and increasing salinity. The damage extends beyond localised pollution, as hydraulic connectivity within the aquifer system could facilitate contaminant migration, thereby affecting larger portions of the groundwater network.

The duration of the impact is temporary because hydrocarbon contamination from minor leaks or spills is likely to diminish over time as natural attenuation processes, such as volatilisation, biodegradation, and dilution, gradually reduce pollutant concentrations in soil and groundwater. Once the construction phase ends and the source of contamination is removed or contained, no further inputs of hydrocarbons will occur, allowing the environment to recover partially through natural processes. Although residual effects may persist in isolated zones, the overall degradation of groundwater quality is not expected to be permanent, and conditions can stabilise or improve over time. The extent of the impact is regional because the contaminated groundwater could migrate beyond the immediate construction area through the hydraulically connected aquifer systems. The Karibib Formation exhibits secondary permeability features, such as fractures, shear zones, and lithological contacts, that facilitate the lateral and vertical movement of contaminants over considerable distances. The probability of the impact occurring is likely because given the intensive equipment use during the development of the explosives magazine, there is a high chance of accidental releases resulting from equipment malfunction, hose rupture, overfilling, or improper handling of fuels and lubricants. Additionally, the area's rocky terrain and limited containment measures increase the likelihood that any spill would infiltrate the subsurface before being contained. Furthermore, the sensitivity of the impact is medium because Karibib Formation aquifer is an important regional groundwater resource that supports mine operations and potentially other water users. However, its hydro chemical and geological characteristics provide a moderate capacity to accommodate change through natural attenuation, dilution, and dispersion processes. Although contamination would degrade groundwater quality and pose operational and environmental risks, the system retains some resilience, allowing partial recovery over time. Therefore, the significance of this impact has been rated adverse moderate (before mitigation) (Table 34). The mitigation measure has been included in Domain 8 of OEMP (Appendix B).

The following mitigation measures should be implemented:

- Maintain machinery regularly, store fuels in bunded tanks, and minimise on-site storage;
- Conduct refueling in designated areas with trained personnel and use drip trays or containment mats;
- Place drip trays under stationary machinery and portable containment mats during refueling to capture minor leaks;
- Store fuels, lubricants, and other hydrocarbons in bunded tanks or containers with spill containment measures capable of holding at least 110% of the tank volume;
- Keep only the minimum necessary quantities of hydrocarbons on-site to reduce the potential spill volume;

- Store hydrocarbons away from surface water channels and in areas with low infiltration potential;
- Maintain well-stocked spill response kits (absorbents, booms, sandbags, shovels) at key locations, and ensure staff are trained in their use;
- In the event of a spill, immediately contain and remove the hydrocarbons from soil surfaces before infiltration occurs;
- Implement a clear hydrocarbon spill response plan, including notification protocols and responsibilities;
- Establish groundwater monitoring points downgradient of the construction area to detect early signs of contamination;
- Conduct regular environmental awareness training for all personnel on spill risks and response procedures;
- Carry out routine environmental audits to verify that hydrocarbon handling and storage practices comply with best practices; and
- Prepare contingency plans for potential in-situ bioremediation or pump-and-treat methods if contamination occurs.

7.5.7.6 *Improper management of sewage and greywater from underground mining facilities can introduce pathogens and organic matter into subsurface and surface water systems, polluting drainage lines and surface water bodies*

The combination of improper use of ablution facilities/open defecation and the inadequate management of sewage and greywater from underground mining operations creates a cascading and severe public health and ecological crisis via unified faecal and organic contamination. When human waste is openly deposited or when untreated sewage and greywater are discharged from underground sumps, they introduce a concentrated load of pathogens (including E. coli, faecal coliforms, Salmonella, and Cryptosporidium) and putrescible organic matter into the surrounding environment. This dual-source contamination first saturates the soil, then rapidly leaches into groundwater and washes into surface water systems via runoff, turning water resources into a potent vehicle for disease transmission. Through microbial decomposition, organic matter consumes dissolved oxygen, which increases the water body's biochemical oxygen demand (BOD), which leads to anoxia. Simultaneously, the nutrient-rich sewage, containing high levels of nitrogen and phosphorus fuels eutrophication and further result in a widespread health threat and the destruction of the riparian ecosystem.

The nature of this impact is considered adverse as the improper use of ablution facilities and inadequate management of sewage and greywater from underground mining operations would create severe public health and ecological risks. Pathogens and organic matter from human waste contaminate soil, groundwater and surface water, leading to waterborne diseases. The impact is considered direct as the discharge of untreated sewage and improper use of ablution facilities from the mine immediately contaminates soil and water, causing oxygen depletion, eutrophication, and health risks without any intermediate steps. The impact is deemed partially reversible as natural processes such as microbial breakdown, dilution can

improve water, soil and ecological conditions, although full restoration to pre-impact is unlikely. The duration of the impact is regarded short-term as it persists only while waste discharge occurs, and natural processes can restore environmental conditions relatively quickly once the source stops. The extent of the impact is considered regional considering that the contamination from sewage and greywater does not remain confined to the immediate mining site. Pathogens, nutrients and organic matter can leach into groundwater, flow into surface water systems and spread downstream, affecting multiple water bodies, riparian zones and communities across the surrounding region rather than just the local site.

The magnitude of change of this impact is rated moderate as the improper disposal of sewage and greywater causes some loss or degradation of water quality and ecological features. Key characteristics of the environment, such as soil structure, groundwater availability and riparian ecosystems are partially impacted. The likelihood of the impact occurring is considered possible (medium) as the conditions that could lead to contamination, such as improper use of ablution facilities, insufficient ablutions or no ablutions at all, open defecation and urination and inadequate management of sewage and greywater exist, although they are not expected to occur consistently or simultaneously without interventions. There is a clear potential pathway for pathogens and nutrients to enter soil and water. The sensitivity of the impact is considered medium as the water resources and riparian ecosystems are regionally important and provide valuable ecological and social functions. although they have a moderate capacity to accommodate changes such as contamination or nutrient enrichment before significant long-term damage occurs. Overall, the significance of the impact is rated adverse moderate, before mitigation (Table 34).

The following mitigation measures must be implemented and are included in Domain 4: Underground mining of the OEMP (Appendix B):

- Install sealed, watertight underground sewage tanks and dedicated greywater sumps;
- Treat all effluent using on-site wastewater treatment plants before reuse or discharge;
- Reuse treated water for dust suppression or non-potable purposes only;
- Provide adequate, accessible and well-maintained toilets and handwashing stations underground and on surface;
- Enforce zero open defecation, urination and proper hygiene practices;
- Train workers on sanitation, disease prevention and waste handling;
- Use impermeable liners and leak-proof piping for all wastewater systems;
- Implement secondary containment and alarms for tanks and sumps;
- Conduct regular water quality monitoring (E. coli, BOD, EC etc.) in groundwater and surface water;
- Inspect and maintain sewage and greywater systems weekly;
- Equip sites with spill response kits and a sewage spill response plan;
- Contain and treat any contaminated water; disinfect or replace affected soil;
- Provide handwashing facilities with soap or sanitizer;
- Ensure safe potable water separate from greywater;

- Conduct health screenings and awareness campaigns;
- Decommission, disinfect, and seal tanks and sumps at closure; and
- Continue post-closure groundwater monitoring for pathogens and nutrients

7.5.7.7 Improper management of sewage and greywater from the construction of the explosive magazine wastewater facilities e.g. portable toilets can introduce pathogens and organic matter into subsurface and surface water systems, polluting drainage lines and surface water bodies

Improper management of sewage and greywater during the construction of the explosives magazine wastewater facilities, including the inadequate handling of waste from portable toilets, can lead to serious environmental and health impacts. If portable toilets are not regularly serviced, leaks, overflows, or spillage of human waste may occur, allowing untreated sewage to infiltrate the soil and contaminate nearby drainage lines, groundwater, or surface water bodies. Similarly, improper disposal of greywater from washing or cleaning activities can introduce organic matter, nutrients, and pathogens into the environment. These contaminants can degrade water quality, promote algal blooms and eutrophication, and create oxygen-depleted conditions harmful to aquatic life. Pathogenic organisms present in the wastewater can also pose direct health risks to construction workers and surrounding communities through contact with contaminated water or soil. Persistent contamination can disrupt local ecosystems, reduce biodiversity, and compromise the natural functioning of drainage and surface water systems.

The nature of the impact is adverse because the mismanagement of sewage and greywater introduces biological and chemical contaminants that degrade environmental quality, pose direct health risks, and disrupt ecosystem integrity. Specifically, the release of untreated human waste and greywater can contaminate soil, groundwater, and surface water sources, leading to pathogen transmission, nutrient enrichment, and oxygen depletion in aquatic environments. The impact is direct because the impact occurs from the improper handling, leakage, or disposal of sewage and greywater during the construction phase, the pollutants and pathogens enter the environment at the point of discharge, causing immediate degradation of water and soil quality, and posing instant exposure risks to workers and nearby communities. The impact is reversible because the affected environmental systems possess a degree of natural resilience and self-purification capacity. Once the improper discharge of sewage and greywater ceases, natural processes such as biodegradation, dilution, oxidation, sedimentation, and microbial decomposition can gradually reduce contaminant concentrations in soil and water. Organic matter and nutrients are broken down by naturally occurring microorganisms, while pathogens are progressively inactivated through exposure to sunlight, temperature fluctuations, and oxygenation. Additionally, rainfall and surface runoff can aid in diluting and dispersing pollutants, facilitating gradual recovery of water quality. The magnitude of change is moderate because the improper management of sewage and greywater can cause noticeable but not permanent degradation of environmental quality and ecosystem integrity. While contamination of soil, groundwater, and surface water may temporarily reduce the quality of these resources, introducing pathogens, nutrients, and organic pollutants,. The affected systems, such as

drainage lines and would experience impairment of water quality and ecological health. However, the fundamental characteristics and functions of these systems would remain recoverable through natural processes once the pollution source is removed.

The duration of the impact is temporary because the environmental and health effects would persist only while the pollution source remains active during the construction phase. Once the discharge or leakage of waste stops, natural attenuation processes such as biodegradation, dilution, and pathogen die-off begin to restore environmental quality within a relatively short period, typically days to months, depending on site conditions. The extent of the impact is local because contaminants can be transported via surface runoff, drainage networks, or shallow groundwater flow, potentially impacting downstream water bodies, adjacent soils, and nearby aquatic ecosystems. Furthermore, this pollution can influence multiple interconnected local watercourses, soils, and habitats within the catchment area. The probability of the impact occurring is possible because factors such as the presence of portable toilets, frequency of servicing, handling practices, and site drainage characteristics influence whether leakage, overflow, or spillage happens. Given that human error, equipment failure, or inadequate waste management procedures can occur, there is a realistic chance that untreated sewage and greywater could enter soil or water systems, but it is not guaranteed for every scenario. Furthermore, the sensitivity of the impact has been rated medium because the environmental receptors affected, such as soil, groundwater, and surface water within the regional catchment, however they do possess some natural capacity to absorb and recover from contamination. For example, soil and water systems can naturally attenuate nutrients and pathogens through processes like biodegradation, dilution, and filtration. Nevertheless, this capacity is limited, meaning that significant or repeated contamination could still cause temporary degradation. Therefore, the significance of this impact has been rated adverse low (before mitigation) (Table 34). The mitigation measures have been included in Domain 8 of the OEMP (Appendix B).

7.5.7.8 *Hazardous wastes including used batteries, solvents, paints and chemical containers containing toxic or corrosive substances used in the underground mining operations can contaminate soil and water if not securely stored*

Hazardous waste comprises of items such as used batteries, solvents, paints and chemical containers that pose critical environmental threats due to the presence of toxic and corrosive substances. Used lead-acid and lithium-ion batteries, for instance, contain heavy metals (e.g., lead, cadmium, mercury) and strong electrolytes (sulfuric acid or lithium salts). Similarly, solvents, paints, and certain chemical residues often contain volatile organic compounds (VOCs) (e.g., benzene, toluene), heavy metal pigments or highly corrosive materials (strong acids or bases). When these wastes are not securely stored or are improperly disposed of, their containment fails, leading to the leaching and migration of contaminants. Through infiltration, these substances can enter the soil matrix, where they sorb to organic matter and clay minerals and increase the soil concentration to phytotoxic or ecotoxic levels. Furthermore, rainwater or runoff can create leachate which transports these soluble and mobile contaminants downward to the groundwater table or laterally into surface water bodies and drainage lines. This contamination, characterised by reduced pH (from acids) or elevated concentrations of

persistent, bio accumulative, and toxic (PBT) chemicals, directly compromises water quality, rendering it unsafe for human consumption and agricultural use.

The nature of this impact is considered adverse as improper storage or disposal of hazardous waste (batteries, solvents, paints, chemical containers) can release toxic, corrosive, and persistent substances into soil and water, contaminating ecosystems, thereby compromising water quality and posing serious risks to human health and the environment. The impact is considered direct as hazardous waste from operational activities would contaminate soil, surface and groundwater resources, causing immediate environmental and health effect. The impact is regarded partly reversible as remediation can restore some environmental quality, although certain effects, such as heavy metal accumulation or long-lasting chemical residues, may persist in soil or water. The duration of the impact is considered long-term considering that hazardous substances like heavy metals, acids and persistent chemicals can persist in the environmental (soil, water and geological features) for years. Despite remediation efforts, the recovery of ecosystems and water quality often requires prolonged periods, resulting in long-lasting environmental effects. The extent of the impact is regarded regional as contaminants from improperly stored or disposed hazardous containers can spread beyond the immediate site through surface runoff, leachate migration, and groundwater flow. This potentially leads to contamination of multiple water bodies, soils, and ecosystems across a wider area. The magnitude of change is rated high as improper disposal of hazardous waste can cause significant degradation of soil and water resources, severely damaging their quality, integrity and key characteristics, such as chemical balance, fertility and potability, beyond minor or easily reversible levels.

The probability of the impact occurring is deemed likely as improper storage and disposal of hazardous waste typically occur at mines and has been observed frequently at mine sites. In most cases this is typically attributed to fast-paced working conditions and pressure to meet Project timelines. Consequently, the sensitivity of this impact is rated medium as there is a potential for contaminants to spread from the mine sites to regional ecosystems and water resources that are dependent upon by rural communities in the broader regional spectrum. Overall, the significance of the impact is rated adverse major, before mitigation (Table 34).

The following mitigation measures must be implemented to minimise the significance of the impact. These measures are also included in Domain 9: Non-mineralised waste facility and bioremediation site of the OEMP (Appendix B):

- Store batteries, solvents, paints and chemical containers separately in labelled, bunded, and ventilated areas;
- Keep storage covered, shaded, and organised to prevent spills or leaks;
- Use secondary containment for all hazardous waste;
- Keep spill kits and absorbents nearby;
- Use airtight containers for volatile or corrosive chemicals;
- Train staff on safe handling and transport;

- Follow SOPs for labelling, storage and transfer of hydrocarbons and chemicals;
- Recycle batteries through licensed recyclers;
- Neutralise acids/bases and dispose of chemicals at licensed hazardous waste facilities;
- Avoid disposal in unlined pits or general landfills;
- Train staff in spill containment and first aid response;
- Minimise storage duration; remove and treat/dispose of waste promptly;
- Decontaminate storage areas at closure; and
- Conduct post-closure soil and groundwater monitoring

7.5.7.9 *Hazardous wastes including used batteries, solvents, paints and chemical containers containing toxic or corrosive substances that can contaminate soil and water if not securely stored during the construction of the explosive magazine*

Used batteries, solvents, paints and chemical containers generated during construction of the explosives magazine often contain heavy metals, toxic organics and corrosive residues that, if not securely stored, can be spilled, leached or volatilised into the surrounding environment. Corroding or damaged containers and poor housekeeping allow contaminants to infiltrate soils, be carried by stormwater into surface water and wetlands, or percolate to groundwater, where mobile solvents and dissolved metals can form persistent plumes and long-lasting hotspots that are difficult and costly to remediate. These pathways expose soil organisms, aquatic life and terrestrial wildlife to acute and chronic toxicity, promote bioaccumulation of metals and persistent organics through food chains, and degrade habitat and ecosystem functioning; people especially site workers face risks from dermal contact, inhalation of fumes or dust, and ingestion of contaminated water or produce, potentially causing acute poisoning or long-term health effects.

The nature of the impact is adverse because improper storage and handling of used batteries, solvents, paints, and chemical containers during construction can release heavy metals, toxic organics, and corrosive residues into soils, surface water, and groundwater, leading to acute and chronic toxicity to soil organisms. Furthermore, bioaccumulation through food chains, degradation of habitat and ecosystem functioning, and posing significant health risks to site workers through dermal contact, inhalation, or ingestion, while forming persistent contamination hotspots that are difficult and costly to remediate. The impact is direct because the improper the generation, storage, and handling of used batteries, solvents, paints, and chemical containers during construction can immediately release heavy metals, toxic organics, and corrosive residues into soils, surface water and groundwater, directly exposing ecological and human receptors to contamination, toxicity, and habitat degradation without any intermediate processes. The impact is partly reversible because while some contaminants may naturally disperse or degrade over time allowing partial recovery of soils, water quality, and ecological receptors, persistent heavy metals, toxic organics, and degraded habitats can remain for extended periods, limiting full restoration. The magnitude of change is moderate because while some aspects of soil integrity, surface and groundwater quality are affected, such as localised contamination, minor degradation of soil, water, remains largely functional and retains most of its essential elements, structure, and ecological value.

The duration of the impact is temporary because the impact occurs only during the period of construction (<1 year) and handling of hazardous materials, and ceases once these activities stop, allowing natural processes and eventual management interventions to progressively reduce contamination and restore environmental conditions. The extent of the impact is regional because the release and spread of contaminants from used batteries, solvents, paints, and chemical containers during construction can affect multiple connected environmental receptors, including soils, surface water (potentially affecting downstream users) and groundwater (which is a regionally shared resource) beyond the immediate construction site. The sensitivity of the impact is medium because the affected soils, water, wetlands, and wildlife have moderate regional value and limited substitutability, and while they can partially tolerate disturbance, they are moderately sensitive to contamination and may experience some degradation of function or quality. Therefore, this impact has been rated adverse minor (before mitigation). The mitigation measures have been included in Domain 8 of the OEMP (Appendix B).

Table 34 - Improper waste management impacts on the receiving biophysical environment

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Improper storage or disposal of waste rock.	Groundwater quality	Acid rock drainage (ARD) and metal leaching.	Adverse Direct Irreversible Permanent Regional Unlikely	Medium	High	Adverse Minor (4)
Improper handling and storage of low-grade ore stockpiles.		Oxidization of low-grade ore, stored for extended periods will release metals and soluble salts into the environment.	Adverse Direct Irreversible Permanent Regional Unlikely	Medium	High	Adverse Minor (4)
Cemented backfill composed of waste rock or tailings.		Cemented backfill composed of waste rock or tailings can leach alkaline compounds	Adverse Direct Irreversible Permanent Regional Possible	Medium	High	Adverse Moderate (6)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		and trace metals into groundwater, if not properly cured.				
Improper waste handling of hydrocarbon-based fluids	Groundwater quality	Leakage or spillage of hydrocarbon-based fluids from underground machinery, compressors or drill rigs can lead to soil and groundwater contamination	Adverse Direct Partly reversible Permanent Regional Likely	Medium	High	Adverse Major (8)
Leakage or spillage of hydrocarbon-based fluids from the explosive magazine construction machinery or compressors	Soil, groundwater, and surface water quality.	Soil, surface water and groundwater contamination from hazardous waste spills.	Adverse Direct Partly reversible Temporary Regional Likely	Medium	High	Adverse moderate (6)
Inadequate management of sewage and greywater from underground facilities.	Drainage lines and surface water bodies	Introduction of pathogens and organic matter into subsurface and surface water systems, polluting drainage lines and surface water bodies	Adverse Direct Partly reversible Short term Regional Possible	Medium	Moderate	Adverse Moderate (6)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Improper management of sewage and greywater from the construction of the explosive magazine	Subsurface and surface water	Introduction of pathogens and organic matter into subsurface and surface water, polluting drainage lines and surface water bodies	Adverse Direct Reversible Temporary Local Possible	Low	Moderate	Adverse low (2)
Hazardous wastes including used batteries, solvents, paints, and chemical containers contain toxic or corrosive substances not securely stored during underground mining	Soil, groundwater, and surface water quality	Soil, surface water and groundwater contamination from hazardous waste spills	Adverse Direct Partly reversible Long term Regional Likely	Medium	Moderate	Adverse Major (8)
Hazardous wastes including used batteries, solvents, paints, and chemical containers contain toxic or corrosive substances	Soil, groundwater, and surface water quality	Soil, surface water and groundwater contamination from hazardous waste spills	Adverse Direct Partly reversible Temporary Possible	Medium	Moderate	Adverse minor (4)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
not securely stored during the construction of the explosive magazine						

7.6 CUMULATIVE IMPACTS

As stated in chapter 6 the cumulative impact assessment will consider both intraspecific and interspecific effects of the Project on the receiving socio-economic and biophysical environment. Intraspecific cumulative impacts arise when multiple activities within the same project compound over time or space, such as dust, noise, and traffic from a single mine collectively affecting nearby communities. Interspecific cumulative impacts occur when different projects or sectors within the same area interact to create amplified or new impacts, such as agriculture, mining, and urban development together contributing to habitat loss and reduced biodiversity. This distinction allows the assessment to capture both project-level and cross-sectoral cumulative effects.

The cumulative impacts assessed are illustrated below, before mitigation measures and are discussed in detail in the sections thereafter. The impact assessment ratings are summarised in Table 35.

7.6.1 INTRASPECIFIC IMPACTS (SOCIO-ECONOMIC ENVIRONMENT: SOCIAL IMPACTS)

7.6.1.1 Air quality cumulative impacts

An illustration of the impacts is shown in Figure 67.

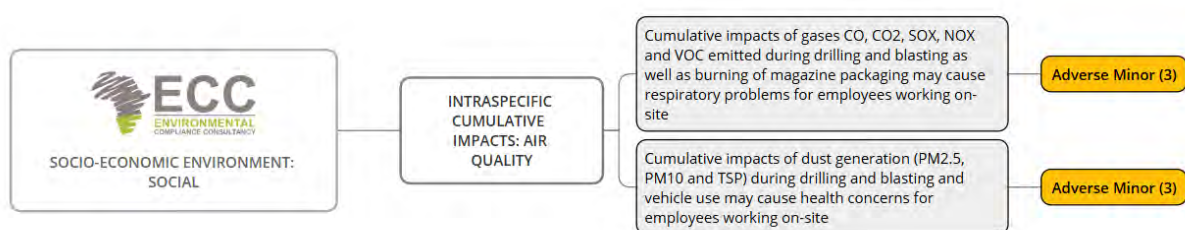


Figure 67 - Cumulative air quality impacts

7.6.1.1.1 *Cumulative impacts of gases CO, CO₂, SO_x, NO_x and VOC emitted during drilling and blasting as well as burning of magazine packaging may cause respiratory problems for employees working on-site*

Explosive magazines, blasting activities and burning of explosives packaging material generate toxic emissions such as CO, NO_x and SO_x. In the absence of sufficient dilution, these gases can accumulate to concentrations that pose significant risks to employee health and safety. Navachab currently has two operational magazines for aboveground mining activities, with a third earmarked for the underground mining activities. Operational activities currently utilise one burn pit, located within the waste landfill site.

The nature of the impact is adverse and cumulative as a result of various sources contributing to air quality degradation. Combustion of packaging generates fine ash and soot (particulate matter), which can penetrate deep into the lungs, causing respiratory irritation and long-term health issues. The impact is irreversible due to potential chronic health effects posed to employees. The duration of the impact is long term, due to expected future use of magazines. The scale of this impact is on site, and the magnitude of the impact is minor as the mine design incorporates a 170 m ventilation raise, which is intended to facilitate the upward movement of contaminated air and improve the overall airflow network. Additionally, the appropriate PPE will be used as a preventive measure, and further mitigation strategies will be implemented to ensure the health and safety of employees. All packaging material will be burnt together and not at separate intervals, taking metrological conditions into account. The probability of this occurring is likely, and the sensitivity is low, as the impact will be limited to the Project site, and the occupational health and safety equipment and measures will be in place. Overall, the significance of the impact is minor (before mitigation). Mitigation measures are described in Table 35.

7.6.1.1.2 *Cumulative impacts of dust generation (PM_{2.5}, PM₁₀ and TSP) during drilling and blasting and vehicle use may cause health concerns for employees working on-site*

Cumulative dust emissions from multiple on-site activities such as drilling, blasting, excavation, and vehicle movement can lead to elevated concentrations of PM_{2.5}, PM₁₀, and TSP within the mining licence area. These fine and coarse particles are primarily generated by the mechanical disturbance of rock and soil, explosives detonation, and vehicle traffic on unpaved roads. The combined effects of these dust sources may contribute to the deterioration of ambient air quality, particularly in dry and windy conditions when dust dispersion is enhanced.

The nature of the impact is adverse and cumulative because of various sources contributing to air quality degradation. The impact is reversible due to appropriate dust suppression practices and PPE used on site. The duration of the impact is expected to occur throughout the LoM (~5 years) which is over a short term. The scale of this impact is on site, and the magnitude of the impact is minor due to mitigations already implemented and monitoring on site. Additionally, the appropriate PPE will be used as a preventive measure, and further mitigation strategies will

be implemented to ensure the health and safety of employees. The probability of this occurring is likely, and the sensitivity is low, as the impact will be limited to the Project site, and the occupational health and safety equipment and measures will be in place. Overall, the significance of the impact is minor (before mitigation). Mitigation measures are described in Table 35.

7.6.1.2 Visual cumulative impacts

An illustration of the cumulative visual impacts is shown in Figure 68 and a viewshed map of the proposed explosive magazine and the two existing explosive magazines up to 10 km from the location of the magazines is shown in Figure 69.

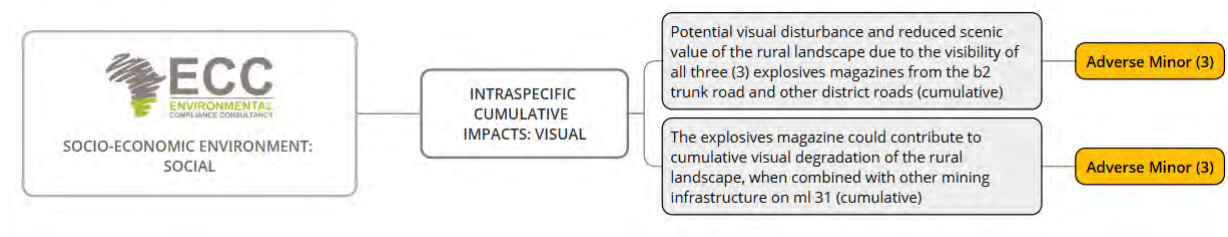


Figure 68 - Cumulative visual impacts

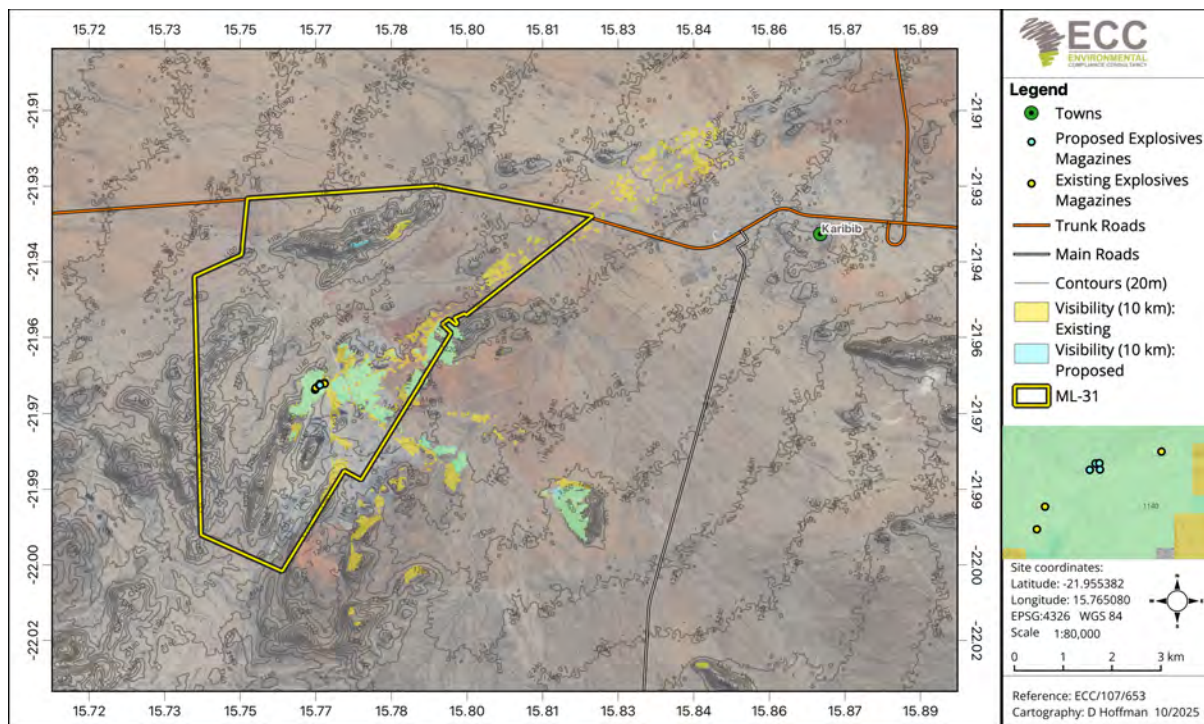


Figure 69 - Viewshed of the existing explosives magazines and the proposed magazines, with a visibility of 10 km from the magazines

7.6.1.2.1 Potential visual disturbance and reduced scenic value of the rural landscape due to the visibility of all three (3) explosives magazines from the b2 trunk road and other district roads (cumulative)

As stated in section 5.10 and 7.3.2 above, the Project area's elevation gradually decreases from approximately 1 287 m in the SE to just below 1 100 m in the NW, resulting in a landscape of

ridges and lower-lying areas that influence visibility. Due to the proximity of the B2 trunk and other district roads, road users travelling approximately 10 km away may have direct or partial views of the three (3) explosives magazines. In certain areas, elevated terrain further enhances the line-of-sight. This visibility creates a visual disturbance, interrupting the otherwise natural or rural landscape and diminishing the scenic quality. The explosives magazines' industrial appearance and potential dust emissions from blast trucks hauling contrasts sharply with the surrounding terrain, and this makes the Project infrastructure and support equipment more prominent features in the view and will potentially alter the perceived visual character of the area along the transport corridor and district roads.

The nature of the impact is considered adverse as the visibility of the explosives magazines disrupts the natural and rural character of the landscape. Their appearance contrasts sharply with the surrounding terrain, creating visual disturbance and reducing scenic quality. Furthermore, the impact is deemed cumulative as the visual presence of the additional explosive's magazine adds to the visibility of the two (2) explosives magazines already existing on ML 31. Together, these structures increase the overall industrial footprint on the landscape, intensify visual disturbance and further diminishing the scenic quality beyond the effect of any single facility alone. The impact is partly reversible as visual intrusion can be mitigated over time through rehabilitation efforts and the eventual removal of the explosive's magazines and other mine infrastructure. However, certain changes, such as altered terrain or permanent structures, may persist, limiting the full restoration of the original landscape. The magnitude of change is considered low as the visual impact from the explosives magazines and other mine infrastructure result in only a minor alteration to the landscape's overall character, considering that the immediate area is already visually disturbed by existing mine infrastructure. Although there are measurable disturbances to the scenic quality of the landscape, these are considered limited to specific viewpoints or elements and does not fundamentally alter the overall character or integrity of the landscape. The impact is deemed long term as the explosives magazines will be retained throughout the underground and above ground open pit life of mine (LoM) (>5 years).

The impact is considered local as it primarily affects areas within the immediate vicinity of the mine, including nearby road users within the approximate 10 km viewshed (travellers on district roads and the B2 road). The likelihood of the impact is likely as the additional explosives magazine and other mine infrastructure will be constructed, whereby the existing two magazines are already constructed and active and will remain visible within the landscape. Additionally, the open terrain, limited natural screening and the mine proximity to the B2 road, district roads and nearby residences, increase the likelihood that observers will experience visual disturbances. The sensitivity of this impact is rated low due several compounding factors. Firstly, the visual receptors primarily consist of transient users, rather than visitors seeking visual amenity. Secondly, the visual receptors would typically experience brief exposure to the site and lastly, the overall landscape is already visually disturbed by other ongoing mining and anthropogenic activities. Therefore, the area has some capacity to accommodate change, such

as infrastructure development. Overall, the significance of the impact is rated adverse minor, before mitigation (Table 35). The proposed mitigation measures are detailed further in the OEMP Domain 8 (Appendix B).

7.6.1.3 The explosives magazine could contribute to cumulative visual degradation of the rural landscape, when combined with other mining infrastructure on ml 31 (cumulative)

The explosives magazine, when considered alongside existing mining infrastructure, may contribute to cumulative visual degradation of the rural landscape. Its industrial form and materials, combined with other existing mine structures, increase the overall visual footprint of the site and further disrupt the area's natural or rural character. This cumulative presence can accentuate the perception of industrialisation, diminish the scenic quality and result in more pronounced visual impacts for observers from nearby roads, farms, and other elevated or open vantage points.

The nature of the impact is considered adverse as the explosives magazine, together with existing mine infrastructure, detracts from the natural and rural visual character of the area. The presence of these structures increases visual intrusion and diminishes the scenic quality and creates an undesirable change in how the landscape is perceived by the visual receptors. The impact is considered cumulative as the visual effect of the additional explosive's magazine adds to the existing visual disturbance already caused by other mine infrastructure. Together, these structures increase the overall industrial footprint, intensify the loss of the area's natural visual character and scenic quality over time. The combined presence of multiple visible facilities amplifies the overall impact beyond what any single component would cause individually. The impact is deemed partially reversible as visual disturbances can be reduced following mine closure through removal of infrastructure and rehabilitation of the site. However, complete reversal may not be possible due to lasting alterations in landform and residual changes to the natural landscape. The additional explosives magazine will result in minor alteration of the overall visual landscape. Therefore, the magnitude of change is rated low. Although the explosives magazine will slightly increase the industrial footprint, the change is limited in scale and does not significantly impact the broader landscape's key features, quality or overall character. The duration of the impact is deemed long term as the explosives magazine and associated mining infrastructure will remain visible and influence the landscape throughout the LoM (>5 years).

The impact is considered local as the visual receptors are primarily not only those located within the immediate mine boundary but also includes land users and road users within the approximate 10 km viewshed. The likelihood of the impact is considered definite as the explosives magazine and other mine infrastructure will be physically present in the landscape and are expected to be visible or partially visible from certain viewpoints, depending on the terrain and vegetation cover. However, the sensitivity of this impact is rated low as the landscape already has industrial or modified elements and transient receptors, such as travellers on the B2 trunk road and district roads would typically have limited awareness or

concern for visual changes due to the short duration of exposure, while residents in the immediate Project area would likely adapt to changes in the scenic landscape as the general area is already altered. Overall, the significance of impact is rated adverse minor, before mitigation (Table 35). The mitigation measures are provided in the OEMP under Domain 8 (Appendix B).

7.6.1.4 Heritage/archaeological cumulative impacts

The simultaneous or effectively instantaneous detonation of three magazines, totalling 120v000 kg (120 metric tons) of ANFO, constitutes a massive explosive event. Based on an industry-standard TNT equivalence factor of 0.85 for ANFO, the total calculated energy release is comparable to 102 metric tons of TNT. Assessing the blast effects relies on established scaling laws, where the destructive range is proportional to the cube root of the explosive mass ($R \propto M^{1/3} \text{TNT}$), providing a quantifiable, though generalised, projection of impact zones.

An illustration of the cumulative heritage impacts is shown in Figure 70.

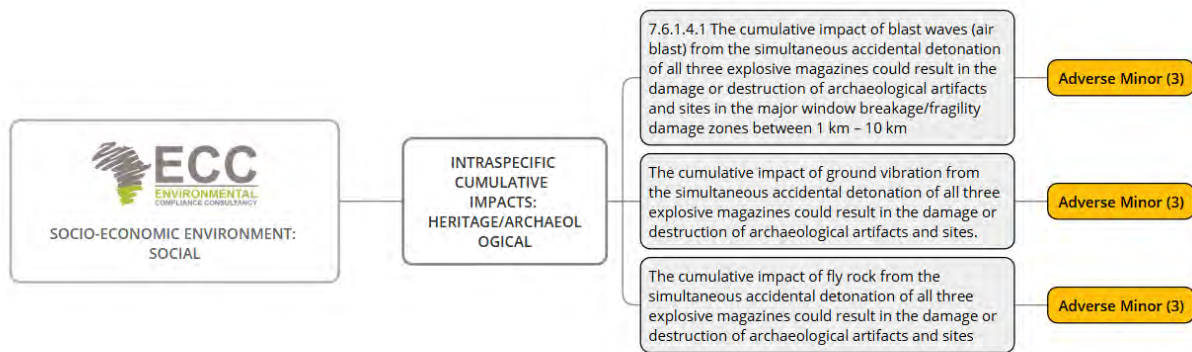


Figure 70 - Cumulative heritage impacts

7.6.1.4.1 The cumulative impact of blast waves (air blast) from the simultaneous accidental detonation of all three explosive magazines could result in the damage or destruction of archaeological artifacts and sites in the major window breakage/fragility damage zones between 1 km – 10 km

The overpressure required to shatter glass universally and cause failure in non-reinforced structures (such as certain historical buildings) would extend to around 700 meters (0.7 km). Beyond this, the acoustic shockwave remains perceptible and capable of rattling windows for distances exceeding 10 km. As the winch anchor (QRS 114/7) and possible iron wagon tyre quenching bath (QRS 114/8) are built from delicate and weathered materials such as loose stone or dry-stacked rock in the case of QRS 114/8, it makes them extremely vulnerable to the temporary but intense forces generated by shockwaves (i.e. air blast). This resultant force could cause stone features to crack, crumble, or collapse, while scattered surface artifacts may be displaced or dispersed. Such disturbance results in the loss of the site's original layout and context, effectively eliminating the scientific and archaeological value of the remaining evidence.

The nature of this impact is adverse because cumulative blast waves could damage fragile structures and scatter artifacts, leading to permanent loss of the sites' archaeological and heritage value. The impact is cumulative because the simultaneous or repeated blast waves from multiple explosive magazines can add to each other over time, causing progressively greater damage to fragile structures and artifacts than a single event would. Each blast compounds the effects of previous vibrations, increasing the overall deterioration and loss of heritage value. The impact is irreversible because the physical destruction of fragile structures and displacement or loss of artifacts cannot be undone. Once stone features crack, crumble, or collapse, and the archaeological context is disturbed, the original integrity, layout and scientific value of the heritage sites are permanently lost.

The duration of the impact is permanent because the damage cracked, collapsed, or destroyed and displaced artifacts cannot naturally regenerate or be fully restored. The loss of the site's original layout and archaeological context results in enduring, long-term degradation of its heritage and scientific value. The extent of the impact is national because the affected heritage sites hold cultural and archaeological significance for Namibia as a whole. Damage to these sites would represent a loss of nationally important historical artifacts, affecting the country's collective heritage rather than just a local area. The magnitude of change is high because cumulative blast waves could cause severe damage or destruction of key features and artifacts at the heritage sites. This would result in the loss of both the resource and its integrity, permanently compromising the archaeological context and scientific value. The probability is rare, although the consequences of a detonation would be severe, strict safety protocols, magazine design standards, regulatory controls, handling procedures and security measures will be in place to prevent accidental high-order explosions. These preventative measures, such as controlled storage distances, blast-proof construction, restricted access and rigorous operational procedures significantly reduce the likelihood of an accidental detonation, making the event improbable even though its potential consequences are extreme. The sensitivity of the impact is high because the heritage sites are of national significance and irreplaceable, with limited or no potential for substitution. Additionally, the sites are extremely vulnerable to physical disturbance, and any damage such as collapsed structures or displaced artifacts cannot be accommodated or reversed, making them highly sensitive to change. Therefore, the significance of this impact has been rated adverse minor (Table 35) and the mitigation measures have been included in Domain 8 of the OEMP.

7.6.1.4.2 The cumulative impact of ground vibration from the simultaneous accidental detonation of all three explosive magazines could result in the damage or destruction of archaeological artifacts and sites.

The local geology, dominated by hard, metamorphosed rocks such as dolomitic marble and schists of the Swakop Group, creates conditions highly conducive to the long-distance transmission of vibration. These dense and consolidated lithologies have low damping capacity, allowing ground vibration from blasting or similar activities to travel further with minimal energy loss. As a result, vibration impacts may extend several kilometres from the source,

posing a heightened risk to fragile archaeological and heritage structures, the winch anchor (QRS 114/7) and possible iron wagon tyre quenching bath (QRS 114/8). Additionally, structural features such as veins, faults and foliation planes can reflect or channel seismic energy, amplifying localised ground motion. This geological context therefore increases the likelihood of vibration-induced damage, even at sites situated beyond the immediate blast zone.

The nature of this impact is adverse because the simultaneous accidental detonation of all three explosive magazines could cause irreversible damage to fragile archaeological and heritage sites. The local geology transmits vibrations over long distances, amplifying vibration from shockwaves and increasing the risk to distant, sensitive structures. This threatens culturally and scientifically valuable artifacts that cannot be replaced. The impact is cumulative because the combined vibrations from all three simultaneous detonations amplify ground motion, increasing the risk and extent of damage to multiple heritage and archaeological sites. The impact is irreversible because the affected artifacts, archaeological artifacts and heritage sites are non-renewable and cannot be replaced or restored once damaged. Any destruction or structural degradation caused by ground vibrations would permanently alter or destroy the historical, cultural and scientific value of these sites. Even minor micro-fractures or destabilisation can lead to long-term deterioration. The duration of the impact is permanent because any damage to archaeological artifacts or heritage structures cannot be undone. Once fragile materials crack, collapse or are destroyed by ground vibrations, their historical, cultural and scientific value is permanently lost, making the effects long-lasting and enduring.

The extent of the impact is national because the affected heritage and archaeological sites are of significance to Namibia as a whole, not just to the local area. Damage would result in the loss of nationally important cultural and historical artifacts, impacting the country's heritage, identity and potential for research and education across Namibia. The magnitude of change is high because the accidental detonation could cause severe damage or complete loss of archaeological and heritage artifacts, including their key characteristics, structural integrity and historical features. The impact would compromise the quality, authenticity and value of these resources, representing a major negative change that cannot be easily mitigated or restored. The probability is rare, although the consequences of a detonation would be severe, strict safety protocols, magazine design standards, regulatory controls, handling procedures and security measures will be in place to prevent accidental high-order explosions. These preventative measures, such as controlled storage distances, blast-proof construction, restricted access and rigorous operational procedures significantly reduce the likelihood of an accidental detonation, making the event improbable even though its potential consequences are extreme. The sensitivity is high because the archaeological and heritage sites are rare and of significant value on a national scale, with unique historical and cultural importance. The sites have limited potential for substitution and are highly vulnerable to change, meaning even minor damage from ground vibrations could irreversibly compromise their integrity and significance. Therefore, this impact has been rated adverse minor (Table 35) and the mitigation measures have been included in Domain 8 of the OEMP.

7.6.1.4.3 *The cumulative impact of fly rock from the simultaneous accidental detonation of all three explosive magazines could result in the damage or destruction of archaeological artifacts and sites*

The potential impact of fly rock on the archaeological sites situated 1–2 km from the accidental detonation of 120 tons of ANFO predominantly involves secondary fragmentation and blast-mobilised debris. While the primary debris hazard from the magazine structure is heavily attenuated at this range, the explosion's massive energy ensures that both high-velocity primary fragments and secondary blast effects remain detrimental to archaeological artifacts in the vicinity of the explosive's magazine. The potent air overpressure wave (likely ≈ 1 psi or higher) can accelerate existing surface elements, such as gravel and small rocks, turning them into high-speed micro-projectiles that cause widespread pitting, abrasion and irreversible surface erosion. This action is particularly damaging to vulnerable assets like rock art or the possible iron wagon tyre quenching bath (QRS 114/8). Furthermore, any direct impact from primary fragments would result in the crushing of fragile artifacts (e.g., pottery or bone), like the winch anchor (QRS 114/7). The potential cumulative impact is the destruction of archaeological context, as the resulting displacement and scattering of artifacts eradicates the spatial relationships essential for scientific data recovery, constituting a catastrophic loss of the sites archaeological and cultural heritage intrinsic value.

The nature of the impact is adverse because an explosion would destroy or damage archaeological artifacts and features, displace materials and erase the spatial context, resulting in an irreversible loss of cultural and scientific heritage value. The impact is cumulative because the fly rock, air overpressure and secondary debris from the accidental detonation combined will affect the same sites simultaneously. The impact is irreversible because the destruction and displacement of archaeological artifacts and features cannot be undone. Once fragile items are crushed, eroded or scattered and the spatial context is lost, the scientific, cultural and heritage value of the site is permanently destroyed, making restoration or recovery impossible. The duration of the impact is permanent because the damage to archaeological artifacts, features and their spatial context cannot be restored, meaning the loss of cultural and scientific heritage is lasting and enduring, with no possibility of returning the site to its original state.

The extent of the impact is national because the affected archaeological sites and cultural heritage assets are of significance beyond the local area, representing irreplaceable historical, scientific and cultural value for Namibia as a whole. Damage to these sites would therefore affect the nation's collective heritage, not just the immediate community. The magnitude of change is high because the impact would result in the loss and severe damage of archaeological artifacts, including fragile artifacts and key site features. The quality and integrity of the sites would be compromised, as the destruction of artifacts and disruption of spatial context eradicates their scientific, cultural and heritage value, representing a major and extensive change to the resource that cannot be mitigated or restored. The probability is rare, although the consequences of a detonation would be severe, strict safety protocols, magazine design standards, regulatory controls, handling procedures and security measures will be in place to

prevent accidental high-order explosions. These preventative measures, such as controlled storage distances, blast-proof construction, restricted access and rigorous operational procedures significantly reduce the likelihood of an accidental detonation, making the event improbable even though its potential consequences are extreme. The sensitivity of the impact is high because the affected archaeological sites and artifacts are of exceptional national value and rarity, with no substitutes for their cultural and scientific significance. Additionally, these artifacts are extremely fragile and highly vulnerable to physical damage, meaning they have very limited capacity to accommodate change, and even minor disturbances can cause irreversible loss of heritage value. Therefore, this impact has been rated adverse minor (Table 35) and the mitigation measures have been included in Domain 8 of the OEMP.

7.6.1.5 Noise cumulative impacts

An overview of the cumulative impacts is visually summarised in Figure 71 and the impact assessment ratings are detailed in Table 35, before mitigation, unless otherwise specified.

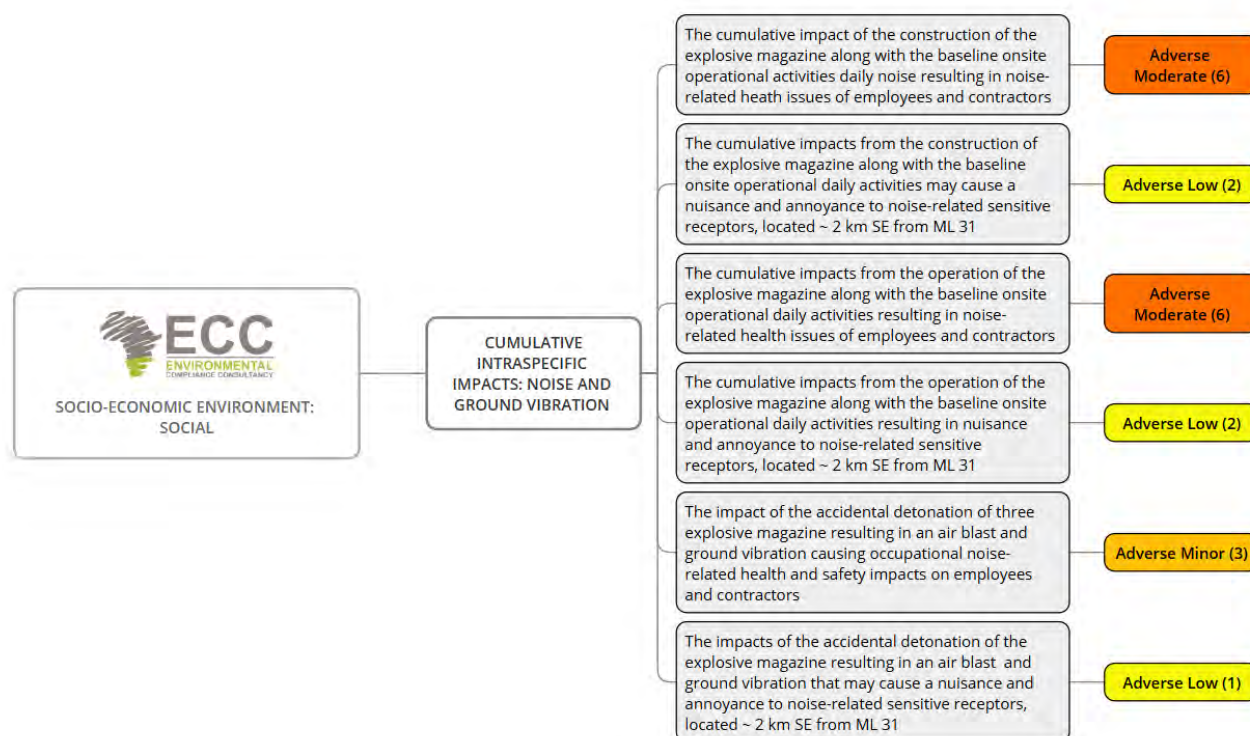


Figure 71 - Cumulative noise impacts

7.6.1.5.1 *The cumulative impacts from the construction of the explosives magazine combined with baseline onsite operational noise, resulting in noise-related health issues of employees and contractors*

Baseline monitoring indicates daytime LAeq levels ranging from 38.9 to 86.8 dBA (May 2025) driven by haul truck movement, rock dumping, excavation, CIP plant operations, reverse hooters and other operational activities. Construction of the explosive's magazine is expected to introduce temporary noise peaks, increasing LAeq and LAFmax levels perceptibly above this baseline, particularly during daytime work hours. The cumulative impact of noise-related occupational health impacts from both the construction of the explosive's magazine and the

ongoing operational mining activities poses significant health risks, categorised into auditory and non-auditory impacts for workers and nearby communities. Construction and heavy mining equipment typically generate high noise levels, often exceeding 85 dB(A), which is the threshold for mandatory hearing protection. Prolonged or repeated exposure at these levels leads to noise-induced hearing loss (NIHL) and conditions like tinnitus. Beyond auditory damage, chronic noise acts as a stressor, particularly affecting communities exposed to continuous noise levels (e.g., 65 dB(A)). This can trigger the body's stress response, leading to severe non-auditory effects, including sleep disturbance, increased risk of cardiovascular diseases (hypertension, ischemic heart disease), and cognitive issues like annoyance, stress, and reduced concentration.

The nature of the impact is adverse because high noise level could cause both permanent and physical damage such as hearing loss and chronic systemic stress. The impact is considered cumulative because noise from the construction of the explosive's magazine will add to the existing operational noise already generated by ongoing mining activities. Over time, repeated and continuous exposure to elevated noise levels can accumulate in its effects on human health, particularly for employees and contractors. The impact is considered partly reversible because while some effects of noise exposure, such as stress, sleep disturbance and annoyance, can diminish once noise levels are reduced or construction activities cease, other effects, particularly noise-induced hearing loss (NIHL) and chronic cardiovascular damage, are irreversible. However, the non-auditory symptoms typically improve over time when exposure is removed or reduced, making the overall impact only partly reversible. The duration of the impact is temporary because the health effects associated with prolonged noise exposure, because the period of exposure during construction is less than a year. The extent of the impact is considered on-site because the highest noise levels are generated and experienced within the mine's operational area, where drilling, blasting and heavy equipment use occur. These activities primarily affect mine workers and equipment operators who are directly exposed to the noise sources. Although some sound may travel beyond the site, it generally diminishes with distance and is unlikely to exceed threshold levels at off-site receptors causing noise related health impacts. Therefore, the noise impact is largely confined to the Project site. The magnitude of change is considered high because prolonged exposure to excessive noise levels from construction and mining operations can cause a significant loss in the health and well-being of affected employees and contractors.

The probability of the impact occurring is possible because the generation of high noise levels during both construction and mining operations is inherent to these activities. Equipment such as drills, trucks and crushers routinely produce noise exceeding safe thresholds, meaning there is a realistic likelihood that workers and nearby receptors could experience adverse health effects if mitigation measures are not effectively implemented. The sensitivity of the impact is high because the sensitivity of the impact is considered high because the affected human health and well-being of the Project's employees and contractors is of critical importance, with no substitute or replacement. Protecting workers from harmful noise exposure is a legal and

ethical priority recognised under occupational health and safety standards and World Health Organization (WHO) noise guidelines. Human auditory and physiological systems are also highly sensitive to change, as prolonged exposure to high noise levels can quickly lead to irreversible hearing damage and chronic health effects. Since these impacts directly threaten a resource of high value and limited capacity to adapt or recover, the sensitivity of the impact is therefore high. Therefore, the significance of the impact has been rated adverse moderate (before mitigation) as is shown in Table 35. The mitigation measures are included in Domain 8 of the OEMP (Appendix B) and discussed further below.

7.6.1.5.2 The cumulative impacts from the operation of the explosives magazine combined with the baseline onsite operational noise, resulting in noise-related health issues of employees and contractors

Baseline monitoring indicates daytime LAeq levels ranging from 38.9 to 86.8 dBA, driven by haul truck movement, rock dumping, excavation, CIP plant operations, reverse hooters and other operational activities. Operations of the explosive's magazine is expected to introduce temporary noise peaks, increasing LAeq and LAFmax levels perceptibly above this baseline, particularly during daytime work hours. The cumulative noise-related health impact resulting from the combined operation of the explosive magazine and the broader gold mining activities is expected to be significant due to the overlap of continuous and impulsive noise sources. Continuous noise from drilling, crushing and heavy vehicle movement increases background sound levels, while intermittent high-intensity blasts (non-planned) from the explosive's magazine contribute short-duration but high-amplitude peaks. Together, these sources extend the period and intensity of exposure for workers and nearby receptors, such as the adjacent farmers. Prolonged exposure to elevated noise levels can cause auditory health effects, including temporary or permanent hearing loss and tinnitus, as well as non-auditory effects such as stress, fatigue, hypertension, sleep disturbance and reduced cognitive performance. Due to the repeated and overlapping nature of these noise emissions, the cumulative impact on human health and wellbeing is greater than that of individual sources alone.

The nature of this impact is adverse because the cumulative noise exposure negatively affects the health, wellbeing and quality of life of employees and contractors. The impact is cumulative because it results from the combined and overlapping noise emissions from multiple sources, the proposed explosives magazine, existing magazines, processing plant, engineering workshops, laydown areas, machinery, vehicle movements and blasting, rather than from a single isolated activity. These noise sources interact over time and space, exposing the same receptors employees and contractors repeatedly and simultaneously to elevated sound levels. The cumulative effect is greater than the sum of individual contributions because continuous background noise from mining operations adds to intermittent high-intensity blasts, increasing overall exposure and the potential for adverse health effects. The impact is partly reversible because temporary effects like stress and fatigue can recover once noise exposure stops but permanent hearing damage from prolonged or intense noise cannot be fully undone.

The duration of the impact is long term because noise exposure from both the explosives magazine, existing magazines and ongoing mining operations persists throughout the operational life of the mine (approx. another 5 years), resulting in repeated and continuous stress on employees and some of the noise related health impacts such as hearing loss and tinnitus will last long after the activity causing the impact has ceased. The extent of the impact is on-site because the noise generated by the explosives magazine and existing mining activities results in noise-related health impacts of employees and contractors within the Project site ML31. The magnitude of change is high because cumulative noise from the explosives magazine and mining operations can cause significant loss or degradation of the employees and contractors hearing and wellbeing. Prolonged or repeated exposure can result in permanent hearing loss, chronic stress, sleep disturbance and reduced quality of life, which represent severe damage to essential characteristics of health and physiological functioning. The probability of the impact occurring is possible because noise from the explosives magazine and mining operations is intermittent but recurrent and while engineering controls, hearing protection and operational procedures may reduce exposure, there remains a chance that employees and contractors will experience adverse health effects over time. The sensitivity of the impact is high because hearing and physiological wellbeing, is of critical value and cannot be substituted. Exposure to prolonged or high-intensity noise can cause irreversible damage and individuals have very limited capacity to accommodate or adapt to such changes, thus even moderate noise increases can result in significant adverse effect. Therefore, this impact has been rated adverse minor (before mitigation) and is shown in Table 35. The mitigation measures are included in Domain 8 of the OEMP (Appendix B).

7.6.1.5.3 The cumulative impact of noise generated by the construction of the explosive's magazine and baseline noise of operational activities on ML 31, could be a nuisance to nearby sensitive noise receptors – the southeast neighbouring farmers to ML 31

Baseline monitoring indicates daytime LAeq levels ranging from 38.9 to 86.8 dBA, driven by haul truck movement, rock dumping, excavation, CIP plant operations, reverse hooters and other operational activities. Construction of the explosive's magazine is expected to introduce temporary noise peaks, increasing LAeq and LAFmax levels perceptibly above this baseline, particularly during daytime work hours. Overall, the combined effect of construction and operational noise may result in nuisance and minor disturbance the nearby sensitive noise receptor, the farmers southeast of the Project/ML 31, although it will not cause permanent auditory damage.

The nature of the impact is adverse because the combined construction and operational noise elevate ambient sound levels, may cause a nuisance and disturbance to nearby farmers and degradation of the existing acoustic environment. The impact is cumulative because the noise from the construction of the explosives magazine adds to the existing operational noise of the Navachab Gold Mine on ML 31, resulting in a combined effect that increases overall ambient noise levels and the potential for disturbance of nearby sensitive receptors. The impact is

reversible because noise levels will decrease once construction of the explosive's magazine is completed and the disturbance will return to baseline operational levels, meaning no permanent change occurs to the acoustic environment or surrounding receptors.

The duration of the impact is temporary because the elevated noise levels will only occur during the construction phase of the explosive's magazine, will be for less than one-year, and will cease once construction activities are completed. The extent of the impact is local because the noise generated from the construction of the explosives magazine and ongoing mining operations extend beyond the Project site, within the surroundings of ML 31, including nearby farms within ~2 km from the ML but will not extend beyond the local area or influence regional noise environments. The magnitude of change is negligible because the additional noise generated by the construction of the explosives magazine will cause only a very minor and temporary (> 1 year) increase in sound levels above the existing operational baseline, resulting in minimal alteration to the overall acoustic environment and no significant loss of environmental quality or disturbance to nearby receptors. The probability of the impact occurring is possible because the construction activities for the explosive's magazine will temporarily overlap with ongoing operational noise, making it possible that elevated noise levels could occur at times, though not continuously and could possibly be a nuisance to nearby sensitive noise receptors. Therefore, this impact has been rated adverse low (before mitigation) as shown in Table 35. The mitigation measures are included in Domain 8 of the OEMP (Appendix B).

7.6.1.5.4 *The cumulative impact of noise generated by the operations of the explosive's magazine and the baseline noise of operational activities on ML 31, could be a nuisance to nearby sensitive noise receptors – the southeast neighbouring farmers to ML 31*

Based on the baseline acoustic measurements at Navachab Gold Mine, noise from the operation of the explosive magazines, haul trucks, excavation, dumping, reverse hooters, plant generators and associated operational activities could be a source of annoyance to sensitive receptors located approximately 2 km from the Project site. The baseline data indicate intermittent and impulsive events with high LAFmax values (e.g., NAQ4N daytime peak of 113.9 dB(A) and LAeq of 86.8 dB(A)), as well as elevated LAeq levels from continuous plant and vehicle operations (e.g., NAQ12 daytime LAeq 48.3 dB(A)), which, even after conservative distance attenuation, remain above common rural annoyance thresholds (45 dB(A) daytime, 35 dB(A) night). The combination of intermittent impulsive events, tonal components (reverse beepers, hooting) and elevated background levels, compounded by nighttime sensitivity and potential downwind propagation under wind gust conditions, increases the likelihood of noise being perceived as disturbing. Although attenuation with distance and screening effects from terrain and vegetation may reduce absolute levels, the observed short-term peaks and cumulative operational noise suggest that annoyance and potential sleep disturbance at receptors ~2 km away is plausible, particularly during nighttime and low-background-noise conditions.

The nature of the impact is adverse because the noise generated by the operations of the explosives magazines and associated operational activities can negatively affect the wellbeing and comfort of nearby sensitive receptors. Even at ~2 km, intermittent high-intensity noise events (e.g., blasting, truck dumping, reverse hooters) and elevated background operational noise can cause annoyance, disturb sleep, increase stress and reduce quality of life. The impact is cumulative because the noise from the explosive's magazine, existing magazines and ongoing operational activities adds to existing noise sources in the surrounding environment, creating a combined effect that is greater than any single source alone. Even if individual operations (e.g., a single truck movement or generator operation) might cause minor disturbance, the continuous and overlapping contributions from multiple activities over time, including haul trucks, dumping, rock rolling, reverse beepers, plant machinery and occasional blasting, can accumulate to sustain elevated noise levels at nearby receptors. The overall impact is greater than the sum of isolated events. The impact is reversible because the noise disturbance is directly linked to ongoing operational activities, and once these activities cease or are reduced, the noise levels at nearby receptors will return to baseline ambient conditions.

The duration of the impact is long term (5< years until end of LoM which is 2033) because the operational activities, haul trucks, excavation, machinery and processing are expected to continue until the end of mine life in 2033. The extent of the impact is local because the noise generated by the mine's operations predominantly affects areas in the immediate vicinity of the Project site and nearby sensitive receptors, such as the farmers within ~2 km southeast from the Project site on ML 31. The magnitude of change is negligible because although operational noise is present, the baseline measurements and distance attenuation indicate that the overall alteration to ambient conditions at distant receptors (~2 km) will be minor. Noise levels at these receptors are only slightly above natural background levels and there is no permanent alteration to the environment or major loss of amenity; only a minor and temporary change in auditory comfort occurs.

The probability of the impact occurring is possible because the operational activities at the mine regularly generate noise that can propagate to nearby sensitive receptors (~2 km away). While not every noise event will reach levels that cause noticeable annoyance, there is a possibility that intermittent high peaks or cumulative operational noise will be perceived by receptors, especially during nighttime or downwind conditions. Furthermore, the sensitivity of the impact is low because the affected farmers are local receptors without special designation for noise sensitivity and are not considered rare or of high value in a regional or national context. Additionally, human receptors and the local environment generally have a reasonable capacity to tolerate or adapt to intermittent operational noise. Therefore, this impact has been rated adverse low (before mitigation) as shown in Table 35. The mitigation measures are included in Domain 8 of the OEMP (Appendix B).

7.6.1.5.5 *Cumulative noise and ground vibration related health impacts from the accidental detonation of three explosive magazines on employees and contractors on the Project site/ML 31*

The cumulative noise and ground vibration impacts resulting from the accidental detonation of the three explosive magazines on the Project Site/ML 31 are expected to produce severe and potentially acute health effects on employees and contractors within the vicinity. The simultaneous or effectively instantaneous detonation of the three magazines, totalling 120 000 kg (120 metric tons) of ANFO, constitutes a massive explosives event. Using an industry-standard TNT equivalence factor of 0.85 for ANFO, the total calculated energy release is approximately 102 metric tons of TNT. Based on established scaling laws, where the destructive range is proportional to the cube root of the explosive mass ($R \propto M^{1/3}_{\text{tnt}}$), the blast effects can be projected to affect a quantifiable, though generalised, zone around the detonation site. The local geology, dominated by hard, metamorphosed rocks such as dolomitic marble and schists of the Swakop Group, facilitates efficient transmission of seismic energy, allowing vibrations to propagate across long distances with minimal attenuation. The resulting shockwave is expected to generate peak particle velocities (PPV) in the range of 30–50 mm/s within 500 m of the blast and overpressures exceeding 15 kPa, sufficient to cause acute auditory and physiological effects in exposed personnel. Ground vibrations at these PPV levels can induce musculoskeletal strain, disorientation and heightened stress responses, while the air blast overpressure can cause temporary or permanent hearing threshold shifts, tinnitus and eardrum rupture(s). Cumulatively, these exposures may exacerbate cardiovascular stress, sleep disturbances and anxiety, particularly if personnel are within proximity to the blast zones.

The nature of the impact is adverse because it directly threatens the health, safety and well-being of employees and contractors on the Project Site/ML 31. Accidental detonations produce extremely high-intensity air blast and ground vibration, which can cause physical harm. These effects compromise the ability of personnel to perform tasks safely and can lead to long-term health consequences (or even death if within a 500 m zone). The impact is cumulative because it results from the combined effects of multiple sources rather than a single isolated incident. In this case, the detonation of three explosive magazines produces overlapping noise, air blast and ground vibration effects that interact with one another, leading to an aggregated exposure for employees and contractors. Even if each individual explosion were managed or partially mitigated, the simultaneous or near-simultaneous detonations of three explosive magazines amplify the total energy released, increasing the potential severity of physiological and auditory impacts. The cumulative nature reflects how multiple contributing factors combine to create a greater, compounded impact on human receptors than any single source alone.

The impact is irreversible because exposure to the high-intensity noise, air blast and ground vibrations from the accidental detonation can cause permanent health effects, such as irreversible hearing loss, tinnitus or lasting physiological stress, which cannot be fully restored to baseline conditions (or even death). The duration of the impact is permanent because the effects on human health, such as hearing loss, tinnitus, or long-term physiological stress from an accidental detonation are lifelong. Once the auditory or physiological damage occurs, it cannot naturally recover over time, meaning the impact persists for the remainder of the affected individual's life. The magnitude of change is high because the accidental detonation of

the three explosive magazines would result in severe damage to key characteristics and features of the affected receptors, in this case, the employees' and contractors' health. The event could cause permanent hearing loss, tinnitus, or serious physiological stress (or death), representing a complete or significant loss of the health that cannot be restored. The intensity of the blast and the cumulative exposure entails that the quality and integrity of the affected resource (human health and safety) would be critically compromised. However, the probability of the impact occurring is rare because strict safety protocols, regulatory controls, magazine design standards, controlled access and operational procedures at the Project Site/ML 31 are specifically implemented to minimise the risk of unintended explosions. While the consequences would be severe if it occurred, the combination of engineering safeguards, handling procedures and routine monitoring makes the actual occurrence of such a catastrophic detonation highly improbable. While the sensitivity of the impact occurring is high because human health and safety is of critical value and irreplaceable, employees and contractors are directly exposed to potentially life-altering effects such as permanent hearing loss, severe physiological stress, or other serious injuries or death, which cannot be substituted or replaced. Additionally, human health has very limited capacity to accommodate sudden, extreme changes like high-intensity blasts and vibrations, meaning even a single accidental detonation would have profound consequences. Therefore, this impact has been rated adverse minor (before mitigation) and shown in Table 35. The mitigation measures are included in Domain 8 of the OEMP (Appendix B).

7.6.1.5.6 The cumulative impact of the accidental detonation of the three explosive magazines on nearby noise sensitive receptors, third parties resulting in air blasts and ground vibration that can be felt by the farmers ~ 2 km from the project site/ML 31 and the town of Karibib (10.5 km from the project site)

The cumulative detonation of the three explosive magazines, totalling 120 000 kg of ANFO (~102 t TNT equivalent), would produce a massive explosive event whose effects would propagate over several kilometres, affecting third-party receptors to varying degrees depending on distance and local geology. At the farms located approximately 2 km southeast of the site, the air blast would be perceived as a very loud, a sharp impulse, accompanied by a sudden change in air pressure that could rattle windows, doors and light structures, and may cause minor cosmetic damage such as small cracks in plaster or flaking paint in older or vulnerable buildings. The strong, hard metamorphic geology of the area, dominated by dolomitic marble and schists, facilitates efficient transmission of seismic energy, so ground vibrations would be perceptible as a rumble or tremor, with peak particle velocities likely in the range of 2–5 mm/s, sufficient to disturb livestock, startle residents and cause noticeable shaking of loose items. In the town of Karibib, approximately 10.5 km from the blast site, the effects would be significantly attenuated; the air blast would be heard as a distant boom and ground vibrations would be very low (<1 mm/s), perceptible only as a faint rumble in sensitive buildings, with negligible risk of structural damage. Across both receptor locations, the suddenness of the detonation could generate alarm or stress among residents and livestock, and if such detonations were repeated, the

cumulative effect could increase nuisance, psychosocial stress and the potential for minor cosmetic damage. Overall, while significant structural impacts are unlikely, the blast would be highly noticeable, producing perceptible vibrations, audible impulses, temporary disturbance to people and sensitive infrastructure.

The nature of the impact is adverse because the air blast and ground vibrations from the detonation are sudden, intense and beyond natural background levels, causing disturbance, alarm and stress to people living or working near the site. The impact is cumulative because the compounding effect of the accidental detonation is greater than if just a single explosive magazine had accidentally detonated. The impact is reversible because once the noise from the blast subsides, receptors return to normal, with no permanent physical damage or lasting alteration to the environment caused solely by the noise. Any disturbance, stress or alarm is temporary and does not cause permanent change. The duration of the impact is temporary because the noise from the detonation is short-lived, occurring only during the blast and dissipating almost immediately afterward. Once the air blast subsides, normal ambient conditions return, and receptors (humans, livestock, and wildlife) are no longer exposed to the noise. The effects, such as startle, alarm, or stress, last only for the brief period of the sound and its immediate aftermath. The extent of the impact is local because it can be felt by nearby receptors outside of the Project site/ML 31 such as nearby farmers and between the town of Karibib and ML 31.

The magnitude of change is negligible because in the context of noise impacts, the detonation produces only minor, temporary disturbances to receptors. Humans or livestock may hear a loud blast or feel a brief vibration, but these effects do not cause lasting harm, structural damage, or permanent alteration to their environment. The noise represents a small, short-term change in their experience or comfort, affecting only one characteristic, the immediate acoustic environment, without significantly reducing its quality or integrity. However, the probability of the impact occurring is rare because under normal mining operations, strict safety protocols, storage regulations, and handling procedures make such an accidental cumulative detonation highly improbable. Furthermore, the sensitivity of the impact is low because the receptors affected by the noise, such as local residents, livestock, and buildings, are not particularly rare, highly valuable, or critically sensitive on a local scale. Humans and animals can tolerate short-term noise disturbances, and most structures can accommodate brief vibrations without significant damage. Therefore, the affected receptors have a considerable capacity to absorb or recover from the noise. Therefore, this impact has been rated adverse low (before mitigation) as shown in Table 35. The mitigation measures are included in Domain 8 of the OEMP (Appendix B).

Table 35 - Intraspecific cumulative impacts of the Navachab Underground Mine (Socio-economic environment: Social impacts)

Receptor	Impacts	Significance of impact	Impact management
Air quality	Activity: Explosive magazines, blasting and other underground mining activities Impact: Toxic airborne emissions from burning of magazine packaging and other mining activities	Minor (3)	– Ventilation systems – ensure adequate airflow using main ventilation raises and auxiliary fans to dilute and remove pollutants (e.g., CO, NO_x, SO_x, PM). – Follow the requirements as stipulated in the Explosives Act, No. 26 of 1956 and associated Regulations. – Fuel efficient driving practices on site, may also help lower exhaust emissions from vehicles and machinery and reduce vehicle entrainment, such as stipulating a maximum speed on all unpaved roads. In addition, other fuel-efficient practices that may lower exhaust emissions include limiting idling of machinery, driving in an upper gear rather than a lower gear as much as possible, ensuring tire pressure are always adequate etc. – Provide the appropriate PPE to employees when working near gas emissions. – Ensure that international and South African air quality standards and best practices are adhered to.
	Activity: Blasting, drilling, vehicle use and other dust generating activities Impacts: Dust and particulate effects of the health of employees	Minor 3	– Dust suppression using water sprays or misting systems at blasting sites, loading areas and roads to minimise particulate matter. – Continuous monitoring of fallout dust around the mining area.

Receptor	Impacts	Significance of impact	Impact management
			– Maintenance and repair of diesel engines should be carried out as prescribed by manufacturer to maximise combustion and reduce gaseous emissions. – Provide the appropriate PPE to employees when working near dust sources. – Ensure that international and South African air quality standards and best practices are adhered to.
Visual	Activity: The construction and operation of a third explosives magazine Impact: Users of the B2 road passing to the north (N) of the mine leaving Karibib towards Usakos, might have direct or partial views of all three (3) explosives magazines leading to visual disturbances.	Minor (3)	– Maintain fenced and clearly demarcated magazine area to prevent accidental entry of wildlife. – Keep surrounding vegetation trimmed to discourage nesting, burrowing, or concealment near the magazine walls. – Regularly inspect for wildlife presence (e.g., snakes, small mammals, birds nesting in crevices); relocate safely using trained personnel when required. – Enforce a strict no-harm policy relating to wildlife around the magazine area, no trapping, feeding, harassment, or removal except for safe relocation. – Keep doors and ventilation points screened or sealed to prevent animals from entering storage buildings. – Minimise noise, vibration, and unnecessary lighting around the magazine to avoid disturbance and nocturnal fauna displacement. – Use downward-facing, low-intensity / motion-activated lighting to reduce attraction of insects and nocturnal species.
	Activity: The construction and operation of a third explosives magazine Impact: The explosives magazine could contribute to the cumulative visual degradation of the area, when combined with other mining infrastructure on ML 31.	Minor (3)	

Receptor	Impacts	Significance of impact	Impact management
			– Ensure all food waste and general refuse is stored in wildlife-proof bins and removed regularly to prevent scavenger attraction. – No water pooling near the magazine, standing water can attract mammals, reptiles, and birds. Maintain proper drainage. – Vehicle speed limits enforced on access roads (e.g., 20–30 km/h) to reduce wildlife collisions. – Routine ECO monitoring to check compliance and record fauna sightings, interactions, or incidents. – Maintain a Fauna Incident Register, documenting any injury, mortality, or relocation events and report in monthly environmental records. – Review and adapt procedures annually or after any fauna-related incident to improve wildlife protection practices. – Engage staff through periodic refresher training on wildlife awareness and safe response procedures around the magazine. – Earth-tone / non-reflective external finishes on magazine buildings (e.g., beige, tan, brown, stone-grey) to blend with local rock and soil colours typical of the Erongo landscape. – Keep lighting minimal and directional, using downward-facing, shielded fixtures to avoid light pollution and sky-glow visible at distance

Receptor	Impacts	Significance of impact	Impact management
			– Establish a natural vegetation buffer using indigenous shrubs and low-growing tree species to soften lines of constructed features. – Rehabilitate construction disturbance zones around the magazine with stockpiled topsoil and local seed mix to reintegrate structure into surrounding terrain. – Use berms or low earthen bunds shaped to mimic natural land contours to visually screen magazines from key viewpoints (e.g., farmers, access roads). – Maintain a clear colour and texture continuity between magazine roofs and surrounding terrain to reduce contrast. – Limit the footprint of associated infrastructure such as access tracks to prevent the visual widening of the project area. – Minimize dust emissions around the magazine area to avoid creating noticeable dust plumes visible at long distances. – Ensure operational waste and equipment storage areas near the magazine are tidy, contained, and not visually cluttering the landscape. – Periodic inspections of visual mitigation effectiveness, especially from known viewpoints or receptor locations (e.g., B2 road, mine settlement points). – Review visual impacts after vegetation establishment, and if screening remains insufficient, supplement planting or adjust bunding.

Receptor	Impacts	Significance of impact	Impact management
Heritage	Activity: The operation of all three explosive magazines Impact: The cumulative impact of blast waves from the simultaneous accidental detonation of all three explosive magazines could result in the damage or destruction of archaeological artifacts and sites in the major window breakage/fragility damage zones between 1 km – 10 km	Minor (3)	– Environmental section to conduct a detailed archaeological and heritage survey of the construction area to prior to clearing activities taking place to determine if there are potential sites of concern. If potential sites are identified, the sites to be demarcated and an archaeological specialist to be contacted to conduct a site visit to determine significance of sites; – Implement the chance find procedure outlining steps to follow if previously unknown artifacts or features are discovered during construction;
	Activity: The operation of all three explosive magazines Impact: The cumulative impact of ground vibration from the simultaneous accidental detonation of all three explosive magazines could result in the damage or destruction of archaeological artifacts and sites	Minor (3)	– Establish exclusion zones around identified heritage sites to prevent accidental disturbance; – Limit excavation to areas already cleared by surveys; use hand tools in sensitive areas to minimise disturbance; – Provide construction personnel with training on identifying heritage materials and following the chance find procedure; – Optimise the layout of infrastructure to avoid sensitive areas where possible;
	Activity: The operation of all three explosive magazines Impact: The cumulative impact of fly rock from the simultaneous accidental detonation of all three explosive magazines	Minor (3)	– Record and where appropriate, remove and preserve artifacts discovered during construction; – Restore disturbed areas as much as possible, including backfilling trenches and re-vegetation, while maintaining any preserved heritage features;

Receptor	Impacts	Significance of impact	Impact management
	could result in the damage or destruction of archaeological artifacts and sites		– Implement ongoing monitoring for any delayed impacts on heritage features and report findings to the relevant heritage authorities; – Obtain necessary approvals and comply with the National Heritage Act, No. 27 of 2004 and local heritage authorities before commencing construction; and – Engage with relevant heritage authorities and local communities to ensure culturally sensitive management of heritage artifacts.
Noise	Activity: Construction of the explosive's magazine along with daily operational activities of the mine Impact: Noise-related health impacts affecting the occupational health and safety of employees and contractors	Moderate (6)	– Use newer or well-maintained machinery with lower noise emissions; – Fit haul trucks, loaders, crushers, and drilling rigs with noise-reducing technologies (e.g., mufflers, acoustic enclosures); – Ensure regular maintenance of equipment to avoid excessive noise from worn components; – Schedule controlled blasts during less sensitive periods (daytime) to minimise exposure to workers; – Use delayed blasting techniques or reduced charge sizes where feasible to reduce peak noise and vibration; – Position noisy equipment away from worker congregation areas or sensitive locations on-site; – Limit individual exposure by rotating workers on high-noise tasks; – Train all employees and contractors on the risks of noise exposure, signs of hearing damage and safe work practices;

Receptor	Impacts	Significance of impact	Impact management
			– Provide clear signage indicating high-noise zones and safe distances; – Mandatory use of high-quality earplugs or earmuffs and provide double protection (earplugs + earmuffs) in peak noise zones (e.g., during blasting or near crushers); – Ensure regular fit testing, training, and replacement of PPE to maintain effectiveness; – Conduct baseline and periodic audiometric testing for all exposed workers; – Implement a health surveillance program to detect early signs of NIHL and related conditions; – Monitor both LAeq (average noise levels) and LAFmax (peak noise levels) to identify risks in real-time; – Investigate and address any exceedances promptly; – Notify local communities of planned noisy activities in advance; – Provide mechanisms for reporting noise complaints and responding promptly; and – Manage reversible stress and sleep disturbance through scheduling and temporary respite areas away from noisy zones
	Activity: Construction of the explosive's magazine along with daily operational activities of the mine	Low (2)	– Limit construction activities to daytime hours (e.g., 07:00–18:00) to avoid disturbance during early morning, evening, and nighttime.

Receptor	Impacts	Significance of impact	Impact management
	Impact: Noise related nuisance and annoyance on noise sensitive receptors, which are farmers ~2 km southeast of the Project/ML 31		– Schedule high-noise activities (e.g., drilling, blasting, heavy vehicle movement) at consistent and predictable times and communicate schedules to affected farmers in advance. – Maintain all vehicles and machinery to ensure engines, exhaust systems, and silencers are functioning properly to reduce avoidable noise. – Use low-noise equipment models where possible and ensure regular lubrication and servicing of moving parts. – Design and orient magazine buildings and infrastructure to take advantage of natural landforms (e.g., ridges, berms) that can serve as noise barriers. – Erect temporary or permanent earthen berms and/or vegetated bunds around the magazine area to provide partial sound attenuation. – Reduce idling time of trucks, generators, and equipment. – Use broadband reversing alarms (white-noise type) instead of tonal “beepers,” which are more intrusive over distance. – Implement speed limits and designated access routes to reduce engine noise and heavy vehicle braking on farm boundaries. – Avoid unnecessary hooting and unnecessary high-rev operation of equipment. – Establish and maintain a stakeholder communication channel (WhatsApp group, SMS alerts, or quarterly meetings) to provide: advance notice of blasting times, updates on any

Receptor	Impacts	Significance of impact	Impact management
			abnormal high-noise activity, opportunity for farmers to raise concerns. – Monitor noise levels periodically at sensitive receptor points (farmhouses, accommodation blocks, livestock kraals), particularly during periods of high activity. – Document complaints and responses in a Noise & Vibration Engagement Register; evaluate trends and adjust mitigation where necessary. – If complaints increase, consider additional noise-damping measures, such as barriers or acoustic cladding on machinery, relocation of high-noise temporary operations if feasible
	Activity: Operation of explosives magazine along with the daily operational activities of the mine Impacts: Noise-related health impacts affecting the occupational health and safety of employees and contractors	Moderate (6)	– Use newer or well-maintained machinery with lower noise emissions; – Fit haul trucks, loaders, crushers, and drilling rigs with noise-reducing technologies (e.g., mufflers, acoustic enclosures); – Ensure regular maintenance of equipment to avoid excessive noise from worn components; – Schedule controlled blasts during less sensitive periods (daytime) to minimise exposure to workers; – Use delayed blasting techniques or reduced charge sizes where feasible to reduce peak noise and vibration; – Position noisy equipment away from worker congregation areas or sensitive locations on-site; – Limit individual exposure by rotating workers on high-noise tasks;

Receptor	Impacts	Significance of impact	Impact management
			– Train all employees and contractors on the risks of noise exposure, signs of hearing damage and safe work practices; – Provide clear signage indicating high-noise zones and safe distances; – Mandatory use of high-quality earplugs or earmuffs and provide double protection (earplugs + earmuffs) in peak noise zones (e.g., during blasting or near crushers); – Ensure regular fit testing, training, and replacement of PPE to maintain effectiveness; – Conduct baseline and periodic audiometric testing for all exposed workers; – Implement a health surveillance program to detect early signs of NIHL and related conditions; – Monitor both LAeq (average noise levels) and LAFmax (peak noise levels) to identify risks in real-time; – Investigate and address any exceedances promptly; – Notify local communities of planned noisy activities in advance; – Provide mechanisms for reporting noise complaints and responding promptly; and – Manage reversible stress and sleep disturbance through scheduling and temporary respite areas away from noisy zones

Receptor	Impacts	Significance of impact	Impact management
	Activity: Operation of the explosive's magazine along with daily operational activities of the mine Impact: Noise related nuisance and annoyance on noise sensitive receptors, which are farmers ~2 km southeast of the Project/ML 31	Low (2)	– Limit noisy operational activities to daytime hours (e.g., 07:00–18:00) to avoid early morning or evening disturbance. – Schedule high-noise operations predictably (e.g., magazine handling, loading, heavy vehicle movements) and communicate schedules to farmers in advance. – Maintain vehicles, generators, and machinery to reduce unnecessary noise (e.g., proper exhausts, lubrication, servicing). – Use low-noise equipment and broadband reversing alarms instead of high-pitched beepers where feasible. – Orient magazine and operational buildings to take advantage of natural landforms as noise buffers. – Install earthen berms or vegetated bunds around operational areas to partially screen noise from nearby receptors. – Reduce idling of vehicles and equipment and enforce speed limits on mine access roads to minimize engine noise. – Ensure proper communication channels with farmers (SMS, email, meetings) to provide notice of blasting or other high-noise events. – Monitor noise levels periodically at sensitive receptor points (farmhouses, livestock areas) to ensure compliance with limits. – Record complaints and actions taken in a noise & vibration engagement register and adjust mitigation measures if recurring issues are identified.

Receptor	Impacts	Significance of impact	Impact management
			– Consider additional noise reduction measures if complaints persist, such as acoustic cladding on high-noise machinery or temporary relocation of noisy activities. – Educate and train staff on noise awareness and minimizing unnecessary noise during operations.
	Activity: The accidental detonation of all three explosive magazines, resulting in air blasts and ground vibrations Impact: Noise and ground vibration related health impacts on employees and contractors	Minor (3)	– Strict compliance with explosives storage regulations (e.g., Namibian Explosives Act) to prevent accidental detonation. – Maintain safe separation distances between magazines, operational areas, and employee workstations according to recommended blast safety zones. – Implement robust magazine design standards, including blast-resistant walls, venting systems, and shock-absorbing features to reduce overpressure and ground vibration propagation. – Conduct regular structural integrity inspections of magazines (walls, roofs, flooring, ventilation) by qualified engineers. – Ensure all explosives handling and transfer procedures follow SOPs, including approved quantities per magazine and controlled access. – Train all employees and contractors in emergency procedures, including evacuation, safe distances, and first aid response to blast-related injuries. – Install warning and alarm systems for any abnormal conditions (heat, sparks, unauthorized access) to allow rapid evacuation.

Receptor	Impacts	Significance of impact	Impact management
			– Establish exclusion zones around magazines, restricting personnel presence to essential staff only. – Use personal protective equipment (PPE) for workers in proximate operational areas (ear protection, helmets, safety goggles). – Conduct regular emergency drills simulating detonation scenarios, including safe evacuation routes and assembly points. – Implement blast monitoring systems (if feasible) to record overpressure and ground vibration levels during controlled testing or accidental events. – Provide health monitoring for employees exposed to any blast-induced vibration or noise, including medical check-ups post-incident. – Document and review incidents and near-misses, updating SOPs and risk assessments accordingly.
	Activity: The accidental detonation of all three explosive magazines, resulting in air blasts and ground vibrations Impact: Shock of nearby farmers outside of ML 31 and the residents of Karibib	Low (1)	– strict compliance with explosives storage regulations (Namibian Explosives Act) to prevent accidental detonations. – – Maintain adequate separation distances between magazines, mine operations, and nearby communities in accordance with blast safety guidelines. –

Receptor	Impacts	Significance of impact	Impact management
			– Design magazines to be blast-resistant, with reinforced walls, shock-absorbing structures, and venting systems to minimize overpressure effects. – Limit maximum explosive quantities per magazine to reduce potential blast energy. – Implement robust access control and security measures to prevent unauthorised entry into magazine areas. – Regular structural integrity inspections by qualified engineers to ensure magazine stability. – Install early-warning systems or alarms to alert workers and, if feasible, nearby communities in the event of abnormal conditions. – Educate employees and contractors on risk mitigation, safe handling procedures, and emergency response for accidental detonations. – Establish a community liaison system to inform residents and farmers about potential risks, emergency contacts, and blast safety information. – Maintain a Blast & Safety Incident Register, recording incidents, near misses, and follow-up corrective actions.

7.6.2 INTRASPECIFIC IMPACTS (BIOPHYSICAL ENVIRONMENT)

7.6.2.1 Surface water cumulative impacts

An illustration of the cumulative surface water impacts is shown in Figure 72.

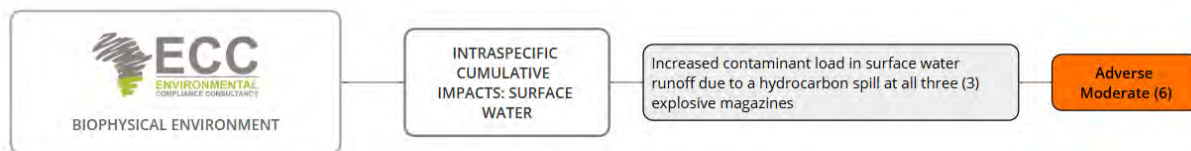


Figure 72 - Cumulative surface water impact

7.6.2.1.1 Increased contaminant load in surface water runoff due to a hydrocarbon spill at all three (3) explosive magazines

There are already two explosive magazines in the same location near the proposed location of the additional (third) explosive's magazine. In the event of a hydrocarbon spillage from all three (3) magazines, there is a potential for significant contaminant loads into the site's drainage network, Aroab River, the Slang River and other downstream surface water bodies. The stormwater management plan identifies the storage and handling of hazardous materials as a critical area for management, requiring impermeable floors, bunding and sumps to contain spills. As the explosives magazines would be classified as "dirty areas," any stormwater runoff from these sites has the potential to become contaminated with hydrocarbons, nitrates, or other pollutants. Placing three (3) such facilities in close proximity would raise both the potential volume and the concentration of contaminants released in the event of a spill or system failure. Contaminated runoff could then be conveyed via the site's drainage networks into downstream channels, directly impact water quality and usage by downstream communities.

The nature of this impact is adverse and cumulative as hydrocarbon spills from all three (3) explosive magazines would result in substantial contaminant loads that may enter on-site drainage lines and surface water bodies. This would direct degrade surface water quality and reduce the availability of clean water for downstream users. This impact is considered reversible as remediation measures can be implemented and hydrocarbon containment systems will be developed as best practice. However, the duration of the impact is considered medium-term as these contaminants have the potential to persist in the environment (in soils and geological substrates) for a long period of time (5 - 15 years), even after the cleanup efforts. The extent of the impact is considered likely to be regional, particularly if spillages coincided with heavy rainfall events, which would facilitate the transport of contaminants through the site's drainage and stormwater management systems to regional drainage lines and surface water bodies. The magnitude of change is assessed as high as there is potential for water quality deterioration, which will also impact its suitability and usage by downstream users. The probability of the impact occurring is possible (medium) as the three (3) explosive magazines will be located close to each other.

The sensitivity of the impact is rated medium, considering the significant value of surface water resources in an arid region such as the Erongo Region, where there are little to no alternative water sources available. Overall, the significance of the impact is rated adverse moderate, before mitigation (Table 37). The two (2) existing explosive magazines are equipped with impermeable floors, appropriate bunding and sumps, which are designed to contain spills. The proposed magazine will incorporate similar design features to ensure compliance with all relevant safety standards.

The mitigation measures, which are included in Table 37 and in the Navachab OEMP under Domain 4, should be implemented.

7.6.2.2 Groundwater impacts

An illustration of the impact is shown in Figure 73.

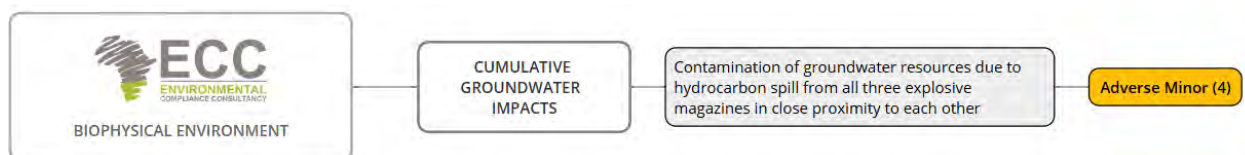


Figure 73 - Cumulative groundwater impact

7.6.2.2.1 Contamination of groundwater resources due to hydrocarbon spills from all three explosive magazines near each other

The cumulative impact of a hydrocarbon (ANFO) spill from all three (3) explosive magazines occurring simultaneously would pose a significant risk of groundwater contamination. Both the existing explosive magazines and the proposed location for the additional magazine are situated above a fractured, fissured or potentially karstified aquifer with moderate to low groundwater potential. In the event of combined spills resulting from an abnormal incident, the cumulative contamination load could exceed the natural attenuation capacity of the subsurface environment, thereby increasing the likelihood of widespread and persistent groundwater pollution. Given the aquifer type in the area, which is characterised by a high transmissivity due to its fractured nature, pollutants have the potential to rapidly infiltrate and contaminate groundwater resources. Furthermore, the presence of isolated karst features further compounds this risk, as these structures can temporarily hold nitrate-rich water, which may suddenly be released as concentrated surge, or "slug load," following shifts in hydraulic pressure. Additionally, a fault line trending northwest (NW) to southeast (SE) is currently undergoing depressurisation, which increases the likelihood that contaminants could be drawn directly into the main open pit. Due to the increased number of explosive magazines (three in total), the contaminated load would significantly increase. This would affect the groundwater quality and availability of water for the mine and local users.

The nature of this impact is adverse and will directly affect the quality of the underground water supply by polluting it with hydrocarbons. The reversibility of this impact is partly reversible because if contamination is detected early via the site's monitoring boreholes, remediate actions can be initiated to prevent potential further spread. The duration of the impact, if not

immediately managed, could result in long-term pollution of the aquifer and groundwater in the local area. The extent of the impact is regional as it will spread beyond the boundaries of ML 31 and affect local users, nearby farmers and the broader Karibib community (downstream communities). The probability of this impact occurring is possible (medium), assessed as a worst-case scenario. However, the Proponent has the required legal mitigation in place for the existing two magazines and will adopt the same measures for the proposed magazine to prevent such an occurrence. This is expected to reduce the likelihood of the impact. The magnitude of change is rated high as the pollution would significantly affect water availability for the mine and multiple downstream users. Furthermore, these spill events would affect the integrity and quality of the groundwater in the aquifer over time, if not promptly addressed. The sensitivity of the impact is rated medium, considering the magnitude of the impact and its impact on a regional scale. Overall, the significance of the impact rated adverse minor, before mitigation measures (Table 36). Mitigation measures are detailed in the Navachab OEMP under Domain 8.

7.6.2.3 Noise cumulative impacts

An overview of the cumulative noise impacts on biodiversity during construction and operations is visually summarised in Figure 74 before mitigation and the impact assessment ratings are detailed in Table 37.

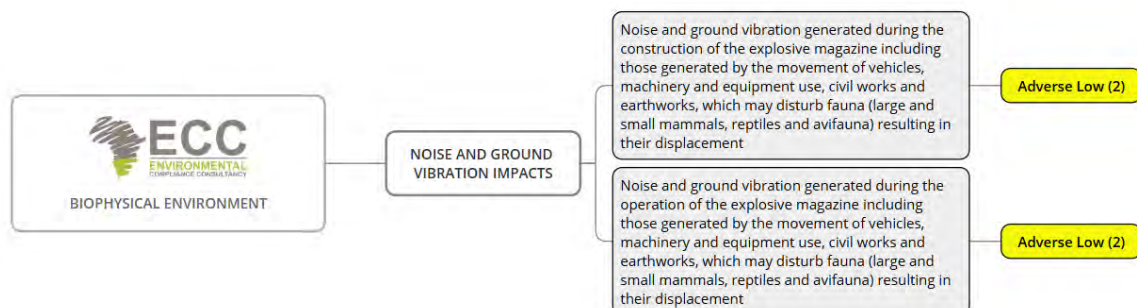


Figure 74 - Cumulative impacts of noise on wildlife

7.6.2.3.1 The cumulative noise impact generated by the construction of the explosives magazine combined with the baseline noise environment from the Navachab daily operational activities may result in the disturbance and temporary displacement of wildlife on the Project site/ML 31

Based on the baseline noise monitoring results for Navachab Gold Mine (ML 31), which recorded daytime noise levels ranging between approximately 38.9 dBA and 86.8 dBA and nighttime levels between 40.6 dBA and 52.8 dBA under prevailing wind gust conditions, the existing environment can be characterised as disturbed by ongoing mining, vehicular and traffic from the B2 national road activities. The construction of the explosive's magazine and the associated operational activities are expected to introduce additional intermittent and continuous noise sources from machinery, vehicle movement and occasional blasting. However, given that the area already experiences elevated ambient noise levels due to existing

operations, the incremental change in acoustic conditions is anticipated to have minimal change to the baseline noise environment. Wildlife within ML 31 is not expected to exhibit significant signs of disturbance to these changes, as most species in the area are locally common and have adapted to persistent anthropogenic disturbances.

The nature of the impact is adverse because increased noise from construction and operational activities will negatively disturb wildlife behaviour and habitat use within the already noisy mining environment. The impact is cumulative because the noise generated from the construction of the explosives magazine and ongoing operational activities will add to the existing baseline noise from current mining operations, vehicle movement and equipment use, thereby increasing the overall and prolonged exposure of wildlife to elevated sound levels within the mining area. The impact is reversible because noise-related disturbance will cease once construction and operational activities stop, allowing wildlife to return and reoccupy previously disturbed areas as ambient sound levels revert to baseline conditions. The duration of the impact is temporary because the increased noise levels will occur only during the construction phase and specific operational periods, after which noise generation will subside or cease, allowing environmental conditions and wildlife activity to recover to baseline levels over time.

The extent of the impact is on-site because the noise generated from construction and operational activities will be confined to the immediate area surrounding the explosives magazine and active operational activities. The magnitude of change is negligible because the additional noise generated during the construction of the explosive's magazine will cause only a very minor alteration to the existing acoustic environment, which is already influenced by ongoing mining and vehicle activity. This means there will be little to no measurable change in overall noise levels or in the behaviour of wildlife, resulting in minimal loss or disturbance to ecological characteristics or features within the mine area. The probability of the impact occurring is possible because the new activities will add some noise, but since the area is already noisy and local animals are used to it, it's uncertain whether the extra noise will disturb them. Therefore, the sensitivity of the impact is low because the wildlife on site have already adapted to ongoing operational and vehicle noise, showing a strong ability to tolerate and recover from changes in their environment. Therefore, this impact has been rated adverse low (before mitigation), shown in Table 37. Mitigation measures are detailed in the OEMP Domain 8 (Appendix B).

7.6.2.3.2 *The cumulative noise impact generated by of the operations of the explosives magazine combined with the baseline noise environment from daily operational activities may result in the disturbance and displacement of fauna on the Project site/ML 31*

The operations of the explosives magazine at the Project site will involve a series of controlled, routine activities such as the delivery, offloading and storage of explosives, loading and unloading of detonators and blasting accessories, internal transport of materials, vehicle

movements to and from the magazine, regular safety inspections and occasional handling or transfer operations prior to blasting events. These activities generate localised, short-duration noise primarily from vehicle engines, reversing alarms, metal handling and low-frequency vibrations during loading and movement. When combined with the existing baseline operational noise environment, where daytime LAeq levels range between approximately 38.9 dBA and 86.8 dBA, and impulsive LAFmax peaks of up to 113.9 dBA have been recorded due to haul truck dumping, vehicle movements and rock falls, the cumulative increase in noise is expected to be minor and well within the existing acoustic range of the mine area. Given that wildlife within ML 31 is already exposed to and has likely habituated to the regular and consistent operational noise associated with mining activities, it is unlikely that animals will be significantly disturbed by the additional operations of the explosive's magazine. Any disturbance that does occur is expected to manifest as temporary avoidance behaviour or short-term displacement of more sensitive species near the magazine site.

Therefore, the nature of this impact is adverse because the operations of the explosive magazine, in combination with ongoing mining activities, introduces additional anthropogenic noise that can negatively affect wildlife behaviour within the Project area. The impact is cumulative because noise from the explosive's magazine combined with existing operational noise sources, increases overall disturbance levels and extending the duration of noise exposure experienced by wildlife. The impact is reversible because the disturbance to wildlife caused by noise from the explosives magazine and ongoing mining activities is temporary and does not result in permanent habitat loss or long-term population declines; once noise levels decrease or activities cease, animals are expected to return to the affected areas and resume their normal behaviour. The duration of the impact is long term because the operations of the explosive magazine, combined with ongoing mining activities, will persist over the LoM, which may be more than five years, resulting in repeated and continuous exposure of wildlife to elevated noise levels. The extent of the impact is on-site because the noise generated by the operation of the explosives magazine and associated mining activities is localised to the immediate area of the magazine and nearby operational zones within ML 31.

The magnitude of change is considered negligible because the operations of the explosives magazine, when combined with existing mining activities, is expected to cause only a very minor alteration to wildlife behaviour, such as temporary avoidance or short-term disturbance, without resulting in significant loss of habitat, population decline or permanent ecological damage. The noise effects are localised, intermittent and occur within an environment where fauna have already adapted to regular operational disturbances, meaning that the overall change to ecological characteristics or key features of the site is extremely limited. The probability of the impact occurring is possible because the operations of the explosive's magazine will generate additional noise within the existing operational environment, which has already been shown through baseline monitoring to affect wildlife behaviour to some degree. While the disturbance is not guaranteed to cause significant displacement for all species, there is a possibility that sensitive individuals or groups may temporarily avoid areas near the

magazine or alter their normal activities. The sensitivity of the impact is low because the wildlife affected by the operations of the explosives magazine on ML 31 is of local ecological value and not particularly rare or sensitive and the species present have already adapted to the existing mining noise and disturbances. This entails localised fauna have a considerable capacity to tolerate additional noise without long-term harm or significant disruption to their populations or habitat use, making the overall sensitivity of the affected receptors low. Therefore, this impact has been rated adverse low (before mitigation) as shown in Table 37. Mitigation measures are detailed in the OEMP Domain 8 (Appendix B).

7.6.2.4 Built environment cumulative impacts

An illustration of the built environment impacts is shown in Figure 75.

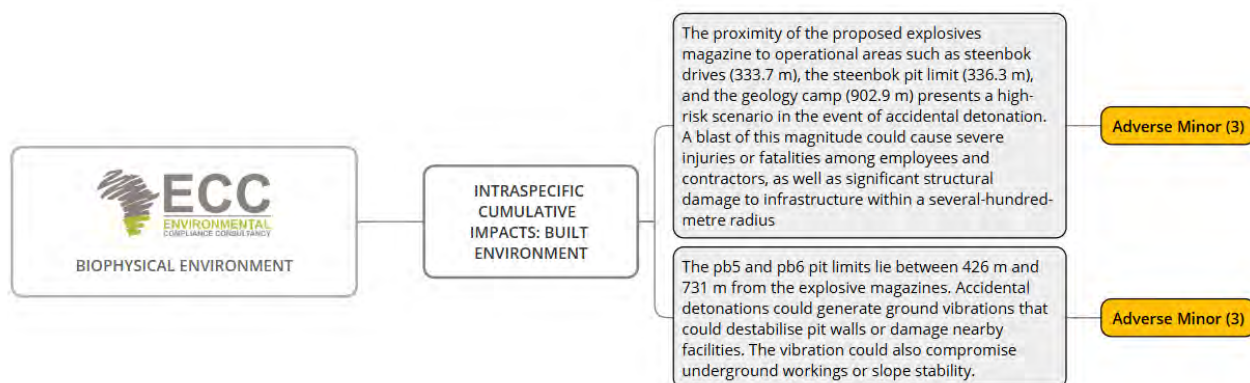


Figure 75 - Cumulative impacts of the operation of the explosive magazine

7.6.2.4.1 The proximity of the proposed explosives magazine to operational areas such as steenbok drives (333.7 m), the steenbok pit limit (336.3 m), and the geology camp (902.9 m) presents a high-risk scenario in the event of accidental detonation. A blast of this magnitude could cause severe injuries or fatalities among employees and contractors, as well as significant structural damage to infrastructure within a several-hundred-metre radius

The proximity of the proposed explosives magazine to active operational areas includes Steenbok Drives (333.7 m), the Steenbok pit limit (336.3 m) and the geology camp (902.9 m)) presents a high-consequence exposure profile. A single accidental high-order detonation could generate multiple simultaneous physical hazards that directly endanger personnel, infrastructure and site operations.

An accidental detonation from dropping, using inappropriate tools, smoking inside/near the magazine, improper loading/unloading, or failure to follow safe procedures resulting in ignition/spark would produce a rapid propagating shock wave (air blast) whose peak overpressure and dynamic pressure could cause immediate blunt-force and barotrauma injuries (eardrum rupture, lung contusion, traumatic brain injury) to unprotected personnel in nearby working areas or even death. In addition, the impulsive dynamic pressure could also

throw people or unsecured equipment, increasing the risk of secondary impact-related blunt-trauma injuries.

The blast also fragments the explosive magazine and surrounding materials, producing high-velocity fragments and fly rock that retain lethal kinetic energy at hundreds of metres and can perforate plant structures, vehicles and sheltering buildings. Concurrently, the detonation energy into the ground as seismic waves (high peak particle velocity) can induce local rock mass failure, destabilise stopes and drives, generate roof falls in underground workings and cause foundation damage to surface structures. This is a particular concern for Steenbok Drives and the pit limit, considering their sub-kilometre separation.

Secondary hazards include ignition of fuel/chemical stores, propagation of collapse or fire through plant corridors and generation of dust and toxic combustion products that would impair evacuation and emergency response. Collectively, these interacting mechanisms mean that personnel within the several-hundred-metre range (145 – 336 m) would face a high probability of severe injury or fatality and extensive structural damage. Assets and personnel working in areas at greater distances (for example the geology camp at ~903 m) would remain at risk from fragmentation, flying debris and auxiliary blast effects. However, the severity would depend on the detonation magnitude and the degree of local shielding and zone of influence.

The impact is considered adverse as an accidental detonation of the proposed explosives magazine could cause severe injuries or fatalities to personnel and extensive damage to surrounding infrastructure (e.g. Steenbok drive, Steenbok pit limit and geology camp and associated mobile services) through air blasts, high-velocity fragments, ground vibrations and secondary hazards such as fire, dust and toxic emissions. Additionally, the impact is considered cumulative as an accidental detonation would amplify overall risks to personnel and infrastructure through combined air blasts, fragmentation, ground vibrations and secondary effects like fire and toxic emissions. The impact is irreversible as an accidental detonation would cause permanent loss of life, serious injuries and structural damage that cannot be remediated, feasibly repaired or recovered. The magnitude of change is rated high due to the nature of irreparable and costly damages that could occur to key elements of the site and personnel in the event of an accidental detonation. The duration of the impact is permanent as the consequences of an accidental detonation, such as loss of life, severe injuries, structural destruction, geological destabilisation and environmental contamination cannot be fully reversed or restored. Even after emergency response and reconstruction, the original conditions, integrity, and value of affected resources and infrastructure cannot be completely recovered.

The extent of the impact is on-site as the primary hazards of an accidental detonation, air blast, fragmentation, ground vibrations, structural damage and secondary fires are concentrated within the immediate vicinity of the explosive's magazine and nearby operational areas. Personnel, underground workings, surface infrastructure and the pit are all located within a few

hundred metres, meaning the physical effects and severe consequences would predominantly remain with the Project site rather than extending far beyond its boundaries. The probability of the impact occurring is considered rare. Although the consequences of a detonation would be severe, strict safety protocols, magazine design standards, regulatory controls, handling procedures and security measures will be in place to prevent accidental high-order explosions. These preventative measures, such as controlled storage distances, blast-proof construction, restricted access and rigorous operational procedures significantly reduce the likelihood of an accidental detonation, making the event improbable even though its potential consequences are extreme. Furthermore, the sensitivity of the impact is rated high as the mine elements, personnel, critical infrastructure and various operational areas are highly valuable and irreplaceable, both from an operational and safety perspective. There is very limited capacity to accommodate or recover from severe disturbances, and any damage to these resources would be result in high recovery or repair costs. The extreme vulnerability of personnel and key infrastructure to the detonation means even a single event could result in irreversible and significant consequences. Therefore, the significance of this impact is rated adverse minor (before mitigation) as shown in Table 37.

7.6.2.4.2 The pb5 and pb6 pit limits lie between 426 m and 731 m from the explosive magazines. Accidental detonations could generate ground vibrations that could destabilise pit walls or damage nearby facilities. The vibration could also compromise underground workings or slope stability.

A simultaneous (effectively instantaneous) detonation of three magazines containing a combined 120 000 kg (120 t) of ANFO would constitute a very large explosive event; using a commonly applied ANFO-to-TNT equivalence factor of 0.85 yields a net TNT-equivalent energy release of ≈ 102 t TNT ($120 \text{ t} \times 0.85 = 102 \text{ t}$) (Zhang et al., 2025). Such an event occurring with the proposed PB5 and PB6 pit limits at ~ 426 m and ~ 731 m would place the main pit walls well inside the high-influence region for blast ground-shock, air-blast and fly rock effects, meaning an accidental or sympathetic detonation could produce high peak-particle velocities (PPV) ($50 \text{ mm/s} <$) capable of triggering geotechnical instability (crack propagation, joint dilation, slope or stope failure) and structural damage depending on local rock mass conditions and structure sensitivities (Kong, 2013). This could result in localised sloughing, planar or wedge failures or in severe cases, large-scale slope collapse.

The dynamic loading could also destabilise geotechnical monitoring installations, pit ramp surfaces and bench crests, creating hazardous working conditions for personnel and machinery. For underground workings in proximity to the main pit shells, induced vibrations may lead to rock burst-like phenomena, roof falls and failure of ground support elements such as rock bolts, mesh and shotcrete. This compromises excavation integrity and worker safety. In addition, vibration transmission to nearby surface facilities or pipelines may cause fatigue cracking, seal failure and misalignment of sensitive process infrastructure. The risk of sympathetic detonation among adjacent magazines further amplifies these effects, as

simultaneous or sequential explosive events could substantially increase cumulative ground motion.

The nature of the impact is considered adverse as explosive detonations near PB5 and PB6 can cause geotechnical instability, structural damage and hazardous conditions for personnel and equipment working within the main pit, while also potentially damaging nearby infrastructure and amplifying risks through sympathetic detonations. The impact is cumulative because it is the summation of the explosion of all three magazines. The impact is deemed irreversible as structural failures in the pit walls, underground workings or surface infrastructure cannot be fully restored to their original state. Once explosive-induced ground vibrations cause rock mass collapse, slope failure or permanent damage to support systems and infrastructure, the natural and built environments are permanently altered. Although with remediation (backfilling, reconstruction or reinforcement) is feasible, the original geotechnical integrity, rock strength and natural slope conditions cannot be fully recovered. The duration of impact is deemed permanent. The magnitude of change is rated high as an accidental detonation near PB5 and PB6 could cause significant loss of the pit, through slope failures, sloughing or large-scale collapse. In addition, the quality and integrity of the remaining rock mass and pit structure would be severely compromised as the explosive-induced vibrations can damage critical geotechnical features, bench crests, ramps and underground supports. This constitutes severe damage to key characteristics and elements of both the natural and engineered environment.

The extent of the impact is on-site as the ground vibrations and resulting damage are confined to the immediate area surrounding the PB5 and PB6 pit wall and the adjacent underground workings. The seismic energy from a detonation dissipates with distance, so significant effects, such as slope failures, rock mass instability, bench and ramp damage and structural compromise, occur primarily within the ML and pit boundaries. The probability of the impact is rare because explosives magazines are typically designed, located and managed with strict safety protocols, including controlled access, separation distances, robust containment and handling procedures. These measures greatly reduce the chance of an accidental detonation.

The sensitivity of the impact is rated high as the pit and underground workings are critical areas of the overall Project and their structural integrity must be maintained throughout the Project operational lifespan. These resources and infrastructures are irreplaceable or have very limited potential for substitution and the geotechnical systems and structural elements have little capacity to absorb or accommodate explosive-induced damage without failure. Any alteration or loss directly affects resource value, operational continuity, and safety, making the system very sensitive to change. Overall, the significance of the impact is rated adverse minor (before mitigation), as shown in Table 37. The mitigation measures have been included in Domain 8 of the OEMP (Appendix B).

Table 36 - Intraspecific cumulative impacts of the Navachab Underground Mine (Biophysical environment)

Receptor	Impacts	Significance of impact	Impact management
Surface water	Activity: Operation of three explosive magazines in close proximity to each other Impact: Increased contaminant load polluting nearby drainage lines and water bodies and polluting downstream water bodies should an explosives spill happen	Moderate 6	– All magazines must be equipped (designed) with impermeable floors, bunding, and sumps to contain spills. – Install stormwater diversion structures to prevent clean runoff from mixing with contaminated areas; – Add redundant containment systems to handle combined spill scenarios; – Implement strict handling protocols for hazardous materials; – Regular stormwater quality monitoring for hydrocarbons and nitrates; – Conduct routine inspections and maintenance of containment and drainage systems; – Develop an integrated spill response plan for all three magazines; – Provide spill response kits and train personnel in emergency procedures; – Conduct spill response drills regularly; – Maintain buffer zones (vegetation or physical barriers) between the magazines and drainage lines; – Use land grading to prevent runoff from flowing directly into rivers; and

Receptor	Impacts	Significance of impact	Impact management
			– Conduct cumulative risk assessments every two (2) years or after major events; and – Review the requirement to update the stormwater management plan to reflect increased risk from multiple magazines
Groundwater	Activity: Operation of the three (3) explosive magazines Impact: Groundwater pollution from increased contamination load from hydrocarbon spills at all three explosive magazines	Minor (4)	– All hydrocarbon materials and containers must be stored correctly, in drip trays or in bunded areas that are impermeable and can contain 110 % of largest volume; – All hydrocarbon containers when transported must be stored in a drip tray and secure from falling over; – Spill kits and spill absorbent treatment material to be present in the workshops and laydown areas; – Teams must be trained on how to use spill kits and how to implement correct spill management controls; – All vehicles, HME and equipment must be serviced on an impermeable surface, such as a workshop concrete floor or liner to prevent leaks and spills; – All spills to be cleaned up within the same shift and an incident to be recorded, where required; – Waste receptacles for hydrocarbon waste to be provided, leak proof and sufficient in quantity; – Soil contaminated by hydrocarbons should be contained, cleaned and stored in adequately bunded containers. Contaminated material should be stored on an impervious surface at the HME wash bay or the bioremediation site,

Receptor	Impacts	Significance of impact	Impact management
			before removal from site to a registered hazardous waste treatment facility; – Maintain separation of clean and dirty stormwater and regularly inspect containment systems; – Implement strict handling and storage procedures for explosives and hydrocarbons; – Keep spill kits on-site and train staff in immediate spill response and cleanup; – Monitor water quality (nitrates, ammonia, hydrocarbons) in nearby drainage lines; – Ensure routine inspections and maintenance of drainage and containment structures; – Dispose of contaminated materials adequately; and – Rehabilitate affected areas and review management plans after any incident.
Noise and fauna	Activity: The construction of the explosive's magazine and the daily mining operational activities Impact: Disturbance and displacement of fauna from the Project site/ML 31	Low (2)	– Conduct a pre-construction ecological survey to identify sensitive fauna habitats and adjust layout if possible. – Provide wildlife awareness training to workers and enforce a no-harm/no-poaching policy. – Ensure an Environmental Control Officer (ECO) is present to oversee clearing and compliance. – Avoid clearing during peak breeding seasons where possible; conduct nest/burrow checks if work cannot be rescheduled.

Receptor	Impacts	Significance of impact	Impact management
			– Relocate fauna (e.g., tortoises, birds, small mammals, reptiles) through a qualified specialist if encountered during clearing. – Enforce low vehicle speed limits and controlled traffic movement to prevent road kills. – Manage food and waste properly to avoid attracting wildlife. – Prohibit domestic animals (e.g., dogs, cats) on site. – Rehabilitate disturbed areas after construction to restore habitat conditions. – Maintain a fauna interaction register and conduct regular monitoring during construction.
	Activity: The operation of the explosive's magazine and the daily mining operational activities Impact: Disturbance and displacement of fauna from the Project site/ML 31	Low (2)	– Maintain fenced and clearly demarcated magazine area to prevent accidental entry of wildlife. – Keep surrounding vegetation trimmed to discourage nesting, burrowing, or concealment near the magazine walls. – Regularly inspect for wildlife presence (e.g., snakes, small mammals, birds nesting in crevices); relocate safely using trained personnel when required. – Enforce a strict no-harm policy relating to wildlife around the magazine area, no trapping, feeding, harassment, or removal except for safe relocation. – Keep doors and ventilation points screened or sealed to prevent animals from entering storage buildings.

Receptor	Impacts	Significance of impact	Impact management
			– Minimise noise, vibration, and unnecessary lighting around the magazine to avoid disturbance and nocturnal fauna displacement. – Use downward-facing, low-intensity / motion-activated lighting to reduce attraction of insects and nocturnal species. – Ensure all food waste and general refuse is stored in wildlife-proof bins and removed regularly to prevent scavenger attraction. – No water pooling near the magazine, standing water can attract mammals, reptiles, and birds. Maintain proper drainage. – Vehicle speed limits enforced on access roads (e.g., 20–30 km/h) to reduce wildlife collisions. – Routine ECO monitoring to check compliance and record fauna sightings, interactions, or incidents. – Maintain a Fauna Incident Register, documenting any injury, mortality, or relocation events and report in monthly environmental records. – Review and adapt procedures annually or after any fauna-related incident to improve wildlife protection practices. – Engage staff through periodic refresher training on wildlife awareness and safe response procedures around the magazine.

8 CONCLUSION

A full and comprehensive amendment report (scoping with impact assessment) and update of the 2020 scoping with impact assessment (ECC) for trial underground mining activities has been undertaken for Phase 2 of underground mining activities. All aspects and associated potential significant impacts have been considered in the impact assessment and have been thoroughly investigated against the planned activities and the receiving social and biophysical environment. Additionally, all mitigation and management measures have been included in the updated OEMP (Appendix B).

Table 37 below summarises the significance of the impacts post mitigation, rated on a scale of 1 to 12 (low to high). The nature of each impact is indicated either as beneficial (B) or negative (N). Where there are considerable significant variations, the average significance is reported. The summary of impacts indicates that, for the overall Project, the significance of the impact will be adverse minor, provided that the recommended mitigation and management measures outlined in the OEMP are implemented.

Table 37 - Summary of the significance ratings, post mitigation for the expected impacts (B=beneficial impact; N=negative impact; scale 1-12 from low to high)

Socio-economic environment: economic		Socio-economic environment: social		Biophysical environment	
Economic stimulation (national and local economy)	B6	Visual impacts from the construction and operation of the explosives' magazine on nearby sensitive receptors within 10 km from ML 31.	N2	Surface water impacts from the construction of the explosive's magazine.	N3
Employment and skills development	B4	Air quality impacts from the construction of the explosive's magazine on contractors.	N2	Surface water impacts from the operation of the explosives' magazine and accidental detonation of explosives.	N3
Increased demand for local goods	B4	Air quality impacts from the underground mining on employees.	N2	Groundwater impacts from underground mining activities.	N3
Over-reliance on mining as major contributor to the local economy poses long term risk, post closure.	N1	Heritage and cultural impacts from the construction and operation of the explosives magazine resulting in the damage or loss of heritage or archaeological artifacts.	N3	Groundwater impacts from the construction of the explosive's magazine	N3
		Noise impacts from the construction of the explosive's magazine on contractors.	N1	Groundwater impacts from the operation of the explosives' magazine, including hydrocarbon and chemical spills and accidental detonation of the explosive magazine.	N3
		Noise impacts from the construction of the explosive's magazine on NSRs.	N1	Soil impacts from the construction and operation of the explosive magazine.	N1

Socio-economic environment: economic		Socio-economic environment: social		Biophysical environment	
		Noise impacts from underground mining activities on operational employees.	N1	Waste impacts on the biophysical environment.	N3
		Waste impacts (visual intrusion) on the social environment.	N3	Biodiversity impacts on fauna and flora from vegetation clearing for the construction of the explosive magazine and displacement of fauna due to movement of machinery and equipment during construction and operation	N3
		Built environment impacts (the impact of potential detonation of the proposed explosives magazine on nearby infrastructure i.e. the geology camp, powerlines, Steenbok satellite pit / drives and PB5 (open pit)	N3	Soil impacts from potential hydrocarbon spills during the construction and operation of the explosive magazine	N2
		Cumulative impacts (the impact of the construction and operation of the proposed explosives magazine and the two already existing explosive magazines on the baseline visual, noise, heritage and built infrastructure on site and for nearby receptors and the cumulative impact operation of the underground mine on air quality and noise and those impacts on employees and contractors)	N2	Cumulative impacts (this includes the impacts of the construction and operation of the proposed explosives magazine and the two existing magazines on groundwater, surface water and the terrestrial biodiversity on site, locally and regionally)	N3

In conclusion, this amendment report adequately outlines the process of the impact assessment (chapter 7) conducted for phase 2 of the underground mining and construction and operations of the additional explosive's magazine at Navachab Gold Mine. Additionally, this amendment assesses all the potential impacts and recommended mitigation and management measures to minimise the significance of the potential impacts. The updated OEMP (Appendix B) also includes the required monitoring requirements that must be undertaken during the current phase (operational phase) and the subsequent decommissioning phase. All stakeholders and registered interested and affected parties (I&APs) are invited to provide comments, if any, on the draft amendment report (this report) and OEMP within a seven (7) day period. Thereafter, the report will be updated and submitted to the office of the Mining Commissioner at MIME, as the competent authority for their review, who will then pass on the final reports to the office of the Environmental Commissioner at MEFT, for their review and record of decision (RoD).

9 BIBLIOGRAPHY

(February 2016). Karibib Urban Structure Plan.

Arnall, B. (2024, February). Cause and Effects of Soil Acidity.

Attridge, R. L. (1991). New mine developments - The Navachab Gold Mine. Journal of the South African Institute of Mining and Metallurgy.

Bethune, S., Griffin, M., & Joubert, D. (2004). National Review of Invasive Alien Species Namibia.

Brady, N. C., & Weil, R. R. (2017). The Nature and Properties of Soils (15th ed.). Pearson Education.

Chamber of Mines of Namibia. (2024). 2023 Annual Review. Windhoek: Chamber of Mines of Namibia.

Chamber of Mines of Namibia. (2025). 2024 Annual Review. Windhoek: Chamber of Mines of Namibia.

Christians, F. (2020). Primary healthcare and family medicine in Namibia. African Journal of Primary Health Care and Family Medicine.

Convention on Biological Diversity. (2025). Namibia - Country Profile. Retrieved from Convention on Biological Diversity: <https://www.cbd.int/countries/profile?country=na>

Correa, H. da S., Blum, C. T., Galvão, F., & Maranhão, L. T. (2022). Effects of oil contamination on plant growth and development: a review. Environmental Science and Pollution Research, 29(1), 1–15.

Day, J., Symes, N., & Robertson, P. (2003). The Scrub Management Handbook: Guidance on the management of scrub on nature conservation sites.

Dehkordi, M. M., Nodeh, Z. P., Dehkordi, K. S., Salmanvandi, H., Khorjestan, R. R., & Ghaffarzadeh, M. (2024). Soil, air, and water pollution from mining and industrial activities: Sources of pollution, environmental impacts, and prevention and control methods. Results in Engineering, 23.

Energy Capital & Power. (2024, March 11). Namibia: TransNamib to expand National Railway Infrastructure. Retrieved from to become a regional logistics hub by modernizing infrastructure and expanding the network: <https://energycapitalpower.com/namibia-transnamib-railway-infrastructure/>

Enviro Dynamics . (2015). Environmental Assessment for the Proposed Subdivision and Establishment of Six Townships within the Karibib Townlands .

Erongo Regional Council. (2015). Demographics. Retrieved from Erongo Regional Council: <https://www.erc.com.na/erongo-region/demographics/>

FAO. (2006). Guidelines for Soil Description (4th ed.). In FAO, Food and Agriculture Organization of the United Nations. Rome.

Finn, H., & Stephens, N. (2017). The invisible harm: land clearing is an issue of animal welfare. Wildlife Research, 44(5), 377–391.

Funk, J. L. (2013). The physiology of invasive plants in low-resource environments. Conservation Physiology, 5(1).

González-Botello, M. A., & Bullock, S. H. (2012). Erosion-reducing cover in semi-arid shrubland. *Journal of Arid Environments*, 84, 19–25.

Griffin, M. (1998). The species diversity, distribution and conservation of Namibian mammals. *Biodiversity and Conservation*, 483–494.

Hafez, M., Zhang, Z., Younis, M., Abdelhamid, M. A., & Rashad, M. (2025). Enhancing Micronutrient Availability Through Humic Substances and Vermicompost While Growing Artichoke Plants in Calcareous Soil: Insights from a Two-Year Field Study. *Plants*, 14(8).

Hartsch, K., & Singh, M. (2019). Basics of Soil Erosion. In *Watershed hydrology management and modeling*.

ICMM. (n.d.). Good Practice for Mining and Biodiversity.

IUSS Working Group WRB. (2022). World Reference Base for Soil Resources: International Soil Classification System for Naming Soils and Creating Legends for Soil Maps (4th ed.). Vienna: International Union of Soil Sciences (IUSS).

Joubert, D. F., Rothauge, A., & Smit, G. N. (2008). A conceptual model of vegetation dynamics in the semiarid Highland savanna of Namibia, with particular reference to bush thickening by *Acacia mellifera*. *Journal of Arid Environments*, 72(12), 2201–2210.

Kameswaran, S., Gunavathi, Y., & Krishna, P. G. (2019). Dust pollution and its influence on vegetation - A critical analysis. *Research Journal of Life Sciences, Bioinformatics, Pharmaceutical and Chemical Sciences*.

Mendelsohn, J., Jarvis, A., Mendelsohn, M., & Robertson, T. (2022). *Atlas of Namibia : its land, water and life*. Windhoek: Namibia Nature Foundation.

Mendelsohn, J., Jarvis, A., Roberts, C., & Robertson, T. (2002). *Atlas of Namibia: A Portrait of the Land and its People*. Cape Town: David Philip Publishers.

Mendelsohn, J., Jarvis, A., Roberts, C., & Robertson, T. (2002). *Atlas of Namibia: A Portrait of the Land and its People*. Windhoek: Namibia Nature Foundation.

Mendelsohn, J., Jarvis, A., Roberts, C., & Robertson, T. (2002). *Atlas of Namibia: A Portrait of the Land and its People*. Windhoek: Namibia Nature Foundation.

MoHSS. (2018). Annual Report. Windhoek: MoHSS.

MoHSS. (2020). COVID-19 Situation Reports 2020. Windhoek: MoHSS.

MoHSS. (2022). Erongo Region. Retrieved from Republic of Namibia: Ministry of Health & Social Services: <https://mhss.gov.na/erongo-region>

Montesinos, D. (2021). Fast invasives fastly become faster: Invasive plants align largely with the fast side of the plant economics spectrum. *Journal of Ecology*, 110(5).

Namib Hydrossearch. (2022). Cleanergy Green Hydrogen Demonstration Plant (GHP) Walvis Bya, Namibia: Environmental Impact Assessment: Surface and Hydrogeology Specialist Study. Namib Hydrossearch.

Namibia Ministry of Health and Social Services . (2017). *Namibia 2014/15 Health Accounts Report*. Windhoek: MoHSS.

Namibia Statistics Agency. (2019). *Namibian Labour Force Survey 2018 Report*. Windhoek: Namibia Statistic Agency.

Namibia Statistics Agency. (2024). *2023 Population & Housing census*. Windhoek: Namibia Statistics Agency. Retrieved from City population.

Namibia Statistics Agency. (2025). 2023 Population and Housing Census Labour Force Report. Windhoek: Namibia Statistics Agency.

Namibian statisitc Agency. (2011). Namibia Population and Housing Census. Windhoek: NSA.

National Planning Commission. (2015). Namibia Poverty Report. Windhoek: National Planning Commission.

New Era. (2021, January 18). Karibib residents wallowing in poverty. Retrieved from New Era: <https://neweralive.na/karibib-residents-wallowing-in-poverty/>

New Era. (2022). Missing TB cases haunt Namibia. Windhoek.

Spill Prevention, P. and R. P. (2019). Focus on: Environmental Harm from Oil Spills.

Thomas, A. D., Elliott, D. R., Dougill, A. J., & Stringer, L. C. (2018). The Influence of Trees, Shrubs and Grasses on Micro-Climate, Soil Carbon, Nitrogen and Co2 Efflux: Potential Implications of Shrub Encroachment for Kalahari Rangelands. Land Degradation & Development, 29(5).

Weather Spark. (n.d.). Climate and Average Weather Year Round in Karibib Namibia. Retrieved from Weather Spark: <https://weatherspark.com/y/78286/Average-Weather-in-Karibib-Namibia-Year-Round>

Wildlife Trusts Wales. (n.d.). How wildlife can be harmed by development. Wildlife Trusts Wales.

APPENDIX A – VALID ENVIRONMENTAL CLEARANCE CERTIFICATE (ECC2200067)

APPENDIX B – NAVACHAB UPDATED OPERATIONAL ENVIRONMENTAL MANAGEMENT PLAN (REV02)

APPENDIX C – 2019 NAVACHAB TRIAL UNDERGROUND MINING AMENDMENT REPORT

APPENDIX D - NAVACHAB UNDERGROUND MINE READINESS PLAN - GROUNDWATER

APPENDIX E – QKRNAV01E CONTRACT SPECIFICATION - PART 2

APPENDIX F – WORK METHOD STATEMENT

APPENDIX G – NAVACHAB 2023 AIR QUALITY IMPACT ASSESSMENT REPORT

APPENDIX H - ARCHAEOLOGICAL RECONNAISSANCE OF NAVACHAB GOLD MINE LEASE AREA, ERONGO REGION, 2009

APPENDIX I – EAP CVS