ENVIRONMENTAL IMPACT REPORT FOR THE TSHIPI BORWA WASTE ROCK DUMP EXTENSION PROJECT

Farm Mamatwan 331 Portion 16 (Portion of Portion 1), 17 (Portion of Portion 2), 18 (Portion of Portion 3) and Portion 8 and Farm Moab 700 (Remaining Extent)

Prepared for: Tshipi é Ntle Manganese Mining (Pty) Ltd

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EXECUTIVE SUMMARY

Introduction to the project

Tshipi é Ntle Manganese Mining (Pty) Ltd (Tshipi) operates the Borwa opencast manganese mine located on Portions 16, 17 and 18 of Farm Mamatwan 331 (Mining Right and surface use areas) and the Remainder of Farm Moab 700 (surface use area). The mine is located approximately 18 km to the south of Hotazel in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality of the Northern Cape Province of South Africa. The regional and local settings are illustrated in Figure 0-1 and Figure 0-2, respectively.

Tshipi currently holds a mining right (NC/30/5/1/2/2/206MR) and an Environmental Management Programme Report (EMPr) approved by the Department of Mineral Resources (DMR) in terms of the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA). In terms of National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA) (as amended) read together with the MPRDA, the approved EMPr (SLR, October 2017d) is now deemed to be an Environmental Authorisation (EA). In addition, Tshipi holds the following authorisations:

- EA (reference number NC/KGA/KATHU/37/2008) issued by the Department of Environment and Nature Conservation (DENC) (then the Department of Tourism, Environment and Conservation) in October 2009 authorising Listed Activities in terms of the Environmental Impact Assessment (EIA) Regulations 2006 and in terms of NEMA (as amended).
- EA (reference number NC/30/5/1/2/2/206/00083MR) issued by the DMR in January 2018 authorising Listed Activities in terms of the EIA Regulations 2014 (as amended) and in terms of section 24G of the NEMA (as amended).
- Water Use Licence (WUL) (reference number 10/D41K/AGJ/1735) issued by the Department of Water and Sanitation (DWS) (then the Department of Water Affairs) in April 2015 authorising water uses in terms of Section 21 of the National Water Act, 1998 (No. 36 of 1998) (NWA) (as amended).

Copies of the Mining Right, EAs and WUL are provided in Appendix A.

Proposed Project Activities

Tshipi is proposing the Tshipi Borwa Waste Rock Dump Extension Project to provide additional overburden storage capacity (the proposed project). The proposed project includes the following components:

- The extension of the existing East Waste Rock Dump (WRD) in a south-easterly direction towards the mining right boundary[1] and finally to ultimately merge with the nearby Mamatwan WRD, essentially filling the narrow void between these two WRDs;
- The extension of the existing West WRD in a south-westerly direction onto a portion of Portion 8 of the Farm Mamatwan 331, in order to provide additional storage capacity for waste rock;

[1] The intention is to fill the void between the Tshipi East WRD and the neighbouring mine's Mamatwan WRD, with waste rock mined from the boundary pillar between Tshipi and Mamatwan, for which permission was granted by the DMR on 3 May 2017. The respective WRDs are currently only separated by service roads on either side of the Mining Right boundaries.

- The construction of an 11 kV overhead powerline along the southern boundary of Portion 8 of Farm Mamatwan 331 and onto the existing Mining Right area. The proposed powerline will be fed by an approved Eskom powerline and substation still to be built, which will also be located on the southern boundary of Portion 8, and connecting this new line into the main distribution centre on the mine; and
- The construction of an overland conveyor system within the existing Mining Right area between the existing crushed product ore stockpile at the secondary crushing and screening plant, to the existing manganese ore product stockpiles located in close proximity to the train load-out station.

Prior to the commencement of these activities, various authorisation requirements are necessary from various government departments in terms of the MPRDA, NEMA, NWA and the National Environmental Management: Waste Act, 2008 (No.59 of 2008) (NEM:WA) (as amended).

SLR Consulting (Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by Tshipi to manage these environmental regulatory processes.

Summary of Authorisation Requirements

The following authorisation requirements are applicable to the proposed project:

- An EA is required from the DMR in terms of NEMA: The proposed project incorporates several activities listed in Government Notice Regulation (GNR) 983 (Listing Notice 1) and 984 (Listing Notice 2). As the proposed project includes activities listed in both Listing Notice 1 and 2, a Scoping and EIA process (hereafter collectively referred to as an "EIA") is required in order for the DMR to consider the application for environmental authorisation.
- A Waste Management Licence (WML) from the DMR in terms of the NEM:WA. The proposed project incorporates waste management activities listed in GNR 921 (as amended). As the proposed project includes activities listed in Category B, an EIA is required in order for the DMR to consider the application for a WML.
- A WUL is required from the DWS in terms of the NWA. The proposed project triggers a water use activity listed in Section 21 of the NWA. An application will also be lodged with the DWS for exemption from the requirements of relevant conditions in terms of the Regulations on Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources (GNR 704 of 4 June 1999) in terms of the NWA. It should be noted that a WUL application process was initiated with the DWS in 2017, for undertaking water uses related to the changes to mine infrastructure as per the previous Tshipi EMPr amendment (SLR, 2017d). The water uses related to the current project will be included in the WUL application still to be submitted to DWS.

Other approvals/permits needed for the proposed project are listed below:

- A permit is required from the Department of Agriculture Forestry and Fisheries (DAFF) and the DENC in terms of the National Forests Act, 1998 (No. 84 of 1998) for the removal or damaging of any protected plant species within areas that will be disturbed.

Other permissions, licences and/or consents may be required in terms of health and safety legislation, such as the Mine Health and Safety Act and Explosives Act, which may have to be obtained by Tshipi, however, this falls outside the scope of the current EIA process.

Stakeholder engagement

The stakeholder engagement process commenced in the Scoping Phase in April 2017 and has continued throughout the environmental assessment process. As part of this process, commenting authorities and interested and affected parties (I&APs) were given the opportunity to attend public meetings, submit questions and comments to the project team, review the background information document and the Scoping Report. This EIA will also be subjected to public and regulatory review. All comments submitted to date by the commenting authorities and I&APs have been included and addressed in this EIA.

Impacts and management measures

This section provides a summary of the assessment of the potential impacts of the project and provides measures to prevent or mitigate the impacts. The potential impacts associated with the mine activities and infrastructure can be categorised into those that have low, medium and high significance in the unmitigated scenario. All three categories of impacts require a measure of management actions which, if successfully implemented will reduce the significance of the impacts and the related residual risk. All identified impacts are considered both incrementally and cumulatively in the context of the existing Tshipi mining infrastructure and activities.

The table below provides a summary of the potential impacts in no particular order of importance.

Table A: Potential Impact Summary

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
Geology	Loss and sterilisation of mineral resources	By the nature of mining, mineral deposits in the natural geology are exploited for the target minerals; thereby impacting the local geology. It is also possible that mineral resources can become sterilised through the mining method, placement of surface infrastructure and waste. These activities already take place on site as the mine is an existing operation. However, the proposed WRD extensions could present the potential for sterilisation of mineral resources. The proposed WRD extensions are not located on economically mineable resource; therefore this impact is rated as insignificant. The cumulative impact rating therefore remains unchanged for the overall mine as per the approved EMPr. Related mitigation measures include applying best mining practises i.e. diligent planning, to ensure that mineral sterilisation is minimised as far as possible.	**High**	**LOW**
Topography	Altering topography	The majority of the natural topography at the Tshipi Borwa Mine has been disturbed as a result of the existing mining infrastructure and activities. The establishment of the proposed WRD extensions will further alter natural topography and cannot be mitigated. However, this impact is considered to be of moderate severity due to the limited areas for the WRD extension areas. The cumulative severity is medium for the overall mine and cannot be mitigated to reduce severity. Related mitigation measures include minimising areas of disturbance and effective rehabilitation of the site to restore natural topography as far as practically possible.	**Medium**	**MEDIUM**

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
Soil and land capability	Loss of soil resources and land capability through contamination and physical disturbance	Soil is a valuable resource that supports a variety of ecological functions and is the key to re-establishing post closure land capability. Soil resources can be disturbed through removal, erosion and compaction, as well as pollution during accidental spills and leaks which can result in a loss of soil functionality as an ecological driver. Existing mining activities have already disturbed soils and related land capability through the establishment of related surface infrastructure and mining activities. The proposed WRD extensions, proposed powerline and conveyor infrastructure will require the disturbance of additional soils and associated activities could present additional pollution risks. The East WRD and conveyors will be established within mining areas and, therefore, not result in significant impacts on soils and land capability. However, the West WRD extension and the powerline will be constructed in land suitable for grazing. While successful mine rehabilitation may result in revegetation of affected areas, soil horizons cannot be returned to their original positions and deep soil compaction is difficult to alleviate. Similarly, the change in land capability can only be partially mitigated once the land has been rehabilitated. The severity of this impact has been rated as moderate in the mitigated scenario. The cumulative impact on soils is rated as having a high severity, reducing to medium with mitigation. Related mitigation measures focus on pollution prevention, implementing soil conservation procedures and limiting site clearance to what is absolutely necessary.	**High**	**MEDIUM**
Biodiversity	Physical destruction and general disturbance of biodiversity	Areas of high ecological sensitivity are functioning biodiversity areas with species diversity and associated intrinsic value. In addition, some of these areas host endangered and protected species. The linking areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas, which is a key function for the broader ecosystem. The transformation of land for any purpose, including mining and associated activities, increases the destruction of the site specific biodiversity, the fragmentation of habitats, reduces its intrinsic functionality and reduces the linkage role that undeveloped land fulfils between	**High**	**MEDIUM**

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
		different areas of biodiversity importance. The proposed Eastern WRD extension and conveyor are located in already disturbed areas. Therefore, no significant biodiversity impacts are expected with regard to this proposed infrastructure. The proposed West WRD extension and powerline will require clearing of vegetation within the Kathu Thornveld habitat unit, which has a moderately high ecological sensitivity. The clearing of vegetation will result in the loss of additional protected trees such as the Camel Thorn *(Vachellia erioloba*) and Grey Camel Thorn (*Vachellia haematoxylon*), as well as several other faunal and floral species of conservation concern. In addition to the loss of habitat, biodiversity may be disturbed through lighting, noise, pollution of soil and water, dust generation, road kills, harvesting of fauna and flora etc. When considered incrementally, this has a medium to high severity in the unmitigated and mitigated scenarios. This will not change the cumulative severity rating of high in the unmitigated scenario, reducing to medium with mitigation. Related mitigation measures focus on limiting the project footprint area, adhering to the DAFF guidelines when clearing trees in the powerline servitude, biodiversity action plans and operation controls to limit on-going disturbance.		

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
Surface water	Alteration of natural drainage patterns	Rainfall and surface water run-off are collected in all areas that have been designed with water containment infrastructure. The collected run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns. The proposed WRD extensions will require the collection of additional storm water and reduce the runoff to the quaternary catchment D41K by 0.04%. This is expected to have a low severity. This will not change the cumulative impact assessment rating of medium in the unmitigated scenario and low in the mitigated scenario for the overall mine with the re-establishment of runoff patterns as far as practically possible. Related mitigation measures focus on minimising the footprint areas associated with containing rainfall and runoff and diverting clean run-off away from the mine site.	**Medium**	**LOW**
	Contamination of surface water resources	Mining projects generally present a number of pollution sources that can have a negative impact on surface water quality if unmanaged in all project phases. Various pollution sources exist on site as the mine is operational: fuel and lubricants, sewage, mine residue (WRDs), dirty water circuit etc. The proposed WRD extensions present additional potential pollution sources as runoff from the WRD extensions could contain contaminants. The construction of the proposed powerline and conveyor infrastructure could present temporary pollution sources through accidental spills and leaks. When considered incrementally the WRD extensions, powerline and conveyor potential pollution impact has a severity of low in both the unmitigated and mitigated scenarios. A key mitigation factor is that the WRDs will have runoff containment infrastructure. This will not change the cumulative impact assessment rating of medium in the unmitigated scenario and LOW in the mitigated scenario for the overall mine with the continued implementation of mitigation measures.	**Medium**	**LOW**

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
Groundwater	Contamination of groundwater resources	There are a number of sources in all mine phases that have the potential to pollute groundwater. The proposed WRD extensions present additional potential pollution sources which are likely to be permanent. Even though some sources are temporary in nature, related potential pollution can be long-term. The operational phase will present more long-term potential sources (existing WRDs and proposed WRD extensions) and the closure phase will present final land forms, such as the backfilled open pit and the tailings dam that may have the potential to pollute water resources through long term seepage and/or runoff. A groundwater model was run for a period of 100 years to simulate 25 years of mining and 75 years post-mining, and included all existing and potential pollution sources and considered both an unlined and lined scenario for the WRDs. Both scenarios result in a pollution plume of low concentration extending beyond the Mining Right area. However there are no known third parties within the predicted plumes using boreholes for water supply, therefore the severity is rated as low in both scenarios. When considering the East and West WRD extensions, the modelling shows that the addition of the pollution sources do not materially change the overall impact of the mine as assessed in the approved EMPr amendment (SLR, 2017d), which remains rated at a low severity. Related mitigation measures focus on monitoring, compensation for third part loss of water supply (if required) and basic infrastructure design.	**Low**	**LOW**
	Lowering of groundwater levels and reducing availability	The proposed project does not include any dewatering activities; therefore, dewatering impacts assessed in the approved EMPr amendment (SLR, 2017d) will remain valid and will not be discussed further in this report.	**Medium**	**LOW**

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
Air quality	Air pollution	Mining projects present a number of air pollution sources that can have a negative impact on ambient air quality and surrounding land uses in all phases. Pollution sources include dust generation from land clearing activities, materials handling, wind erosion from stockpiles, wind erosion of disturbed areas, vehicle movement along unpaved roads and exhaust gas emissions mainly from mobile equipment, vehicles and generators. These activities already take place on site as the mine is in operation; however, the establishment and operation of the proposed WRD extensions, powerline and conveyor could present additional dust generation sources. There is potential for increased inhalable particulate ground level concentrations and dust fallout rates off-site and at nearby receptors. This unmitigated impact is, therefore, rated as having a high severity. With mitigation measures in place these impacts should be limited, and reduce the severity to low. Key mitigation includes dust allaying along haul routes and service/access roads, monitoring at the closest receptors and taking additional action to supress dust generation if required. The proposed project will therefore not change the cumulative impact of the mine, rated as having a high severity in the unmitigated scenario. The Mn concentrations predicted to exceed World Health Organisation (WHO) guidelines at nearby receptors maintains the high severity in the mitigated scenario.	**High**	**MEDIUM (HIGH FOR MN)**
Noise	Increase in disturbing noise levels	Two types of noise are distinguished: noise disturbance and noise nuisance. The former is noise that can be registered as a discernible reading on a sound level meter and the latter, although it may not register as a discernible reading on a sound level meter, may cause nuisance because of its tonal character (e.g. distant humming noises). Noise pollution can create nuisance that will have different impacts on different receptors because some are very sensitive to noise and others are not. The development and disposal of waste rock on the WRDs has the potential to increase both day-time and night-time noise levels. When considered incrementally, this has a medium severity in the unmitigated and mitigated scenarios given the small population density in the area and related distance to potential noise receptors. The cumulative severity rating assessing the impact of the changes to the operations	**Medium**	**LOW (DAY-TIME) MEDIUM (NIGH-TIME)**

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
		within the context of the approved mining operations is medium in the unmitigated and mitigated scenarios. Related mitigation measures focus on noise pollution prevention and monitoring when required.		
Visual	Negative visual views	Visual impacts on this receiving environment may be caused by activities and infrastructure in all mine phases. The more significant visual impacts relate to the larger infrastructure components (such as the waste rock dumps) which are likely to remain post closure. Lighting can be visible from some distance away and also negatively impact on the visual landscape. The visual landscape within the Tshipi Borwa Mine area has been transformed due to the presence of approved mining infrastructure and activities. The proposed WRD extensions, conveyor and powerline will influence existing negative visual impacts however these facilities will be established within and adjacent to existing mine infrastructure and will therefore be absorbed by this infrastructure to some extent. When considered incrementally, this has a moderate severity in the unmitigated and mitigated scenarios. This impact has a medium severity in the unmitigated scenario when considered cumulatively within the context of the current approved operations. The severity is unlikely to reduce with management actions until the closure phase when the site has been rehabilitated (in the mitigated scenario). Related mitigation measures focus on landscaping interventions particularly during the decommissioning and rehabilitation stages.	**High**	**MEDIUM (PRE-CLOSURE)** **LOW (AT CLOSURE)**
Traffic	Road disturbance and traffic safety	Traffic impacts can occur during the construction, operational and decommissioning phases when trucks, buses, and private vehicles make use of the private and public transport network in and adjacent to the Tshipi Borwa Mine. The key potential traffic related impacts are on road capacity and public safety. The proposed WRD extensions, powerline and conveyor infrastructure is not expected to generate additional traffic. The mine implements measures to manage traffic and road safety in accordance with the approved EMPr amendment (SLR,	**Medium**	**LOW**

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
		2017d). Consequently the potential for increased traffic and road safety risks due to project activities is expected to be negligible. The management actions in the approved EMPr will continue to be implemented by Tshipi. The cumulative impact rating therefore remains unchanged for the overall mine. Related mitigation measures focus on road maintenance in conjunction with other role players and the relevant road authorities.		
Blasting	Ground vibration, air blasts and fly rock	The proposed project does not include any blasting activities; therefore, blasting impacts assessed in the approved EMPr amendment (SLR, 2017d) will remain valid and will not be discussed in this report.	**High**	**MEDIUM**
Heritage/ cultural and palaeontological resources	Loss of heritage/cultural resources	The establishment of the proposed WRD extensions, powerline and conveyor infrastructure has the potential to damage or destroy heritage/cultural resources, either directly or indirectly. This could result in the loss of the resource for future generations, if such resources are present. However no heritage resources have been found in the Tshipi Mining Right area, or the proposed infrastructure areas, and it is unlikely that heritage resources will be found on site. This impact is therefore insignificant.	**Insignificant**	**INSIGNIFICANT**

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
Socio-economic	Inward migration	Mining operations tend to bring with them an expectation of employment in all phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. Given that the project forms part of an existing approved mine the relocation of surface infrastructure, the establishment of additional facilities and activities will not generate any additional employment opportunities as Tshipi will make use of existing managers, staff and contractors on site. Mitigating factors such as the monitoring of workers' living conditions, recruitment disciplines and HIV/Aids awareness and management already exist. As a result the potential for increased social risks due to the proposed project activities is negligible. Therefore, the predicted impact assessment remains in accordance with the original EMPr (Metago, 2009). The management actions in the approved EMPr (SLR, 2017d) will continue to be implemented by Tshipi. These measures focus on recruitment processes, communication and health awareness training.	**High**	**LOW**
	Economic impact	Mining has a positive net economic impact on the national, local and regional economy. Direct benefits are derived from wages, taxes and profits. Indirect benefits are derived through the procurement of goods and services, and the increased spending power of employees. The proposed project forms part of an existing approved mine and the proposed project will not generate any significant additional employment opportunities as Tshipi will make use of existing contractors and workers on site. Therefore, the predicted impact assessment remains in accordance with the original EMPr (Metago, 2009). The management actions in the approved EMPr (SLR, 2017d) will continue to be implemented by Tshipi, which focus on clear communication, recruitment and procurement processes.	**Medium-high +**	**MEDIUM-HIGH +**

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Cumulative impact significance (the ratings are negative unless otherwise specified)	
			Unmitigated	Mitigated
Land use	Change in land use	Mining activities have the potential to affect land uses both within the mine area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. Tshipi operations have already changed the land use in the mining area. The proposed West WRD extension and powerline will further change land use in the area and surrounds. The East WRD extension and conveyor will be established within the existing mining area and will not change the current land use. The change in land use is considered to have a low severity given that mining is the dominant land use in the project area. As such, the cumulative impact rating in the approved EMPr (Metago, May 2009) remains unchanged. Related mitigation measures include communication with neighbouring communities, land users, and land owners to facilitate information sharing.	**Medium**	**LOW**

Environmental statement

The assessment of the proposed Waste Rock Dump Extension Project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical and socio-economic environments both on the project site and in the surrounding area. However, when considered in the context of the existing mining operation, the addition of the proposed infrastructure will not significantly change the overall cumulative impacts of the mine. With management actions these potential impacts can be prevented or reduced to acceptable levels.

It follows that provided the EMPr is effectively implemented there is no reasonable environmental, social or economic reason why the project should not proceed.

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APPENDICES

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
ABA	Acid base accounting
ADE	Aquifer Dependent Ecosystem
Al	Aluminium
As	Arsenic
B	Boron
Ba	Barium
BID	Background Information Document
Ca	Calcium
CARA	Conservation of Agricultural Resources Act, 1983 (No. 43 of 1983)
CBA	Critical Biodiversity Area
Cd	Cadmium
CH_4	methane
Cl	Chloride
cm	Centimetre
CO	carbon monoxide
CO_3	Carbonate
COC	Chemicals of concern
CV	Curriculum Vitae
DEA	Department of Environmental Affairs
DENC	Department of Environment and Nature Conservation
DAFF	Department of Agriculture, Forestry and Fisheries
DMR	Department of Mineral Resources
DPM	Diesel Particulate Matter
DPRT	Department of Police, Roads and Transport
DWAF	Department of Water Affairs and Forestry
DWEA	Department of Water and Environmental Affairs
DRDLR	Department of Rural Development and Land Reform
DRT	Department of Roads and Transport
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme Report
F	Fluoride

Acronym / Abbreviation	Definition
Fe	Iron
GN	Government Notice
GNR	Government Notice Regulation
ha	Hectare
HCs	hydrocarbons
HCO_3	Bicarbonate
HDPE	High Density Polyethylene
HDSA	Historically Disadvantaged South African
I&AP	Interested and Affected Party
IBA	Important Bird Areas
ICP	Inter Coupled Plasma Scan
IDP	Integrated Development Framework
IUCN	International Union for Conservation of Nature
IWUL	Integrated Water Use Licence
IWWMP	Integrated water and waste management plan
K	Potassium
km	Kilometre
kV	Kilovolt
kVA	Kilovolt ampere
LED	Local economic development
LMO	Lower manganese ore body
LOM	Life of Mine
L/s	Litres per second
m	Meter
m^2	Square meters
m^3	Cubic metres
mbgl	Meters below ground level
mamsl	Metres above mean sea level
Mg	Magnesium
mm	Millimetres
Mn	Manganese
MS	Mass Spectrometry
m/s	Metres per second
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002)
MVA	Mega volt ampere
Na	Sodium
N	Nitrate
NAAQS	National Ambient Air Quality Standards
NAEIS	National Atmospheric Emissions Inventory System

Acronym / Abbreviation	Definition
NDCR	South African National Dust Control Regulations
NCNCA	Northern Cape Nature Conservation Act (No. 9 of 2009)
NDCR	National Dust Control Regulations
NEM:AQA	National Environmental Management: Air Quality Act, 2004
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004)
NFEPA	National Freshwater Ecosystem Priority Areas 2011
NEMA	National Environmental Management Act, 1998 (No. 107 of 1998)
NEM:WA	National Environmental Management: Waste Act, 2008 (No 59 of 2008)
NFA	National Forest Act (No. 84 of 1998)
NGO	Non-government organisation
NPAES	National Protected Areas Expansion Strategy 2008
NPR	Neutralising Potential Ratio
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NWA	National Water Act, 1998 NWA, 1998 (No. 36 of 1998)
OHL	Overhead Line (electricity)
ONA	Other Natural Areas
Pb	Lead
PGS	PGS Heritage
PRECIS	Pretoria Computer Information Systems
TDS	Total Dissolved Solids
RoM	Run-of-mine
SACNASP	South African Council for Natural Scientific Professionals
SAHRA	South African Heritage Resource Agency
SANBI	South African National Botanical Institute
SANS	South African National Standards
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SLR	SLR Consulting (Africa) (Pty) Ltd
SLP	Social and Labour Plan
SO_2	Sulphur dioxide
SO_4	Sulphate
SPLP	Synthetic Precipitation Leaching Procedure
STS	Scientific Terrestrial Services
TDS	Total dissolved solids ()
TWQR	Target Water Quality Guideline
$\mu g/m^3$	Micrograms per cubic metre
UMK	United Manganese of Kalahari
UMO	Upper manganese ore body

Acronym / Abbreviation	Definition
WHO	World Health Organisation
WML	Waste Management Licence
WRD	Waste Rock Dump
WUL	Water Use Licence
WULA	Water Use Licence Application

INTRODUCTION

PROJECT BACKGROUND

Tshipi é Ntle Manganese Mining (Pty) Ltd (Tshipi) operates the Borwa opencast manganese mine located on Portions 16, 17 and 18 of Farm Mamatwan 331 (Mining Right and surface use areas) and the Remainder of Farm Moab 700 (surface use area). The mine is located approximately 18 km to the south of Hotazel in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality of the Northern Cape Province of South Africa. The regional and local settings are illustrated in Figure 0-1 and Figure 0-2, respectively.

Tshipi currently holds a mining right (NC/30/5/1/2/2/206MR) and an Environmental Management Programme Report (EMPr) approved by the Department of Mineral Resources (DMR) in terms of the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA). In terms of National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA) (as amended) read together with the MPRDA, the approved EMPr (SLR, October 2017d) is now deemed to be an Environmental Authorisation (EA). In addition, Tshipi holds the following authorisations:

- EA (reference number NC/KGA/KATHU/37/2008) issued by the Department of Environment and Nature Conservation (DENC) (then the Department of Tourism, Environment and Conservation) in October 2009 authorising Listed Activities in terms of the Environmental Impact Assessment (EIA) Regulations 2006 and in terms of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA) (as amended).
- EA (reference number NC/30/5/1/2/2/206/00083MR) issued by the DMR in January 2018 authorising Listed Activities in terms of the EIA Regulations 2014 (as amended) and in terms of section 24G of the NEMA (as amended).
- Water Use Licence (WUL) (reference number 10/D41K/AGJ/1735) issued by the Department of Water and Sanitation (DWS) (then the Department of Water Affairs) in April 2015 authorising water uses in terms of Section 21 of the National Water Act, 1998 (No. 36 of 1998) (NWA) (as amended).

Copies of the Mining Right, EAs and WUL are provided in Appendix A.

PROPOSED PROJECT ACTIVITIES

Tshipi is proposing the Tshipi Borwa Waste Rock Dump Extension Project to provide additional overburden storage capacity (the proposed project). The proposed project includes the following components:

- The extension of the existing East Waste Rock Dump (WRD) in a south-easterly direction towards the existing Mining Right boundary and finally to ultimately merge with the nearby Mamatwan WRD, essentially filling the narrow void between these two WRDs; [2]

[2] The long-term intention is to fill the void between the Tshipi East WRD and the neighbouring mine's Mamatwan WRD, which are only separated by service roads on either side of the Mining Right boundaries, thereby minimising the effective dump surfaces that need to be rehabilitated. This will, however, be subject to Mamatwan receiving authorisation through a separate application process, to extend the footprint of its Mamatwan WRD. If Mamatwan fails to receive approval for the extension of the Mamatwan WRD, the East WRD will be appropriately shaped to terminate on the Tshipi Mining Right boundary.

- The extension of the existing West WRD in a south-westerly direction onto a portion of Portion 8 of the Farm Mamatwan 331, in order to provide additional storage capacity for waste rock;
- The construction of an 11 kV overhead powerline along the southern boundary of Portion 8 of Farm Mamatwan 331 and onto the existing Mining Right area. The proposed powerline will be fed by an approved Eskom 132 kV overhead powerline and 132/11 kV substation still to be built, which will also be located on the southern boundary of Portion 8 , and connecting this new line into the main distribution centre on the mine; and
- The construction of an overland conveyor system within the existing Mining Right area between the existing crushed product ore stockpile at the secondary crushing and screening plant to the existing manganese ore product stockpiles located in close proximity to the train load-out station.

Prior to the commencement of these activities, various authorisation requirements are necessary from various government departments in terms of theNEMA, NWA and the National Environmental Management: Waste Act, 2008 (No.59 of 2008) (NEM:WA) (as amended).

SLR Consulting (Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by Tshipi to manage these environmental regulatory processes.

SUMMARY OF AUTHORISATION REQUIREMENTS

The following authorisation requirements are applicable to the proposed project:

- An EA is required from the DMR in terms of NEMA: The proposed project incorporates several activities listed in Government Notice Regulation (GNR) 983 (Listing Notice 1) and 984 (Listing Notice 2) (refer to Table 3-1). As the proposed project includes activities listed in both Listing Notice 1 and 2, a Scoping and EIA process (hereafter collectively referred to as "EIA") is required in order for the DMR to consider the application for environmental authorisation.
- A Waste Management Licence (WML) from the DMR in terms of the NEM:WA. The proposed project incorporates waste management activities listed in GNR 921 (as amended) (refer to Table 3-2). As the proposed project includes activities listed in Category B, an EIA is required in order for the DMR to consider the application for a WML.
- A WUL is required from the DWS in terms of the NWA. The proposed project triggers a water use activity listed in Section 21 of the NWA (refer to Table 3-3). An application will also be lodged with the DWS for exemption from the requirements of relevant conditions in terms of the Regulations on Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources (GNR 704 of 4 June 1999) in terms of the NWA. It should be noted that a WUL application process was initiated with the DWS in 2017, for undertaking water uses related to the changes to mine infrastructure as per the previous Tshipi EMPr amendment (SLR, 2017d). The water uses related to the current project will be included in the WUL application still to be submitted to DWS.

Other approvals/permits needed for the proposed project are listed below:

- A permit is required from the Department of Agriculture Forestry and Fisheries (DAFF) and the DENC in terms of the National Forests Act, 1998 (No. 84 of 1998) for the removal or damaging of any protected plant species within areas that will be disturbed.

Other permissions, licences and/or consents may be required in terms of health and safety legislation, such as the Mine Health and Safety Act and Explosives Act, which may have to be obtained by Tshipi, however, this falls outside the scope of the current EIA process.

OBJECTIVES OF THE EIA PROCESS AND ENVIRONMENTAL IMPACT REPORT

The objectives of the EIA process are as follows:

- ensure the EIA is undertaken in accordance with the requirements of NEMA, EIA Regulations 2014, NEM:WA and NWA;
- ensure the EIA is undertaken in an open, participatory manner to ensure that all potential impacts are identified;
- undertake a formal public participation process, which includes the distribution of information to interested and affected parties (I&APs) and provides the opportunity for I&APs to raise any concerns/issues, as well as an opportunity to comment on all EIA documentation;
- commission specialist studies to assess key issues and concerns identified during the scoping process; and
- integrate all the information, including the findings of the specialist studies and other relevant information, into an Environmental Impact Report (EIR) to allow an informed decision to be taken on the proposed project.

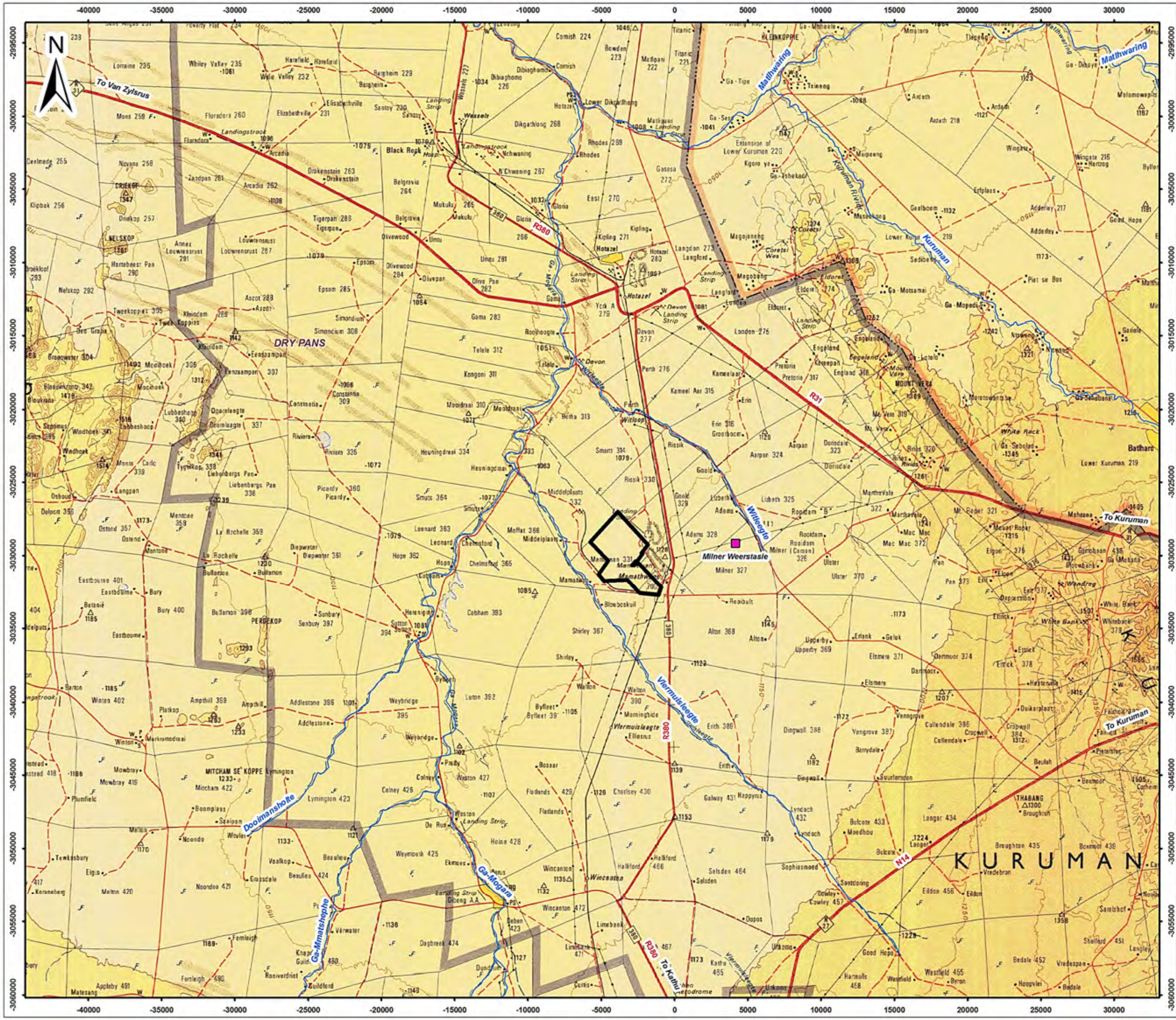
Further to this and in accordance with Appendix 3 of GNR 982 the key objectives of this EIR are to:

- determine the policies and legislation relevant to the activity and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity in the context of the development footprint on the preferred site as contemplated in the accepted Scoping Report;
- identify feasible alternatives related to the project proposal;
- ensure that all potential key environmental issues and impacts that will result from the proposed project are identified;
- assess potential impacts of the proposed project alternatives during the different phases of project development;
- identify the most ideal location of the activity within the development footprint of the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- present appropriate mitigation or optimisation measures to avoid, manage or mitigate potential impacts or enhance potential benefits, respectively; and
- identify residual risks that need to be managed and monitored.

Through the above, ensure informed, transparent and accountable decision-making by the relevant authorities.

STRUCTURE OF REPORT

This document has been prepared in accordance with the DMR EMPr Report template format (see Table 4-2).



Legend

- Main Roads
- Rivers
- Project Area

0 4 8 Kilometers

Scale: 1:20 000 000 @ A3

Projection:Transverse Mercator
Datum: Hartebeeshoek, Lo 23

Tshipi é Ntle Manganese Mining (Pty) Ltd

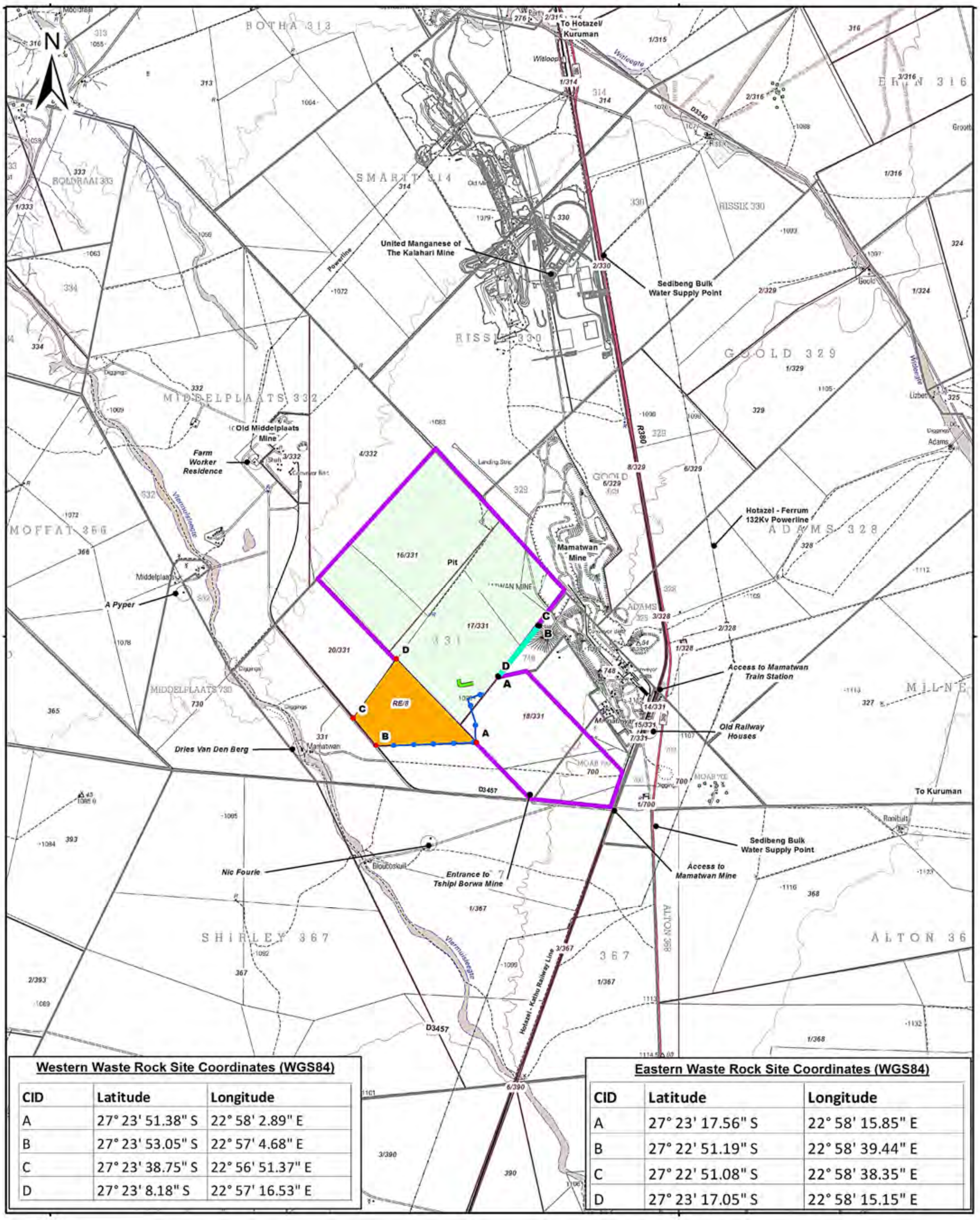
Figure 0-1

Regional Setting

SLR

SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.20008.00041 | 04/05/2018



Western Waste Rock Site Coordinates (WGS84)

CID	Latitude	Longitude
A	27° 23' 51.38" S	22° 58' 2.89" E
B	27° 23' 53.05" S	22° 57' 4.68" E
C	27° 23' 38.75" S	22° 56' 51.37" E
D	27° 23' 8.18" S	22° 57' 16.53" E

Eastern Waste Rock Site Coordinates (WGS84)

CID	Latitude	Longitude
A	27° 23' 17.56" S	22° 58' 15.85" E
B	27° 22' 51.19" S	22° 58' 39.44" E
C	27° 22' 51.08" S	22° 58' 38.35" E
D	27° 23' 17.05" S	22° 58' 15.15" E

Legend

- Main Road
- Rivers
- 20m Contours
- Power Lines
- Proposed 11kV Power Line
- Proposed Overland Conveyor System
- Proposed West Waste Rock Dump Extension
- Proposed East Waste Rock Dump Extension
- Approved Mining Right Area
- Surface Use Area
- Farm Boundaries
- Farm Portions

0 1 000 2 000 Meters

Scale: 1:60 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 0-2

Local Setting

SLR

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PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1. DETAILS OF THE EAP

1.1 DETAILS OF THE EAP WHO PREPARED THE REPORT

The details of the Environmental Assessment Practitioners (EAPs) and specialist consultants that were involved in the preparation of this EIR are provided in Table 1-1 below.

TABLE 1-1: DETAILS OF THE EAP AND SPECIALIST CONSULTANTS

SLR contact details		
Organisation	SLR Consulting (South Africa) (Pty) Ltd	
Postal address	PO Box 1596, CRAMERVIEW, 2060	
Tel No.	011 467 0945	
Fax No.	011 467 0975	
E-mail address	lmunro@slrconsulting.com (Project Manager)	
EAP		
Name	**Organisation**	**Responsibility on the project**
Linda Munro and Marline Medallie	SLR	Project Manager, public participation process, specialist report review and report writing
Jonathan Crowther	SLR	Reviewer
Jeremy Blood	SLR	EIR compilation
SPECIALIST CONSULTANTS		
Mihai Muresan	SLR	Groundwater Study
Hanlie Liebenberg-Enslin	Airshed Planning Professionals	Air Quality Specialist Study
Christopher Hooton	Scientific Terrestrial Services	Terrestrial Ecological Habitat Integrity Investigation
Emile Basson van der Westhuizen		
Ilan Smeyatsky	PGS Heritage	Heritage Impact Assessment
Mariné Pienaar	Terra Africa Environmental Consultants	Soil, Land Use and Land Capability Report
Arno Smit	SLR	Storm water Management Plan and Water Balance update Waste Rock Dump designs

Neither SLR nor any of the specialists involved in the EIA process have any interest in the proposed project other than fair payment for consulting services rendered as part of the EIA process. An undertaking by SLR is provided in Section 0.

1.2 EXPERTISE OF THE EAP

1.2.1 SLR Project Team

Linda Munro, Jeremy Blood and Jonathan Crowther each hold MSc degrees in Environmental Management, are registered as professional natural scientists (Environmental Science) with the South African Council for Natural Scientific Professions (SACNASP) and have over 15 years of relevant experience. Marline Medallie holds an MSc degree in Botany and has over 10 years of relevant experience and has been involved in several impact assessments for mining developments in South Africa.

Jeremy and Jonathan are certified as Environmental Practitioners with the Interim Certification Board for Environmental Assessment Practitioners of South Africa. All project team members have been involved in several impact assessments for large-scale mining developments in Africa.

Relevant curricula vitae (including proof of registrations) are attached in Appendix B.

1.2.2 Specialists

Five specialist consultants were appointed to assess / investigate the key issues identified during the Scoping Phase (refer to Table 1-1 for the specialist team). Specialists' CVs, which presents their experience and qualifications, are included in each of the respective specialist reports (refer to Appendix E to Appendix K).

2. PROPERTY DESCRIPTION

2.1 PROPERTY DESCRIPTION

A description of the property on which the proposed project is located is provided in Table 2-1.

TABLE 2-1: DESCRIPTION OF THE PROPERTY

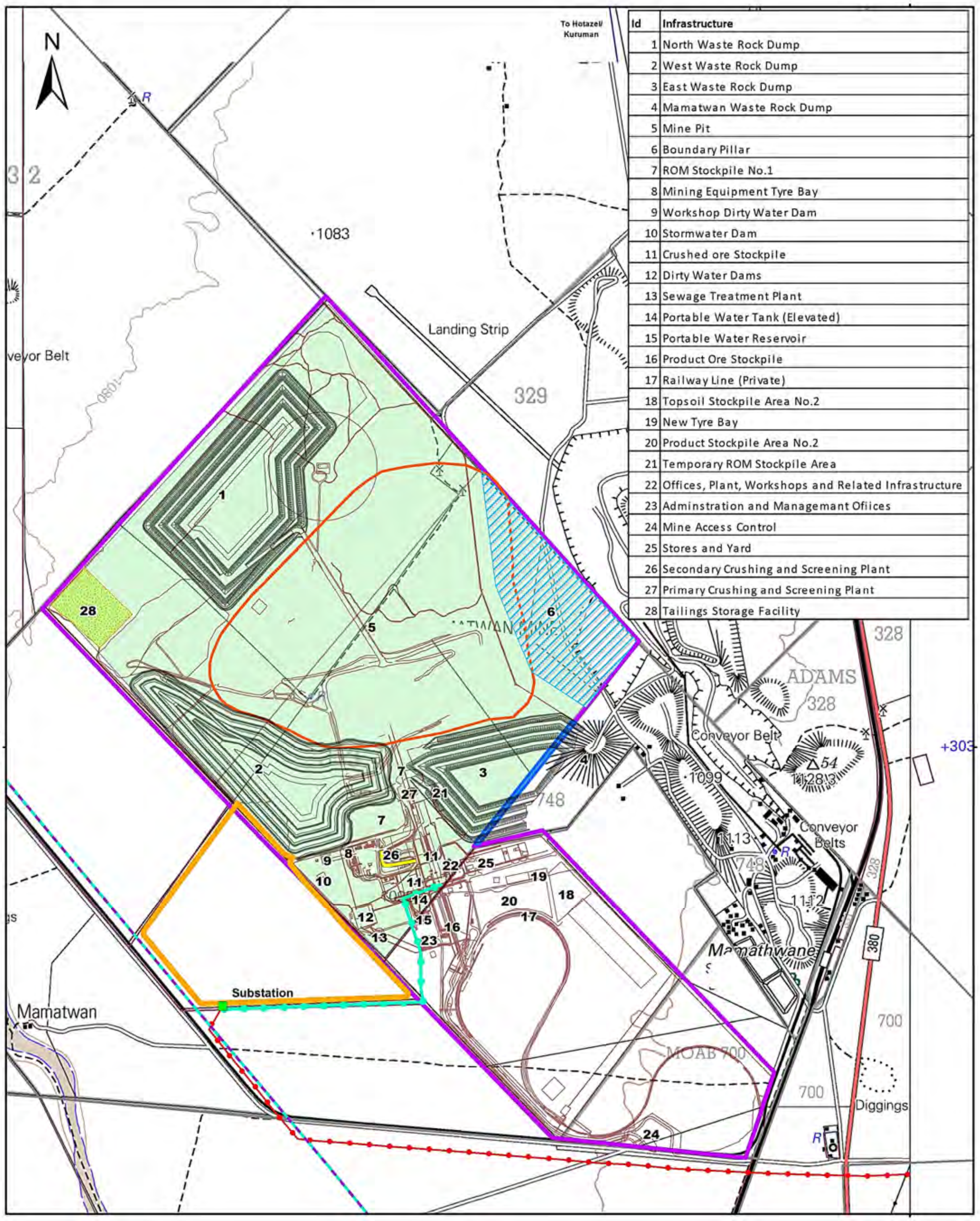
<table>
<tr><th>Description</th><th>Details</th></tr>
<tr><td>Farm Names</td><td>Portion 8 of the Farm Mamatwan 331.
Portion 16 (Portion of Portion 1) of the Farm Mamatwan 331.
Portion 17 (Portion of Portion 2) of the Farm Mamatwan 331.
Portion 18 (Portion of Portion 3) of the Farm Mamatwan 331.
Remainder of the Farm Moab 700.</td></tr>
<tr><td>Application area (ha)
(Areas have been revised after scoping phase, based on designs)</td><td>The proposed East WRD extension area is approximately (~) 5 ha.
The proposed West WRD extension area is ~ 128 ha (including access roads).
The proposed 11 kV overhead powerline is ~ 5.5 ha.
The proposed overland conveyor system is ~ 2.5 ha.</td></tr>
<tr><td>Magisterial district</td><td>The mine is located within the Kuruman Magisterial District and in the John Taolo Gaetsewe District Municipality.</td></tr>
<tr><td>Distance and direction from nearest town</td><td>The closest towns are Hotazel and Kathu, located approximately 18 km north and 42 km south of the Tshipi Borwa Mine, respectively. The regional setting is illustrated in Figure 0-1.</td></tr>
<tr><td>21 digit Surveyor General Code for each farm portion</td><td>TO0000000000033100016
TO0000000000033100017
TO0000000000033100018
TO0000000000033100008
TO0000000000070000000</td></tr>
<tr><td>Co-ordinates</td><td>The project components are illustrated in Figure 0-2. The co-ordinates of main project components are presented below.
The four corner points of the East WRD extension area include:
<table>
<tr><th>CID</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>A</td><td>27° 23' 17.56" S</td><td>22° 58' 15.85" E</td></tr>
<tr><td>B</td><td>27° 22' 51.19" S</td><td>22° 58' 39.44" E</td></tr>
<tr><td>C</td><td>27° 22' 51.08" S</td><td>22° 58' 38.35" E</td></tr>
<tr><td>D</td><td>27° 23' 17.05" S</td><td>22° 58' 15.15" E</td></tr>
</table>
The four main corner points of the West WRD extension area include:
<table>
<tr><th>CID</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>A</td><td>27° 23' 51.38" S</td><td>22° 58' 2.89" E</td></tr>
<tr><td>B</td><td>27° 23' 53.05" S</td><td>22° 57' 4.68" E</td></tr>
<tr><td>D</td><td>27° 23' 8.18" S</td><td>22° 57' 16.53" E</td></tr>
<tr><td>C</td><td>27° 23' 38.75" S</td><td>22° 56' 51.37" E</td></tr>
</table>
The 11kv overhead powerline co-ordinates are as follows:
<table>
<tr><th>CID</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>0</td><td>27° 23' 53.02" S</td><td>22° 57' 14.46" E</td></tr>
<tr><td>1</td><td>27° 23' 51.43" S</td><td>22° 58' 2.57" E</td></tr>
</table></td></tr>
</table>

Description	Details		
	2	27° 23' 29.05" S	22° 57' 57.71" E
	3	27° 23' 26.08" S	22° 58' 7.18" E
	The overland conveyor system co-ordinates are as follows:		
	CID	**Latitude**	**Longitude**
	0	27° 23' 18.82" S	22° 57' 52.57" E
	1	27° 23' 20.82" S	22° 57' 52.74" E
	2	27° 23' 21.90" S	22° 57' 53.09" E
	3	27° 23' 21.90" S	22° 57' 54.81" E
	4	27° 23' 20.98" S	22° 58' 0.84" E

2.2 LOCALITY MAP

The regional and local settings are illustrated in Figure 0-1 and Figure 0-2, respectively.

A site layout plan showing the location of proposed project components is illustrated in Figure 2-1, and in more detail in Figure 3-1 and Figure 3-2.



Id	Infrastructure
1	North Waste Rock Dump
2	West Waste Rock Dump
3	East Waste Rock Dump
4	Mamatwan Waste Rock Dump
5	Mine Pit
6	Boundary Pillar
7	ROM Stockpile No.1
8	Mining Equipment Tyre Bay
9	Workshop Dirty Water Dam
10	Stormwater Dam
11	Crushed ore Stockpile
12	Dirty Water Dams
13	Sewage Treatment Plant
14	Portable Water Tank (Elevated)
15	Portable Water Reservoir
16	Product Ore Stockpile
17	Railway Line (Private)
18	Topsoil Stockpile Area No.2
19	New Tyre Bay
20	Product Stockpile Area No.2
21	Temporary ROM Stockpile Area
22	Offices, Plant, Workshops and Related Infrastructure
23	Adminstration and Managemant Ofiices
24	Mine Access Control
25	Stores and Yard
26	Secondary Crushing and Screening Plant
27	Primary Crushing and Screening Plant
28	Tailings Storage Facility

Legend

- Approved Eskom 33/11/kV 10mVA Substation
- Approved Eskom Power Line
- Approved 400kV Eskom Powerline
- Proposed 11kV Power Line
- Proposed Overland Conveyor System
- Proposed West Waste Rock Dump Extension
- Proposed East Waste Rock Dump Extension
- Waste Rock Dumps
- Mine Infracture
- Approved Mining Right Area
- Surface Use Area
- Tailings Storage Facility
- Mine Pit
- Boundary Pillar

Kilometers
0 0.5 1
Scale: 1:60 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 2-1

Site Layout

SLR

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3. DESCRIPTION OF THE SCOPE OF THE ACTIVITY

A site layout plan showing the location of existing and proposed project activities / components is illustrated in Figure 3-1 and Figure 3-2.

3.1 LISTED AND SPECIFIED ACTIVITIES

The proposed project triggers various activities for which authorisation is required in terms of the NEMA, NEM:WA and NWA. The associated listed or specified activities are summarised below.

3.1.1 NEMA and the EIA Regulations 2014

The EIA Regulations 2014 (as amended) promulgated in terms of Chapter 5 of NEMA, and published in GNR 982 (as amended) control certain listed activities. These activities are listed in GNR 983 (Listing Notice 1; as amended), GNR 984 (Listing Notice 2; as amended) and GNR 985 (Listing Notice 3; as amended), and are prohibited until EA has been obtained from the competent authority.

The proposed project includes activities in both Listing Notice 1 and 2 (see Table 3-1) and it is thus necessary that an EIA process is undertaken in order for the DMR to consider the application in terms of NEMA.

It should be noted that the WRD extension areas have been marginally revised and finalised since the scoping phase with design information now available.

TABLE 3-1: PROJECT ACTIVITIES AND ASSOCIATED LISTED ACTIVITIES IN TERMS OF THE EIA REGULATIONS 2014

Description of the project activity	Aerial extent of the activity (ha)	Listed activity number, applicable listing notice and activity description
Clearing of vegetation in areas designated for the proposed WRD extensions and supporting infrastructure.	East WRD extension: ~5 ha. West WRD extension: ~128 ha.	**Activity 28 of Listing Notice 1 (GNR 983)** *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game, farming, equestrian purposes or afforestation on or after 1 April 1998 and where such development:* *ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; …*
		Activity 30 of Listing Notice 1 (GNR 983) *Any process or activity identified in terms of Section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).*
		Activity 15 of Listing Notice 2 (GNR 984) *The clearance of an area of 20 hectares or more of indigenous vegetation, …*

Description of the project activity	Aerial extent of the activity (ha)	Listed activity number, applicable listing notice and activity description
Establishment of private on-mine haul and service roads.	This forms part of the ~5 ha of disturbance for the East WRD extension and ~128 ha of disturbance for the West WRD extension.	**Activity 24 of Listing Notice 1 (GNR 983)** *The development of a road –* *(ii) with a reserve wider than 13.5 metres, or where no reserve exists where the road is wider than 8 metres; …*
		Activity 56 of Listing Notice 1 (GNR 983) *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre–* (i) *where the existing reserve is wider than 13.5 metres; or* (ii) *where no reserve exists, where the existing road is wider than 8 metres; …*
Stockpiling waste rock on the WRD extension areas and use of waste rock to establish roads and berms.	This forms part of the ~5 ha of disturbance for the East WRD extension and ~128 ha of disturbance for the West WRD extension.	**Activity 6 of Listing Notice 2 (GNR 984)** *The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, …*
Mining infrastructure	This forms part of the ~5 ha of disturbance for the East WRD extension and ~128 ha of disturbance for the West WRD extension.	**Activity 17 of Listing Notice 2 (GNR 984)** *Any activity including the operation of that activity which requires a Mining Right as contemplated in Section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including—* *(a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or* (b) *the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; …*
Construct an overland conveyor network from the existing secondary crushing and screening plant to the existing manganese product stockpile.	The conveyor system is approximately 1.2 km. The conveyor is located within the existing mine infrastructure area.	N/A – No listed activities applicable to this project activity. However, authorisation is required under the MPRDA based upon the advice provided by the Regional Office of the DMR, Northern Cape Region.
Construct 11 kV overhead powerline	The powerline is approximately 2.5 km in length with a 22 m wide servitude, resulting in a 5.5 ha footprint.	N/A - No listed activities applicable to this project activity. However, authorisation is required under the MPRDA based upon the advice provided by the Regional Office of the DMR, Northern Cape Region.

3.1.2 NEM:WA

Waste management activities that have, or are likely to have, a detrimental effect on the environment are listed in GNR 921 (as amended). Activities above certain thresholds are subject to a process of impact assessment and licensing. NEM:WA also provides for the setting of norms and standards for the storage and disposal of waste. These norms and standards are listed in GNR 926 of 2013 (storage) and GNR 636 of 2013 (disposal).

The proposed project triggers waste management activities in Category B (see Table 3-1) and it is thus necessary that an EIA process is undertaken in order for the DMR to consider the application in terms of NEMA:WA.

It should be noted that the WRD extension areas have been marginally revised and finalised since the scoping phase with design information now available.

TABLE 3-2: WASTE MANAGEMENT ACTIVITIES LISTED IN TERMS OF NEM:WA (GNR 921)

Description of project activity	Aerial extent of the activity (ha)	Listed activity number, applicable listing notice and activity description
Stockpiling waste rock on the WRD extension areas and use of waste rock to establish roads and berms.	This forms part of the ~ 5 ha of disturbance for the East WRD extension and ~128 ha of disturbance for the West WRD extension.	**Activity 7 in Category B (GNR 921)** *The disposal of any quantity of hazardous waste to land.*
		Activity 10 in Category B (GNR 921) *The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).*
		Activity 11 in Category B (GNR 921) *The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a Mining Right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002).*

3.1.3 NWA

A WUL is required for any new water use that is not listed in Schedule 1 of NWA or that is not covered by a General Authorisation. The proposed project triggers a water use activity listed in Section 21 of the NWA (refer to Table 3-3). Thus, a WUL application will be submitted to the DWS for approval.

An application will also be lodged with the DWS for exemption from the requirements of relevant conditions on Regulation 704 (4 June 1999) in terms of the NWA .

TABLE 3-3: LISTED WATER USE ACTIVITIES IN TERMS OF THE NWA

Description of project activity	Aerial extent of the activity (ha)	Water use number and description

Description of project activity	Aerial extent of the activity (ha)	Water use number and description
Proposed WRD extensions; using water from the mine's dirty water collection system for dust suppression, road maintenance etc.	The proposed East WRD extension area is ~5 ha. The proposed West WRD extension area is ~128 ha (including access roads).	**Section 21(g) of the NWA** *Disposing of waste in a manner which may detrimentally impact on a water resource.*

3.2 DESCRIPTION OF THE ACTIVITIES

3.2.1 PROJECT OVERVIEW

The Tshipi Borwa Mine is an existing open pit (open pit) manganese mine that has been in operation since 2012. The mine uses conventional truck and shovel open pit mining methods. Concurrent backfilling takes place whereby waste rock is hauled back to mined-out areas of the pit where it is dumped. Where concurrent in-pit dumping is not possible i.e. when there is insufficient space between the working faces and the in-pit dumping areas, waste rock is hauled onto the WRDs and tipped there.

Mineral processing entails crushing and screening of the ore which is then stockpiled before loading onto trains and/or road-going trucks for delivery to ports around the country. An overview of the existing operation is provided in Section 3.2.2.

Note that in the context of evolving technical, commercial, socio-economic, environmental, legal and cumulative considerations, Tshipi is continually re-evaluating its mine closure solution, including its pit backfilling options.

At this time, Tshipi is now proposing to:

- Extend the existing East WRD in a south-easterly direction to the existing Mining Right boundary;
- Extend of the existing West WRD towards the south-west onto Portion 8 of Farm Mamatwan 331;
- Construct an 11 kV overhead powerline along the southern boundary of Portion 8 of Farm Mamatwan 331 onto the existing Mining Right area, and connect this new powerline into the main distribution centre on the mine; and
- Construct an overland conveyor system within the existing Mining Right area from the existing secondary crushing and screening plant to the existing manganese ore product stockpiles, located in proximity to the train load-out station.

An overview of the proposed activities and infrastructure associated with each project phase is provided in Table 3-4 and is illustrated in Figure 3-1 and Figure 3-2. Further information pertaining to the proposed activities is presented in Section 3.2.3 below.

TABLE 3-4: LIST OF PROPOSED PROJECT ACTIONS / ACTIVITIES / PROCESSES

Main activity/ process	Sub-activities	Construction Phase	Operation Phase	Decommissioning Phase	Closure Phase
Site preparation	Vegetation clearing (trees, bushes and grasses) in line with the WRD extension and 11 kV overhead powerline servitude will be cleared of vegetation in accordance with the DAFF guidelines.	On-going	On-going		
	Removal of existing minor structures such as fencing (if present).	On-going	On-going		
	Establishing and maintaining the construction contractor's area.	On-going			
Earthworks & civils	Stripping and stockpiling of topsoil resources in line with soil management programme.	On-going	On-going		
	Levelling and excavating activities by dozer, grader, excavator, loader and haul-trucks.	On-going	On-going		
	Establishing temporary access and construction roads.	On-going	On-going		
	Excavation, preparation and compaction of WRD extension foundations, substation foundations, overhead powerline trenches and conveyor system foundations. Erection of the overhead powerline wooden or steel poles, stringing of powerlines and construction of the overland conveyor system (concrete work and reinforcing steelwork).	On-going	On-going (only WRD foundations)		
	Construction of initial and expansion cells in WRD extension areas in a phased manner over the life of the mine.	On-going	On-going		
	Establishing and maintaining storm water controls (berms, cut-off drains/trenches and channels) as per storm water management plan.	On-going	On-going maintenance		
Waste rock (Mineralised waste) management	Hauling, tipping and dozing of waste rock	On-going	On-going		
	Waste rock stored in cells on the WRD extensions	On-going	On-going		
	Concurrent backfilling of the pit (in-pit dumping)		On-going		
	Rehabilitation of WRDs (on-site, on surface)			Permanent	Permanent

Main activity/ process	Sub-activities	Construction Phase	Operation Phase	Decommissioning Phase	Closure Phase
Storm water management **continue until infrastructure can be removed or successfully rehabilitated*	Diversion of clean water from dirty areas	On-going	On-going	On-going*	
	Containment of dirty water collected from dirty areas.	On-going	On-going	On-going*	
Transport systems	Construction and maintenance of on-mine private (gravel) haul, access and service roads.	On-going	On-going	On-going	
	Movement of construction vehicles/machinery within the site boundary (via on-mine private roads).	On-going	On-going	On-going	Limited
	Movement of waste rock with dozers, excavators, loaders and/or haul-trucks.		On-going	On-going	
Non-mineralised (general and industrial hazardous) waste management	Collection of general and hazardous waste on mine site.	On-going	On-going	On-going	
	Disposal and/or treatment of contaminated soils.	On-going	On-going	On-going	
	Removal of waste by contractor for recycling, re-use and/or final disposal at permitted waste disposal facilities.	On-going	On-going	On-going	
Site support services	Access control and roaming security activities at mine entrance and on Mining Right and Surface Right areas.	On-going	On-going	On-going	
	Maintenance of firebreaks.	On-going	On-going	On-going	
	Maintenance of on-mine private roads, fencing and lighting for security.	On-going	On-going	On-going	
	Appointment of contractors and workers.	On-going	On-going	On-going	
Site management	Site management (monitoring, inspections, maintenance of facilities, security, access control).	On-going	On-going	At start of phase	
	Environmental awareness training and emergency response.	On-going	On-going	On-going	On-going
	On-going rehabilitation of facilities/disturbed areas (where possible).	On-going	On-going	On-going	
	Implementing and maintaining management plans.	On-going	On-going	On-going	

Main activity/ process	Sub-activities	Construction Phase	Operation Phase	Decommissioning Phase	Closure Phase
	Removing contractor's camp infrastructure (if not incorporated into WRD extension footprints).	On-going	On-going	On-going	
Demolition	Dismantling and demolition of fixed infrastructure and removal of equipment.	At end of phase			
	Demolition of ramps, haul, service and access roads (no longer needed).		For maintenance	On-going	
	Replacing soil resources.		On-going	On-going	
Rehabilitation	Slope stabilisation, erosion control and landscaping.		As required	On-going	Maintenance
	Re-vegetation of landscaped areas.	On-going	On-going	On-going	Maintenance
	Removal of alien invasive species from rehabilitated sites.		On-going	On-going	Maintenance
	Restoration of natural drainage patterns as far as practically possible.		On-going	On-going	Maintenance
	Aftercare and maintenance of rehabilitated areas.		On-going	On-going	Maintenance
	Monitoring, maintenance and repair of facilities and rehabilitated areas.			At end of phase	Maintenance
Maintenance and aftercare	Monitoring, maintenance and repair of facilities and rehabilitated areas.		On-going	On-going	On-going until rehabilitation measures are successful and a closure certificate is obtained

3.2.2 OVERVIEW OF EXISTING OPERATION

3.2.2.1 Surface Infrastructure

The surface infrastructure approved as part of the original EMPr process (Metago, 2009) and the previous EMPr amendment process (SLR, 2017d) are summarised in Table 3-5 and illustrated in Figure 3-1 and Figure 3-2. The proposed WRD Extension Project will not change the overall existing mining operations with the exception of hauling and disposal of waste rock.

TABLE 3-5: LIST OF APPROVED INFRASTRUCTURE

Infrastructure approved as part of the original EMPr (Metago, 2009)	
Explosive Magazine and Emulsion Silos	Workshop Dirty Water Collection Dam
Explosives Destruction Bay	Area Designated for DMS, Tertiary Crushing Plant, Sinter Plant, Product Stockpile Area and the Sinter Plant Feed Stockpile
Open Pit	Reverse osmosis plant
Topsoil Stockpile No.1 and No.2	Potable water facilities (Potable Water Tank (elevated), Potable Water Reservoir, fire water tank and the Temporary Construction Dam)
Temporary Mobile Crushing Plant	Mining Brake-test Ramps
Conveyors (Crushed ROM Conveyor)	Plant Brake-test Ramp
Mining Equipment Service Bay	Spares Yard
Mining Equipment Tyre Bay	Main Fuel Depot (Diesel Farm)
Primary Crushing and secondary crushing and screening	Boiler Shop
Thickener	Main Security, Gate and Offices;
Eastern Waste Rock Dump	Mining Shift Change Building
Western Waste Rock Dump	Clinic
Northern Waste Rock Dump	Laboratory
Tailings Dam and Return Water Dam (not yet in use)	Change House and Laundry
ROM Stockpile No.1 and temporary ROM stockpile area	Weighbridges and control room (Weighbridge and Crushed Ore Weighbridge)
ROM Pad and Crushed ROM Stockpile	Mine General Store, Core Stores, Rigging Store and Hazardous Store
Product Stockpile Area No. 1 and No. 2	Heli-pad (Still to be established)
Haul Roads (incl. to Northern Waste Rock Dump) and Truck Roads	Offices (Mining Office No.1 and No. 2, Main Admin Offices, Engineering and Projects Offices, Ancillary Equipment Workshop, Plant Production Offices, Engineering Offices)
Railway line	Wash Bay
Train Load-Out Station	Mining Training Rooms
Sewage Treatment Plant	Salvage Yard and Waste Storing/Sorting/Reclaim Area
Overhead Power line	Parking (Mining Mobile Equipment Hardpark, Ancillary Mobile Equipment Hardpark, ambulance bay, Road Truck, Vehicle Parking Bay and General Parking Area)

Infrastructure approved as part of the original EMPr (Metago, 2009)	
Substations (No. 1 to No. 6)	Truck Parking
Generator Powerhouse Diesel Tanks	Storm water management facilities (Dirty Water Dams, Workshop dirty water collection dam, Storm water Dam)
Tyre Bays (Tyre bay and mining equipment tyre bay)	
Sinter plant (Still to be established)	
Infrastructure approved as part of the 2017 EMPr amendment (SLR, 2017d)	
Waste rock dumps (additional)	Office, plant, workshop and related infrastructure (amendment)
Temporary ROM stockpile area (additional)	Railway line (amendment)
Weighbridges (additional)	Secondary crushing and screening plant (amendment)
Topsoil stockpile area (No. 2) (additional)	Storm water management system (amendment)
Tyre bays (additional)	Potable water storage facility (amendment)
Sewage treatment plant (amendment)	Ore stockpiles (amendment)
Diesel farm (section 24G rectification)	Widening of haul road (section 24G rectification)

3.2.2.2 Open Pit Mining Method

Current operations comprise conventional truck and shovel open pit mining methods. The mining of the open pit commenced in the south-east of the mining right area and is progressing in a northerly direction. The depth of the manganese seam at the start of mining was approximately 70 m below the surface and the deepest point will be approximately 330 m below surface. Further detail pertaining to the mining method is provided in Table 3-6 below. A conceptual process flow diagram of current operations is presented in Figure 3-4.

TABLE 3-6: MINING METHOD DESCRIPTION

Activity	Description
Site preparation	Site preparation includes the clearing of vegetation and topsoil stripping. Topsoil is stockpiled, for later use in rehabilitation.
Earthworks	Following site preparation all subsoil and some waste rock is dozed and stockpiled separately for re-use for rehabilitation activities.
Drilling and blasting	Once the topsoil and some of the waste rock has been removed by dozing, the waste rock is drilled and blasted in benches until the economic ore horizon is exposed. Similarly drill and blast methods are used to break the ore with careful attention being paid to avoiding contamination of the ore with waste. Blasting occurs only a few times a week i.e. not daily and only in daylight hours. Blasting does not take place on weekends under normal circumstances. Access to the open pit is by means of engineered ramps from either the high wall, low wall or end wall of the pit. In the future, access to the underground workings will be by means of adits or portals excavated off the high wall on the ore-body horizon i.e. on the floor of the open pit.
Removal of waste rock	Broken waste rock is loaded into mining dump-trucks by excavator and then hauled either to the worked out area of the pit or onto the surface WRDs where it is tipped and dozed into final position.
Removal of Run-	Broken ore is also loaded by excavator into mining dump-trucks and then hauled either directly to

Activity	Description
of-Mine (ROM) ore	the ROM pad – adjacent to the mine tip and crusher or to various grade stockpile areas. The ROM is then transferred into the primary crusher from where it is conveyed to the crushed ore stockpile. From the crushed ore stockpile it is transferred to the secondary crushing and screening plant. Further detail regarding the mineral processing method is provided in Table 3-7. The extended ROM stockpile area is only utilised when the designated ROM pad is unable to accommodate for the ROM tonnages at that time. In addition to this, a temporary ROM stockpile area near the ROM pad is utilised in the event that there is a shortfall in capacity at the ROM stockpile. Low grade ore that cannot be sent for crushing and screening is stockpiled at one of the product stockpile areas (No. 1 and No. 2). Low grade ore is sent off-site for sale via truck and/or train.
In-pit Dumping	Once the open pit reaches a steady state, on-going rehabilitation of the mined out areas occurs as mining advances. In this regard, waste rock is used as backfill (once there is sufficient space to dump safely). Once sufficient pit-room is established, broken waste rock will be hauled and dumped into the pit void thereby minimising the amount of waste rock that will report to the surface WRDs.
Rehabilitation	Once the extremities of the WRDs and the In-pit Dumps are established, rehabilitation i.e. the profiling, topsoiling and vegetation of these slopes can commence.

3.2.2.3 Mineral Processing Method

The current mineral processing method is described in Table 3-7 below. A conceptual process flow diagram of current operations is presented in Figure 3-4.

TABLE 3-7: MINERAL PROCESSING METHOD

Activity	Description
Primary crushing and screening	ROM is delivered to the primary crushing and screening plant with mining dump trucks. The primary (jaw) crusher reduces the size of the run-of-mine ore to fractions manageable by the secondary crusher i.e. <150mm. Crushed ROM ore is conveyed to the crushed ore stockpile, adjacent to the secondary crushing and screening plant. Dust suppression by means of water sprays is installed at the tip, the primary crusher, screens and conveyor transfer points.
Secondary crushing and screening	The secondary crushing and screening plant is used to size the ore according to product specifications. Crushed ROM ore is first screened and the >75mm ore reports to a cone crusher before reporting to a the <75mm stockpile. The <75mm ore is then reclaimed by conveyor and screened to produce two stockpiles; a 75mmm X 6mm lumpy product and a <6mm fines product. Dust allaying by water sprays at the crusher, screens and conveyor transfer points is done continuously while the plant is in operation. The water is either retained as surface moisture on the ore or evaporates, there is minimal if any run-off water. Currently front end loaders and haul trucks are used to transfer the ore to the product stockpiles adjacent to the rail load-out facility. As trains arrive at the mine product ore is reclaimed and put into the wagons via a load-out silo. Road trucks are loaded with front-end-loaders form the same product stockpiles.

Activity	Description
Thickener and tailings dam (not constructed or commissioned at this time)	Secondary screening fines waste (<1 mm) material is sent to the thickener plant via conveyor. Water removed from the secondary screening fines waste during the thickener process is re-used within the mining system as process water for dust suppression at the primary and secondary screening plants. The fines waste processed at the thickener is disposed as tailings.
Tertiary crushing and screening (not constructed or commissioned at this time)	The tertiary crushing and screening section (-40+6 mm material) is used to prepare the ore for sinter plant feed. High grade product is stockpiled at the tertiary product stockpile prior to being sent to the sinter plant. Manganese that is below the required grade from the tertiary crushing and screening plant is stockpiled at a low grade stockpile prior to being sent to the Dense Medium Separator (DMS) for further processing. Any fines material (-1 mm) produced at the tertiary crushing and screening plant are sent to the thickener for disposal to the tailings dam.
Sintering (not constructed or established at this time)	In the sinter plant, ore is sintered by the application of heat, to agglomerate it and to increase the manganese content (by burning off the carbonaceous material). Raw materials are mixed with the manganese ore in a rotating mixing pan prior to agglomeration in a rotary drum. The agglomerated material is fed into the sinter furnace on a steel belt. The sinter furnace is a multi-compartment oven that is ignited with gas or heavy fuel oil. The front compartments are used for drying, ignition and sintering. The back compartments are for cooling. Gas emissions are scrubbed in cascade scrubbers to remove most of the particulates and pollutants. The dirty scrubber water is re-cycled in the thickener plant. Dust emissions are captured in bag filters and recycled into the sinter feed. The final product is stockpiled on the product stockpile prior to being loaded onto trains for sale to third parties.
Dense medium separation (not constructed or commissioned at this time)	Prior to the sintering stage, manganese ore that is below the saleable manganese grade is beneficiated using DMS, effectively upgrading the ore. Using density differential between manganese and waste; the material is sent to the sinter feed stockpile prior to being sent to the sinter plant while the waste is disposed onto the temporary discard dump.

3.2.2.4 Mineralised Waste Management

Waste rock

The EMPr amendment (SLR, 2017d) make provision for three approved waste rock dumps, namely the northern, eastern and western WRDs, which were designed to comply with Regulation 73 of Regulation 527 of the MPRDA Regulations as outlined in Table 3-8 below. It should be noted that the designs of the WRDs have been completed subsequent to the approved of EMPr in 2017 and the volumes and footprints indicated below are as per the current designs, with the relevant extensions. The proposed extension areas have also been marginally revised and finalised since the scoping phase with the designs now available. The position of the approved WRDs is illustrated in Figure 3-1. It is anticipated that any waste rock generated as part of mining the boundary pillar will be deposited onto the eastern WRD.

TABLE 3-8: DESIGN FEATURES OF THE WASTE ROCK DUMPS INCLUDING EXTENSIONS

<table>
<tr><th>Feature</th><th>Detail</th></tr>
<tr><td>Physical dimensions</td><td>
<table>
<tr><td></td><td>East</td><td>West</td><td>North</td><td>Total</td></tr>
<tr><td>Area (ha)</td><td>54 (49)</td><td>215.76 (41)</td><td>94.75 (118)</td><td>364,51</td></tr>
<tr><td>Height (m)</td><td>80</td><td>86</td><td>86</td><td></td></tr>
<tr><td>Capacity (M m^3)</td><td>24 (17)</td><td>117.15 (41)</td><td>47 (59)</td><td>188.15</td></tr>
<tr><td></td><td colspan="4">(values in parenthesis are those approved in 2017 EMPr)</td></tr>
</table>
</td></tr>
<tr><td>Physical characteristics</td><td>The material comprises rock including sand, calcrete, clay and (uneconomic) banded iron. The water content is expected to be about 5%. The void ratio is approximately 0.5.</td></tr>
<tr><td>Management, transport, placement and backfilling</td><td>Waste rock is loaded into mining dump trucks and hauled either to worked out areas of the pit or onto the WRDs where it is tipped and dozed into final position.</td></tr>
<tr><td>Diversion of clean water and containment of dirty water</td><td>Run-off from the WRDs is managed in toe paddocks or with perimeter berms to contain run-off water which is then allowed to evaporate.</td></tr>
<tr><td>Topsoil stripping</td><td>Topsoil in the WRD footprint areas is stripped and stockpiled in accordance with the soil conservation procedure (see Table 27-3) at the designated topsoil stockpile near the tailings dam area. Stripping and stockpiling of topsoil is done immediately in advance of dumping.</td></tr>
<tr><td>Lining</td><td>No lining is provided for the waste rock dumps. The waste rock dumps need to conform to Class D liner specification (Rip and Re- Compact).</td></tr>
<tr><td>Side slopes</td><td>The slopes of the waste rock dumps do not exceed thirty-three degrees (33°) for each lift, the benches are thirty metres (30 m) wide, which reduces the overall side slopes.</td></tr>
<tr><td>Under drains</td><td>No under drainage has been provided. Surface runoff is directed around the waste rock dump and dump surfaces provide positive drainage to prevent ponding and infiltration.</td></tr>
<tr><td>Access and access control</td><td>Mining haul roads are constructed using selected waste rock (calcrete). No perimeter fence has been provided around the individual waste rock dumps. Rather a perimeter fence has been installed around the perimeter of the mine.</td></tr>
<tr><td>Waste minimisation</td><td>Selected waste rock is used to construct foundations and haul roads as backfill in the open pit.</td></tr>
<tr><td>Monitoring</td><td>A monitoring strategy has been developed to manage excessive surface cracking, bulging, foundation creep, and seepage at the waste rock dump.</td></tr>
<tr><td>Dust control</td><td>During operation roads are watered using water and/or chemical solutions for dust suppression. During the post operational phase no measures are necessary due to the rehabilitation of the waste rock dumps. Monitoring forms part of the overall site monitoring.</td></tr>
<tr><td>Closure</td><td>Material from the waste rock dumps is used to backfill the pit. However, where waste rock remains after mining, these will be flattened to a maximum side slope of 1V:3H. Land use options for rehabilitation will be considered during the life of mine in accordance with changes in the mine’s development. On closure of any remaining waste rock dumps, access ramps and berms will be eliminated prior to rehabilitation to reduce erosion risks.

No active groundwater protection measures are envisaged during closure given the relatively low pollution potential of the residual waste rock material.

In the event that water quality monitoring around any waste rock dump indicates that the waste rock dumps are causing pollution, additional management measures will be investigated in consultation with a qualified specialist.

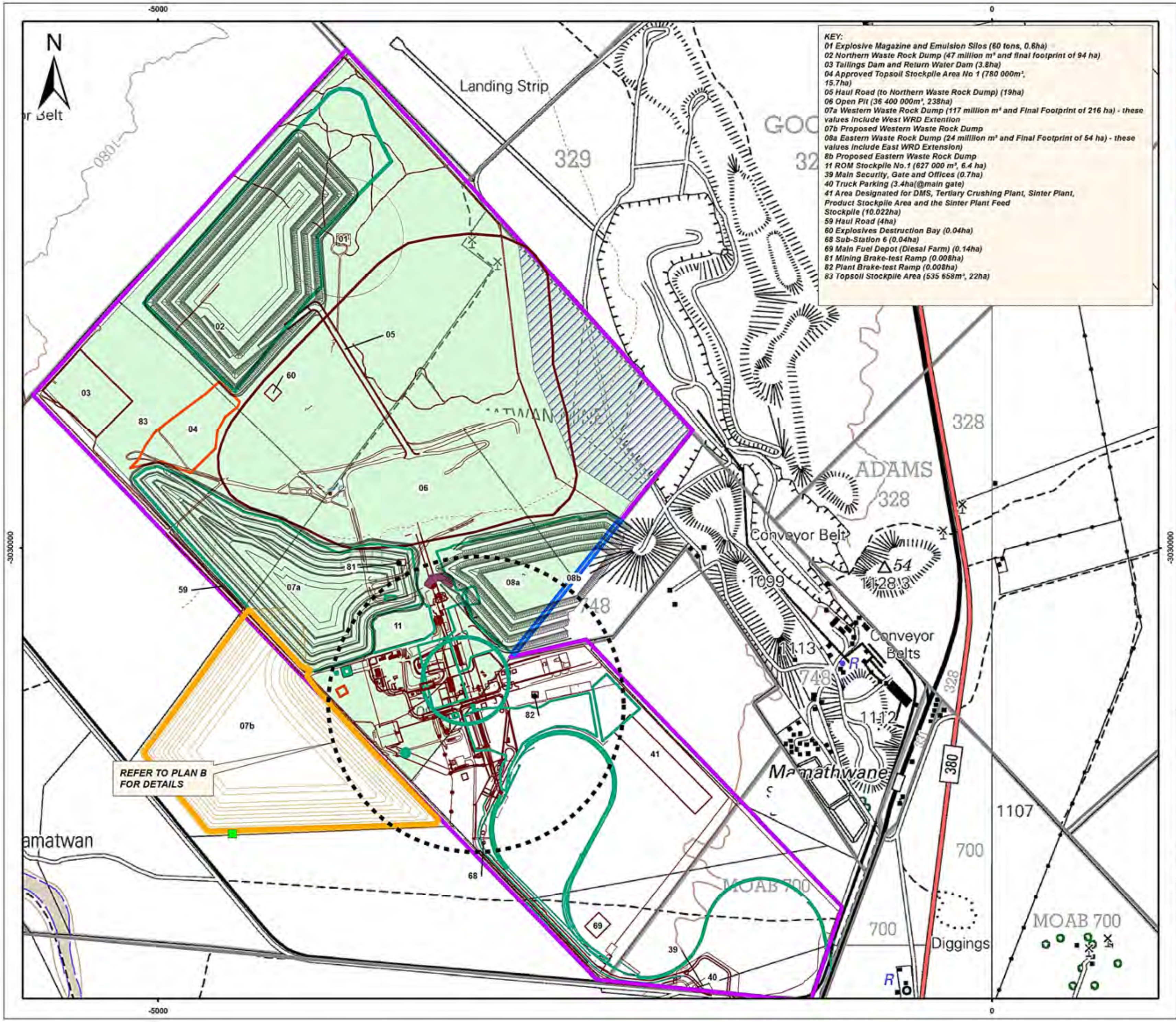
The footprint of the waste rock dumps will be rehabilitated by ripping the underlying subsoil,</td></tr>
</table>

Feature	Detail
	then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period.
Rehabilitation success criteria	Rehabilitation success will be determined by monitoring trends in soil nutrient levels, soil microbial levels, vegetation cover and vegetation biodiversity levels and comparing data and temporal trends in the data to numerical targets.

Safety classification of waste rock dumps

The safety classification for the approved WRDs was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of the MPRDA. The summarised classifications are included in Table 3-9 below.

With reference to Table 3-9, the WRDs are classified as a **low safety risk**.



Legend

- Approved Eskom 33/11/kV 10mVA Substation
- Waste Rock Dumps
- Proposed East Waste Rock Dump Extension
- Proposed West Waste Rock Dump Extension
- Surface Use Area
- Approved Mining Right Area
- Mine Infrastructure (no changes to approved infrastructure layout)
- Changes to Approved Layout (already implemented)
- Approved changes to Layout
- Barrier Pillar

0 500 1 000 Meters

Scale: 1:22 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

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Figure 3-1

Close Up A of New Surface Infrastructure Layout

SLR

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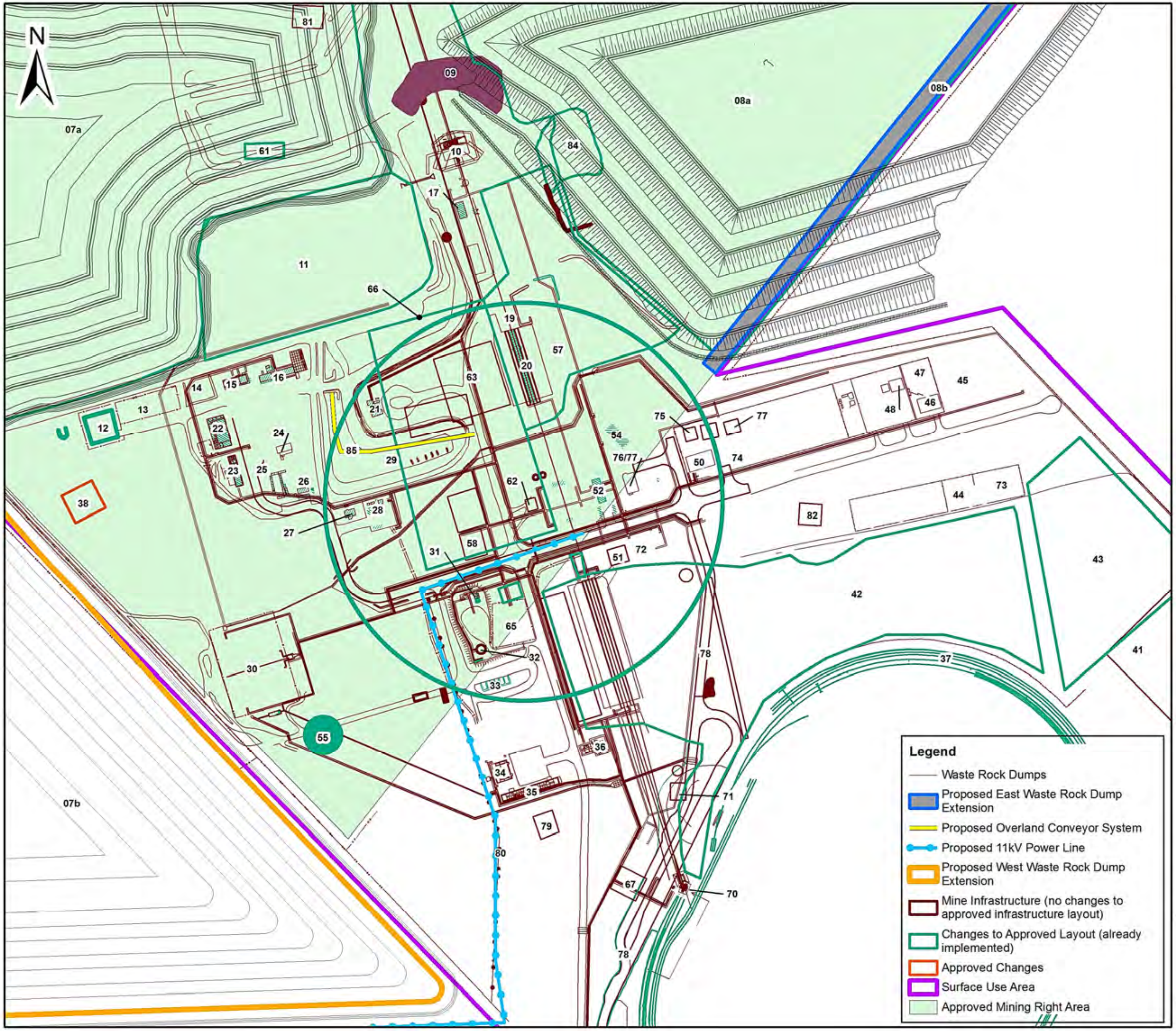
710.20008.00041 | 07/08/2018



KEY:
07a Western Waste Rock Dump (41 million m³ and Final Footprint
07b Proposed Western Waste Rock Dump (47 million m³ and Final Footprint of 94 ha)
08a Eastern Waste Rock Dump (11.56 milllion m³ and Final Footprint of 58 ha - these values include East WRD Extension)
8b Proposed Eastern Waste Rock Dump
09 ROM Pad (73 000 m³,16 ha)
10 Primary Crusher (±0.7ha)
11ROM Stockpile No1 (627 000 m³, 7.6 ha)
12 Workshop Dirty Water Collection Dam (4Ml, 0.2 ha)
13 Spares Yard (0.4ha)
14 Mining Equipment Tyre Bay (0.001ha)
15 Boiler Shop (0.06ha)
16 Mining Equipment Service Bay (0.07ha)
17 Sub-station No. 4 (0.08ha))
19 Crushed ROM Conveyor (2.1ha)
20 Crushed ROM Stockpile (1.7ha)
21 Mining Shift Change Building (0.05ha)
22 Mining Equipment Workshop (0.14ha)
23 LDV Workshop (0.06ha)
24 Wash Bay (0.04ha)
25 Mining Office No.1 (0.1ha)
26 Mining Training Rooms (0.04ha)
27 Sub-station No.3 (0.04ha)
28 Mining Office No.2 (0.3ha)
29 Mining Mobile Equipment Hardpark (1ha)
30 Dirty Water Dams (24Ml, 1.2 ha)
31 Fire Water Tank (Approximately 0.01 ha and 653 m³), Elevated Potable Water Storage Tank (Approximately 0.02 ha and 75 m³), Sedibeng meter and RO plant
32 Potable Water Reservoir (2 000m³, 0.01ha)
33 Ancillary Mobile Equipment Hardpark (0.06ha)
34 Change House and Laundry (0.06ha)
35 Main Admin Offices and Clinic (0.12ha) and Ambulance Bay
36 Laboratory (0.08ha)
37 Railway Line (3ha)
38 Stormwater Dam (78ML,3ha)
40 Road Truck and Vehicle Parking Bay(3.4ha)
41 Sinter Plant, Including Feed and Product Stockpiles (future) (10ha)
42 Product Stockpile Area No. 2 (940 500 m³, 17 ha)
43 Topsoil Stockpile Area No.2 (290 000m³, 5.8ha)
44 Engineering and Projects Offices (1.7ha)
45 Salvage Yard and Waste Storing/Sorting/Reclaim Area (0.4ha)
46 Ancillary Equipment Workshop (0.05ha)
47 Ancillary Equipment Diesel Storage and Refueling Area (0.003ha)
48 Plant Production Offices (0.05ha)
50 Mine General Store (0.1ha)
51 Generator Powerhouse Diesel Tanks and Engineering Offices (0.2ha)
52 Plant MCC, Control Room and Offices (0.05ha)
54 General Parking Area (0.1ha)
55 Sewage Treatment Plant (Treatment capacity of 96 m³, ± 0.25 ha)
57 Temporary Mobile Crushing Plant (8.9ha)
58 Thickener (future)
61 ROM Weighbridge (210ton) and Control Room
62 Crushed Ore Weighbridge (80ton) and Control Room
63 Secondary Crushing and Screening Plant
65 Temporary Construction Dam (9 000 m³, 0.24ha)
66 Product Stockpile Area No.1 (434 500 m³ 7.9ha)
67 Satellite Workshop
70 Train Load-Out Station
71 Sub-Station No.5 (0.08ha)
72 Sub-station No.1 (0.04ha)
73 Tyre Bay (0.001ha)
74 Core Stores (0.0612ha)
75 Hazardous Store (0.02ha)
76 Engineering Workshop (0.054ha)
77 Rigging Store (0.05ha)
78 Truck Road
79 Heli-pad
80 Proposed 11kV Power Line
81 Mining Brake-test Ramp
82 Plant Brake-test Ramp
84 Temporary ROM Stockpile Area (20 000 m³, 1ha)
85 Proposed Conveyor

0 100 200 Meters
Scale: 1:6 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 3-2

Close Up B of New Surface Infrastructure Layout

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25/06/2018

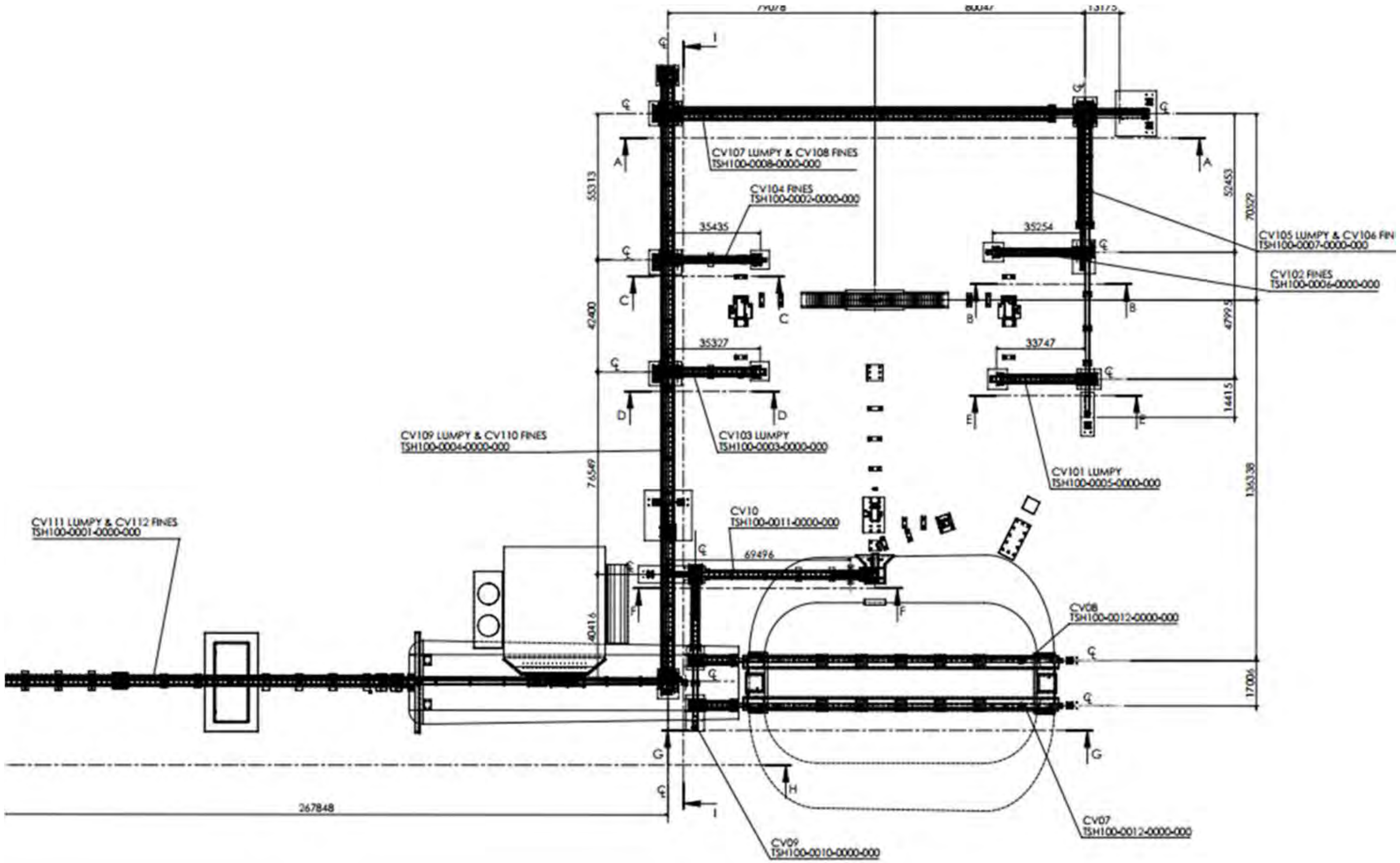


FIGURE 3-3: LAYOUT OF THE OVERLAND CONVEYOR SYSTEM

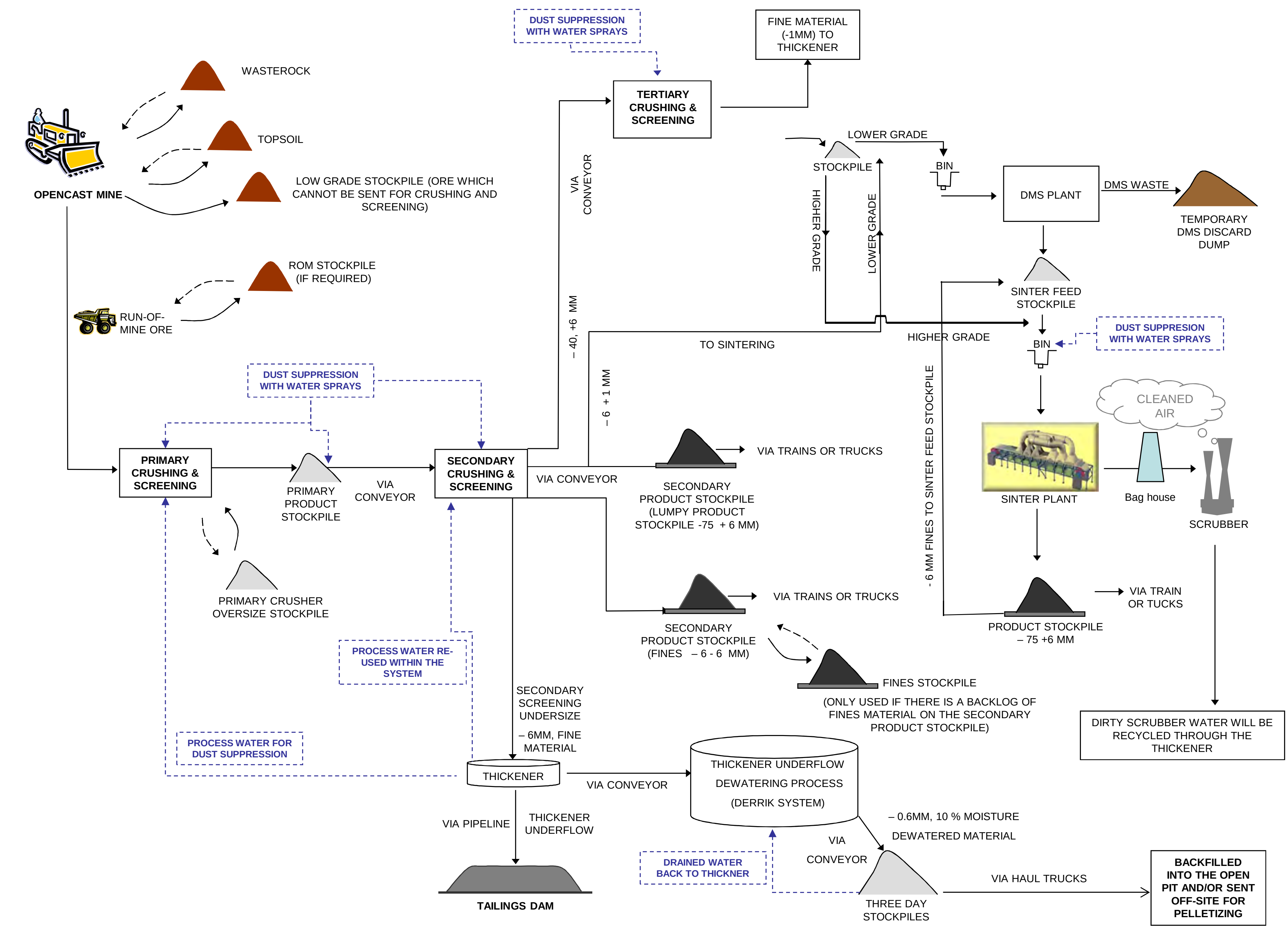


FIGURE 3-3: CONCEPTUAL PROCESS FLOW DIAGRAM

TABLE 3-9: SAFETY CLASSIFICATION CRITERIA FOR WASTE ROCK DUMPS

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in Zone of Influence	0 (Low hazard)	There are no farmhouses or other structures within the zone of influence.	Low Hazard
		1 -10 (Medium hazard		
		>10 (High hazard)		
2	No. of Workers in Zone of Influence	<10 (Low hazard)	The waste rock dumps are located near the open pit and as such mine workers may be located in the zone of influence, however majority of the main activities will take place in the pit area.	Medium Hazard
		11 – 100 (Medium hazard)		
		>100 (High hazard)		
3	Value of third party property in zone of influence	0 – R2 Million (Low hazard)	No formal assessment of the value of property has been done in the zone of influence. The characteristics of the waste rock dumps are such that catastrophic failures will be localised and no extended flow will be experienced.	Low Hazard
		R2 – R20 million (Medium hazard)		
		>R20 million (High hazard)		
4	Depth to underground mine workings	>200 m (Low hazard)	There are no known underground mine workings beneath the tailings dam site. Any future workings would be more than 270m below surface.	Low Hazard
		50 m – 200 m (Medium hazard)		
		<50 m (High hazard)		

Environmental classification for the waste rock dumps

In accordance with Regulation 5 of GNR 632 of the NEM:WA, waste rock stockpiles need to be classified taking into account Regulation 8 of GNR 634 of 2013, which references the following associated National Norms and Standards:

- the National Norms and Standards for the assessment of waste for landfill disposal (GNR 635 of 2013); and
- the National Norms and Standards for disposal of waste to landfill (GNR 636 of 2013).

A waste assessment of the waste rock generated at the Tshipi Borwa Mine was undertaken by Golder Associates (Golder, 2016). The results of the waste assessment indicate that waste rock generated as part of the Tshipi Borwa Mine operations is classified as a Type 1 waste, which requires a Class A liner, which consists of a compacted clay liner, leachate detection, geotextile membranes and geotextile filters. It should be noted that WRDs were established prior to the promulgation of this legislation.

In June 2016, the DWS accepted a proposal by the Chamber of Mines of South Africa to follow a risk based approach on a case-by-case basis to allow for representations on alternative barrier systems for Mine Residue Deposits and Stockpiles (29 June 2016). The risk based assessment enables an evaluation of the efficacy of an alternative barrier system to prevent pollution as required in terms of Section 19(1) and (2) of the NEM:WA (Singh, 2016).

Since the purpose of the Norms and Standards is to protect water resources it may be appropriate to consider the potential water quality risk associated with the WRDs at the Tshipi Borwa Mine, rather than a formulaic application of the Norms and Standards for the following reasons:

- a Class A liner is impractical for a waste rock dump on the basis of geotechnical properties given that the liner is likely to fail;
- the leachable concentrations of all the constituents are below the LCT0 limit, indicating a low seepage risk;
- the waste rock material will be dry and does not contain waste water; and
- the waste rock material is non-hazardous and not acid generating (Section 6.4.1.1).

Taking the above into consideration Golder recommended, via a formal motivation letter to the DWS, that a Class D liner (stripping topsoil and base preparation) is considered appropriate for the proposed WRDs at the Tshipi Borwa Mine. A response from the DWS is still pending.

Tailings

The original EMPr (Metago, 2009) made provision for a standalone tailings dam (see Figure 3-1). The conceptual design features associated with the tailings dam, in compliance with Section 73 of Regulation 527 of the MPRDA, are outlined in Table 3-10 below.

TABLE 3-10: DESIGN FEATURES OF THE APPROVED TAILINGS DAM (METAGO, 2009)

<table>
<tr><th>Feature</th><th colspan="2">Detail</th></tr>
<tr><td rowspan="5">Physical dimensions</td><td>Item</td><td>Value</td></tr>
<tr><td>Footprint (m^2)</td><td>300 000</td></tr>
<tr><td>Maximum height (m)</td><td>24</td></tr>
<tr><td>Volume (m^3)</td><td>2 000 000</td></tr>
<tr><td>Rate of deposition (tpa)</td><td>177 845</td></tr>
<tr><td rowspan="8">Physical properties</td><td>Characteristic</td><td>Value</td></tr>
<tr><td>Particle size (mm)</td><td><1.5</td></tr>
<tr><td>Solids mass (%)</td><td>75</td></tr>
<tr><td>Liquid mass (%)</td><td>25</td></tr>
<tr><td>Particle specific gravity (t/m^3)</td><td>3.32</td></tr>
<tr><td>Wet density (t/m^3)</td><td>2.1</td></tr>
<tr><td>Dry density (t/m^3)</td><td>1.6 (1.8 after consolidation)</td></tr>
<tr><td>Average void ratio</td><td>0.85</td></tr>
<tr><td>Lining</td><td colspan="2">The tailings dam will be lined with an HDPE (High Density Polyethylene) liner.</td></tr>
<tr><td>Delivery and deposition</td><td colspan="2">The proposed method of depositing the tailings will be the advancing cone method via a 100 mm carbon steel pipeline. During commissioning and deposition behind the starter wall, the tailings will be directed to the base of the starter wall by means of flexible hosing. Once the cone-shaped tailings deposit has reached the elevation of the starter wall, the pipe will be moved horizontally along the length of the wall.

Upon reaching the height of the starter wall along the full length of the wall the outlet pipe will be moved forward, i.e. away from the starter wall, to achieve a 0.25 m layer thickness. The pipe is then moved horizontally along the length of the wall to achieve the 0.25 m layer thickness along its full</td></tr>
</table>

Feature	Detail
	length. The pipe is moved along following this pattern until the toe of the beached tailings reaches the designated toe line. Once this toe line is reached the perimeter walls are to be raised with waste rock from the mining operations. The raised walls will be 6 m each and 3 lifts in total. No decanting will be required as the area is free draining towards the storm water dam. The storm water dam will need to be managed such that the dam has a capacity to absorb the storm water event arising from the 1:50 year storm event, over and above the normal operating conditions.
Rate of rise	The allowable rate of rise is the time it takes a layer to reach a moisture content at which shrinkage ceases. This will be provided in the operating manual.
Storm water diversion	A one metre deep storm water trench adjacent to the north-western and south-western slopes, i.e. immediately downstream of the dam lined spill way, will collect water and direct it to the return water dam.
Topsoil stripping	Topsoil will be stripped to a depth of between 0.3 m to 0.5 m and stockpiled in accordance with the soil conservation procedure. Stripping and stockpiling of topsoil will be done as part of the initial tailings dam construction.
Embankments /slopes and walls	The overall side slopes of the tailings dam will be limited to a maximum of 1:4 for rehabilitation purposes. There will be no step ins and there will be 6 m height increases between lifts at the prescribed 1:4 outer slope. The tailings dam will have placed waste rock starter walls with a crest width of 8 m and height of 6 m constructed from waste rock stripped at the pit.
Under drains	The tailings and underlying soils are free draining, but will have a relatively low water content and will produce a small amount of supernatant water. This negates the need for drains.
Decant system	No decant system is required because, as mentioned above, the area is free draining towards the return water dam. The return water dam will need to be managed such that the dam has a capacity not to spill more than once in 50 years, over and above the normal operating conditions.
Access and access control	A calcrete/waste rock gravel access road will be constructed around the perimeter of the tailings dam to enable access for inspection. A perimeter fence will be constructed around the property boundary to keep livestock and people out.
Waste minimisation	No re-processing of the tailings is envisaged at this stage. Tshipi will investigate options once operations commence.
Rehabilitation	Rehabilitation will be conducted concurrently as the outer wall rises. The exposed face of the tailings dam, upon reaching the designated toe line, is to be covered with waste rock to reduce dust and assist with access. Waste rock and/or vegetation will be used for concurrent rehabilitation of the out walls.
Monitoring	The monitoring of the tailings dam will include monitoring closure activities to ensure that slope vegetation is successfully established, earthworks have not been impaired in any way and repairing areas where degradation has occurred since closure. For this project, the reasonable time frame for after care has been deemed 5 years.
Dust control	The tailings dam access roads and ramps will be watered as necessary to ensure that dust pollution is kept to a minimum. In addition, concurrent rehabilitation through waste rock and/or vegetation of the tailings dam outside slopes will further reduce dust emission rates.
Closure	At the end of the dam's life the tailings surfaces will be covered with waste rock and/or vegetation. It is

Feature	Detail
	envisaged that the remaining surfaces will be accessible within the first month following closure for the removal of pipelines, valves, etc.; minor earthworks to roads, trenches, etc.; and reshaping of the storm water dam and spillway

Safety classification of the approved tailings dam

The safety classification of the approved tailings dam was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements. The summarised classifications are included in Table 3-11.

With reference to Table 3-11, the Tshipi Borwa Mine tailings dam classifies as a **low hazard dam** with a low overall risk. In accordance with Regulation 73 of the MPRDA Regulations, a risk analysis is required before project implementation as outlined in the approved EMPr (Metago, 2009). It is important to note that while the approved EMPr (Metago, 2009) refers to these regulations, they are no longer applicable. It thus follows that at the time of implementing the use of the tailings dam consideration will have to be given to relevant legislation and guidelines.

TABLE 3-11: SAFETY CLASSIFICATION CRITERIA FOR THE APPROVED TAILINGS DAM

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in Zone of Influence	0 (Low hazard)	There are no farmhouses or other structures within the zone of influence.	Low Hazard
		1 -10 (Medium hazard		
		>10 (High hazard)		
2	No. of Workers in Zone of Influence	<10 (Low hazard)	The tailings dam is situated inside the surface use area with only mine employees accessing the area.	Medium Hazard
		11 – 100 (Medium hazard)		
		>100 (High hazard)		
3	Value of 3rd party property in zone of influence	0 – R2 Million (Low hazard)	No formal assessment of the value of property has been done in the zone of influence. The characteristics of the tailings dam are such that catastrophic failures will be localised and no extended flow will be experienced.	Low Hazard
		R2 – R20 million (Medium hazard)		
		>R20 million (High hazard)		
4	Depth to underground mine workings	>200 m (Low hazard)	There are no known underground mine workings beneath the tailings dam site. Any future workings would be more than 270 m below surface.	Low Hazard
		50 m – 200 m (Medium hazard)		
		<50 m (High hazard)		

Environmental classification for the tailings dam

The tailings dam does not pose a potential threat to the contamination of groundwater resources from leachate given that the facility will be lined. Dust emissions, however, do pose a potential risk to the surrounding environment. In the mitigated scenario, the tailings dam impacts on air quality can all be mitigated to a lower significance. The tailings dam is therefore classified as a **low to medium hazard facility** because with management actions there is less potential for significant impact on the environment. More discussion on the impacts and management actions are included in Appendix D and Section 27 of the EIR.

DMS temporary discard

As per the original EMPr (Metago, 2009), a temporary coarse discard dump will be developed adjacent to the sinter plant to accept dry temporary discard from the dense media separation plant. Depending on market requirements this material will be re-processed through the tertiary crushing and screening section. If it is not re-processed, some of the material can be used for backfilling the open pit, with the remainder being disposed of on the WRDs.

Low grade and fines stockpiles

The original EMPr (Metago, 2009) and subsequent amendment (SLR, 2017d) provide for two low grade stockpiles (see Figure 3-2). These include:

- Product stockpile No. 1 covers an area of approximately 7.9 ha and can cater for a capacity of 434 500m^3.
- Product stockpile No. 2 covers an area of 17 ha and caters for a capacity of 940 500m^3.

These product stockpiles receive product from both the primary and secondary crushing and screening circuits prior to being sent-off site via road truck and train for sale to third parties.

ROM stockpile

The original EMPr (Metago, 2009) made provision for the generation of ROM. The ROM is loaded and hauled using truck and shovel methods and is transported to the primary crushing and screening plant from where it is sent for further crushing and screening at the secondary and tertiary plant. ROM is stockpiled at the designated ROM pad prior to being fed into the primary crushing and screening process. The ROM stockpile is only utilised when the designated ROM pad is unable to accommodate for the ROM tonnages at that time. In addition to this, a temporary ROM stockpile area near the ROM pad is utilised in the event that there is a shortfall in capacity at the ROM stockpile. The ROM pad has a total capacity of 73 000 m^3 and covers an area of approximately 16 ha. The ROM stockpile has a total capacity of 627 000 m^3 and covers an area of approximately 7.6 ha. The temporary ROM stockpile has a total capacity of 20 000 m^3 and covers an area of approximately 1 ha. The location of the ROM pad, ROM stockpile and the temporary ROM stockpile is illustrated in Figure 3-1 and Figure 3-2.

3.2.2.5 Transport System – Site Access and Roads

Access to the mine

The Tshipi Borwa Mine is located approximately two kilometres west along the D3457 district gravel road, which is accessed via an intersection off the provincial R380 road between Kathu and Hotazel. (see Figure 3-1 and Figure 3-2).

Internal roads

There is also a network of private internal access and service gravel roads within the Mining Right area as illustrated in Figure 3-1 and Figure 3-2

Internal haul roads are used for the mining operation to transport ROM, product, waste rock between the mine pit, the WRDs and the ROM stockpiles and tip. Access and service roads are used to transport personnel, portable equipment, spares and mining consumables to various working sections within the mine area. The haul roads are constructed from selected and suitably sized and compacted waste rock which varies in width up to a maximum width of 25 m.

Transportation requirements

During operation transportation includes: employees / contractors travel to and from site; vehicles transport ROM; vehicles removal waste material; and trucks transport manganese product. Table 3-12 below provides a conceptual indication of the traffic volumes associated with the operational phase of the Tshipi Borwa Mine. A traffic study (Siyazi, 2017), which was undertaken as part of the 2017 EMPr amendment process, identified the need for road infrastructure improvements from a road safety point of view. These improvements included providing a 60 m dedicated right-turn lane on the northern approach and reflective road studs. The previous EMPr amendment process recommended that these upgrades be discussed in collaboration with neighbouring mines and the relevant roads department. According to Tshipi, the relevant provincial roads department is planning to upgrade the R380. However Tshipi and neighbouring mines must still ensure that the recommendations of the traffic study are implemented i.e. dedicated turning lanes included in the design and scope of work.

TABLE 3-12: OPERATIONAL PHASE TRAFFIC

Items to be transported		Transport mechanism	Approximate trips per day	Most likely route
Group	Specific			
Staff and visitors	Skilled, semi-skilled and unskilled	Company vehicles / private vehicles / mini bus/ buses	220 / day	From Kathu, Hotazel and Kuruman via the R31 and/or R380
Raw materials and domestic waste	Plant raw materials	30-tonne trucks	5 / week	From Kuruman or Gauteng via the R31 and/or the R380.
	Explosives	30-tonne trucks	5/ week	
	Diesel	Tanker	2 / week	
	Spares truck	30-tonne trucks	2 / week	
	Other consumables	Trucks	1 / week	
	Domestic and industrial waste collection	Trucks	1 / week	
Within the mining operation	Ore	Dump/Haul trucks	Within the boundaries of the surface use area	From mining areas to processing and crushing areas.

Items to be transported		Transport mechanism	Approximate trips per day	Most likely route
Group	Specific			
Outside the mining operation	Manganese product	Either 30-tonne trucks or by train.	300 / day - trucks or between 1 and 3 trains a day	Export manganese product to port using R31 to Kuruman and R380 to Kathu.

Conveyors

Various surface (open) conveyors are (and will be) used to move material from;

- The tip/primary crushing and screening plant,
- To the crushed ore stockpiles
- To the secondary crushing and screening plant
- To the product stockpiles,
- To the train load-out silo, and in future
- To the tertiary crushing and screening plants, and the
- Sinter plant (once established).

These conveyors have widths of 1 200 mm, 1 500 mm or 1 800 mm and are located within the approved surface use area and are routed to support the operations at the Tshipi Borwa Mine.

As part of the proposed project, Tshipi is proposing to construct an overland conveyor system from the existing secondary crushing and screening plant to the existing manganese ore product stockpiles located adjacent to the train load-out silo. (refer to Section 3.2.3.3).

Railway siding

In the original EMPr (Metago, 2009), a short railway siding was planned between the regional Transnet railway line (adjacent to the R380) and the Tshipi silo/loading area. However, the design of the approved railway siding was changed during the 2017 EMPr amendment process to increase the length of the railway siding to approximately six kilometres (see Figure 3-1).

Pipelines

A pipeline (100 mm diameter) connection to the Sedibeng Vaal-Gamagara pipeline supplies the mine with potable and process water. Secondary pipelines (250 mm to 300 mm diameter) transfer water within the mining areas. These pipelines are located within the approved surface use area and are routed to support the operations at the Tshipi Borwa Mine. Secondary pipelines will be installed to transfer water between the return water dam and processing plant area when the tailings dam is operational.

3.2.2.6 Water Supply and Management

Potable water

As noted above, water for the mine is sourced from the Sedibeng Vaal Gamagara Water Supply pipeline. This water is piped to the on-site reverse osmosis treatment plant prior to use within the mine for potable use.

Tshipi requires a maximum of 27 387 m^3/month of water from the Sedibeng Vaal Gamagara Water Supply pipeline.

Process water

Process water is currently provided by a combination of water from the Sedibeng Vaal Gamagara Water Supply pipeline (when make-up water is required), dewatering from the open pit, the collection of storm water runoff and from planned water supply boreholes within the Mining Right area. Tshipi requires a total of 9 432 m^3/month. When the tailings dam and sinter plant are in operation, the process water requirements will increase to 15 004 m^3/month.

Water storage facilities

One steel water tank (1 500 m^3) is located in the plant area for the storage and dispensing of process water. This tank receives water from the storm water dam and sewage plant, the pit dewatering and from the Vaal Gamagara Water Supply pipeline. In addition to this, provision has been made for a steel water tank (1 000 m^3) for the mining and primary crushing section stores. Further to this, provision is also made for various other water tanks (1 000 m^3 each) to store and dispense potable water.

Potable water is currently stored in one of four water storage facilities (see Figure 3-1 and Figure 3-2) including:

- a potable water reservoir with a capacity of 1 000 m^3;
- a fire-fighting water tank with a capacity of 653 m^3;
- an elevated potable water storage tank with a capacity of 75 m^3; and
- a temporary construction dam with a capacity of 9 000 m^3.

3.2.2.7 Storm water Management

The mine has an existing storm water management system to divert clean water around dirty water generating areas (i.e. intercepting clean water runoff and diverting this water around the WRDs and the pit) in order to contain dirty water. This system has been updated to include the proposed infrastructure. In this regard, the separation of clean and dirty water systems at the mine is designed, implemented and managed in accordance with the provisions of Regulation 704 (4 June 1999) for water management on mines. In general, the footprint of all dirty areas is minimised by isolating these areas from clean water runoff and dirty water is contained in designated systems.

The conceptual storm water management plan for the Tshipi Borwa Mine is presented in Figure 3-5, whilst Figure 3-6 presents more detail on storm water management around the plant area. The key features of the storm water management plan include:

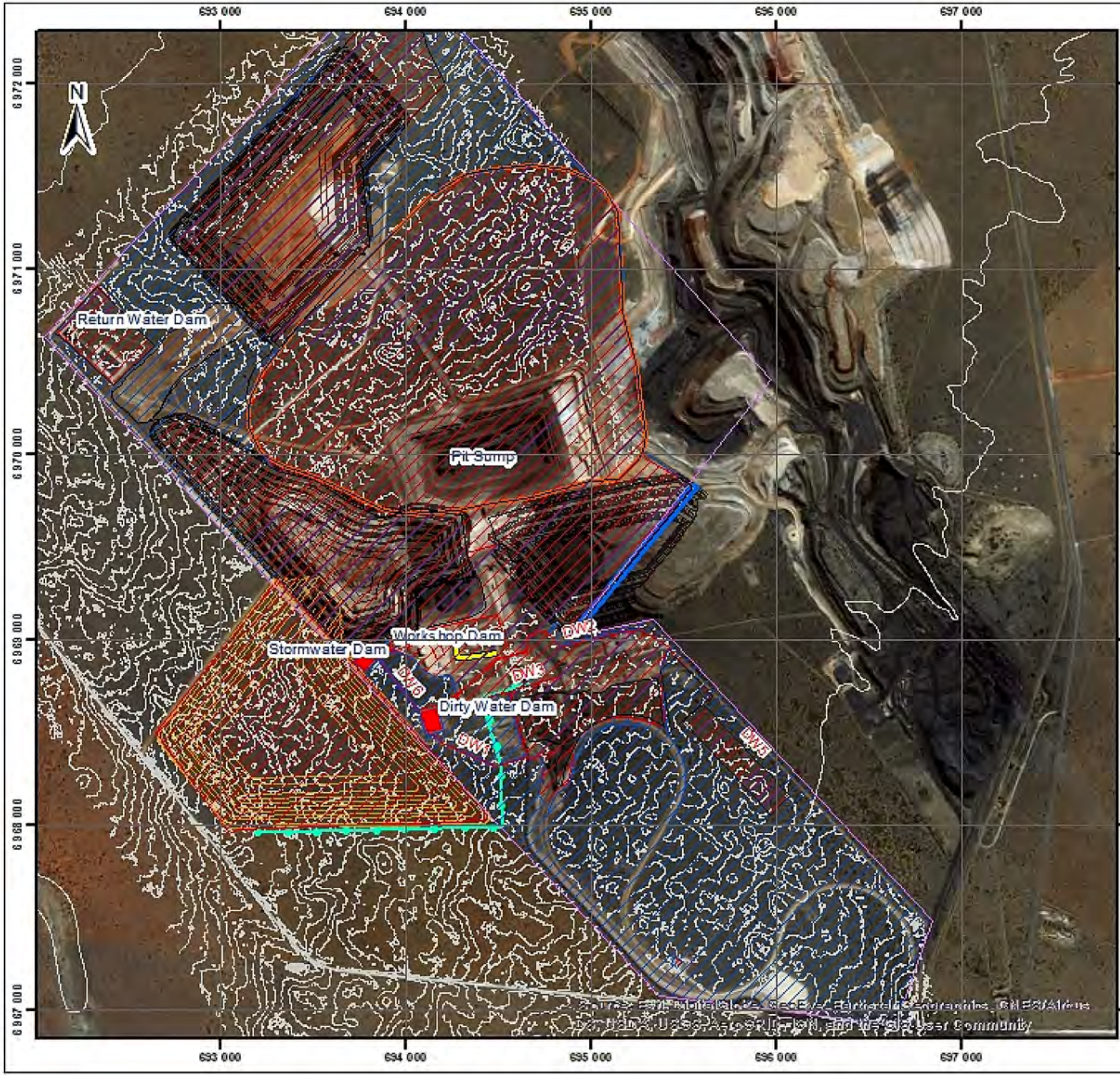
- Clean storm water will be prevented from entering dirty water catchments by creating perimeter berms around dirty water areas and dirty water collection infrastructure (channels and dams).
- Dirty storm water from the operational areas (crushers, ore stockpiles, load out stations, workshops, stores, contractor's area etc.) will be collected by lined drainage channels and conveyed into dirty water containment facilities, either the dirty water dam or workshop dirty water collection dam.
- During significant storm events, the dirty water dam and workshop dirty water collection dam will spill via new channels into a storm water dam/ pollution control dam)(PCD), and this storm water will be pumped back to the dirty water dam for re-use after the storm event.

- Dirty storm water and any groundwater collecting within the pit will be collected and pumped to the dirty water dam or will be used directly for dust allaying in contaminated areas
- Runoff from the waste rock dumps will be prevented from entering any surface water receptors by creating perimeter storm water retention berms(10m from the toe of the WRD) to collect runoff and allow it to evaporate and/or infiltrate to ground. Given the waste rock dumps do not pose a significant risk to water resources, and the low rainfall in this region, this is considered compliant with R704.
- Dirty storm water from the tailings storage facility will be collected within the return water dam and pumped back to the dirty water dam for re-use. Both the tailings storage facility and the return water dam are HDPE lined. Further detail pertaining to the approved return water dam in provided in Table 3-13 below.
- The topsoil stockpile will be revegetated and any runoff from this will be classified as clean.
- Dirty water within the dirty water containment facilities will be re-used at the site for dust suppression, wash down or other non-potable uses where water quality permits.

TABLE 3-13: CONCEPTUAL DESIGN PARAMETERS OF THE APPROVED RETURN WATER DAM (METAGO, 2009)

Feature	Detail	
Physical Dimensions and Capacity	Wall height above NGL	2 m
	Surface area at FSL	14 884 m^2
	Total footprint area	25 600 m^2
	FSL Capacity	35 000 m^3
	Freeboard	1 m
	Avg water depth at FSL	3 m
	Depth of excavation (max)	2.50 m
	Return water dam was designed to not spill more than once in every 50 years (R704 of NWA). Water located in the return water dam will be pumped back to the processing plant via return water pipelines for re-use in the system.	
Topsoil Stripping	Topsoil within the return water dam footprint was stripped and stockpiled in accordance with the soil conservation procedure (see Table 27-3). Stripping and stockpiling of topsoil was done as part of the initial tailings dam and return water dam construction.	
Lining	The return water dam was lined with an HDPE liner.	
Embankments	A compacted starter wall was constructed as part of the initial civil engineering works for the return water dam. It was constructed in 150 mm layers compacted to a 98% standard proctor density. The embankment walls of the return water dam have an inner and outer slope of 1V: 3H	
Leakage Detection	A leakage detection system was established	
Access and Access Control	An access road was constructed around the perimeter of the return water dam to allow access to the return water pump station. This road was constructed of suitable gravel material. A 2 m high, 6 stranded barbed wire perimeter fence was constructed around the return water dam to prevent livestock and unauthorised people from entering.	
Drowning Prevention	The dam will be largely empty during its operations and only be full during periods of high rainfall. The dam side slopes are flat (1:3) and constructed from a granular material that would facilitate escape should a person fall into the dam.	
Settling Facility	The dam will collect runoff from the tailings dam once operational. The material of the tailings dam will be high in density and fairly coarse. Given these characteristics, the runoff is not expected to carry a significant amount of tailings in suspension. A settling facility is, therefore, not recommended.	
Emergency Spillway	In the event of a storm greater than the design storm event, an emergency spillway has been designed to control the discharge of excess water.	
Monitoring and Maintenance	Monitoring of the return water dam, once operational, will include daily, monthly and quarterly inspections. These will consist of: Daily monitoring: 1) The water level in the dam will fluctuate over time. These levels need to be monitored to ensure that the return water dam will not exceed its limit; and 2) The operation of pumps and controls needs to be monitored to ensure that they are operating correctly and that there are no faults. This will ensure that the return water dam will be able to operate at its optimum potential and will allow any problems to be detected early. Monthly monitoring: 1) The sump needs to be monitored monthly to ensure that there is no damage to the HDPE liner, lining the sump. If leakage is detected then action needs to be taken in order to locate the problem and act appropriately; and	

Feature	Detail
	2) A physical inspection needs to be completed in order to find and locate any damage or potential problems to the liner. If any potential problem is identified, then immediate action can be taken to ensure that the problem will not progress. Quarterly monitoring: 1) The ground water needs to be monitored on a quarterly basis to ensure that there has been no contamination of ground water; and 2) Inspection of the side slopes.
Contingency Plans	In the event that the downstream borehole monitoring indicates that possible pollution has occurred, the source needs to be identified and investigated by a specialist to determine the following: 1) Possible leakage from the pipelines; 2) Possible leakage from the dam; and 3) Possible alternative sources of pollution. Once the source of pollution has been identified, appropriate action should be implemented to prevent further pollution and if necessary, clean up the existing plume. Initial geochemistry work indicates that the ore and tailings have an insignificant pollution potential. If any pollution is detected, tests should be conducted to confirm the initial test findings.
Closure	On completion of the mine, the sump and pump station within the return water dam will be removed, including all pipes and plastic liners and the dam will remain for continued storm water attenuation.



Legend

	Infrastructure
	Surface Use Area
	Dirty Stormwater Channels
	Stormwater Berms
	Dirty Catchments
	Dirty Water Dams
	Clean Catchments
	Proposed West Waste Rock Dump Extension
	Proposed Overland Conveyor System
	Proposed East Waste Rock Dump Extension
	Proposed 11kV Power Line
	Non-Perennial Watercourses
	0.5m Contours
	20m Contours

0 0.5 1 2

Kilometers

Projection: Transverse Mecator
Datum: WGS 1984_UTM Zone 34S

Tshipi Borwa Mine

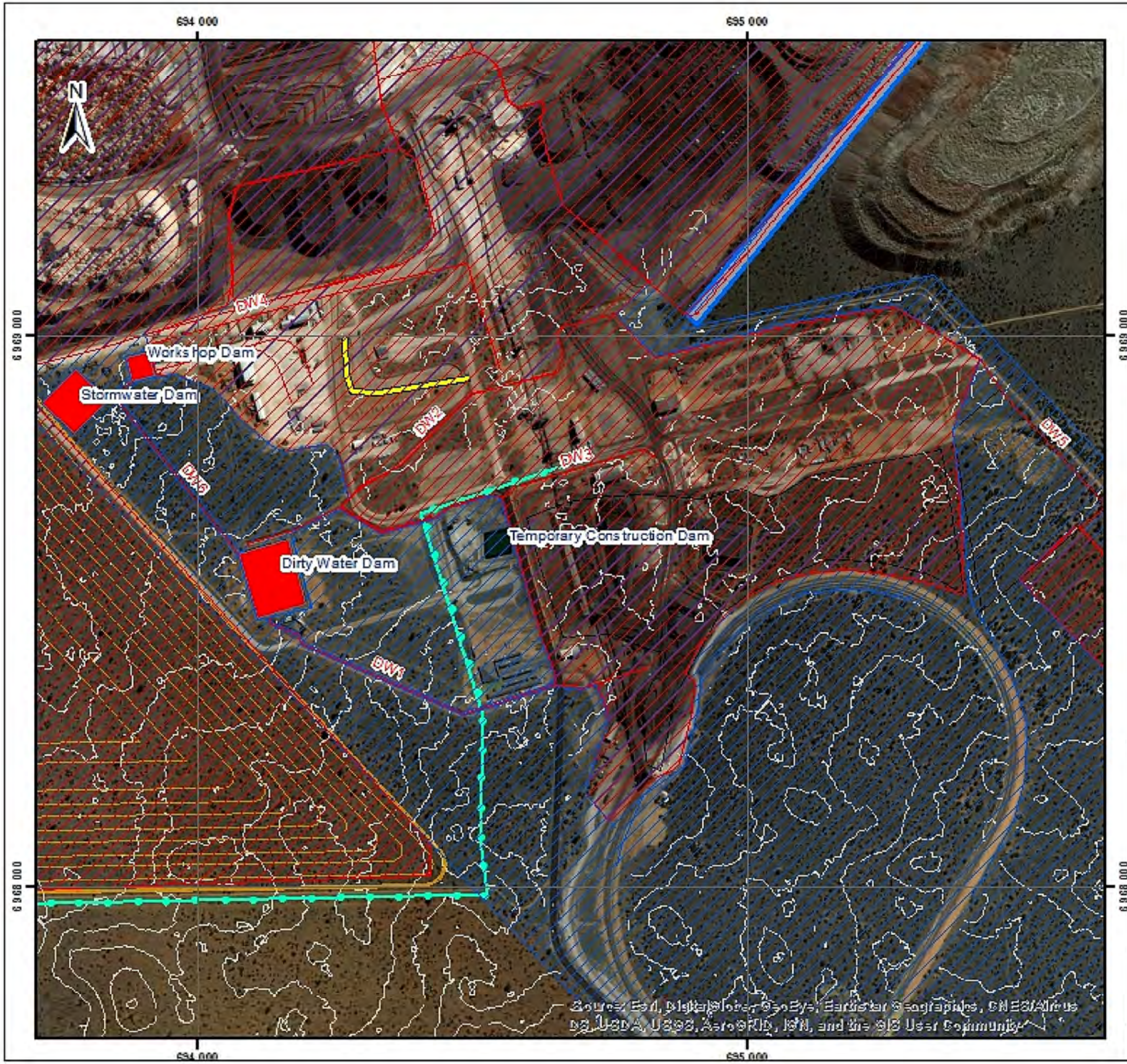
Figure 3-4

Site Wide Conceptual Stormwater Management Plan

SLR

SLR Consulting (Africa) (Pty) Ltd
PO Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.20008.00062 | June 2018



Tshipi Borwa Mine

Figure 3-5

Plant Conceptual Stormwater Management Plan

SLR Consulting (Africa) (Pty) Ltd
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710.20008.00062 | June 2018

3.2.2.8 Water Balance

A site wide water balance model has been prepared to understand flows within the Tshipi Borwa Mine's operational water circuit during average dry seasons and average wet seasons during different phases of the mine (SLR, 2018a). To demonstrate how variations in groundwater inflows and operational water requirements will impact upon the water balance, the following scenarios were modelled:

- Current average wet and dry seasons;
- Year 10 average wet and dry seasons; and
- Life of mine average wet and dry seasons.

The wet season and dry season for the three scenarios is illustrated in FIGURE 3-7 to FIGURE 3-12. The water balance shows that during the current scenario, groundwater inflows are negligible and the mine is reliant on makeup water from Sedibeng with monthly demand estimated to be between 11 111 m^3 and 27 387 m^3.

Groundwater inflow and storm water collecting within the open pit becomes a very significant source of water for the mine in future years and from year 10 of mining onwards the mine could be expected to be water positive during the wet season, although there is still expected to be a requirement for makeup water through the dry season. When the mine is water positive, the mine will store the water. If the mine is unable to store all the water, water will need to be discharged.

3.2.2.9 Electricity

The electrical power requirements for the mine will be approximately four mega volt ampere (MVA) at full production, which will increase to 9 MVA once the sinter plant is constructed and comes into operation. Operational power was planned to be sourced from Eskom via a dedicated powerline (Metago, 2009). However, it transpired that Eskom could not supply grid-power timeously and the planned backup diesel generators became the primary source of electrical power for the mine.

Tshipi is now planning to connect into an approved Eskom (still to be constructed) 132kV overhead line via a 132/11kV substation which will be located on the southern boundary of Portion 8 of Farm Mamatwan 331 (refer to Section 3.2.3.2 for details on the proposed 11 kV overhead powerline). The substation will be equipped with transformers and switchgear to enable the voltage from the regional 132 kV powerline to be stepped down to 11kV and then transmitted to the Tshipi distribution centre.

Internal power reticulation (from the diesel generators and the substation/distribution centre) is by means of an 11 kV distribution network comprising underground cabling and mini substations. The diesel generators, substation and mini substations are equipped with impermeable floors with bunds and collection traps for any spilled diesel, oil and lubricants. This power supply infrastructure is located within the approved surface use area to support the operations at the Tshipi Borwa Mine. The position of the generators and substations is illustrated in Figure 3-1 and Figure 3-2.

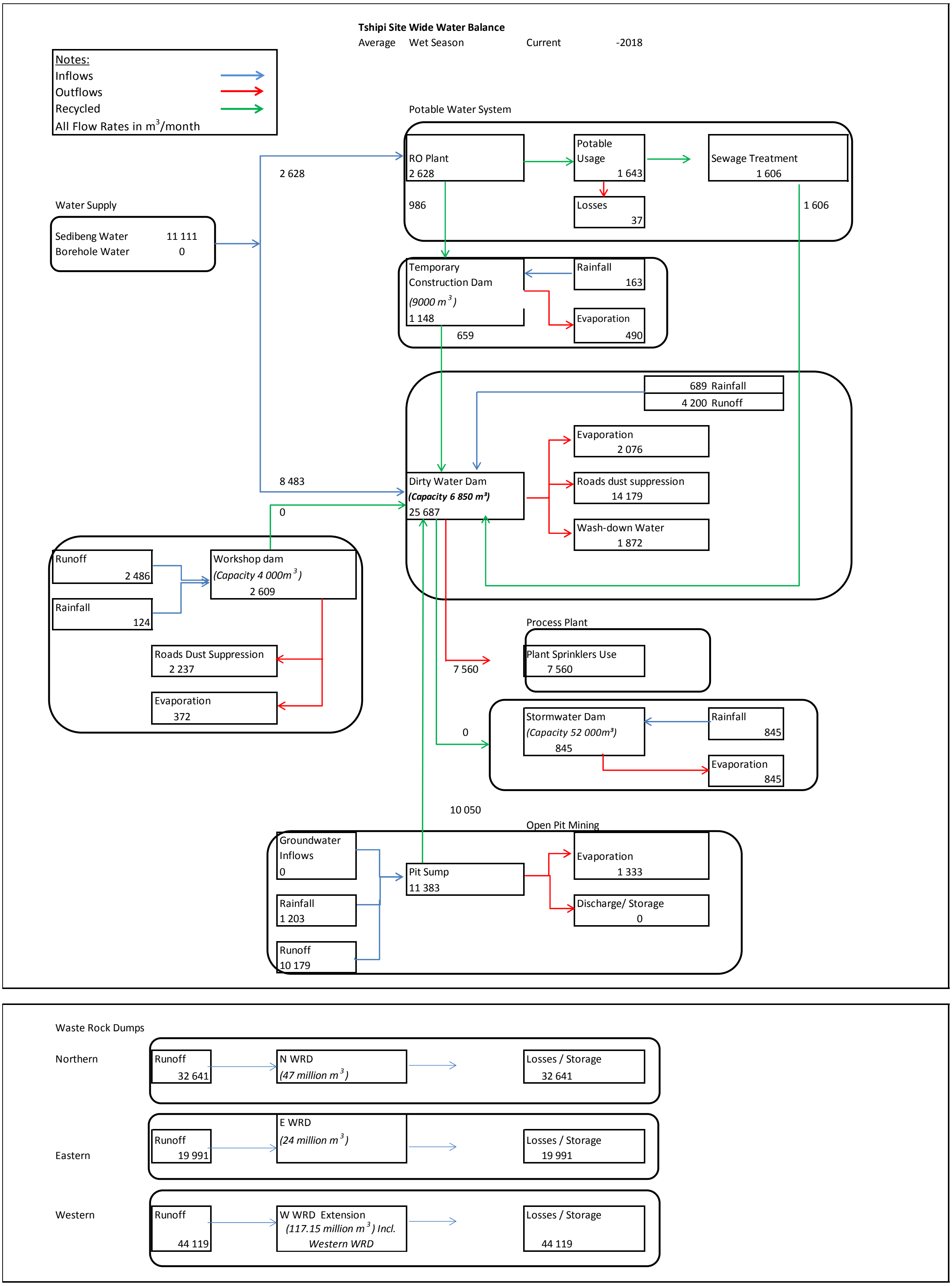


FIGURE 3-7: WATER BALANCE - CURRENT WET SEASON

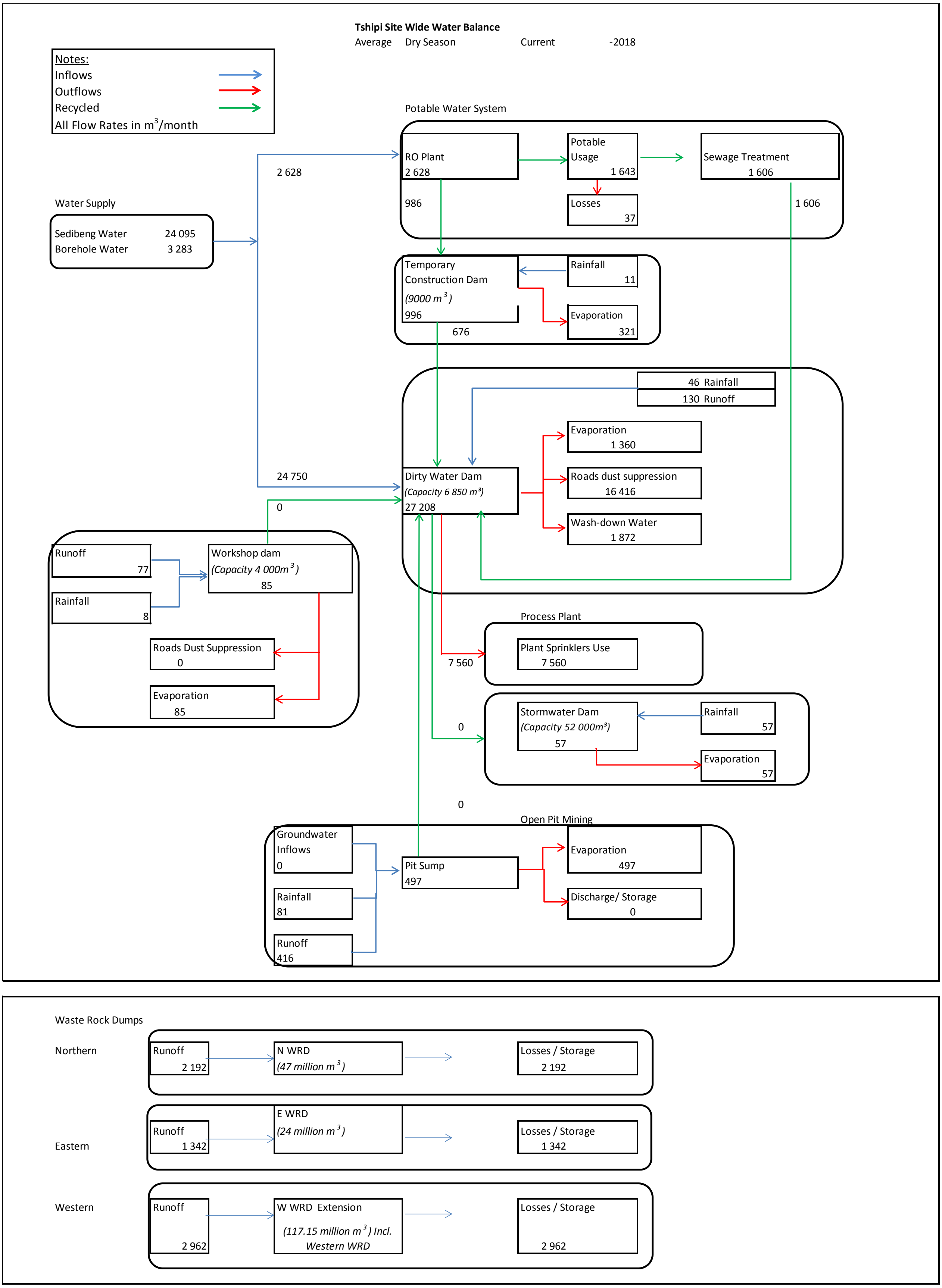


FIGURE 3-8: WATER BALANCE - CURRENT DRY SEASON

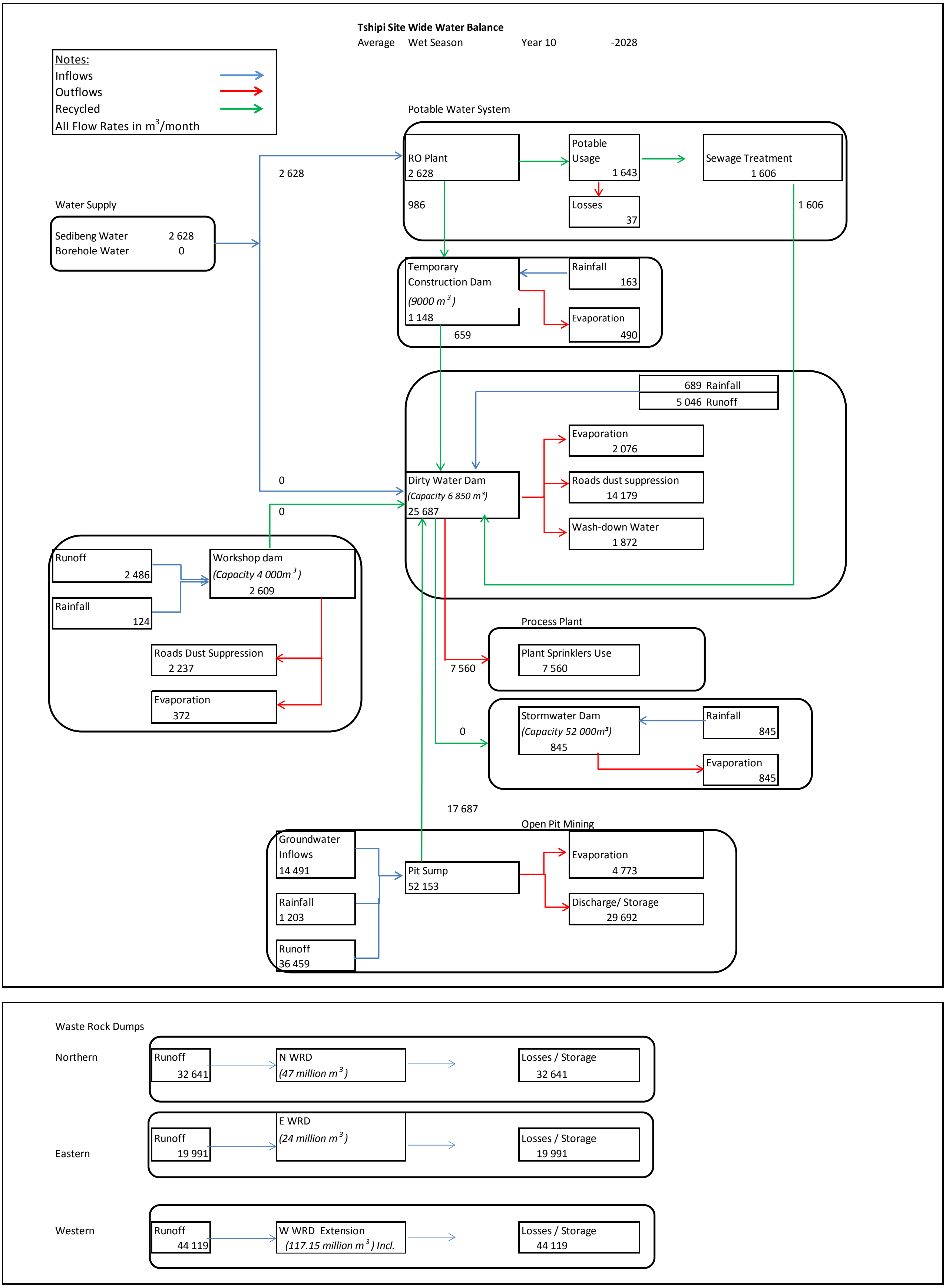
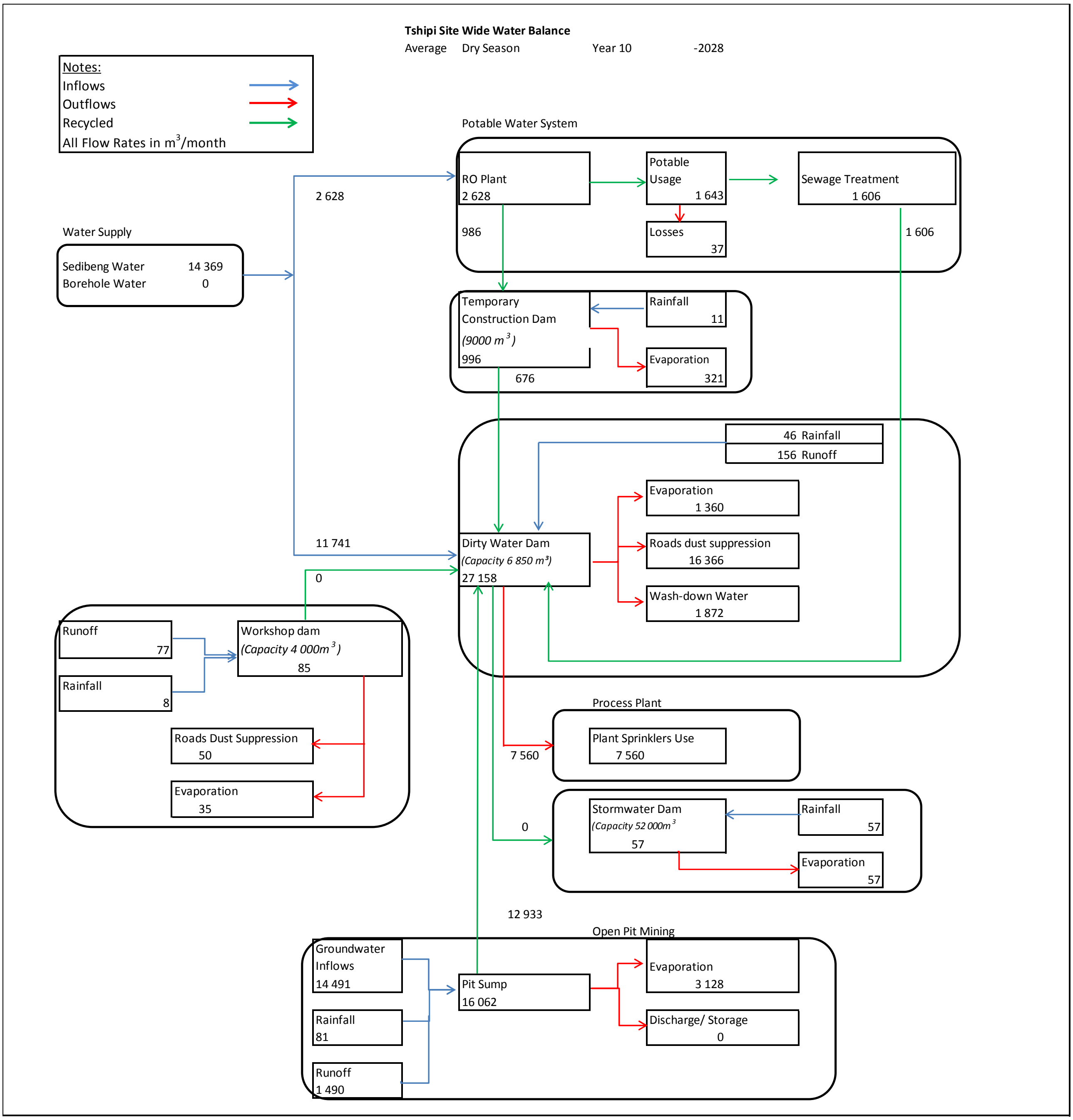


FIGURE 3-9: WATER BALANCE - YEAR 10 WET SEASON



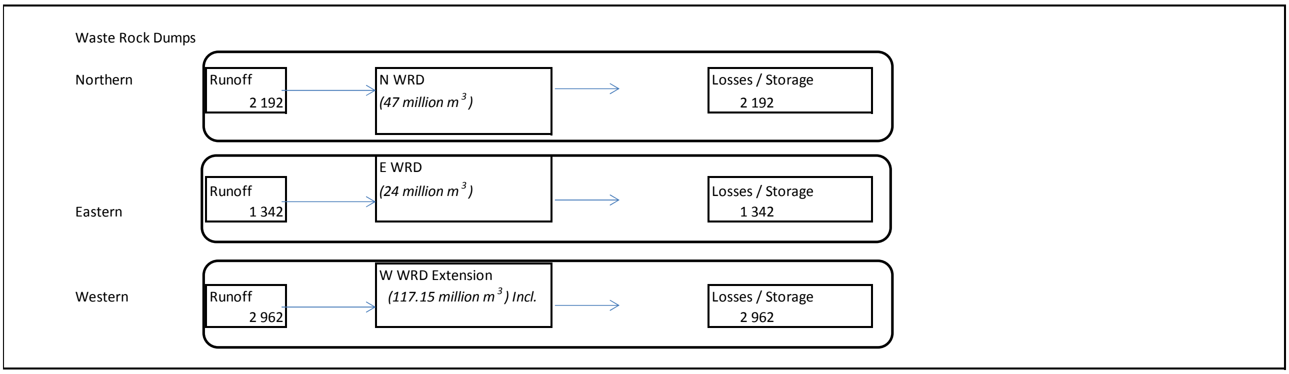


FIGURE 3-10: WATER BALANCE - YEAR 10 DRY SEASON

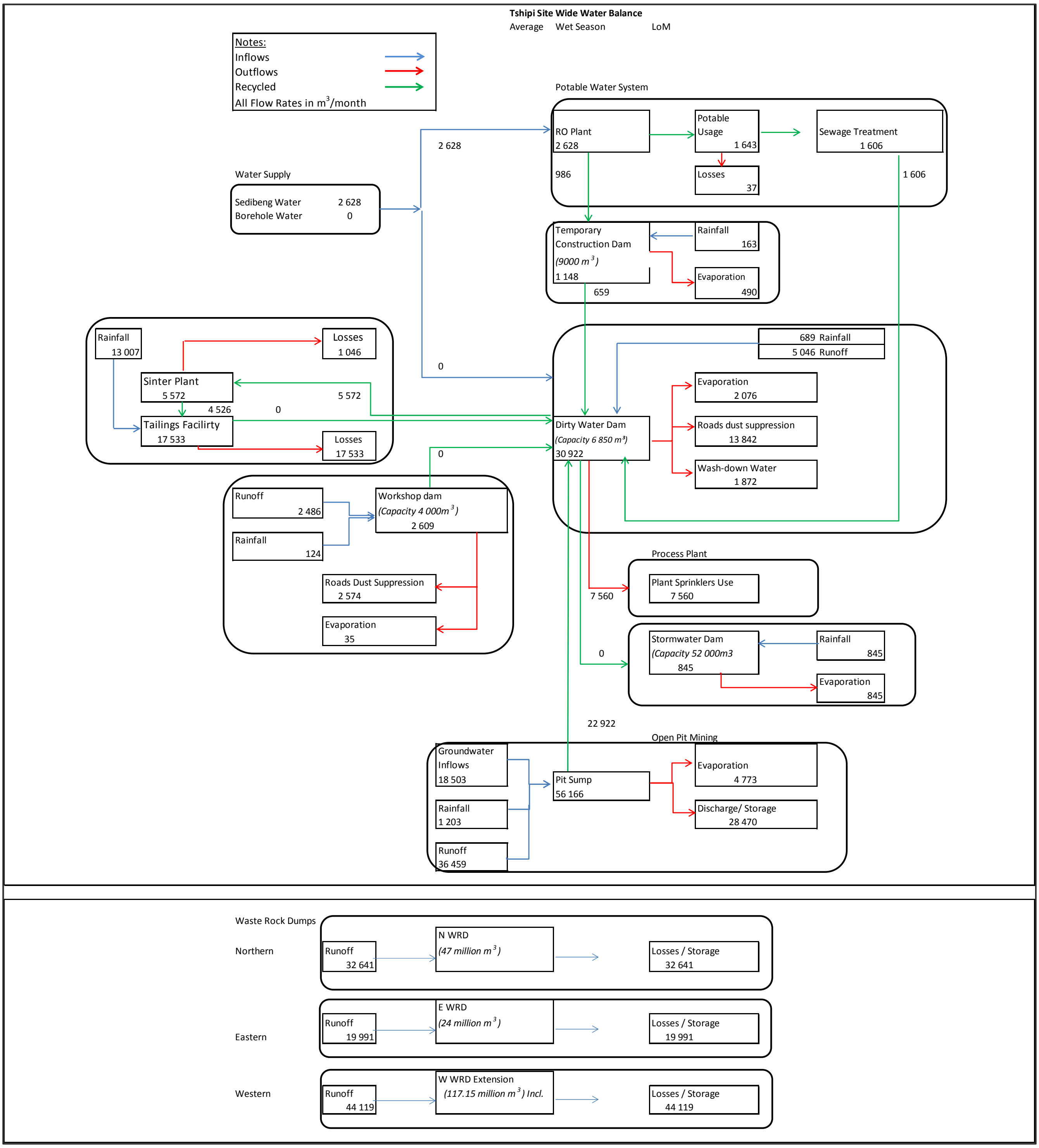


FIGURE 3-11: WATER BALANCE - LIFE OF MINE WET SEASON

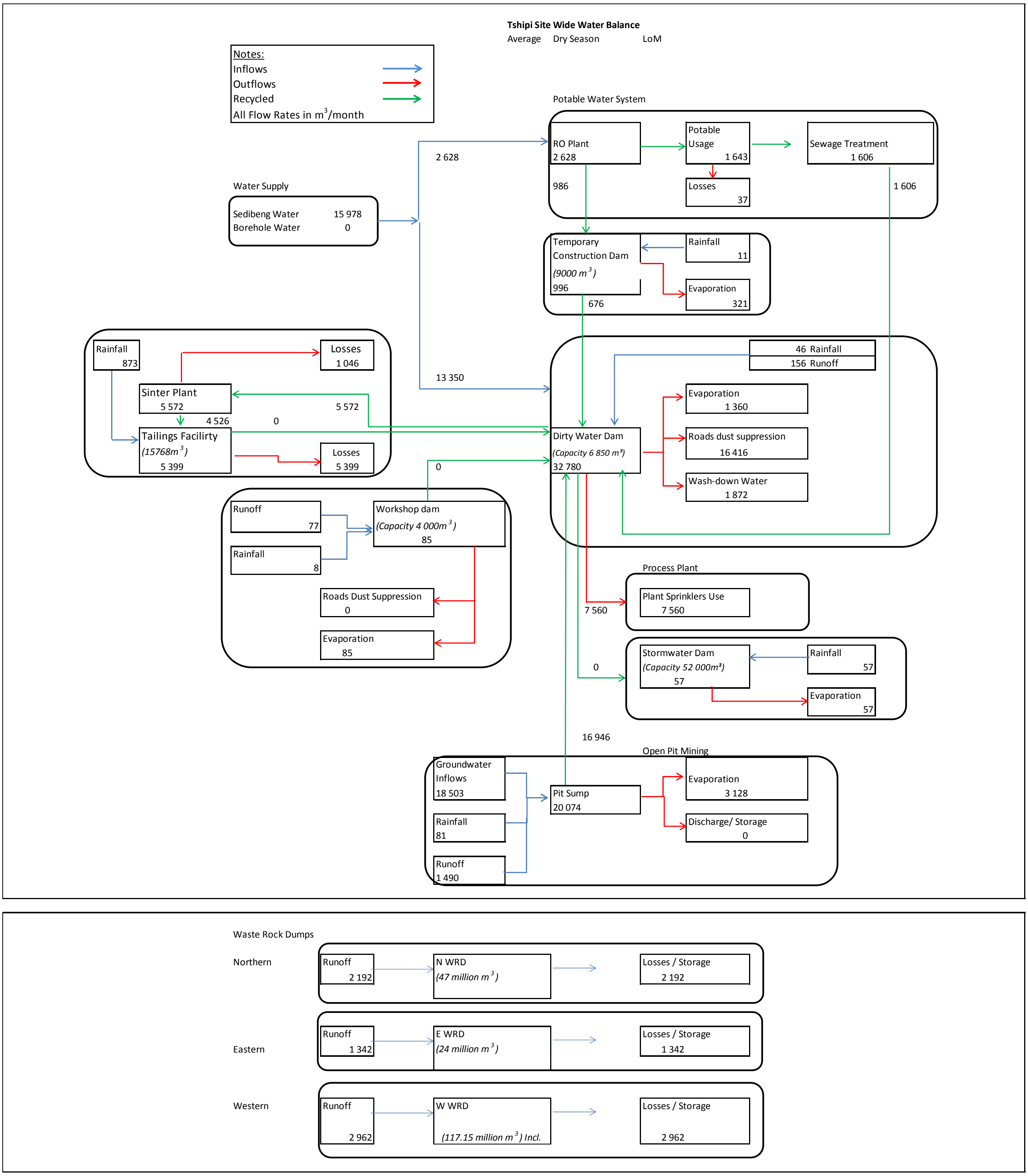


FIGURE 3-12: WATER BALANCE – LIFE OF MINE DRY SEASON

3.2.2.10 Non-Mineralised Waste Management

Domestic and industrial waste

General and hazardous wastes[3] as defined under the NEM:WA that are generated at the mine including the method of storage and disposal is included in Table 3-14 below.

The proposed WRD extension project will not alter the types of waste generated at the mine.

TABLE 3-14: GENERAL AND HAZARDOUS WASTE ASSOCIATED WITH THE MINE

Type of waste	Description of waste	Method of storage	Disposal
General waste	Office waste, building rubble, scrap metal and rubber, glass, plastic, wood, garden waste, air filters, food waste and uncontaminated PPE.	General waste generated at the mine is collected and temporarily stored in skips on site at the salvage yard, scrap yard or the designated temporary waste storage area.	All general waste on site is regularly removed by contractors for disposal at the licenced landfill site in Kuruman.
Hazardous waste	Electrical/material off-cuts and scrap metal, paints, solvents, contaminated metals, oil filters, plastic rubber, wood and contaminated particles.	Hazardous waste generated by the mine is collected and stored in skips on site at the salvage yard and scrap yard.	All hazardous waste on site is temporarily handled and stored before being removed by contractors for disposal at the licenced Holfontein landfill site.
	Plastic and used conveyor belts.	Hazardous waste generated by the mine is collected and stored in skips on site at the salvage yard and scrap yard.	Plastic and used conveyor belts are recycled on-site or removed by a contractor for recycling.
	Hydrocarbons (used oil, grease).	Used oil and grease will be stored in drums in bunded areas at the designated temporary waste storage area. The bunded area will be able to accommodate 110% of the container contents and include a sump and oil trap.	Used oils and grease are recycled on-site or removed by a contractor for recycling.
	Used chemicals (Anthracite/coke, FeSi and	Used chemicals are stored in sealed containers at the designated	All hazardous waste on site is regularly removed by contractors

[3] Waste is defined in Schedule 3 of the NEM:WA as follow:

- *"general waste" means waste that does not pose an immediate hazard or threat to health or to the environment , and includes (a) domestic waste; (b) building and demolition waste; (c) business waste; (d) inert waste; or (e) any waste classified as non- hazardous waste in terms of the regulations made under section 69, and includes non-hazardous substances, materials or objects within business, domestic, inert, building and demolition wastes;*
- *"hazardous waste" means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste , have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste , residue deposits and residue stockpiles.*

Type of waste	Description of waste	Method of storage	Disposal
	Benonite) and laboratory waste (hydrochloric acid).	temporary waste storage area. The bunded area will be able to accommodate 110% of the container contents.	(Enviroserve) for disposal at the licenced Holfontein landfill site.
	Used explosive packaging.	Collected and temporarily stored in designated skips at the salvage yard, scrap yard or the designated temporary waste storage area.	
	Contaminated soil (accidental spills).	Contaminated soil is collected and temporarily stored in designated drums at the salvage yard, scrap yard or the designated temporary waste storage area.	Contaminated soil on site is temporarily handled and stored before being removed by contractors for treatment off-site. Alternatively, contaminated soil can be treated on at the on-site bioremediation facility.
Medical waste	Swabs, bandages.	Designated sealed containers in bunded storage area.	Medical waste is temporarily handled and stored before being removed by contractors for disposal at an appropriately licenced waste disposal facility.

<u>**Sewage**</u>

The original EMPr (Metago, 2009) made provision for an anaerobic digester sewage treatment plant for the treatment of 60 m^3 of sewage per day. However, as part of the 2017 EMPr amendment (SLR, 2017d), the design of the sewage treatment plant was changed to a sludge activated system with a sewage treatment capacity of 96 m^3 per day. The sludge activated sewage treatment process and stages are described in further detail below and in Figure 3-13.

Sewage collection

Raw sewage is collected in numerous conservancy tanks located at the mine. Sewage effluent is sourced from the plant and office ablutions facilities and change houses. The sewage effluent is pumped from these designated conservancy tanks for storage in two inlet buffer tanks prior to being sent to the sewage plant for treatment.

Anaerobic treatment

Raw sewage stored in the inlet buffer tanks is pumped to the anoxic tank for anaerobic treatment. Anaerobic treatment allows for bacterial processes to be carried out in the absence of oxygen to allow for the digestion of sludge.

Aeration treatment

Sewage effluent from the anoxic tank is transferred to the aeration tank, where air (oxygen) is introduced into the system by means of a Diffused Air Header, driven by Side Channel Blowers. Aeration treatment allows for bacterial processes to occur which enables bacteria to rapidly consumes organic matter.

Any debris (floating fraction of sewage solids) collected on the surface of the sewage effluent during aeration treatment is removed and stored in a conservancy tank prior to being removed off-site by a certified contractor.

Settling

Effluent from the aeration tank is transferred to the settling tank. Solids (sludge) settle out in the bottom of the tank and clear supernatant flows upwards and over to the collection weir to the Chlorine Contact Tank. Sludge that has settled at the bottom of the settling tank is sent back to the anoxic tank for further treatment. Any excess sewage sludge remaining in the settling tank is removed by a certified contractor, when required.

Chlorination

The sewage effluent in the chlorine contact tank is subjected to inline chlorination by means of Sodium Hypo-chloride, calcium hypo-chloride or chlorine gas. Chlorination ensures that any remaining bacteria are killed.

Filtration

The final effluent is processed through a series of sand filters to remove any remaining suspended solids.

Treated sewage effluent

Treated sewage effluent is collected in a lined storm water dam (referred to as the dirty water dams on Figure 3-2) and re-used within the mine process. The treated sewage effluent is not to be used for domestic purposes. Any sewage sludge is removed off-site by a certified contractor and disposed of at a licenced sewage works.

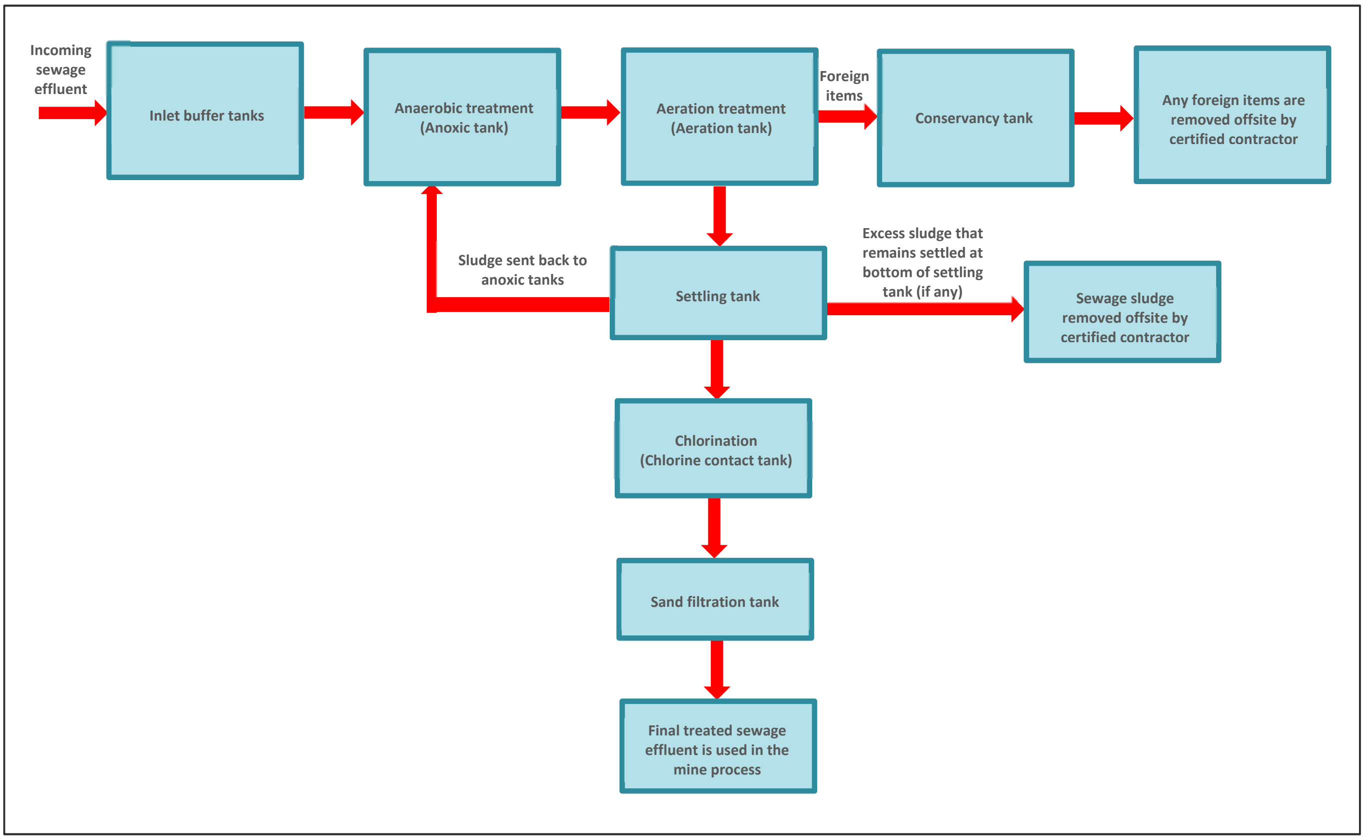


FIGURE 3-13: SEWAGE TREATMENT PLANT PROCESS

3.2.2.11 Support Services

Diesel storage facilities

The original EMPr (Metago, 2009) made provision for a number of storage tanks of diesel with a total capacity of approximately 500 000 litres located within the offices, plant and workshop area. However, the total storage capacity of diesel on site is currently 996 000 litres. Under the NEMA, the unlawful commencement of activities may be authorised through an application for rectification made in terms of Section 24G of the NEMA. In this regard, a separate Section 24G process was undertaken and an authorisation received from the DMR for the increase in diesel capacity. It follows that this will not be assessed as part of the project.

Tyre Bays

The 2017 EMPr amendment (SLR, 2017d) provides for two tyre bay areas that had been established on site (see Figure 3-2), one for mining equipment tyres and the other for light vehicle tyres. New tyres are temporarily stored at the tyre bays prior to use. Old tyres are temporarily stored at the tyre bays prior to being collected for disposal off-site.

Topsoil stockpiles

The original EMPr (Metago, 2009) and subsequent 2017 EMPr amendment (SLR, 2017d) provide for two topsoil stockpile areas, namely:

- Topsoil stockpile No. 1 (near the tailings dam facility): The capacity of this stockpile area is approximately 1 315 658 m^3 and covers an area of 35.7 ha.
- Topsoil stockpile No.2 (near the plant area): The capacity of topsoil stockpile area No. 2 is 290 000 m^3 and covers an area of 5.8 ha.

Topsoil has been and will continue to be stripped, stored and managed in accordance with the soil conservation procedures for the mine as outlined in Table 27-3. Topsoil will be used for rehabilitation purposes.

Weighbridges

The original EMPr (Metago, 2009) and subsequent 2017 EMPr amendment (SLR, 2017d) provide for two weighbridges. The ROM weighbridge can cater for 210 tonnes and the crushed ore weighbridge can cater for 80 tonnes.

Other support services

As per the original EMPr (Metago, 2009) provision was also made for additional support services (see Figure 3-1 and Figure 3-2) including:

- parking areas for trucks, cars, busses and a helicopter. (helipad);
- a laboratory at the plant – used for sample preparation and analysis;
- workshops and wash bays – used for servicing equipment and general maintenance;
- a laydown and storage areas;
- stores, tanks and handling areas for storage of general raw materials, consumables, and hazardous chemical substances including anthracite/coke, oil/lubricants, hydraulic fluid, diesel, heavy fuel oil or LPG Gas. The volume of stored hazardous substances may vary during the course of the operation

depending on delivery and scheduling constraints. As an order of magnitude guide, the following volumes are provided for on the site:

> anthracite/coke – approximately 6 000 ton stockpile on a concrete bunded slab in the sinter plant area;
> gas – 10 000 litres;
> heavy fuel oil - 22 000 litres; and
> oil/lubricants and hydraulic fluid - approximately 10 000 litres.

- a salvage, scrap yard and other waste areas for the temporary storage of waste before re-use or collection and removal;
- a polluted soil bioremediation area;
- an explosives storage magazine and destruction area designed and operated in accordance with the relevant mine explosives safety and security legislation;
- a change-houses with ablution facilities for all employees;
- a medical clinic facility for the primary treatment of injuries and illness;
- bus/taxi off-loading and loading areas;
- security checkpoints at all entrances;
- fencing and lighting (with masts) within the mining area for security and safety reasons;
- infrastructure for communication – telephone lines and communication masts; and
- main office/admin block and secondary offices at the mining contractor's areas.

3.2.2.12 Employment and Housing

As per the original EMPr (Metago, 2009), it was anticipated that a maximum of approximately 400 employees will be on site during the operational phase. This number was increased to approximately 800 as part of the 2017 EMPr amendment process.

3.2.2.13 Operating Hours

The original EMPr (Metago, 2009) and subsequent 2017 EMPr amendment (SLR, 2017d) makes provision for mining, crushing, screening and related activities (including train loading at night and over weekends) taking place continuously (24 hours per day, 7 days a week).

3.2.2.14 Life of mine

The mine has been operational for seven years and the anticipated remaining life of mine for the open pit operations, using current economic parameters, is approximately 25 years.

3.2.3 DESCRIPTION OF THE PROPOSED ACTIVITIES

3.2.3.1 Proposed Waste Road Dump Extensions

Tshipi is proposing to:

- Extend the existing East WRD in a south-easterly direction to the Mining Right boundary (see Figure 3-14). It is anticipated that the East WRD extension footprint will be approximately five hectares (ha).

  As noted earlier, the intention is to fill the void between the Tshipi East WRD and the Mamatwan (Sinterfontein) WRD, with waste rock mined from the boundary pillar between Tshipi and Mamatwan, for which permission was granted by the DMR on 3 May 2017. The respective WRDs are only separated by service roads on either side of the Mining Right boundaries (see Figure 3-16), and filling the void will thereby minimise the effective dump slopes that will have to be profiled (excavated) and the dump surfaces that need to be rehabilitated. This also maximises the use of an already disturbed footprint.

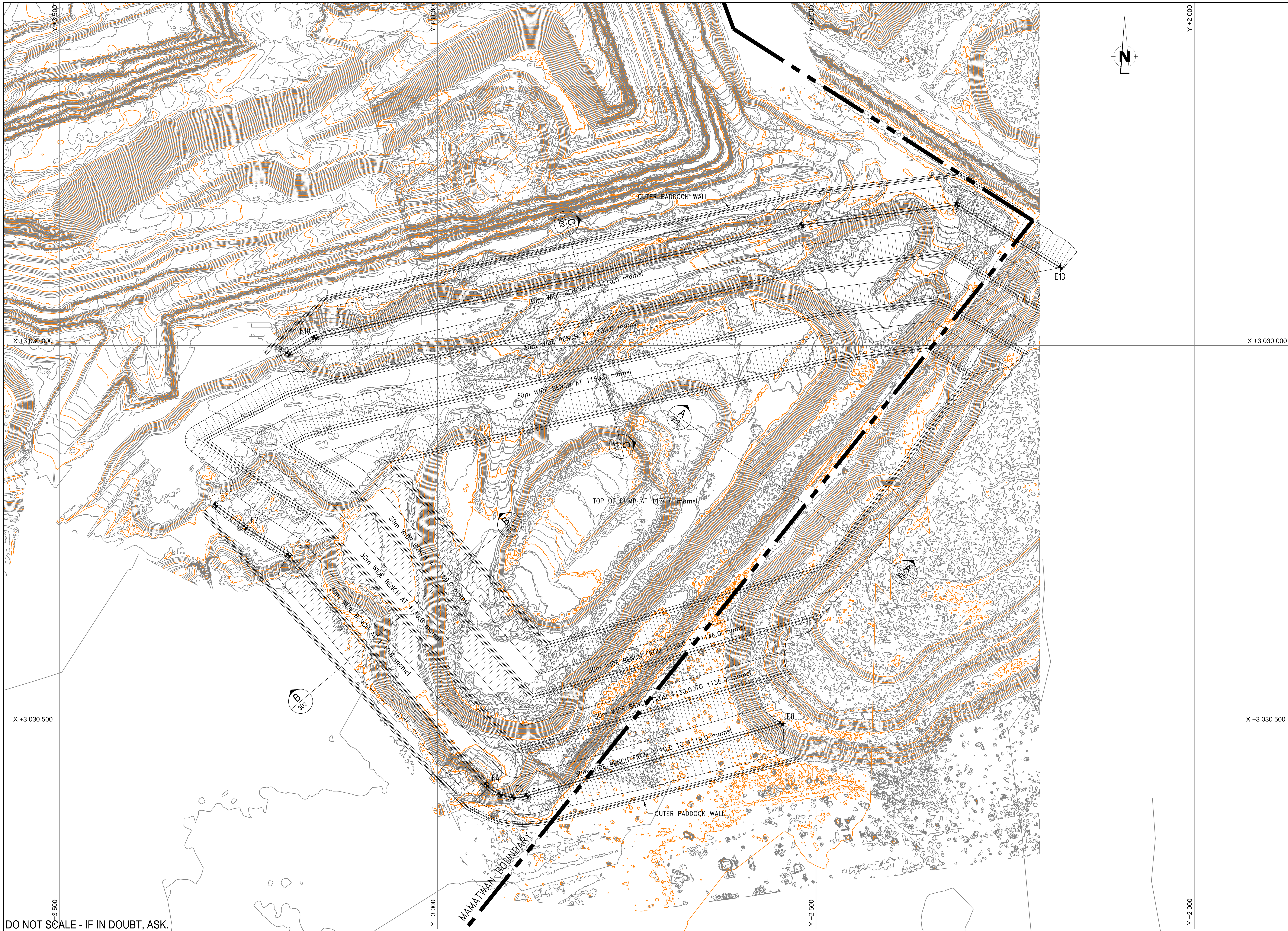
- Extend the existing West WRD towards the south-west onto Portion 8 of Farm Mamatwan 331 (see Figure 3-15 and Figure 3-17). It is anticipated that the West WRD extension footprint will be approximately 128 ha (including access roads). A buffer of approximately 30 m, which will include the WRD access road, cut-off drains and berms, will be maintained from the toe of the WRD to the property boundary. This area will be utilised for the water management infrastructure (berms), ramps and access/service roads around the WRD.

A site layout plan showing the location of existing and proposed project activities / components is illustrated in Figure 3-1 and Figure 3-2.

Waste Rock Dump Design

The proposed East and West WRD extensions will comply with Regulation 73 of the MPRDA Regulations as outlined in Table 3-8. The physical dimensions of the proposed WRD extensions are presented in TABLE 3-8.

The extension foundations will be designed taking cognisance of the geotechnical conditions and the base preparation will be in accordance with the required barrier system determined by a waste classification in accordance with regulations R632 and R634, promulgated in terms of NEM:WA.



DO NOT SCALE - IF IN DOUBT, ASK.

GENERAL NOTES:

EASTERN WASTE ROCK DUMP AREA AND VOLUME SCHEDULE	
CONSOLIDATED EASTERN AND MAMATWAN WRD	
FOOTPRINT AREA	580 400 m2
VOLUME: TSHIPI WRD	11 555 689 m3
VOLUME: TOTAL	14 739 900 m3

COORDINATE LIST

EASTERN WASTE ROCK DUMP		
POINT	Y-COORD	X-COORD
CONST:		
E1	3293.403	3030211.231
E2	3254.290	3030240.121
E3	3196.884	3030277.302
E4	2935.601	3030580.556
E5	2917.248	3030593.174
E6	2899.857	3030597.155
E7	2882.050	3030595.181
E8	2545.834	3030499.342
E9	3197.700	3030011.342
E10	3162.054	3029989.636
E11	2518.880	3029840.955
E12	2313.087	3029814.256
E13	2176.770	3029897.235

REFERENCE

DRAWING NUMBER	TITLE
710.20008.00060-301	EASTERN WASTE ROCK DUMP - TYPICAL CROSS SECTIONS SHEET 1

REVISIONS

No.	DESCRIPTION	BY	CHKD	DATE
0	ISSUED FOR INFORMATION	T.G	D.A.S	19.07.17

SLR
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APPROVED BY CLIENT			
DESIGNATION	DATE	INITIALS	SIGN
1.)			
2.)			
APPROVED BY SLR			
DESIGNATION	DATE	INITIALS	SIGN
DRAUGHTSMAN	25.05.18	T.G	
DESIGN ENGINEER	25.05.18	D.A.S	
PROJECT DIRECTOR	25.05.18	F.VH	
PROFESSIONAL ENGINEER (REG No.)	25.05.18	D.A.S	

Tshipi E' Ntle Manganese (Pty) Ltd
TSHIPI BORWA MINE
WASTE ROCK DUMPS

FIGURE 3-14:
EASTERN WASTE ROCK DUMP
GENENEARL LAYOUT AND SETTING OUT POINTS

SCALE 1:2500
CO-ORD SYSTEM
SHEET 1 OF 1
A1
DRAWING NUMBER : 710.20008.00060-300
REV : A

M:\Projects 3\710.20008.00060 WRD Design for tshipi EMP 2 amendment\Drawings\Conceptual\Working\710.20008.00060 - 300 - EASTERN DISCARDS DUMP - CONSOLIDATED - GA.dwg Jun 05, 2018 - 4:10pm

GENERAL NOTES:

WESTERN EXTENSION WASTE ROCK DUMP AREA AND VOLUME SCHEDULE		
	EXISTING WRD	NEW WRD
FOOTPRINT AREA	-	1 280 922 m2
VOLUME	-	74 023 304 m3
TOTAL VOLUME		74 023 304 m3

WESTERN EXTENSION WRD COORDINATE LIST

POINT	Y-COORD	X-COORD
P1	4456.422	3030373.465
P2	5071.167	3031210.605
P3	5077.941	3031232.364
P4	5069.883	3031253.681
P5	4709.870	3031687.227
P6	4697.292	3031696.791
P7	4681.789	3031699.848
P8	3345.237	3031655.721
P9	3327.374	3031643.276
P10	3331.458	3031621.892
P11	4101.783	3030778.231
P12	4106.325	3030768.949
P13	4104.139	3030755.986
P14	4086.862	3030728.409

DO NOT SCALE - IF IN DOUBT, ASK.

REFERENCE

DRAWING NUMBER	TITLE
710.20008.00060-101	WESTERN EXTENSION WASTE ROCK DUMP - DETAIL LAYOUT AND SECTIONS

REVISIONS

No.	DESCRIPTION	BY	CHKD	DATE
A	ISSUED FOR INFORMATION	MM	DAS	29.05.18

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DESIGNATION	DATE	INITIALS	SIGN
1.)			
2.)			

APPROVED BY SLR

DESIGNATION	DATE	INITIALS	SIGN
DRAUGHTSMAN	29.05.18	MM	
DESIGN ENGINEER	29.05.18	DAS	
PROJECT DIRECTOR	29.05.18	FVH	
PROFESSIONAL ENGINEER (REG No.)	29.05.18	DAS	

Tshipi E'Ntle Manganese (Pty) Ltd
TSHIPI BORWA MINE
WASTE ROCK DUMPS

FIGURE 3-15:
WESTERN EXTENSION WASTE ROCK DUMP
GENERAL LAYOUT AND SETTING OUT POINTS

SCALE 1:3000
CO-ORD SYSTEM
SHEET 1 of 1
A1
DRAWING NUMBER : 710.20008.00060-100
REV : A

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FIGURE 3-16: VIEW OF PREVIOUSLY DISTURBED AREAS WITHIN THE PROPOSED EAST WRD FOOTPRINT (PGS, 2018)

FIGURE 3-17: VIEW OF SITE LOCATION FOR THE PROPOSED WEST WRD (PGS, 2018)

Safety Classification of Waste Rock Dumps

The safety classification for the proposed waste rock dumps will be determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of the MPRDA Regulations 527 of 23 April 2004. Based on the classification in Table 3-9, the proposed WRD extensions are classified as a **low safety risk**.

Environmental Classification for the Waste Rock Dumps

As noted in Section 3.2.2.4, the waste rock generated as part of the Tshipi Borwa Mine operations is classified as a Type 1 waste, which requires a Class A liner consisting of a compacted clay liner, leachate detection, geotextile membranes and geotextile filters. However, a motivation for a Class D liner (stripping topsoil and base preparation) has been submitted in the approved EMP (SLR, 2017), in addition the waste assessment was discussed with DWS in the WULA pre-application meeting held in April 2017.

Transport System – Site Access and Roads

New access points and haul roads to the proposed West WRD extension area will be constructed to tie in with the mine's existing internal gravel road network in order to transport staff, material, equipment, and waste to and from the construction site. These roads will be maintained throughout the construction phase as part of the current road maintenance programme. The access road will be constructed of selected (inert), suitably sized and compacted waste rock i.e. calcrete obtained from the existing WRDs.

Storm water Management

Clean and dirty areas will be delineated and separated by the construction of clean and dirty water diversion berms and cut-off drains, as well as dirty water containment facilities. Clean water diversion berms will be constructed to divert clean water away from dirty water generating areas (i.e. intercepting clean water runoff and diverting this water around construction activities).

The storm water management system has been revised in order to contain runoff from the proposed East WRD and West WRD extensions (see Figure 3-5).

Surface Infrastructure

In addition to that described above, surface infrastructure will include the following:

- Lighting facilities at the proposed East WRD and West WRD extension, at the 132/11 kV substation, and along the overland conveyor system; and
- Security fencing, access control and roaming security facilities on the Tshipi Mining Right boundaries.

3.2.3.2 Proposed 11 kV Overhead Powerline

The proposed 11 kV overhead powerline will consist of aluminium cables strung along steel or wooden mono-poles, which will be erected along the centre-line of a 22 m wide servitude adjacent to the southern boundary of Portion 8 of Mamatwan 331 (see Figure 3-1) and onto the existing Mining Right area. The proposed powerline would be approximately 2.5 km in length, connecting the still to be constructed 132/11kV Eskom substation and the Tshipi power distribution centre. The sub-station will be supplied from a still to be constructed Eskom 132kV overhead (dual) power line.

A service road will be graded along the route of the 11 kV powerline from the substation, adjacent to the powerline and connect with the existing service road network on the mine site.

3.2.3.3 Proposed Overland Conveyor System

The proposed overland conveyor system will be erected within the existing Mining Right area (refer to Figure 3-2). It will consist of numerous inter-linked conveyors (with a cumulative length of approximately 1.2 km) that will receive crushed manganese ore from the lumpy and fines product ore stockpiles at the existing secondary crushing and screening plant and will transfer the ore to the product stockpiles adjacent to the train load-out station (Figure 3-3).

3.2.3.4 Construction Phase

Waste Rock Dump Extensions

Construction of the proposed East WRD and West WRD extensions is expected to take place in a staged manner throughout the life of the facilities and construction of new cells will coincide with the operation of established cells.

Site clearance within the WRD footprints will include the removal of vegetation (trees, bushes and grasses) and any defunct structures. Thereafter, topsoil will be excavated, loaded and hauled to dedicated topsoil stockpiles in accordance with the mines' soil management procedure. Both site clearance and topsoil striping of the WRD extensions will be undertaken in phases with cells being developed as additional waste rock storage capacity is required.

The internal access, service and haul roads required during the construction phase will be planned such that they will become the permanent access, service and haul roads during operational phase.

Overhead Powerline

The construction of the powerline will include; the preparation of the servitude corridor by levelling and clearing trees and bushes (to prevent the powerline from being overgrown or affected by veld fire), which will be done in according to the DAFF guideline (protected trees may only be cleared directly underneath and within 4 metres of the powerline), the excavation of shallow foundations at designed intervals for the mono-poles, the erection of steel or wooden mono-poles – with cast concrete and the stringing of aluminium powerlines between the poles.

This project will be done by specialist contractor and the construction phase of the overhead powerline will be in the order of 12 to 18 months (short-term duration).

Conveyor System

The construction of the overland conveyor system will include the levelling of the conveyor route (over disturbed ground within the existing mining area), the excavation and casting of shallow foundations, the erection of (steel) conveyor structures (including conveyor gantries, drive arrangements, head/tail-ends and transfer chutes), the installation conveyor idlers and belting, motors and gearboxes, the installation of electrical cabling and switchgear.

This project will be done by specialist contractor and the construction phase of the conveyor system will be in the order of 12 to 18 months (short-term duration).

Construction-related facilities

Temporary facilities will be established on site to support the construction phase of the WRDs, the powerline and the conveyor system. For each site, these facilities are likely to include a fenced construction yard – on a prepared terrace, with various temporary buildings and facilities including:

- Temporary access road from existing mine service roads and access control;
- Lighting;
- Lay-down area;
- Portable site office;

- Temporary store and yard;
- Temporary workshop;
- Temporary potable water storage (header tank) and reticulation;
- Portable ablution and kitchen facilities;
- A temporary (buried) septic tank for effluent and French drain; and
- Storm water management arrangements.

In the case of the WRD extension construction, which will continue during operations, these facilities will be semi-permanent.

Water Supply and Management

Water will be required during the construction phase for ground compaction, mixing of concrete, dust suppression and as general wash-down water. This water will be sourced from the mine's existing dirty water containment facilities and supplied by means of water bowsers and/or the mines existing piped water network.

Potable water, for human consumption will be piped from a header tank into ablution and kitchen facilities and drinking water will be provided in water coolers and/or as bottled water.

Waste Management

Domestic and Industrial Waste

General and hazardous wastes as defined under the NEM:WA generated during the construction phase will be managed in accordance with the approved EMPr amendment (SLR, 2017d). Although the proposed WRD expansion will not alter the types of waste generated at the mine, it will add to the existing waste generated on site.

Sewage

During the construction phase portable toilets will be utilised and the sewage removed by specialist contractor and treated at the mine's approved sewage treatment plant.

Electricity Supply and Use

The construction of the proposed East WRD and West WRD extensions will only require electrical power at the construction site for lighting and electrical points in the offices, store, workshop, ablution, and kitchenette. This electrical power will be supplied from the nearest existing on-mine substation in the case of the WRD construction camp and the overland conveyor system.

The construction camp for the 11 kV overhead powerline will use a portable generator as power supply due its remote locality and temporary nature.

Employment and Housing

During the construction phase of the East and West WRD extensions, specialist contractors will deploy managers, supervisors, senior artisans and machine operators from other sites, but will employ junior skilled and semi-skilled staff from the local communities. A limited number of permanent positions may be created as construction will be on-going with operations.

Employment opportunities for the construction of the 11 kV overhead powerline and the overland conveyor system will be temporary and of a limited duration (i.e. 12 - 18 months). Specialist contractors will deploy managers, supervisors and senior artisans from other sites, but will employ junior skilled and semi-skilled staff from the local communities.

Contractors will be expected to house their workers in nearby towns and no housing will be provided on site.

Operating Hours

It is anticipated that the construction phase will consist of one shift per day for conventional construction activities between 06:00 to 18:00 from Monday to Saturday. Should construction fall behind, or if emergency work must be undertaken, then working hours may be extended. Tshipi has permission to operate 24 hours per day for seven days per week. Shift rotation will be implemented to ensure work hours do not exceed that permissible by law.

Security and Access Control

To prevent unauthorised and/or inadvertent access during the construction phase, a fence will be erected around the perimeter of the proposed East WRD and West WRD extension construction zones if they are not enclosed by existing fencing.

A similar arrangement will apply to the 11 kV overhead powerline route

The overland conveyor system is located within Tshipi's security area, and thus requires no additional security requirements.

3.2.3.5 Operational Phase

Proposed Waste Road Dump Extensions

The WRD operational phase will entail the hauling of waste rock from the mine pit over existing and new haul-roads onto the WRDs and the dumping and dozing of the waste rock on the WRD. In-pit dumping of waste rock will also take place as described in TABLE 3-6.

Mineralised Waste Management

Mineralised waste will be disposed of onto the proposed WRD extensions. As indicated previously, the long-term intention is to fill the void between the Tshipi East WRD and the Mamatwan WRD, thereby minimising the effective dump surfaces that need to be rehabilitated. Cells will be created between the toe of each dump with competent rock (e.g. banded iron formation). As each cell is filled with waste rock new cells will be created, stepping back each time to maintain the design slope angle, until the final design height is reached. If Mamatwan fails to receive approval for the extension of its Mamatwan WRD, the East WRD will be appropriately shaped to terminate on the Tshipi Mining Right boundary.

Transport System – roads and access points

The internal access, service and haul roads required during the construction phase will be planned such that they will become the permanent access, service and haul roads during operational phase and will be maintained throughout the operational phase.

Water Supply and Management

Process water will be required during the operational phase for dust suppression and maintenance (e.g. cleaning). This will be sourced from the mine's existing process water supply system and will be piped to the respective areas or supplied by means of water bowsers. The proposed WRD extensions will not require an additional potable water supply.

Storm water Management

As part of the project, the storm water management plan has been reviewed and updated in order to contain runoff from the proposed East WRD and West WRD extensions (see Figure 3-5).

Employment and Housing

Limited, if any, permanent and/or temporary employment opportunities will be created by the proposed activities and no housing of new staff will be required during the operational phase.

Proposed 11 kV Overhead Powerline

Activities during the operational phase of the 132/11kV substation and 11 kV overhead powerline will be limited to inspections and periodic maintenance.

Proposed Overland Conveyor System

Typical activities during the operational phase of the overland conveyor system will include attendance by operators including lashing of spillage back onto the conveyor and electro-mechanical maintenance activities of the conveyor components e.g. replacement of rollers and conveyor belting from time to time.

3.2.4 DECOMMISSIONING AND CLOSURE

A preliminary mine closure plan has been compiled for Tshipi Borwa Mine in accordance with the DMR guideline document of January 2005 (SLR, 2017e). This closure plan has been updated to include the addition of the proposed WRD extension project (see Appendix K).

The closure cost liability was calculated as per the methodology of the DMR guideline document of January 2005.

As is required by the MPRDA and the MPRDA Regulations thereof, a detailed closure plan will be submitted to the DMR prior to decommissioning and closure. The compilation of this detailed closure plan will involve a public participation process similar to that undertaken during the EIA process. The detailed closure plan will determine specific closure strategies and action plans taking regulatory, environmental, social, economic and sustainable development principles into account.

4. POLICY AND LEGISLATIVE CONTEXT

This chapter outlines the key legislative requirements applicable to the proposed project. Table 4-1 below provides a summary of the applicable legislative context and policy.

TABLE 4-1: LEGAL FRAMEWORK

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context?
National Environmental Management Act No. 107 of 1998) (NEMA), as amended	Introduction, Section 3.1.1 and Table 4-2	The proposed project incorporates several activities listed in Government Notice Regulation (GNR) 983 (Listing Notice 1; as amended) and 984 (Listing Notice 2; as amended) (refer to Table 3-1). Since the proposed project includes activities listed in both Listing Notice 1 and 2, a Scoping and EIA process (hereafter collectively referred to as "EIA") is required in order for the DMR to consider the application for environmental authorisation. A combined NEMA and NEM:WA application has been lodged with DMR.
Regulations 982 of 4 December 2014 (EIA Regulations), as amended		
National Environmental Management: Waste Act (No 59 of 2008) (NEM:WA), as amended	Introduction, Section 3.1.2 and Table 4-2	The proposed project incorporates waste management activities listed in GNR 921 (as amended) (refer to Table 3-2). Since the proposed project includes activities listed in Category B, an EIA is required in order for the DMR to consider the application for a WML. A combined NEMA and NEM:WA application has been lodged with DMR.
SANS 10234 as per Waste Classification and Management Regulations (GNR 634 of 23 August 2013) and the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GNR 635 of 23 August 2013)	Section 3.2.2.4	A waste assessment was undertaken for the Tshipi Borwa Mine by Golder Associates in February 2016. This assessment and Golder recommendation was presented to DWS at a WULA pre-application meeting in April 2017. The Golder motivation indicated that a Class D liner is considered appropriate for the WRDs at the Tshipi Borwa Mine.
Guideline on the need and desirability in terms of the Impact Assessment (EIA) Regulations, 2010, GNR 891 of 2014.	Section 5	Need and desirability has been taken into account as part of project planning.
National Water Act (No. 36 of 1998) (NWA), as amended	Introduction, Section 3.1.3 and Table 4-2	The proposed project triggers a water use activity listed in Section 21 of the NWA (refer to Table 3-3). As such, a WUL is required from the DWS in terms of the NWA. An application will also be lodged with the DWS for exemption from the requirements of relevant conditions on Regulation 704 (1999) in terms of the NWA. In addition to this, Tshipi will ensure
Regulation 704 of 1999 in terms of the NWA		

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context?
		compliance with GNR 704 for the separation of clean and dirty water.
National Forest Act (No. 84 of 1998) (NFA)	Introduction and Section 27	Applications will have to be submitted to obtain the required permits to remove and/or translocate protected species. This is applicable to the new area to be disturbed for the West WRD extension and powerline servitude.
Northern Cape Nature Conservation Act No. 9 of 2009 (NCNCA)		
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Section 6.4.1.6, 8 and 27	Biodiversity was taken into account as part of project planning and in the assessment of potential impacts.
Alien Invasive Species Regulations GNR 598 of 2014 in terms of the NEM:BA		
Alien and Invasive Species List, GNR 864 of 2016		
South African National Botanical Institute (SANBI) Integrated Biodiversity Information		
National Freshwater Ecosystem Priority Areas 2011 (NFEPA)		
National Protected Areas Expansion Strategy 2008 (NPAES)		
Conservation of Agricultural Resources Act (No. 43 of 1993) (CARA)		
Mining Biodiversity Guideline (2012)		
Important Bird and Biodiversity Areas (IBAs)		
National Heritage Resource Act (No. 25 of 1999)	Section 6.4.1.13, 8 and 27	Heritage resources were taken into account as part of project planning and in the assessment of potential impacts.
National Atmospheric Emission Reporting Regulations in terms of the National Environmental Management: Air Quality Act (No. 39 of 2004)	Table 29-1	Operation is registered on the National Emissions Inventory System.
Explosives Act (No. 15 of 2003)	Table 27-1	Blasting and explosives legislation was taken into account as part of initial project planning and approval.
Mine Health and Safety Act (No. 29 of 1996)	Table 27-1	

This document has been prepared in accordance with the DMR EMPr Report template format, and was informed by the guidelines posted on the official DMR website. This is in accordance with the requirements of the MPRDA. This report also complies with the requirements of the NEMA and Appendix 3 of EIA Regulations 2014, as amended (GNR 326).

Table 4-2 provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

TABLE 4-2: STRUCTURING OF THE EIR

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
Part A of DMR report template	**Appendix 3 of the NEMA regulations**	**Section/Appendix**
The EAP who prepared the report	Details of the EAP who prepared the report.	Section 1.1
Expertise of the EAP	Details of the expertise of the EAP, including curriculum vitae.	Section 1.2 and Appendix B
Description of the property	The location of the activity, including - the 21 digit Surveyor General code of each cadastral land parcel. Where available the physical address and farm name. Where the required information is not available, the coordinates of the boundary of the property or properties.	Section 2
Locality plan	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken or on land where the property has not been defined, the coordinates within which the activity is to be undertaken.	Section 2.2
Description of the scope of the proposed overall activity	A description of the scope of the proposed activity, including all listed and specified activities triggered.	Section 3.1
Description of the activities to be undertaken	A description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for and a description of the associated structure and infrastructure related to the development.	Section 3.2
Policy and legislative context	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	Section 4
Need and desirability of the proposed activity	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location.	Section 5
Motivation for the preferred development footprint within the approved site including	A motivation of the preferred development footprint within the approved site including.	Section 6
A full description of the process followed to reach the proposed development footprint within the approved site	A full description of the process followed to reach the proposed development footprint within the approved site.	Section 6
Details of the development footprint alternatives considered	Details of all the alternatives considered.	Section 6.1

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
Details of the public participation process followed	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs.	Section 6.2
Summary of issues raised by I&APs	A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.	Section 6.3
Environmental attributes associated with the development footprint alternatives	The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	Section 1.1
Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts including the degree of the impacts	The impacts and risks identified, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be reversed, may cause irreplaceable loss of resources and can be avoided, managed and mitigated.	Section 6.5
Methodology used in determining the nature, significance, consequence, extent, duration and probability of potential environmental impacts and risks	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks.	Section 6.6
The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternative will have on the environment and the community that may be affected	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	Section 6.7
The possible management actions that could be applied and the level of risk	The possible management actions that could be applied and level of residual risk.	Section 6.8
Motivation where no alternative sites were considered	If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such.	Section 6.9
Statement motivating the alternative development location within the overall site	A concluding statement indicating the preferred alternatives, including preferred location within the approved site.	Section 6.10
Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (in respect of the final site layout) through the life of the activity	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structure and infrastructure will impose on the preferred location through the life of the activity including a description of all environmental issues and risks that were identified during the environmental impact assessment process and an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of management actions.	Section 7

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
Assessment of each identified potentially significant impact and risk	An assessment of each identified potentially significant impact and risk including cumulative impacts, the nature, significant and consequence of the impact and risk, the extent and duration of the impact and risk, the probability of the impact and risk occurring, the degree to which the impact can be reversed, the degree to which the impact and risk may cause irreplaceable loss of a resources and the degree to which the impact and risk can be mitigated.	Section 8 and Appendix D
Summary of specialist reports	Where applicable the summary of the findings and recommendations of any specialist report complying with Appendix 6 of these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	Section 9
Environmental impact statement	An environmental impact statement which contains a summary of the key findings of the environmental impact assessment, a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers and a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	Section 10
Proposed impact management objectives and the impact management outcomes for inclusion in the EMPr	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.	Section 11
Final proposed alternatives	The final proposed alternatives which respond to the impact management actions, avoidance, and management actions identified through the assessment.	Section 12
Aspects for inclusion as conditions of authorisation	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	Section 13
Description of any assumptions, uncertainties and gaps in knowledge	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and management actions proposed.	Section 14
Reasoned opinion as to whether the proposed activity should or should not be authorised	Reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Section 15
Period for which environmental authorisation is required	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.	Section 16

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
Undertaking	An undertaking under oath or affirmation by the EAP in relation to the correctness of the information provided in the reports, the inclusion of comments and inputs from stakeholders and I&APs, the inclusion of inputs and recommendations from the specialist reports where relevant and any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.	Section 17
Financial provision	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.	Section 18
Deviation from the approved scoping report and plan of study	An indication of any deviation from the approved scoping report, including the plan of study, including any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and a motivation for the deviation.	Section 19
Other information required by the competent authority	Any specific information required by the competent authority.	Section 20
Other matter required in terms of section 24(4)(a) and (b) of the Act	Any other matter required in terms of section 24(4)(a) and (b) of the Act.	Section 21
Part B of the DMR report template	**Appendix 4 of the NEMA regulations**	**Section/Appendix**
Details of EAP	Details of the EAP who prepared the EMPr and the expertise of that EAP to prepare the EMPr, including a curriculum vitae.	Section 22
Description of the aspects of the activity	A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	Section 23
Composite map	A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers.	Section 24
Description of impact management objectives including management statements	A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including planning and design, pre-construction activities, construction activities, rehabilitation of the environment after construction and where applicable post closure; and where relevant, operation activities.	Section 25
The determination of closure objectives		Section 25.1

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity	-	Section 25.2
Potential acid mine drainage	-	Section 25.3
Steps taken to investigate, assess and evaluate the impact of acid mine drainage	-	Section 25.4
Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage	-	Section 25.5
Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage	-	Section 25.6
Volumes and rate of water use required for the mining	-	Section 25.7
Has a water use licence been applied for?	-	Section 25.8
Impacts to be mitigated in their respective phases	-	Section 25.9
Impact management outcomes	A description and identification of impact management outcomes required for the aspects contemplated in paragraph.	Section 26
Impact management actions	A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes be achieved, and must, where applicable, include actions to avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; comply with any prescribed environmental management standards or practices; comply with any applicable provisions of the Act regarding closure, where applicable comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.	Section 27
Financial provision		Section 28
Mechanism for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon	The method of monitoring the implementation of the impact management actions.	Section 0
	The frequency of monitoring the implementation of the impact management actions.	
	An indication of the persons who will be responsible for the implementation of the impact management actions.	
	The time periods within which the impact management actions must be implemented.	

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
	The mechanism for monitoring compliance with the impact management actions.	
	A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations.	
Environmental Awareness Plan	An environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work; and risks must be dealt with in order to avoid pollution or the degradation of the environment.	Section 30
Specific information required by the competent authority	Any specific information that may be required by the competent authority.	Section 31
Undertaking	-	Section 0

5. NEED AND DESIRABILITY OF THE PROJECT

The DEA guideline on need and desirability (GNR 891, 20 October 2014) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. Thus, the over-arching framework for considering the need and desirability of development in general is taken at the policy level through the identification and promotion of activities / industries / developments required by civil society as a whole. The DEA guideline further notes that at a project level (as part of an EIA process), the need and desirability of the project should take into consideration the content of regional and local plans, frameworks and strategies.

5.1 ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES

Due to the nature of mining projects, impacts on sensitive biodiversity areas, linkages between biodiversity areas and related species, and the role that they play in the ecosystem, are probable. The proposed project also has the potential to directly disturb fauna and flora, especially within the proposed West WRD extension footprint and powerline servitude. In addition to this, soil is a valuable resource that supports a variety of ecological functions. The proposed project has the potential to damage soil resources through physical disturbance and/or contamination, which has a direct impact on the potential loss of the natural capability of the land.

As part of the EIA process, independent biodiversity and soil specialists were appointed to determine the sensitivity of areas within the proposed WRD expansion development footprints. In this regard, the broader Tshipi Borwa Mine incorporates some highly sensitive protected species, namely the Grey Camel Thorn (*Vachellia haematoxylon*) and Camel Thorn (*Vachellia erioloba*), which are protected under the NFA, and the Goldblatt (*Moraea longistyla*), which is protected under the NCNCA (refer to Section 6.4.1.6 for further information). Where mining activities are currently in operation, it is highly likely that these species were removed, specifically within the *Vachellia haematoxylon* Savannah and the Mixed *Vachellia* Savannah vegetation communities, which are associated with a high density of Grey Camel Thorn and Camel Thorn trees. The establishment of the proposed West WRD extension and powerline servitude will require clearing of vegetation within the Kathu Thornveld habitat unit, which will result in the loss of additional protected trees (e.g. Camel Thorn and Grey Camel Thorn), as well several other faunal and floral species of conservation concern. Linked to this, is the loss of soil functionality and related land capability as an ecological driver for vegetation and ecosystems that rely on soil (Refer to Appendix D for the detailed assessment).

Measures that were considered to avoid the destruction and disturbance of biodiversity and the loss of soil resources include limiting the extent of the WRD footprint to that what is absolutely necessary. Where sensitive biodiversity areas cannot be avoided, management actions focus on ensuring ecological sustainability through rehabilitation that aims at restoring pre-mining land capability to grazing and wilderness potential. It is important to note that Tshipi liaises directly with DAFF for tree removal permits in accordance with the NFA for the removal of protected tree species such as the Grey Camel Thorn and Camel Thorn trees. DAFF currently monitors the number of protected tree species that have been removed by Tshipi to date. DAFF has indicated that they will inform Tshipi when an offset needs to be implemented to compensate for unavoidable loss of protected trees. It follows that Tshipi is committed to implement an offset when required by DAFF. Refer to Section 27 for further detail pertaining to biodiversity related management actions.

5.2 PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT

Community/society priorities are officially expressed through public documents including the provincial growth and development strategy and spatial development framework documents. In this regard, the priorities of the Joe Morolong Local Municipality's Integrated Development Framework (IDP) and the John Taolo Gaetsewe District Municipality's Spatial Development Framework (SDF) (May 2016) are mainly focused around the reduction of unemployment and halving poverty, as well as establishing affordable accommodation in towns experiencing rapid expansion by investing in key sectors and developing and upgrading basic service delivery and infrastructure. One of the ways of achieving this, according to the SDF, is to discourage urban sprawl, and to promote more compact and efficient cities. In order to achieve this, development must be channelled into specific nodes and corridors (John Taolo Gaetsewe District Municipality, 2016). In addition, one of the Key Focus Areas for economic growth is the Gamagara Development Corridor; within which the mine is located (see Figure 5-1).

Taking the above into consideration the mine will result in continued positive socio-economic impacts. The mine already contributes to the national South African economy at macro level by exporting its product that leverages foreign income into the country. Direct economic benefits will be derived from wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the spending power of employees (Refer to Appendix D for the detailed assessment). Further to this, through employment at the mine, employees are afforded the opportunity to further their education through the skills development plan of the mine's social and labour plan (SLP) (Tshipi, December 2014). In addition, supplementary plans to enhance the socio-economic benefits of the mine are also in place, including a career progression plan, a mentorship plan and internships and bursaries. In addition to these social development plans, the mine also has in place an Employment Equity Plan and targets relating to historically disadvantaged South Africans (HDSAs). The mine will also allow for local economic development (LED), since the mine is located within the Gamagara Development Corridor, which has been identified as a key sector to develop within the province to enhance economic growth. Further to this, the SLP includes plans that are in line with the IDP of the John Taolo Gaetsewe District Municipality and the Joe Morolong Local Municipality. In a broad sense this will include a housing and living conditions plan to improve living conditions of employees, an LED project plan and a procurement plan focusing on assisting HDSAs (Tshipi, December 2014).

Due to the expectation of employment associated with mining projects there is a potential for negative socio-economic impacts to occur (Refer to Appendix D for the detailed assessment). In this regard, an influx of job seekers to an area may in turn increase pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. Management actions to manage and remedy these impacts include the implementation of a health policy on HIV/AIDs and tuberculosis, working together with local and regional authorities to address social service constraints and to monitor and prevent the development of informal settlements. In addition to this, formal communication structures and procurement procedures will be developed. Refer to Section 27 for further detail pertaining to socio-economic related management actions.

5.3 RATIONALE FOR THE PROPOSED PROJECT ACTIVITIES

As the Tshipi Borwa mine has developed it has become apparent to Tshipi, through long-term planning which has determined a longer life of mine, that additional waste rock storage areas are needed to allow continued optimal operation of the mine.

The WRD extensions will facilitate the optimisation of the waste rock hauling cycles thereby making the economic viability of the mine more robust. In addition, Tshipi is now an established mine and on-going mine planning, based upon more detailed geological and mining information, has led to the development of an in-pit dumping plan which will limit the quantum of waste rock that must be dumped on the WRDs.

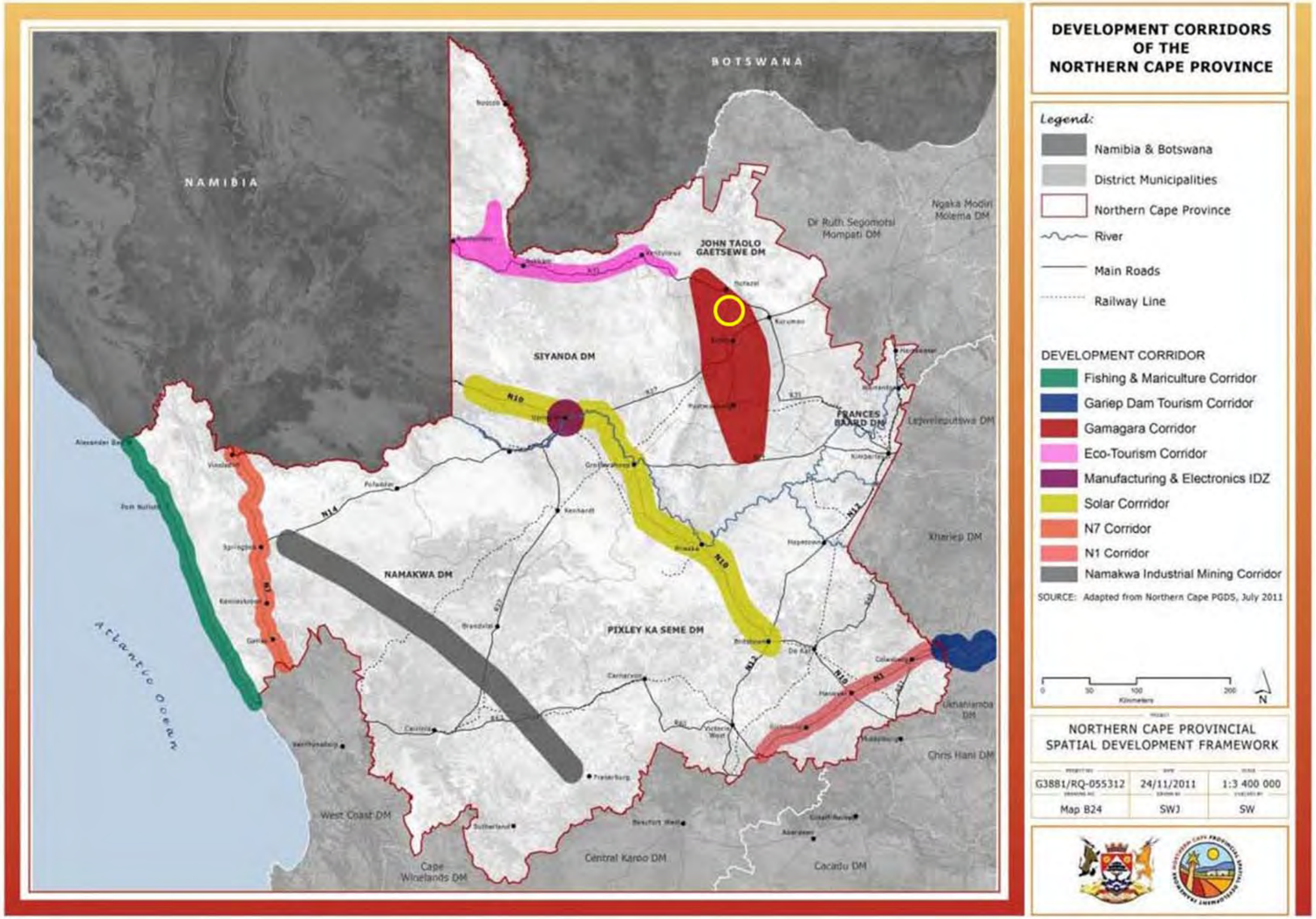


FIGURE 5-1: MINING RIGHT AREA (YELLOW CIRCLE) IN RELATION TO DEVELOPMENT REGIONS AND CORRIDORS OF THE NORTHERN CAPE (NPSDF, 2012)

6. MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT ON THE SITE INCLUDING THE PROCESS FOLLOWED TO DEFINE THE PREFERRED DEVELOPMENT ALTERNATIVES

6.1 DETAILS OF THE DEVELOPMENT FOOTPRINT CONSIDERED

This section describes land use or development alternatives that have been considered for the proposed extensions to the West and East Waste Rock dumps (WRD), electrical grid-power connection, conveyance of product ore and the consequences of not proceeding with the proposed project.

The main project alternatives to be considered include:-

- Locality;
- Technology; and
- The “no-go” alternative.

6.1.1 Waste Rock Dump extensions

The location of the proposed West and East WRD extension has relied on the identification of a property to meet the following criteria;

- of sufficient size to accommodate the required volume of waste rock and,
- with no economically minable underlying resource (a waste rock dump located on a minable resource would sterilize such a resource),
- located in close proximity to the open pit to optimise the haul distance.

Locations adjacent to the pit, in the north, east, south and west have been considered (See FIGURE 6-17):

- The existing North WRD is located immediately north of the final pit footprint and therefore this location is already committed and beyond the North WRD is the UMK MR area.
- To the east of the Tshipi Mining Right area is the Hotazel Manganese Mines (Mamatwan) MR area therefore this location is already committed.
- Tshipi’s mine infrastructure is located south of the Tshipi pit on portion 18 – except on portion 17, where the corridor between the existing Tshipi East WRD and the Mamatwan Sinterfontein WRD is already impacted by WRD activities, therefore this area has been selected for the extension of the East WRD.
- To the west of the Tshipi pit is the existing West WRD and beyond this is portion 8, a property over which Tshipi has Surface Rights and on which there is no commercial activity e.g. farming. It follows therefore that Portion 8 of the farm Mamatwan 331 is the most suitable location for the West WRD extension.

In terms of surface environmental features neither the West and/or East WRD extensions overly a water course and are not within close proximity to the Vlermuisleegte River, which is approximately two kilometres west of Tshipi Borwa’s mining area.

In addition, neither the West and/or East WRD extensions are in close proximity to either rural settlements and/or farmsteads.

No other locational alternatives have been considered as they would then be located remotely from the mine and would increase the aerial extent of impact on the environment.

6.1.2 Eskom Grid-power connection

In developing the grid-power project an alternative location for the Eskom Sub-station on the property Moab 700 was considered. This property was identified as being less than optimal as it is traversed by the private railway siding, which would have to be crossed by maintenance staff in their vehicles. Further, Eskom require unrestricted access to their sub-stations and on this property Eskom personnel and their vehicles would have to pass through Tshipi's main gate and security check-point, a 'non-negotiable' for Eskom.

The location on a servitude (in Eskom's favour) on Mamatwan portion 8 is adjacent to the district road so that Eskom can have exclusive access to the sub-station site.

6.1.3 Overland Conveyor System

The proposed Overland Conveyor System is the globally proven most suitable technology for continual longer-term transfer of ore from one fixed point to another over short distances – a few hundred metres, to medium distances – a few thousand metres. The readily available technology has the lowest environmental impact and a well-designed and maintained conveyor has the lowest risk to operational and maintenance staff.

6.1.4 THE "NO-GO" ALTERNATIVE

The alternative to the Extension of the West and East WRD extensions is In-pit Dumping. In 2017 Tshipi's Mineral Resource Management (MRM) Department developed a Life of Mine (LOM) plan based upon the latest techno-economic information. This LOM plan takes into account the 'haul-back' of waste rock from where it is broken at the working faces in the pit and the dumping of it in the mined-out area of the pit – commonly called In-pit dumping. The West and East WRD extensions have taken into account In-pit Dumping (as maximised in the LOM Plan). Therefore, without the West and east WRD extensions the viability of Tshipi Borwa will be seriously hampered and could lead to premature closure with obvious consequences.

The alternative to the Eskom Grid-power Connection is to continue operating as is, i.e. using diesel-powered generators to produce electricity. This methodology is less than optimal because it is diesel-power intense which has a 'heavier' carbon footprint than producing power in bulk i.e. Eskom power station produces less green-house gasses per kilowatt than diesel-powered generators.

Further, electricity produced by diesel-powered is approximately 4 – 5 times more expensive than grid-power therefore the latter contributes to making the business more competitive and more resilient to challenging market conditions i.e. when commodity prices are depressed.

The alternative to the Overland Conveyor System is to continue operating as is, i.e. loading ore by means of one or more diesel-powered font-end-loaders (FELs) onto articulated dump trucks (ADTs) and then hauling the ore for approximately 1500m to the product stockpiles adjacent to the dedicated Tshipi train load-out facility and tipping the ore there. This is a less than optimal process because it is diesel-power intense which have both health and safety consequences i.e.

- The loading and hauling are dust generation activities with limited opportunity for dust suppression,
- The diesel engines are noisy, generate COx fumes and as consumers of fossil fuels have a high carbon emission footprint.
- The FELs and ADTs pose an on-going 'moving machinery' hazard to staff working in and around the crushing and screening plant.

6.2 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

This section describes the public participation process undertaken during the EIA process in accordance with the requirements of Chapter 6 of the EIA Regulations 2014 (as amended).

6.2.1 Public Participation Process undertaken during Scoping

The objective of the scoping public participation process was to ensure that I&APs were notified about the proposed project and EIA process, given a reasonable opportunity to register on the project database and to provide comments. Steps undertaken during the Scoping Phase are summarised in Table 6-1 below.

TABLE 6-1: PUBLIC PARTICIPATION PROCESS UNDERTAKEN DURING THE SCOPING PHASE

Task	Description
1	**DMR pre-application meetings and follow up meetings** Initially a pre-application meeting was held with the DMR in Kimberley on 11 April 2017. The purpose of the meeting was to discuss the legislative requirements and the approach to the Scoping and EIAR/EMPr process for the application to ensure agreement and compliance. SLR and Tshipi subsequently met with DMR again on 8 August 2017 to provide an update of the environmental legal compliance at Tshipi Borwa Mine and to discuss the different environmental authorisation application processes that were in progress at the time. A further meeting was held with the DMR case officer (Mr. Takalani Khorombi) on 29 August 2017 to present the formal response regarding the application option to be pursued (namely undertaking the current EIA process concurrently with the 2017 EMPr amendment process). A meeting was held with the DMR on 10 October 2018 following the submission of the the Scoping Report to the DMR on 8 September 2018. The purpose of the meeting was to discuss comments raised by the DMR pertaining to the Scoping Report and lodged application. The DMR requested that reference to the term amendment should be removed from the Scoping Report and application and re-submitted to the DMR for

Task	Description
	consideration. During the week of 31 October 2018 a notification letter was distributed via e-mail, normal postage, fax and sms messages to registered I&APs to inform them of the non-material changes made to the application and Scoping Report. A pre-application meeting was held with DWS on 10 October 2018. The minutes of these meetings and a copy of the I&AP notification letter and proof of distribution are provided in Appendix C.
2	**Identification of I&APs** SLR developed a preliminary I&AP database comprising of Non-Governmental Organizations ("NGOs"), community-based organisations, commenting authorities, adjacent landowners and other key stakeholders with a potential interest in the application. This database included municipal officials, ward councillors, traditional authorities, Government Departments with jurisdiction in the area. Additional I&APs were added to the database based on the tasks described below. The latest version of the I&AP database is included in Appendix C2.
3	**Notification letters and Background Information Document (BID)** In September 2017, notification letters and a Background Information Documents (BID) were distributed, via email, to all I&APs registered on the database, including the adjacent Mamatwan mine (Wezi Banda) and the following State Departments/Organs of State: • Department of Mineral Resources (DMR); • Department of Environmental Affairs (DEA); • Department of Environment and Nature Conservation (DENC); • Department of Water and Sanitation (DWS); • South African Heritage Resources Agency (SAHRA); • Department of Agriculture, Forestry and Fisheries (DAFF); • Department of Public Works, Roads and Transport (DPWRT); • Department of Rural Development and Land Reform (DRDLR); • Northern Cape Department of Agriculture (NCDA); • John Taolo Gaetsewe District Municipality (JTGDM); and • Joe Morolong Local Municipality (JMLM). Due to changes to the project description, an updated notification letter and BID were distributed to registered I&APs during the week of 28 May 2018. The purpose of the letters and BIDs was to inform I&APs about the proposed project, the EIA process, environmental attributes, possible environmental impacts and provided an initial opportunity to comment. The initial letter and BID also included details of the planned public meeting. The letters and BIDs were made available in English and Afrikaans. Copies of the letters and BIDs are included in Appendix C3.
4	**Advertisements and site notices** I&APs were also notified of the proposed project and EIA process through advertising and site notices. These adverts and notices also encourage people to register on the I&APs database and provided an initial opportunity to comment. Press advertisements were placed in the following newspapers: • Kathu Gazette on Thursday 1 September 2017 and 31 May 2018; and • Kalahari Bulletin on Thursday 7 September 2017 and 31 May 2018. In addition, a general notice was published in the Provincial Gazette of 6 September 2017. On 26 August 2017 and 30 May 2018, site notices (in English) were placed at the entrance to the Tshipi Borwa

Task	Description
	Mine and at key conspicuous public places in towns around the project area, including Kathu Public Library, the Joe Morolong Local Municipal offices, the John Taolo Gaetsewe District Municipal offices, the Hotazel public library and the Black Rock library. Proof of the placement of the laminated A2 site notices and advertisements is included in Appendix C4.
5	**Public and authority information-sharing meetings** A general public scoping meeting was held in Hotazel on 14 September 2017. The purpose of the meeting was to: • provide an overview of the proposed project and EIA process; • provide an overview and obtain input on the existing status of the environment; • outline and obtain input on impacts identified for the proposed project; • record any comments and issues raised; and • agree on the way forward and the logistics for report distribution. Although the meetings were held in English, some attendees spoke in Afrikaans. Minutes of the public meeting are included in Appendix C5. All authorities registered on the I&AP database were invited to an authority meeting which was to be held in Hotazel on 14 September 2017. However, subsequent to setting up the meeting none of the invited authorities were able to attend the meeting.
6	**Land claims commissioner consultation** As part of the project the Department of Rural Development and Land Reform (DRDLR) was contacted to confirm if any land claims have been lodged on Portion 8 of Farm Mamatwan 331. DRDLR confirmed that no land claims had been lodged (refer to correspondence in Appendix C6).
7	**Review of the draft Scoping Report and I&AP notification** The draft Scoping Report was made available for a 30-day review and comment period from 14 June 2018 to 16 July 2018. Copies of the report were made available on the SLR website and at public libraries in Hotazel and Kathu. Registered I&APs were notified of the review and comment period via email and sms messages. A Summary of the draft Scoping Report was also distributed to all registered I&APs via e-mail and normal postage. Copies of the notification letters are included in Appendix C3.
8	**Acceptance of the final Scoping Report** The final Scoping Report was prepared in compliance with Appendix 3 of the EIA Regulations 2014 (as amended) and was informed by all comments received during the scoping tasks described above. The final Scoping has been submitted to the DMR on 7 September 2018. On request by the DMR the Scoping Report and application was updated by removing all references to “Environmental Management Programme (EMPr) amendment”. The corrected Scoping Report and application have been submitted to the DMR on 15 November 2018. On 21 January 2019, the same Scoping Report has been re-submitted to the DMR. The final Scoping Report was accepted by DMR on 1 February 2019 (see Appendix C7).

6.2.2 Public Participation Process undertaken during EIA Phase

This draft EIR has been prepared in compliance with Appendix 3 of the EIA Regulations 2014 (as amended). The specialist studies and other relevant information / assessments have been integrated into this report.

This report presents information in accordance with the DMR EMPr Report template format and provides further opportunity for I&APs to comment on the proposed project and findings of the EIA process. Steps undertaken or to be undertaken during the EIA Phase are summarised in Table 6-2 below.

TABLE 6-2: PUBLIC PARTICIPATION PROCESS DURING THE EIA PHASE

Task	Description
1	**Review of draft EIR and I&AP notification** The draft EIR has been published for a 30-day review and comment period from 12 March to 11 April 2019. Copies of the report have been made available on the SLR website and at public libraries in Hotazel and Kathu. Registered I&APs have been notified of the review and comment period via email and sms messages. A Summary of the draft EIR was also distributed to all registered I&APs via e-mail and normal postage. Proof of notification will be included in the final EIR. Public and authority meetings will only be held if deemed necessary.
3	**Submission of final EIR to DMR for decision-making** After closure of the draft EIR comment period, it will be updated into a final EIR taking cognisance of all comments received on the draft report. A Comments and Responses Report will be appended to the final EIR. The final EIR will be submitted to DMR for decision-making.
4	**Submission of final EIR to DMR for decision-making** The final EIR will be uploaded onto the SAMRAD website for DMR decision making purposes.
5	**I&AP notification of DMR's decision** Registered I&APs will be notified of DMR's decision and the statutory appeal process.

6.3 SUMMARY OF ISSUES RAISED BY I&APS

A summary of the issues and concerns raised by I&APs to date is provided in TABLE 6-3 below. This table will be updated after the closure of the draft EIR comment period.

TABLE 6-3: SUMMARY OF ISSUES AND CONCERNS RAISED BY I&APS DURING THE SCOPING PHASE

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
AFFECTED PARTIES				
Surrounding Land Owners				
Andries van den Berg	14 September 2017 at the public scoping meeting.	X	I live very close to the mine and I am concerned about the dust aside chemicals that wash into my grazing, are the chemicals harmful and how will that be handled? Will the access road be tarred or how will the dust aside runoff be controlled?	The use of dust-a-side is a means of managing the generation of dust along gravel roads. This is in compliance with Tshipi's EMP management actions that stipulate the use of dust binding agents. It is understood that dust-a-side is not considered to be harmful to the environment and will not contribute towards pollution. During the application of the dust-a-side, Tshipi needs to ensure that the dust-a-side is limited to the road surface only.
			What angles are you going to use for the stockpiles? What is the acceptable angle according to the law or best practise and how far will they be from the fence?	During a meeting with the DMR it was confirmed that 18 to 26 degrees would be acceptable. James Manis indicated that the distance between the side slope and the fence would be 30 metres. The EIR will contain detail on the slope angles of the WRDs.
			What storm water infrastructure will be constructed around the WRD to prevent contaminated runoff running onto my land?	In terms of the legal requirements the storm water runoff from the WRD must be contained. This report includes detail on how water will be managed at the WRDs – refer to Section 3.2.2.7. In this respect contaminated water will be contained in compliance with Regulation 704 requirements.
			In terms of groundwater, I have two boreholes that lie next to the substation and farmhouse on the remainder of the farm	The proposed project will not require further dewatering activities. As such the dewatering impacts assessed in the 2017 EMPr remain valid.

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
			Mamatwan 331. The two boreholes have dried up and deliver no water. I would like to know what will happen in future and whether the mine will supply us with water?	The dewatering modelling showed that your borehole could experience a drop in water levels of 4 to 7 metres. The Tshipi EMPr includes a commitment to monitor third party boreholes and if borehole users experience any mine related water loss, Tshipi will, in conjunction with other mines in the area that are contributors to the cumulative impact, provide compensation, which could include an alternative water supply of equivalent water quality and quantity as per the approved EMPr. James Manis from Tshipi confirmed at the meeting that there is a commitment in the approved EMP (SLR, October 2017) in terms of water provision to provide water if it is proven that the mine has compromised water supply to third parties, and that commitment will be carried across into this EMPr.
			I am concerned about the changing rainfall patterns. There seems to be a sharp decline of rainfall on my land surrounding the mine, could the change in the local topography by the pit and WRDs and wind patterns have anything to do with this?	Input has been obtained from Airshed Planning Professionals as follows: Most of the rain over the three years (2015 – 2017) was received during the months of January and February 2017. In total, 2016 had the highest rainfall at Kuruman over the three years. Rainfall is not likely to be significantly influences by local topographical changes and is more likely the result of climate change. The Water Research Commission (WRC) is investigating the changes in extreme rainfall in the medium term (2040 – 2060)

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
				and the synoptic drivers of this change in the long term (2070 – 2099). An initial assessment indicates drier than normal conditions projected over much of southern Africa alongside increased possibility of extreme rainfall. (http://www.csag.uct.ac.za/projected-changes-in-extreme-rainfall-over-south-africa/)
OTHER INTERESTED AND AFFECTED PARTIES				
L Mathonsi Acting Depot Manager, Transnet, Kimberley	6 September 2017, letter.	X	This office has no objection to the proposal. Transnet and its OD's are not affected as the site lies approximately 2,4 km south-east from the closest development (diesel farm). Technically speaking, from a Civil point of view, we foresee no objections to the proposal. Transnet Freight Rail would however, like the opportunity to re-evaluate our position with regards to this proposal once final plans have been prepared.	Your comment is noted. This report provides more detailed information about the proposed project in Section 3 and you will be given the opportunity to review this report.
Sepalamelo Masthidiso	14 September 2017 at the public scoping meeting.	X	As you have mentioned the involvement of regulatory authorities in your presentation, will you be having another meeting with them?	Yes, a separate meeting was scheduled to take place on 14 September 2017 at 12:00 and all relevant regulatory authorities were invited, however no officials attended this meeting. Meetings were also held with the Department of Mineral Resources (DMR) prior to the commencement of the project (pre-application meetings).

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
			How will the backfilling process take place? Will Tshipi haul some waste rock from the existing waste rock dump?	Concurrent backfilling takes place as the pit is developed. At the time of this public meeting, Tshipi was considering partial backfill instead of complete backfill of the pit. However Tshipi has subsequently reconsidered its immediate mine development requirements and due to changed priorities it will not at this stage apply for a change in the mine backfill/closure objectives. Therefore, at this stage waste rock from the remaining WRDs will be placed in the final pit void during closure, although some waste rock may remain on surface in perpetuity. In accordance with Tshipi's EMPr, closure objectives (including pit backfilling) are constantly being assessed throughout the life of the mine as driven by changes in the mining plan, laws and related circumstances.
			Will SLR be involved in implementing the proposed project (i.e. construction) or will they just do the environmental assessment?	SLR is an independent environmental consulting firm and will not be involved in implementing the proposed project. James Manis confirmed that by law, Tshipi requires the services of an independent company to transparently report on any project related-environmental issues to the public.
		X	Following my previous question, will any procurement opportunities be presented?	James Manis confirmed that the procurement process will solely be handled by the mine, depending on whether it receives authorisation for the project.
			Will there be a second round of public participation before the submission of the	The public participation process will continue during the EIA phase. As such all I&APs will continue to be

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
			final EIA?	informed about the project and have the opportunity to review the reports and provide input at any stage in the EIA process.
Lennox Ka Tong	14 September 2017 at the public scoping meeting.	X	Will Tshipi advertise during the implementation phase of this project?	SLR will not be involved in advertising any tenders or contracts for the project. Tshipi will follow normal procurement and employment procedures during the implementation phase.
Erol Tshelang Motlhatlhedi	3 June 2018 via email	X	I have a small construction company based here in Kathu. My view to this project is that with projects like these it is highly important as this will benefit the unemployed in our region as there is a lot of unemployment here. At least few men and women will get the opportunity for permanent and temporary jobs and this is the best breaking news also to us local business as we also can have opportunity to make business. My company is Termo Construction (Pty) Ltd, my business is general building construction and supply of goods and materials.	Your comment is noted.
Hendrik Petrus Venter	2 September 2017 via email	X	We find your proposed project to be in order.	Your comment is noted.
Albertus Viljoen CEO - Tshiping WUA	Via email 26 June 2018	X	The report mentions that a WULA was not submitted to DWS. Please advise on the current situation of such application.	The WULA has not been submitted to DWS as yet. However the WULA process has commenced with the placement of the site notices and adverts, and consultation with the DWS.
REGULATORY AUTHORITIES				

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
Natasha Higgit South African Heritage Resources Agency (SAHRA)	Via email 5 June 2018	X	Thank you for notifying SAHRA of the proposed development. Please note that all development applications are processed via our online portal, the South African Heritage Resources Information System (SAHRIS) found at the following link: http://sahra.org.za/sahris/. Please create an application on SAHRIS and upload all documents pertaining to the Environmental Authorisation Application Process. As per section 38(8) of the National Heritage Resources Act, Act 25 of 1999 (NHRA), an assessment of heritage resources must form part of the process and the assessment must comply with section 38(3) of the NHRA. Once all documents including all appendices are uploaded to the case application, please ensure that the status of the case is changed from DRAFT to SUBMITTED. Please ensure that all documents produced as part of the EA process are submitted as part of the application, and are submitted to SAHRA at the beginning of the Public Review periods. Once all these documents have been uploaded, I will be able to issue an informed comment as per section 38(4) and 38(8) of	An application has been created on SAHRIS as requested. A heritage specialist study was conducted as part of the EIA and complies with the relevant legal requirements (report provided in APPENDIX I). The Scoping Report, EIAR /EMPr along with relevant specialist reports have been uploaded onto SAHRIS as these become available for review.

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
			the NHRA.	
	Via SAHRIS site 12 July 2018 Comment on Scoping Report	X	Thank you for notifying SAHRA of the Environmental Authorisation (EA) for the proposed Tshipi Borwa Waste Rock Dump Extension Project, near Hotazel, Northern Cape Province. As the proposed development is undergoing an EA Application process in terms of the National Environmental Management Act, 107 of 1998 (NEMA), NEMA Environmental Impact Assessment (EIA) Regulations for activities that trigger the Mineral and Petroleum Resources Development Act, No 28 of 2002 (MPRDA)(As amended), it is incumbent on the developer to ensure that a Heritage Impact Assessment (HIA) is done as per section 38(3) and 38(8) of the National Heritage Resources Act, Act 25 of 1999 (NHRA). This must include an archaeological component, palaeontological component and any other applicable heritage components. The HIA must be conducted as part of the EA Application in terms of NEMA and the NEMA EIA Regulations. A draft Scoping Report has been submitted and the report states that the HIA will be	The final Scoping Report, Draft EIA and appendices, including the heritage assessment and the required palaeontological assessment, will be submitted to the SAHRIS Case application.

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
			done as part of the EIA phase of the EA applications. We await the draft EIA phase and HIA. The quickest process to follow for the archaeological component of the HIA, would be to contract a specialist (see www.asapa.org.za or www.aphp.org.za to provide an Archaeological Impact Assessment (AIA). The AIA must comply with the SAHRA 2007 Minimum Standards: Archaeological and Palaeontological Component of Impact Assessments. Should the project be highly disturbed, the archaeologist may draft a Letter of Recommendation for Exemption for further studies to be completed. The proposed expansion area is located within an area of moderate sensitivity in terms of palaeontological resources. An assessment of the impact of the development on palaeontological resources is required to be completed by a qualified palaeontologist. The report must comply with the SAHRA 2012 Minimum Standards: Palaeontological Component of Heritage Impact Assessments (see	

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
			www.palaeontologicalsociety.co.za for qualified palaeontologists). Should the project be highly disturbed, the palaeontologist may draft a Letter of Recommendation for Exemption for further studies to be completed. Any other heritage resources as defined in section 3 of the NHRA that may be impacted, such as maritime archaeology, built structures over 60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or views capes must also be assessed. The Final Scoping Report, Draft EIA and appendices must be submitted to the SAHRIS Case application so that an informed comment can be issued.	
Jacoline Mans – Chief Forester – Department of Agriculture Forestry and Fisheries	Via email 16 July 2018 Comment on Scoping Report	X	1. The proposed East waste rock dump (WRD) extension area is approximately 13 ha and the proposed West WRD extension area is approximately 142 ha (including access roads), thus a total anticipated footprint of approximately 155 ha in Kathu Bushveld vegetation type. The draft Scoping Report confirmed	Your comment is noted. It should be noted that only the habitat in West WRD extension area was considered to be in good condition by the biodiversity specialist. The clearing of vegetation will result in the loss of approximately 4 365 Grey Camel Thorn trees and approximately 1 140 Camel Thorn trees as described in Appendix E. As such a permit will need to be obtained prior to removal of

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
			that the habitat is considered to be in a good condition, and is populated by a high number of the protected tree species *Vachellia erioloba* and *Vachellia haematoxylon*. The Department would like to point out that cumulative impacts on protected trees will be assessed and once a certain threshold is exceeded, the DAFF may request a biodiversity offset.	these trees. It is noted that DAFF will cumulatively assess the impacts on protected trees and may require a biodiversity offset in this regard.
		X	2. A Forest Act License NCU 6530516 was granted in 2016, permitting the felling of 1858 *V. erioloba* and 91 *V. haematoxylon* to clear 11.4 ha. The license contained a special condition regarding implementation of a greening project whereby three trees must be planted for every protected tree destroyed under the license. The compliance report was due on 23 May 2018, but is still outstanding. Tshipi Mine should note that the Department will not process any new license applications until the previous license conditions were complied with to the satisfaction of this office and the report submitted.	Your comment is noted. Your correspondence has been submitted to the Tshipi Safety Health and Environmental Manager for his attention and action.
		X	3. The clearing of 11 ha resulted in the loss of almost 2 000 protected trees, therefore clearing of an additional 142 ha may have significant impacts on protected trees. It is important to	Your comment is noted. A specialist biodiversity study has been completed and identified approximately 4 365 Grey Camel Thorn trees and approximately 1 140 Camel Thorn trees within the West WRD extension area (refer to Appendix E).

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
			provide an accurate estimation of number and sizes of protected tree species that will be destroyed in the 155 ha proposed development footprint.	
		X	4. Please note that trees with bird nests may not be damaged or disturbed without a valid Fauna Permit from the provincial Department of Environment and Nature Conservation (DENC) under the Northern Cape Nature Conservation Act, Act 9 of 2009 (NCNCA), if affected.	Your comment is noted. No bird nests were noted during the biodiversity specialist fieldwork, however the relevant fauna permits will be applied for if needed at the time of vegetation clearing.
		X	5. The Draft Scoping Report mentioned the construction of a 2.5 km long 11kv overhead powerline along the Portion 8 boundary onto the existing mining right area, with 22 m wide servitude. Page 19 of the report stated that “this strip will be cleared of all trees and bushes…” Kindly note the DAFF has specific guidelines for clearing of protected trees under powerlines. The guidelines were developed in consultation with Eskom and only permits clearing of protected trees directly under and up to 4 meters away on either sides of the outer lines. The whole servitude of 22 meters may not be cleared of protected trees.	Your comment is noted and this management measure has been included in the management measures in this report (refer to Section 27).
		X	6. The proposed development footprint must be overlaid on the Northern Cape Critical Biodiversity Area (CBA) map and	Your comment is noted. The required map is provided in Figure 6-10, which shows that the Tshipi

I&AP DETAILS	DATE AND MODE OF COMMUNICATION		ISSUE RAISED	RESPONSE (as amended for the purposes of the Scoping Report)
			the map must be supplied to the DAFF and DENC. Impacts on Critical Biodiversity Areas and Ecological Support Areas must be avoided.	Borwa Mine does not fall within any CBA areas.
		X	7. The report mentioned a number of provincially protected plant species present on site. Some can be rescued and relocated under a Flora Permit, for example *Boophone disticha.* Therefore, prior to disturbance of plant species a suitable qualified botanist must do a search and rescue of plants of conservation concern and where possible relocate such plant.	Your comment is noted and this management measure has been included in the management measures in this report (refer to Section 27).
		X	8. If a specialist fauna and flora impact assessment is conducted as part of the EIR, please forward a copy thereof to the Forestry Office in Upington.	A copy of the report will be submitted as requested.

6.4 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PROJECT AND ALTERNATIVES

An understanding of the environmental and social context and sensitivity within which the proposed project activities are being located is important to understanding the potential impacts. This section provides a description of the attributes of the biophysical and socio-economic receiving environment of the project area.

6.4.1 BASELINE ENVIRONMENT AFFECTED BY THE PROPOSED ACTIVITY

6.4.1.1 Geology

INTRODUCTION AND LINK TO IMPACT

Geology and associated structural features provide a basis from which to understand:

- The potential for sterilisation of mineral reserves;
- The geochemistry and related potential for the pollution of water from mineralised waste facilities and stockpiles (tailings dam and waste rock dumps); and
- The potential for geological lineaments such as faults and dykes. Faults, dykes and other lineaments can act as preferential flow paths of groundwater, which can influence both the dispersion of potential pollution plumes and the inflow of water into mine workings.

Geological processes also influence soils forms (see Section 6.4.1.4) and the potential for palaeontological resources (see Section 6.4.1.13).

DATA SOURCES

Information in this section was sourced from the groundwater study undertaken for this EIA (see Appendix G), the 2017 groundwater study (SLR, 2017c) and the previous geochemical analysis (SLR, 2014).

A geochemical analysis (SLR, 2014) was undertaken to determine the potential for acid mine drainage and the potential leachate from mineralised waste (waste rock and tailings) and ore that is stockpiled on surface at the Tshipi Borwa Mine. Samples of different lithologies were taken from the open pit for the geochemical analysis of waste rock material. Tailings material is currently not generated at the mine and as such a tailings sample was generated at the laboratory at the mine. Although the proposed activities do not relate to tailings generation or disposal, the results are included for the purpose of completeness.

DESCRIPTION

<u>Regional geology</u>

The world's largest land based sedimentary manganese deposit is contained in the Kalahari Manganese Field, situated 47 km north-west of Kuruman in the Northern Cape. The general stratigraphic column of the Kalahari Manganese Field is included Table 6-4 below (SLR, 2017c). The Kalahari Manganese Field comprises five erosional, or structurally preserved, relics of the manganese bearing Hotazel Formation of the Paleoproterozoic Transvaal Supergroup. These include the Mamatwan-Wessels deposit (also known as the main Kalahari Basin), the Avontuur and Leinster deposits, and the Hotazel and Langdon Annex/Devon deposits. The Tshipi Borwa Mine is located in the Hotazel Formation (Transvaal Supergroup) towards the southern end of the Kalahari Basin (Metago, 2009). The Hotazel Formation typically consists of repeated thin layers of black iron oxides (magnetite or hematite) alternating with bands of iron-poor shales and cherts – the so called banded iron formations.

TABLE 6-4: GENERAL STRATIGRAPHIC COLUMN FOR THE KALAHARI MANGANESE FIELD (SLR, 2017C)

<table>
<tr><th colspan="4">Supergroup / Group / Subgroup / Formation</th><th>Geological Description</th></tr>
<tr><td colspan="4">Kalahari Group</td><td>Kalahari sands, calcrete, clays & gravel beds</td></tr>
<tr><td colspan="5">Kalahari unconformity</td></tr>
<tr><td colspan="4">Karoo Supergroup</td><td>Dwyka tillite</td></tr>
<tr><td colspan="5">Dwyka unconformity</td></tr>
<tr><td colspan="3" rowspan="2">Olifantshoek Supergroup</td><td>Lucknow Formation</td><td>White ortho-quartzite</td></tr>
<tr><td>Mapedi Formation</td><td>Green, maroon and black shales and quartzites</td></tr>
<tr><td colspan="5">Olifantshoek unconformity</td></tr>
<tr><td rowspan="9">Transvaal Supergroup</td><td rowspan="9">Postmansburg Group</td><td rowspan="8">Voelwater Subgroup</td><td>Mooidraai Formation</td><td>Dolomite, Chert</td></tr>
<tr><td rowspan="7">Hotazel Formation</td><td>Banded ironstone (upper)</td></tr>
<tr><td>Upper Manganese Ore Body</td></tr>
<tr><td>Banded Ironstone (middle)</td></tr>
<tr><td>Middle Manganese Ore Body</td></tr>
<tr><td>Banded Ironstone (middle)</td></tr>
<tr><td>Lower Manganese Ore Body</td></tr>
<tr><td>Banded Ironstone (lower)</td></tr>
<tr><td colspan="2">Ongeluk Formation</td><td>Andesitic Lava</td></tr>
</table>

Local and operational geology

The Hotazel Formation is underlain by basaltic lava of the Ongeluk Formation (Transvaal Supergroup) and directly overlain by dolomite of the Mooidraai Formation (Transvaal Supergroup) as shown in Table 6-4 (SLR, 2017c).

The Transvaal Supergroup is overlain unconformably by the Olifantshoek Supergroup, which consists of arenaceous sediments, typically interbedded shale, quartzite and lavas overlain by coarser quartzite and shale. The different formations at the Tshipi Borwa Mine include the Mapedi and Lucknow units. The whole Supergroup has been deformed into a succession with an east-verging dip.

The Olifantshoek Supergroup is overlain by Dwyka Formation, which forms the basal part of the Karoo Supergroup. At the Tshipi Borwa Mine this consists of tillite (diamictite), which is covered by sands, claystone and calcrete of the Kalahari Group (SLR, 2017c).

Tshipi is exploiting the manganese from the banded iron stones of the Hotazel Formation. The ore is contained within a 30 to 45 m thick mineralised zone which occurs along the entire Tshipi Borwa Mine and is made up of three manganese rich zones; the Upper Manganese Ore Body (UMO), the Middle Manganese Ore Body (MMO) and the Lower Manganese Ore Body (LMO) (see Table 6-4). The UMO is 10 cm to 15 cm thick and comprises moderate deposits of manganese. The poorly mineralised MMO is approximately 1 m thick and not economically viable. The LMO is highly mineralised and makes up the bulk of the ore body. The ore layer dips gradually to the north-west at approximately five degrees (SLR, 2017c).

Faults and dykes

No significant faults, fractures or other lineaments have been identified on site (Metago, 2009).

Geochemistry analysis – Acid base accounting (ABA)

Acid base accounting (ABA) is undertaken to determine the potential for mined material to generate acid mine drainage. A total of 23 samples were analysed to determine if waste rock, ore and tailings are likely to generate acid mine drainage; the results of which are presented in Table 6-5 below.

The ABA results show that the total sulphur content and more importantly the sulphide sulphur content of all samples are below the laboratory detection limit of <0.01% which suggests the potential to generated acid is negligible for waste rock, ore and tailings. In addition, the neutralising potential ratio (NPR) of all samples is above 2, with some significantly above 2, which implies all lithologies have sufficient neutralising potential to offset the low acid potential. This is interpreted to be due to carbonate minerals, as suggested by the generally high inorganic carbon in the samples and the carbonate-rich geology (calcretes, dolomites, etc.) (SLR, 2014).

Geochemistry analysis – leachate

Synthetic Precipitation Leaching Procedure (SPLP) was used to determine the potential drainage quality from the sampled lithologies at the Tshipi Borwa Mine at neutral (pH7) drainage conditions. A total of 23 samples were analysed; the results of which are provided in Table 6-6 below.

The results indicated that a number of metals are leachable at concentrations in excess of relevant water quality standards for waste rock, ore and tailing. These include:

- Aluminium (Al) in terms of the SANS 241 (2105) Operational standards for waste rock
- Arsenic (As) in terms of the World Health Organisation (WHO) standard for Drinking Water (2011) for ore and waste rock
- Barium (Ba) in terms of the WHO standard for Drinking Water (2011) for waste rock
- Cadmium (Cd) in terms of the WHO standard for Drinking Water (2011) for waste rock, ore and tailings
- Iron (Fe) in terms of the SANS 241 (2015) Aesthetic standards for ore
- Manganese (Mn) in terms of the SANS 241 (2015) Aesthetic standards for ore and waste rock
- Lead (Pb) in terms of the WHO standard for Drinking Water (2011) for ore, tailings and waste rock
- pH in terms of IFC Mining Effluent (2007) for waste rock
- Electrical conductivity in terms of SANS 241 (2015) Aesthetic for tailings
- Nitrate (N) in terms of the WHO standard for Drinking Water (2011) for waste rock.

TABLE 6-5: ACID BASE ACCOUNTING RESULTS FOR THE TSHIPI BORWA MINE (SLR, 2014)

Sample ID	Lab ID	Lithology	Elevation (mamsl)	Location	Paste pH	Acid Potential (AP) (kg/t)	Neutralization Potential (NP)	Nett Neutralization Potential (NNP)	Neutralising Potential Ratio (NPR) (NP : AP)	NAG pH: (H_2O_2)	NAG (kg H_2SO_4 / t)	Total Sulphur (%)	Sulphate Sulphur as S (%)	Sulphide Sulphur (%)	Total Carbon (%)	Organic Carbon (%)	Inorganic Carbon (%)
SLR-TB-01	**11220**	Braunie Lutite	1021.922	East Side	8	0.313	280	280	897	8.4	<0.01	<0.01	<0.01	<0.01	5.6	0.172	5.428
SLR-TB-02	**11221**	Upper BIF	1020.801	East Side	8.5	0.313	66	66	213	8.3	<0.01	<0.01	<0.01	<0.01	0.86	0.208	0.652
SLR-TB-03	**11222**	Lower BIF	1018.252	East Side	8.4	0.313	13	13	41	8.8	<0.01	<0.01	<0.01	<0.01	0.148	0.13	0.018
SLR-TB-04	**11223**	Lower BIF - red in colour	1018.919	East Side	8.4	0.313	130	130	417	8.5	<0.01	<0.01	<0.01	<0.01	4.09	0.202	3.888
SLR-TB-05	**11224**	VW Ore Zone	1015.028	East Side	8.6	0.313	167	167	535	8.4	<0.01	<0.01	<0.01	<0.01	6.7	0.17	6.53
SLR-TB-06	**11225**	Top Cut Ore	1013.186	East Side	8.8	0.313	146	145	466	8.4	<0.01	<0.01	<0.01	<0.01	6.91	0.118	6.792
SLR-TB-07	**11226**	Lower Ore body	1010.049	East Side	8.5	0.313	122	121	389	8.4	<0.01	<0.01	<0.01	<0.01	7.33	0.231	7.099
SLR-TB-08	**11227**	Pebble bed in calcareous clay	1026.990	North Side	8.3	0.313	4.26	3.95	14	8.2	<0.01	<0.01	<0.01	<0.01	0.07	0.069	0.001
SLR-TB-09	**11228**	Pebble bed in red calcareous clay	1030.217	North Side	8.5	0.313	323	323	1034	8.3	<0.01	<0.01	<0.01	<0.01	7.8	0.258	7.542
SLR-TB-10	**11229**	Red clay	1031.184	North Side	8.2	0.313	51	51	163	8.8	<0.01	<0.01	<0.01	<0.01	3.34	0.257	3.083
SLR-TB-11	**11230**	Lower BIF	1012.341	North Side	8.7	0.313	100	100	322	8.5	<0.01	<0.01	<0.01	<0.01	3.38	0.119	3.261
SLR-TB-12	**11231**	Red clay	1030.098	South Side	8.2	0.313	74	73	236	8.8	<0.01	<0.01	<0.01	<0.01	1.28	0.247	1.033
SLR-TB-13	**11232**	White Clay	1052.157	South Side	8.1	0.313	5	4.69	16	7.7	<0.01	<0.01	<0.01	<0.01	0.335	0.331	0.004
SLR-TB-14	**11233**	White gravel bed	1054.877	South Side	8.6	0.313	5.75	5.43	18	7.8	<0.01	<0.01	<0.01	<0.01	0.278	0.273	0.005
SLR-TB-15	**11234**	Red Iron Calcareous Sand	1066.225	South Side	8.3	0.313	110	109	351	8.5	<0.01	<0.01	<0.01	<0.01	2.5	0.361	2.139
SLR-TB-16	**11235**	Pebbly Calcrete	1067.984	South Side	8.5	0.313	79	79	254	8.4	<0.01	<0.01	<0.01	<0.01	2.01	0.203	1.807
SLR-TB-17	**11236**	Iron rich Ccalcareous Sands	1067.131	South Side	8.4	0.313	106	106	339	8.5	<0.01	<0.01	<0.01	<0.01	2.76	0.272	2.488
SLR-TB-18	**11237**	Pebbly Calcrete	1072.483	South Side	8.5	0.313	106	105	338	8.5	<0.01	<0.01	<0.01	<0.01	5.41	0.275	5.135
SLR-TB-19	**11238**	Red Kalahari Sands	1088.848	East Side	8.1	0.313	2.73	2.41	8.72	7.7	<0.01	<0.01	<0.01	<0.01	0.26	0.255	0.005
SLR-TB-20	**11239**	Calcrete	1081.302	East Side	8.5	0.313	146	146	467	8.5	<0.01	<0.01	<0.01	<0.01	4.48	0.356	4.124
SLR-TB-21	**11240**	Pebbly Calcrete	1075.395	-	8.7	0.313	113	113	361	8.3	<0.01	<0.01	<0.01	<0.01	3.32	0.314	3.006
SLR-TB-22	**11241**	Tailings Sample	-	-	8.4	0.313	101	100	322	8.4	<0.01	<0.01	<0.01	<0.01	11.5	0.203	11.3
SLR-TB-23	**11242**	Dolomite	998.00	-	8.7	0.313	115	114	367	8.4	<0.01	<0.01	<0.01	<0.01	11.48	0.148	11.33

TABLE 6-6: LEACHATE RESULTS FOR SAMPLES COLLECTED AT THE TSHIPI BORWA MINE (SLR, 2014)

Lithology	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
WHO Standard for Drinking Water (2011)	**N/A**	**N/A**	**0.01**	**2.4**	**0.7**	**N/A**	**N/A**	**N/A**	**0.003**	**N/A**	**0.05**	**2**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.07**
IFC Mining Effluent (2007)	**N/A**	**N/A**	**0.1**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.05**	**N/A**	**0.1**	**0.3**	**2**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.5**
SANS 241 (2015) Operational	**N/A**	**0.3**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
SANS 241 (2015) Aesthetic	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.3**	**N/A**	**N/A**	**N/A**	**0.1**	**N/A**	**200**	**N/A**
SANS 241 (2015) Acute Heath	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
SANS 241 (2015) Chronic Health	**N/A**	**N/A**	**0.01**	**2.4**	**0.7**	**N/A**	**N/A**	**N/A**	**0.003**	**0.5**	**0.05**	**2**	**2**	**N/A**	**N/A**	**N/A**	**0.4**	**N/A**	**N/A**	**0.07**
Braunie Lutite	<0.025	<0.100	<0.010	0.04	<0.025	<0.025	<0.025	14	0.005	<0.025	<0.025	<0.025	<0.025	1.1	<0.025	10	<0.025	<0.025	13	<0.025
Upper BIF	<0.025	<0.100	0.01	<0.025	<0.025	<0.025	<0.025	12	0.005	<0.025	<0.025	<0.025	0.031	<1.0	<0.025	6	<0.025	<0.025	3	<0.025
Lower BIF	<0.025	<0.100	<0.010	0.06	0.072	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	0.478	<1.0	<0.025	<2	0.128	<0.025	3	<0.025
Lower BIF - red in colour	<0.025	<0.100	<0.010	<0.025	<0.025	<0.025	<0.025	14	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	7	<0.025	<0.025	9	<0.025
VW Ore Zone	<0.025	<0.100	<0.010	0.087	0.079	<0.025	<0.025	9	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	6	<0.025	<0.025	7	<0.025
Top Cut Ore	<0.025	<0.100	<0.010	0.05	<0.025	<0.025	<0.025	9	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	8	0.119	<0.025	<2	<0.025
Lower Ore body	<0.025	<0.100	<0.010	0.102	<0.025	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	8	0.09	<0.025	3	<0.025
Pebble bed in calcareous clay	<0.025	<0.100	<0.010	0.082	0.105	<0.025	<0.025	6	0.005	<0.025	<0.025	<0.025	<0.025	1.3	<0.025	4	<0.025	<0.025	10	<0.025
Pebble bed in red calcareous clay	<0.025	<0.100	<0.010	0.074	0.139	<0.025	<0.025	13	0.005	<0.025	<0.025	<0.025	<0.025	1	<0.025	6	<0.025	<0.025	8	<0.025
Red clay	<0.025	<0.100	0.019	0.12	0.134	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	<0.025	1.4	<0.025	6	<0.025	<0.025	14	<0.025
Lower BIF	<0.025	<0.100	0.023	0.074	0.096	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	8	<0.025	<0.025	2	<0.025
Red clay	<0.025	<0.100	<0.010	0.073	<0.025	<0.025	<0.025	11	0.005	<0.025	<0.025	<0.025	0.041	1.3	<0.025	6	<0.025	<0.025	12	<0.025
White Clay	<0.025	<0.100	<0.010	<0.025	<0.025	<0.025	<0.025	5	0.005	<0.025	<0.025	<0.025	0.045	1.8	<0.025	3	<0.025	<0.025	9	<0.025
White gravel bed	<0.025	<0.100	<0.010	0.064	0.173	<0.025	<0.025	7	0.005	<0.025	<0.025	<0.025	0.037	1.3	<0.025	4	<0.025	<0.025	7	<0.025
Red Iron Calcareous Sand	<0.025	<0.100	<0.010	<0.025	<0.025	<0.025	<0.025	11	0.005	<0.025	<0.025	<0.025	0.038	1.6	<0.025	6	<0.025	<0.025	9	<0.025

Lithology	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Pebbly Calcrete	<0.025	<0.100	<0.010	<0.025	0.042	<0.025	<0.025	12	0.005	<0.025	<0.025	<0.025	0.069	1.8	<0.025	7	<0.025	<0.025	9	<0.025
Iron rich Calcareous Sands	<0.025	<0.100	0.013	0.146	1.21	<0.025	<0.025	12	0.005	<0.025	<0.025	<0.025	<0.025	1.4	<0.025	6	<0.025	<0.025	14	<0.025
Pebbly Calcrete	<0.025	<0.100	0.012	0.107	1.06	<0.025	<0.025	11	0.005	<0.025	<0.025	<0.025	<0.025	1.3	<0.025	7	<0.025	<0.025	13	<0.025
Red Kalahari Sands	<0.025	1.72	0.022	0.053	0.027	<0.025	<0.025	5	0.005	<0.025	<0.025	<0.025	1.51	4.1	<0.025	3	<0.025	<0.025	2	<0.025
Calcrete	<0.025	<0.100	<0.010	<0.025	<0.025	<0.025	<0.025	14	0.005	<0.025	<0.025	<0.025	<0.025	3	<0.025	8	<0.025	<0.025	42	<0.025
Pebbly Calcrete	<0.025	0.147	<0.010	<0.025	0.028	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	0.196	1.9	<0.025	5	<0.025	<0.025	19	<0.025
Tailings Sample	<0.025	<0.100	<0.010	0.126	<0.025	<0.025	<0.025	21	0.005	<0.025	<0.025	<0.025	<0.025	1.1	<0.025	14	<0.025	<0.025	10	<0.025
Dolomite	<0.025	<0.100	0.014	0.129	1.07	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	17	<0.025	<0.025	4	<0.025

Table 6-6 CONT.

Lithology	P	Pb	Sb	Se	Si	Sn	Sr	Ti	V	W	Zn	Zr	pH Value at 25˚C	Electrical Conductivity	Alkalinity as $CaCO_3$	Chloride as Cl	Sulphate as SO_4	Nitrate as N	Fluoride as F
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	pH Value	mS/m	mg/l	mg/l	mg/l	mg/l	mg/l
WHO Standard for Drinking Water (2011)	N/A	0.01	0.02	0.04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11	1.5
IFC Mining Effluent (2007)	N/A	0.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5	N/A	09-Jun	N/A	N/A	N/A	N/A	N/A	N/A
SANS 241 (2015) Operational	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5 - 9.7	N/A	N/A	N/A	N/A	N/A	N/A
SANS 241 (2015) Aesthetic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5	N/A	N/A	170	N/A	300	250	N/A	N/A
SANS 241 (2015) Acute Heath	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	500	11	N/A
SANS 241 (2015) Chronic Health	N/A	0.01	0.02	0.04	N/A	N/A	N/A	N/A	0.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.5
Braunie Lutite	<0.025	0.02	<0.010	<0.020	6	<0.025	0.029	<0.025	<0.025	<0.025	<0.025	<0.025	10.1	21.1	12	12	7	2	0.3
Upper BIF	<0.025	0.02	<0.010	<0.020	17.2	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	8	11.7	16	<5	<5	<0.2	0.2
Lower BIF	<0.025	0.02	<0.010	<0.020	15.4	<0.025	<0.025	<0.025	<0.025	<0.025	0.098	<0.025	7.9	7.7	12	<5	<5	<0.2	0.2
Lower BIF - red in colour	<0.025	0.02	<0.010	<0.020	6.6	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	8.1	17.1	20	<5	5	1	0.3
VW Ore Zone	<0.025	0.02	<0.010	<0.020	3.1	<0.025	<0.025	<0.025	<0.025	<0.025	0.07	<0.025	8.1	12.7	60	<5	<5	0.3	0.5
Top Cut Ore	<0.025	0.02	<0.010	<0.020	<0.2	<0.025	0.026	<0.025	<0.025	<0.025	<0.025	<0.025	8.2	11.8	64	<5	<5	<0.2	0.2
Lower Ore body	<0.025	0.02	<0.010	<0.020	<0.2	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	8.1	12.5	60	<5	<5	<0.2	0.2
Pebble bed in calcareous clay	<0.025	0.02	<0.010	<0.020	4.7	<0.025	0.042	<0.025	<0.025	<0.025	0.102	<0.025	7.9	11.7	52	<5	<5	<0.2	0.5
Pebble bed in red calcareous clay	<0.025	0.02	<0.010	<0.020	3.6	<0.025	0.06	<0.025	<0.025	<0.025	0.06	<0.025	8.4	14.7	64	<5	<5	0.3	0.5
Red clay	0.072	0.02	<0.010	<0.020	1.3	<0.025	0.065	<0.025	<0.025	<0.025	0.061	<0.025	8.2	16.8	80	<5	6	0.4	0.7
Lower BIF	0.124	0.02	<0.010	<0.020	0.7	<0.025	0.026	<0.025	<0.025	<0.025	0.041	<0.025	8.5	13.6	56	<5	<5	<0.2	0.7

Lithology	P	Pb	Sb	Se	Si	Sn	Sr	Ti	V	W	Zn	Zr	pH Value at 25˚C	Electrical Conductivity	Alkalinity as $CaCO_3$	Chloride as Cl	Sulphate as SO_4	Nitrate as N	Fluoride as F
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	pH Value	mS/m	mg/l	mg/l	mg/l	mg/l	mg/l
Red clay	<0.025	0.02	<0.010	<0.020	0.7	<0.025	0.061	<0.025	<0.025	<0.025	<0.025	<0.025	8.1	16.7	68	<5	6	0.5	0.9
White Clay	<0.025	0.02	<0.010	<0.020	10.8	<0.025	0.027	<0.025	0.027	<0.025	<0.025	<0.025	7.8	10.9	32	<5	6	1.6	0.8
White gravel bed	<0.025	0.02	<0.010	<0.020	9	<0.025	0.049	0.042	<0.025	<0.025	0.116	<0.025	7.8	11	52	<5	5	1.2	0.3
Red Iron Calcareous Sand	<0.025	0.02	<0.010	<0.020	19.2	<0.025	0.062	<0.025	0.029	<0.025	<0.025	<0.025	9	15.1	64	<5	<5	2.4	0.5
Pebbly Calcrete	<0.025	0.02	<0.010	<0.020	13.9	<0.025	0.076	<0.025	<0.025	<0.025	<0.025	<0.025	8	12.7	68	5	<5	3.4	0.5
Iron rich Calcareous Sands	<0.025	0.02	<0.010	<0.020	19.9	<0.025	0.083	<0.025	<0.025	<0.025	0.211	<0.025	8.2	15.8	72	<5	<5	2.1	0.6
Pebbly Calcrete	<0.025	0.02	<0.010	<0.020	14.8	<0.025	0.081	<0.025	<0.025	<0.025	0.127	<0.025	8.2	16.3	68	<5	<5	2.8	0.5
Red Kalahari Sands	0.207	0.02	<0.010	<0.020	21	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	7.7	6.5	40	<5	11	0.5	0.2
Calcrete	<0.025	0.02	<0.010	<0.020	12.4	<0.025	0.08	<0.025	<0.025	<0.025	<0.025	<0.025	8.1	24.9	60	26	26	18	0.4
Pebbly Calcrete	<0.025	0.02	<0.010	<0.020	11.3	<0.025	0.049	<0.025	<0.025	<0.025	<0.025	<0.025	8.2	24.9	68	6	<5	5.6	0.4
Tailings Sample	<0.025	0.02	<0.010	<0.020	4.1	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	8.3	172	92	<5	33	2	0.4
Dolomite	<0.025	0.02	<0.010	<0.020	<0.2	<0.025	0.03	<0.025	<0.025	<0.025	0.039	<0.025	8.9	0.7	96	<5	<5	<0.2	0.4

CONCLUSION

Where mineralised waste is produced by a project, there is the possibility that sterilisation can occur depending on the project design and placement of infrastructure. Geochemical tests and analysis indicate that there is a limited possibility for the WRDs to generate acid. Leachate could exceed the SANS guidelines for various parameters for waste rock, and this presents a potential pollution risk for both surface and groundwater in the both the short and long term. It follows that short- and long-term pollution prevention measures must be considered with respect to the establishment of the proposed WRD extensions.

6.4.1.2 Topography

INTRODUCTION AND LINK TO IMPACT

The establishment of the proposed WRD extensions will alter the natural topography of the project area. This in turn may impact on surface water drainage (discussed in Section 6.4.1.7) and visual aspects (discussed in Section 6.4.1.11).

DATA SOURCES

Information in this section was sourced from site visits undertaken by the project team and topographical data.

DESCRIPTION

In general the area surrounding the Tshipi Borwa Mine is relatively flat with a gentle slope towards the north-west. The elevation varies from 1 087 m to 1 107 m above mean sea level (mamsl). The Vlermuisleegte River is located approximately 1 km west from the boundary of Portion 8 of the Farm Mamatwan 331. The natural topography of the area surrounding the Tshipi Borwa Mine has been influenced largely through mining activities such as the Mamatwan Mine, the old Middelplaats Mine and the United Manganese of Kalahari Mine (see Section 6.4.2 for further information). The highest topographical features near the Tshipi Borwa Mine are the Mamatwan waste rock dumps located adjacent to the eastern boundary of the Tshipi Borwa Mine (see Figure 0-2).

The majority of the natural topography at the Tshipi Borwa Mine has been disturbed as a result of the existing mining infrastructure and activities. The topography of the undisturbed areas of Portion 8 of Farm Mamatwan 331 is relatively flat with a slight north-west slope towards the Vlermuisleegte River (see Figure 0-2).

CONCLUSION

While the topography of the Tshipi Borwa Mine has been altered by mining and associated infrastructure, the establishment of the proposed WRD extension has the potential to alter the topography and the natural state of undisturbed areas.

6.4.1.3 Climate

INTRODUCTION AND LINK TO IMPACT

Climate can influence the potential for environmental impacts and related mine design. Specific issues include:

- Rainfall could influence erosion, evaporation, vegetation growth, rehabilitation planning, dust suppression and surface water management planning;
- Temperature could influence air dispersion through impacts on atmospheric stability and mixing layers, vegetation growth, and evaporation which could influence rehabilitation planning; and
- Wind could influence erosion, the dispersion of potential atmospheric pollutants and rehabilitation planning.

DATA SOURCES

Information in this section was sourced from a review of available literature undertaken for nearby mining operations (Airshed, 2009), a review of the approved EMPr amendment (SLR, 2017d; Airshed, 2017), the storm water management plan prepared for the 2017 EMPr amendment project (SLR, 2017a) and the air quality specialist study undertaken for this EIA (see Appendix J)

DESCRIPTION

Regional climate

The project area falls within the Northern Steppe Climatic Zone, as defined by the South African Weather Bureau (Metago, 2009). This is a semi-arid region characterised by seasonal rainfall, hot temperatures in summer, and colder temperatures in winter (SLR, 2017a).

Rainfall, rainfall depths and evaporation

Monthly rainfall and evaporation data for the Milner weather station (approximately 7 km to the east of the Tshipi Borwa Mine) is summarised in Table 6-7 below (SLR, 2017a). Rainfall depth frequency data is summarised in Table 6-8 below.

With reference to Table 6-7 below, the average rainfall at the Milner weather station is 372 mm per annum. Given that the Milner weather station is only 7 km from the project area, similar rainfall levels can be expected at the mine. The average evaporation rates recorded at the Milner weather station are 2 351 mm per annum for S-Pan and 1 972 mm per annum for open water (see Table 6-7).

TABLE 6-7: SUMMARY OF AVERAGE MONTHLY AND ANNUAL RAINFALL AND EVAPORATION DATA (SLR, 2017A)

Month	Rainfall (mm)	WR2005	WR2005
	Milner (393083 W)	S-Pan Evaporation	Open Water Evaporation
January	59.8	276.9	232.6
February	63.0	209.9	184.8
March	72.3	193.3	170.1
April	39.9	144.1	126.8
May	19.2	114.7	99.8
June	9.1	91.0	77.3

Month	Rainfall (mm)	WR2005	WR2005
	Milner (393083 W)	S-Pan Evaporation	Open Water Evaporation
July	1.3	106.0	88.0
August	5.4	153.8	124.5
September	6.4	213.0	172.5
October	19.2	269.7	218.4
November	31.5	248.0	232.9
December	44.5	294.6	244.5
Annual	**372.0**	**2351.0**	**1972.0**

TABLE 6-8: RAINFALL DEPTH FREQUENCY (SLR, 2017A)

Storm Duration (m/h/d)	Return Period (years)						
	2	5	10	20	50	100	200
15 m	15.0	21.3	25.7	30.2	36.3	41.2	46.2
30 m	19.8	28.1	34.0	40.0	48.0	54.4	61.1
45 m	23.3	33.1	40.1	47.1	56.6	64.1	71.9
1 hr	26.1	37.2	45.0	52.8	63.5	72.0	80.7
1.5 hr	30.8	43.8	53.0	62.2	74.8	84.7	95.1
2 hr	34.6	49.2	59.5	69.9	84.0	95.2	106.8
4 hr	40.0	56.9	68.8	80.7	97.0	110.0	123.4
6 hr	43.5	61.9	74.9	87.9	105.6	119.7	134.3
8 hr	46.2	65.7	79.5	93.3	112.1	127.1	142.6
10 hr	48.4	68.8	83.3	97.8	117.5	133.1	149.4
12 hr	50.3	71.5	86.5	101.5	122.0	138.3	155.2
16 hr	53.4	75.9	91.9	107.8	129.6	146.9	164.8
20 hr	55.9	79.6	96.2	113.0	135.8	153.9	172.6
24 hr	58.1	82.6	100.0	117.3	141.0	159.8	179.3
1 d	46.7	66.5	80.5	94.5	113.5	128.6	144.3
2 d	56.8	80.8	97.7	114.7	137.9	156.2	175.3
3 d	63.6	90.5	109.5	128.5	154.4	175.0	196.3
4 d	68.2	97.1	117.4	137.8	165.7	187.7	210.6
5 d	72.0	102.5	124.0	145.5	174.9	198.2	222.4
6 d	75.3	107.2	129.6	152.1	182.9	207.2	232.5
7 d	78.2	111.3	134.6	158.0	189.9	215.1	241.4

Temperature

Monthly mean, maximum and minimum temperatures for the project area are provided in Table 6-9 below. Temperatures range between -0.6 C and 35 C. During the day, temperatures increase to reach a maximum at around 15:00 in the afternoon. Ambient air temperature decreases to reach a minimum at around 06:00 just before sunrise (Airshed, 2009).

TABLE 6-9: MONTHLY TEMPERATURE DATA (AIRSHED, 2009)

Months	Minimum	Maximum	Average
January	15.3	35.0	26.4
February	14.1	34.1	25.8
March	10.1	32.5	24.5
April	4.4	29.9	18.7
May	2.4	26.9	15.4
June	-0.6	22.3	10.8
July	1.0	21.7	11.4
August	0.4	28.3	13.1
September	2.1	27.8	16.8
October	6.7	32.3	20.5
November	8.8	34.7	23.3
December	11.9	35.0	25.2

Wind

The annual average wind roses for the Kuruman Weather Station (located approximately 43 km to the west of Tshipi Borwa Manganese Mine) for the years 2015, 2016 and 2017 are shown in Figure 6-1 with the period average wind field (2015-2017) and diurnal variability in the wind field provided in Figure 6-2. The predominant wind direction is from the south-south-east and south with most of strong winds from the west. Frequent winds also occur from the north. Over the three-year period (2015 – 2017), the frequency of occurrence of south-south-easterly wind was between 12% and 17%, with winds with a westerly component occurring approximately 15% of the time. Winds occur less frequently from the easterly sector (Airshed, 2018).

During the day winds are more frequent from the westerly and the northerly sectors, with the strongest winds directly from the west (see Figure 6-2). The wind shifts during the night-time to dominantly south-south-easterly and southerly winds. Day-time calms occurred for 9% of the time, with night-time calms for 24% of the time (Airshed, 2018).

The prevailing wind field is similar to the data used in the 2009 study (Airshed, 2009), with a slight shift in the overall wind field from south-east and south-south-east (2001-2005 data) to the south-south-east and south (2015-2017). Similarly, the 2001-2005 Kuruman data had more prevalent north-westerly winds with a shift to more westerly winds in the later dataset

According to the Beaufort wind force scale, wind speeds between 6-8 m/s equates to a moderate breeze, with wind speeds between 14-17 m/s near gale force winds. Based on the three years of SAWS data (2015-2017), wind speeds exceeding 6 m/s occurred for only 1% of the time, with a maximum wind speed of 10 m/s. The average wind speed over the three years was 2.06 m/s. Calm conditions (wind speeds < 1 m/s) occurred for 17% of the time (see Figure 6-3). The US EPA indicates a friction velocity of 5.4 m/s to initiate erosion from a coal storage piles (US EPA, 2006). Thus, the likelihood exists for wind erosion to occur from open and exposed surfaces, with loose fine material, when the wind speed exceeds at least 5.4 m/s. Wind speeds exceeding 5.4 m/s occurred only for 2% over the three years (2015 -2017) (Airshed, 2018).

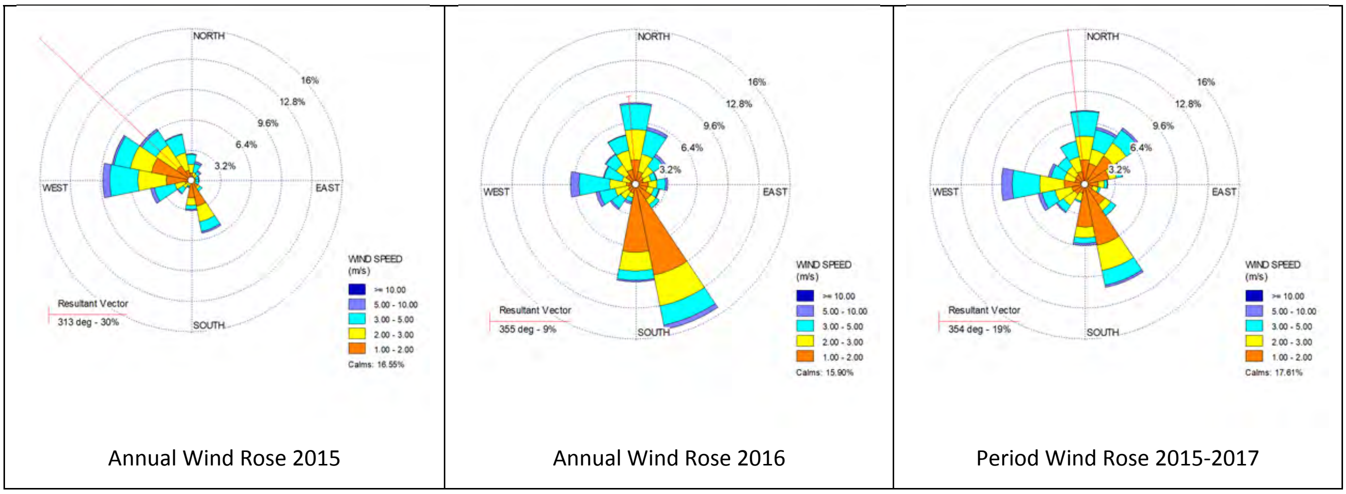


FIGURE 6-1: PERIOD AND ANNUAL WIND ROSES (SAWS KURUMAN DATA; 2015, 2016 AND 2017)

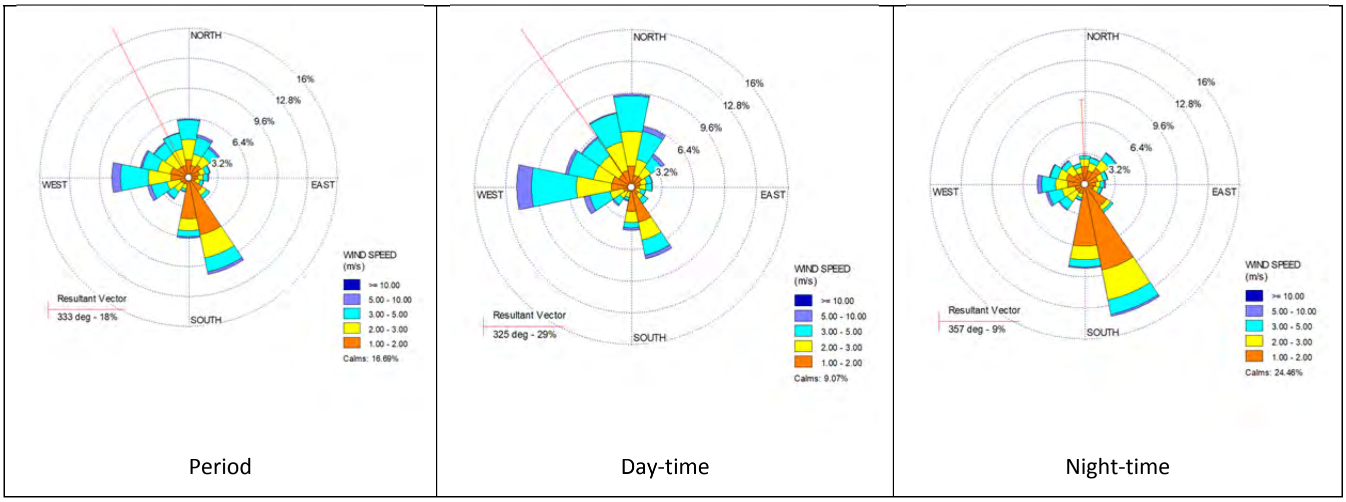


FIGURE 6-2: PERIOD, DAY-TIME AND NIGH-TIME WIND ROSES (SAWS KURUMAN DATA; 2015 TO 2017)

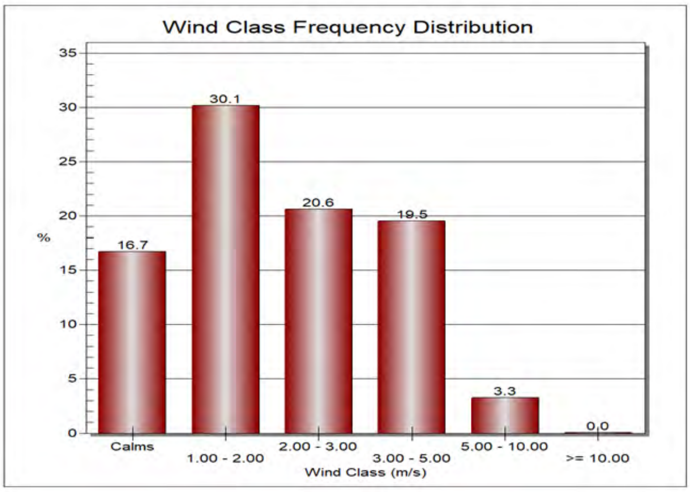


FIGURE 6-3: WIND SPEED CATEGORIES (SAWS KURUMAN DATA; 2015 TO 2017)

Atmospheric Stability

During the daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface and the predominance of an unstable layer. During unstable conditions, ground level pollution is readily dispersed thereby reducing ground level concentrations. Night-times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds and less dilution potential. During windy and/or cloudy conditions, the atmosphere is normally neutral (which causes sound scattering in the presence of mechanical turbulence).

For low level releases, such as activities associated with mining operations, the highest ground level concentrations would occur during weak wind speeds and stable (night-time) atmospheric conditions. However, windblown dust is likely to occur under high winds (neutral conditions).

CONCLUSION

Physical and meteorological mechanisms govern the dispersion, transformation, and eventual removal of pollutants from the atmosphere. The analysis of average meteorological data is necessary to facilitate a comprehensive understanding of the dispersion potential of the site.

The project area is characterised by hot to very hot summers and cool to warm winters with rain generally occurring in the form of localised thunderstorms that last for short periods at a time during rainy periods (October to April). High evaporation rates reduce infiltration, while rainfall events can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does, however, reduce the effects of erosion. The mixing of layers resulting in the formation of temperature inversions, and the presence of cloud cover limits the dispersion of pollutants. Wind significantly affects the amount of material that is suspended from exposed surface and wind speed determines the distance of downward transport as well as the rate of dilution of pollutants in the atmosphere. The likelihood exists for wind erosion to occur from open and exposed surfaces, with loose fine material, when the wind speed exceeds at least 5.4 m/s. These climatic aspects need to be taken into consideration during operations, rehabilitation and surface water management planning.

6.4.1.4 Soil

INTRODUCTION AND LINK TO IMPACT

Soils are a significant component of most ecosystems. As an ecological driver, soil is the medium in which most vegetation grows and a range of vertebrates and invertebrates exist. In the context of mining operations, soil is even more significant if one considers that mining is a temporary land use where after rehabilitation (using soil) is the key to re-establishing post closure land capability that will support post closure land uses.

Mining projects have the potential to damage soil resources through physical loss of soil and/or the contamination of soils, thereby impacting on the soils' ability to sustain natural vegetation and altering land capability. Contamination of soils may in turn contribute to the contamination of surface and groundwater resources. Loss of the topsoil resource reduces chances of successful rehabilitation and restoration.

DATA SOURCES

Information in this section was sourced from the soil, land use and land capability study undertaken for this EIA (see Appendix H).

DESCRIPTION

Land type

The entire study area consists of land type Ah9. The landscape is flat to very slightly undulating with slopes ranging between 0 and 3%. The soil formed from Aeolian sand of Recent age and the riverbeds in the larger area around the project area formed on outcrops of Tertiary Kalahari beds (in most cases limestone layers can be seen where they have been exposed through sediment transport by water and wind). The texture of soil in this land type is dominated by sand with the clay fraction estimated as always less than 10%. Deep Hutton and Clovelly soil forms (deeper than 120 cm) constitutes the largest portion of this land type with very limited possibility for finding shallow, rocky soils of the Mispah and Glenrosa forms over the entire land type area (an estimated 3.5%) (Terra Africa, 2018).

Soil classification

The soil forms identified within the study area are presented in Figure 6-4 and described below.

In situ soil forms

In situ soil forms refer to those soils where horizon organisation has not been disturbed by human activities. Only one group of *in situ soil forms* were identified within the project area, namely Hutton and Clovelly soil forms. The Hutton and Clovelly soil forms consist of an orthic A horizon on either a red apedal B (Hutton) or yellow-brown apedal (Clovelly) horizon overlying unspecified material.

The entire area for the proposed WRD extension consists of the Hutton and Clovelly soil forms, which comprise the following physical characteristics (Terra Africa, 2017):

- The defining red soil colours identified are highly bleached (5YR 5/8), thus borderline red. In situ soil profiles in the other project areas most likely also exhibit red colour ranges, which can be classified as red or yellow-brown. The colour differentiation has no significance to the proposed project, as all other properties are similar and it will not affect soil management and mitigation measures such as topsoil stripping guidelines.
- Soil texture is dominated by the sand fraction and all the samples analysed indicated a sand fraction of 96.9% (see Table 6-10).
- Soil depths of the Hutton profiles surveyed on site are all beyond 150 cm without signs of wetness.
- Soil of the Hutton form is highly suitable for stripping and stockpiling for rehabilitation purposes as it is deep and apedal with no horizon differentiation within the sub-surface and no complex pedohydrological systems of water storage depending on the arrangement of soil horizons.

FIGURE 6-4: SOIL MAP OF THE STUDY AREA (TERRA AFRICA, 2017)

TABLE 6-10: TEXTURE ANALYSIS RESULTS OF IN SITU SOIL PROFILES (HUTTON FORM) IN THE PROJECT AREA (TERRA AFRICA, 2018)

Sample no.	> 2mm	Sand	Silt	Clay
	(%)	(% < 2 mm)		
1	0.2	96.9	1.9	1.3
2	0.0	96.9	1.8	1.3
3	0.1	96.9	1.9	1.3
4	0.0	96.9	1.8	1.3

Anthropogenic soil forms

Anthropogenic soil forms include soils that have undergone physical, chemical and hydrological impacts to the extent that "land use options, as well as performance of vegetation that they support, are strongly and often permanently affected" (Soil Classification Working Group, 2018). The areas already impacted by the mining activities at the Tshipi Borwa Mine fall can be classified as follows (Terra Africa, 2017):

- Witbank Form: This soil form can be subdivided into a number of soil families that includes ex-natural soils covering natural soils (topsoil stockpiles covering the in situ soil profiles in areas that were previously natural veld) and anthropogenic materials covering undisturbed natural soils and anthropogenic materials (in the cause of haul roads and surfaced roads, permitting that there is no soil chemical pollution).
- Industria Form: This soil form was identified in areas where active mining and processing is ongoing. Due to the fact that it is open cast mining (usually associated with adding pollutants, especially heavy metals to the environment), the areas of the open pits and associated infrastructure, has been classified as Industria. These areas are most likely to have a different chemical composition than topsoil that is stockpiled in other areas.

<u>Soil chemical characteristics</u>

The results of the soil chemical analysis from site are presented in Table 6-11. The pH levels of soil in the study area range between 4.74 (strongly acid) and 6.21 (slightly acid). The soil pH levels do not pose a risk to plant growth and will not inhibit rehabilitation success. The phosphorus levels are as low as expected for natural veld conditions in South Africa. At lower pH levels, phosphorus becomes unavailable for uptake by plant roots. The cation levels (calcium, magnesium and potassium) indicate natural low soil fertility in the area as a result of the low cation exchange capacity. The cation complex is dominated by calcium, followed by magnesium and then potassium. Sodium levels are very low and do not pose a risk of causing sodic soils. The organic carbon content is very low and ranges between 0.22 and 0.26% (Terra Africa, 2017).

TABLE 6-11: SOIL CHEMICAL ANALYSIS RESULTS (TERRA AFRICA, 2018)

Sample no.	Ca	Mg	K	Na	P	pH(KCl)	Organic C
	(mg/kg)						%C
1	143.5	36.0	4.5	0.5	1.9	4.58	0.26
2	229.5	29.0	10.0	0.5	2.9	6.18	0.22
3	229.0	38.5	17.5	0.5	2.6	6.21	0.25
4	132.0	33.5	15.5	0.5	1.6	4.74	0.26

Agricultural potential

Dryland agriculture potential

Hutton and Clovelly soils with no restrictions shallower than 50 cm are generally good for dryland crop production (Fey, 2010) permitting that the climate is suitable for crop production, especially rainfall in the absence of the availability of irrigation water. However, since the project area receives an average of 372 mm of rain annually, the soils are very well drained, and the evaporation rate is high, due to high temperatures, commercial crop production would be at high risk of suffering losses as a result of droughts.

Irrigated crop potential

The proposed WRD extension areas do not have any irrigation infrastructure in use. No large dams with irrigation potential have been observed in proximity to the project area. The Hutton and Clovelly soil forms identified on the project area are suitable for irrigated crop production if irrigation water is available. Although the establishment of irrigation infrastructure requires high initial capital investment, the site has potential for this production method should it ever become a future land use possibility.

Grazing potential

The grazing capacity of the veld for the proposed WRD extension areas is 21 to 30 hectares per large animal unit or large stock unit. The area is also suitable for small grazers and browsers such as goats or sheep although the area is most suitable for cattle production. The proposed West WRD extension area, therefore, has a grazing potential for 4 to 7 head of cattle. Although the areas within the boundaries of the existing Mining Right are not being grazed, the areas where the horizon organisation has not been disturbed by human activities together with the proposed West WRD extension has a grazing capacity for 26 to 37 head of cattle.

CONCLUSION

The Hutton and Clovelly soil forms found in the proposed WRD extension areas are homogeneous in terms of texture, structure and soil depth. These soil forms are well-drained sandy soils, which allows for high infiltration rates and low organic content. These soils are therefore highly erodible. The rapid drainage nature of the Hutton and Clovelly soil forms reduces the dryland production potential, as well as the irrigation potential. The soil fertility is low due to a deficiency in key nutrients, such as phosphorus. In general, the soil forms located on the project area are highly suitable for stripping and stockpiling for rehabilitation purposes.

Soil resources at the Tshipi Borwa Mine have already been influenced through existing mining activities and the presence of approved infrastructure. The establishment of and the proposed WRD extensions have the potential to contribute to additional sources of soil pollutants and increase the disturbance footprint. The soils of the project area will require appropriate management actions to prevent the loss of soil resources through pollution and erosion.

6.4.1.5 Land Capability

The project area can be divided into two land capability class, including "grazing" and "wilderness" land capability (see Figure 6-5). The deep soils of the Hutton and Clovelly soil forms has arable land capability and could also be suitable for irrigated crop production. Due to unfavourable climatic conditions and lack of irrigation water the land capability of these parts of the study area is that of extensive grazing. The nutritional quality of natural veld on Hutton and Clovelly soils is expected to be good. Mine rehabilitation efforts should aim to restore the land capability back to grazing land capability to the extent reasonably possible.

The Witbank and Industria soil forms have either "wilderness" or "industrial" land capability depending on whether it is currently occupied by active mining and processing (industrial) or used for stripping and stockpiling (wilderness).

6.4.1.6 Biodiversity

INTRODUCTION AND LINK TO IMPACT

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known value of biodiversity and ecosystems are:

- Soil formation and fertility maintenance;
- Primary production through photosynthesis, as the supportive foundation for all life;
- Provision of food and fuel;
- Provision of shelter and building materials;
- Regulation of water flows and water quality;
- Regulation and purification of atmospheric gases;
- Moderation of climate and weather;
- Control of pests and diseases; and
- Maintenance of genetic resources.

The establishment of infrastructure as well as certain supportive activities have the potential to result in the loss of vegetation, habitat and related ecosystem functionality through physical disturbance and/or contamination of soil and/or water resources.

As a baseline, this section provides an outline of vegetation type occurring on site and the status of the vegetation, highlights the occurrence of sensitive ecological environments including sensitive/ endangered species (if present) that require protection and/or additional management actions should they be disturbed.

FIGURE 6-5: LAND CAPABILITY MAP OF THE STUDY AREA (TERRA AFRICA, 2017)

DATA SOURCE

Information in this section was sourced from the biodiversity study undertaken for this EIA (see Appendix E), the 2017 biodiversity study (Ecological Management Services, EMS, 2017) conducted in support of the approved EMPr amendment (SLR, 2017d).

CONSERVATION CHARACTERISTICS

Data accessed as part of the desktop assessment (see Table 6-12) indicates that the project area does not fall within any protected or priority areas. This table also describes the vegetation type, Kathu Bushveld, and the dominant species of this vegetation type in the project area.

TERRESTRIAL HABITAT UNITS

Two habitat units were identified within the project area (refer to Figur 6-6). These are described below.

Kathu Thornveld Habitat Unit

The Kathu Thornveld Habitat Unit (see Figure 6-6) is characterised by a well-developed herbaceous layer interspersed with woody species, notably that of *Grewia flava, Vachellia erioloba* and *Vachellia haematoxylon*, which are characteristic for the region. This habitat unit encompasses much of the current mining area. A number of small mammal species, invertebrates and avifauna where observed, evident that anthropogenic activities in this habitat unit are low and have had a minimal impact on the overall habitat utilization and behaviour of species. Overall, the habitat is considered to be in a good condition, and is populated by a high number of the protected tree species *Vachellia erioloba* and *Vachellia haematoxylon*, listed in the National Forest Act (1998) (as amended). Habitat integrity is deemed to be medium-high.

The previous biodiversity study (EMS, 2017) mapped three vegetation types within the Tshipi Borwa Mine area, namely the Mixed *Vachellia* Savannah, the *Vachellia haematoxylon* Savannah and the *Grewia* Flava Scrub (see Table 6-13 and Figure 6-9).

Disturbed Habitat Unit

This unit consists of the mining / infrastructure areas and the small pockets of vegetation remaining therein, or directly adjacent to (see Figure 6-8). This habitat unit, because of the development and daily functioning of the mine, has been subjected to increased levels of dust, vegetation clearing activities, dumping of excavated material and clearing of new roads. As a result, the natural vegetation has decreased, creating an ideal environment for the proliferation of alien and invasive plant species. Although habitat degradation has occurred, there were still several *Vachellia erioloba* and *Vachellia haematoxylon*, which are listed in the National Forest Act (1998) (as amended) were observed. Habitat integrity is deemed to be moderately low.

TABLE 6-12: SUMMARY OF THE CONSERVATION CHARACTERISTICS FOR THE STUDY AREA (ADAPTED FROM STS, 2018)

Details of the project area in terms of Mucina & Rutherford (2006)	
Biome	The project area is situated within the Savanna Biome.
Bioregion	The project area is located within the Eastern Kalahari Bushveld Bioregion.
Vegetation Type	The project area is situated within the Kathu Bushveld.
Conservation details pertaining to the project area (Various databases)	
NBA (2011)	The project area falls within an area that is currently not protected.
National Threatened Ecosystems (2011)	The project area falls within an area that is least threatened.
NPAES (2009), SACAD (2017) & SAPAD (2017)	The project area is not located within or near any protected or conservation areas (within a 10km radius).
IBA (2015)	Not located within or near an Important Bird Area (IBA) (within 10 km).
Mining and Biodiversity Guidelines (2013)	
According to the Mining and Biodiversity guidelines, the project area is not ranked as a priority area, nor is it located near (within 10 km) an area considered to be of biodiversity importance.	

Description of the vegetation type(s) relevant to the project area (Mucina & Rutherford 2006)	
Vegetation Type	Kathu Bushveld
Climate	Summer and autumn rainfall, very dry winters
Altitude (m)	960 – 1 300
MAP* (mm)	375
MAT* (°C)	18.5
MFD* (Days)	27
MAPE* (mm)	2 883
MASMS* (%)	85
Distribution	Northern Cape Province
Geology & Soils	Aeolian red sand and surface calcrete, deep (>1.2 m) sandy soils of Hutton and Clovelly soil forms.
Conservation	Least threatened. Target 16%. None conserved.in statutory
Vegetation & landscape features	Medium-tall tree layer with *Vachellia erioloba* in places, but mostly open and including *Boscia albitrunca* as the prominent trees. Shrub layer generally most important with for example *Acacia mellifera, Diospyros lycioides* and *Lycium hirsutum*. Grass layer variable in cover.
Tall Tree	*Vachellia erioloba* (d)
Small Trees	*Senegalia mellifera* subsp. *detinens* (d), *Vachellia. leudertzii* var. *leudertzii* (k), *Boscia albitrunca* (d), *Terminalia sericea,*

Northern Cape Critical Biodiversity Areas (2016)
The majority of the project area falls within an area considered to be Other Natural Areas (ONA). According to the Technical Guidelines for Critical Biodiversity Area (CBA) Maps document, ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or Ecological Support Areas (ESAs) (SANBI, 2017).
Northern Cape Provincial Spatial Development Framework (NPSDF, 2012)
The proposed project area is situated within the Griqualand West Centre of Endemism and the within the Gamagara Development Corridor. The corridor focuses on the mining of iron and manganese.

Description of the vegetation type(s) relevant to the project area (Mucina & Rutherford 2006)	
Tall Shrubs	*Diospyros lycioides* subsp. *lycioides* (d), *Dichrostachys cinereal, Grewia flava, Gymnosporia buxifolia, Rhigozum brevispinosum*
Low Shrubs	*Aptosimum decumbens, Grewia retinervis, Nolletia arenosa, Sida cordifolia, Tragia dioica,*
Graminoids	*Aristida meridionalis* (d), *Brachiaria nigropedata* (d), *Centropedia glauca* (d), *Eragrostis lehmanniana* (d), *Schmidtia pappophoroides* (d), *Stipagrostis uniplumis, Tragus berteronianus, Anthephora argentea* (k), *Megaloprotachne albescens* (k), *Panicum kalaharense* (k)
Herbs	*Acrotome inflate, Erlangea misera, Gisekia Africana, Heliotropium cillatum, Hermbstaedtia fleckii, H. odorata, Limeum fenestratum, L. viscosum, Lotononis platycarpa, Senna italic* subsp. *arachoides, Tribulus* terrestris, *Neuradopsis bechuanensis* (k)

TABLE 6-13: DESCRIPTION OF VEGETATION TYPES (EMS, 2017)

Vegetation type	Description
Mixed *Vachellia* Savannah	This vegetation type is characterised by the height of the tree layer which is mainly comprised of tall Camel Thorns (*Vachellia erioloba)* trees. Three vegetation strata are evident within this vegetation unit. There is a prominent tree layer between 2.5 m – 6 m, a shrub layer, between 1.5 m – 2.5 m and a grass layer with an average height of 70 cm. Camel Thorns (*Vachellia erioloba),* Grey Camel Thorns (*Vachellia haematoxylon),* and Candle-pod Thorn (*Vachellia hebeclada)*, are prominent within this vegetation type, however Buffalo Thorn (*Ziziphus murconata),* Brandybush *(Grewia flava)* and Black Thorn (*Vachellia mellifera)* also occur. The grass layer contains species such as Lehmanns lovegrass (*Eragrostis lehmanniana)*, Beesgrass (*Stipagrostis uniplumis),* Bushman grass *(Schmidtia kalihariensis),* Single Grass *(Aristida stipitata)* and Cats-Tail Three-Awned Grass (*Aristida congesta)* are common. Other common species include Besembossie (*Gnidia polycephala),* Dubbeltjie *(Tribulus zeyheri),* Bitterbos (*Chrysocoma ciliate)* and *Walafrida geniculate.* Within this vegetation type there are areas that contain a significantly higher percentage of Camel Thorn (*Vachellia erioloba)* trees. These areas form distinctive patches but have not been mapped as a separate vegetation unit as they cover relatively small areas and do not show a significantly different floristic composition.
Vachellia haemoatoxylon Savannah	This community has a moderate grass cover (50-60%), the shrub layer is moderately developed. Grey Camel Thorn (*Vachellia haematoxlyon)* is the dominant shrub species. The tree layer is poorly developed with individuals of Camel Thorn (*Vachellia erioloba)* occurring within the community. Common grass species include, Blougras (*Schmidtia pappophoroides)* (dominant), Lehmanns love grass (*Eragrostis lehmanniana)*, Finessa grass (*Eragrostis micrantha)*, Silky bushmans grass *(Stipagrostis uniplumis)*, Long-Awned Three awn (*Aristida congesta)* and Single Grass (*Aristida stipitata)*. Other common species within this vegetation type include Gemsbok cucumber (*Acanthosicyos naudiniana),* Large-flowered devil-thorns *(Tribulus zeyheri),* Besembossie *(Gnidia polycephala), Helichrysum argyrosphaerum* and *Monochema incanum*.
Grewia Flava Scrub	This vegetation type is characterised by a high percentage occurrence of Brandybush (*Grewia flava)*. This vegetation type is characteristically shorter although scattered individuals of taller trees do occur. Grey Camel Thorn (*Vachellia haematoxylon),* Desert wolfberry (*Lycium hirsutum)* and Black Thorn (*Senegalia mellifera)* are also present within this vegetation type. The grass layer is very patchy, but in some areas it is moderately well developed. Species such as, Blou gras (*Schmidtia pappophoroides),* Lehmann lovegrass *(Eragrostis lehmanniana),* Sickle Grass *(Pogonarthria squarrosa),* Giant Three-awn *(Aristida meridionalis)* and Cats-Tail Three-Awned Grass (*Aristida congesta)* are common.

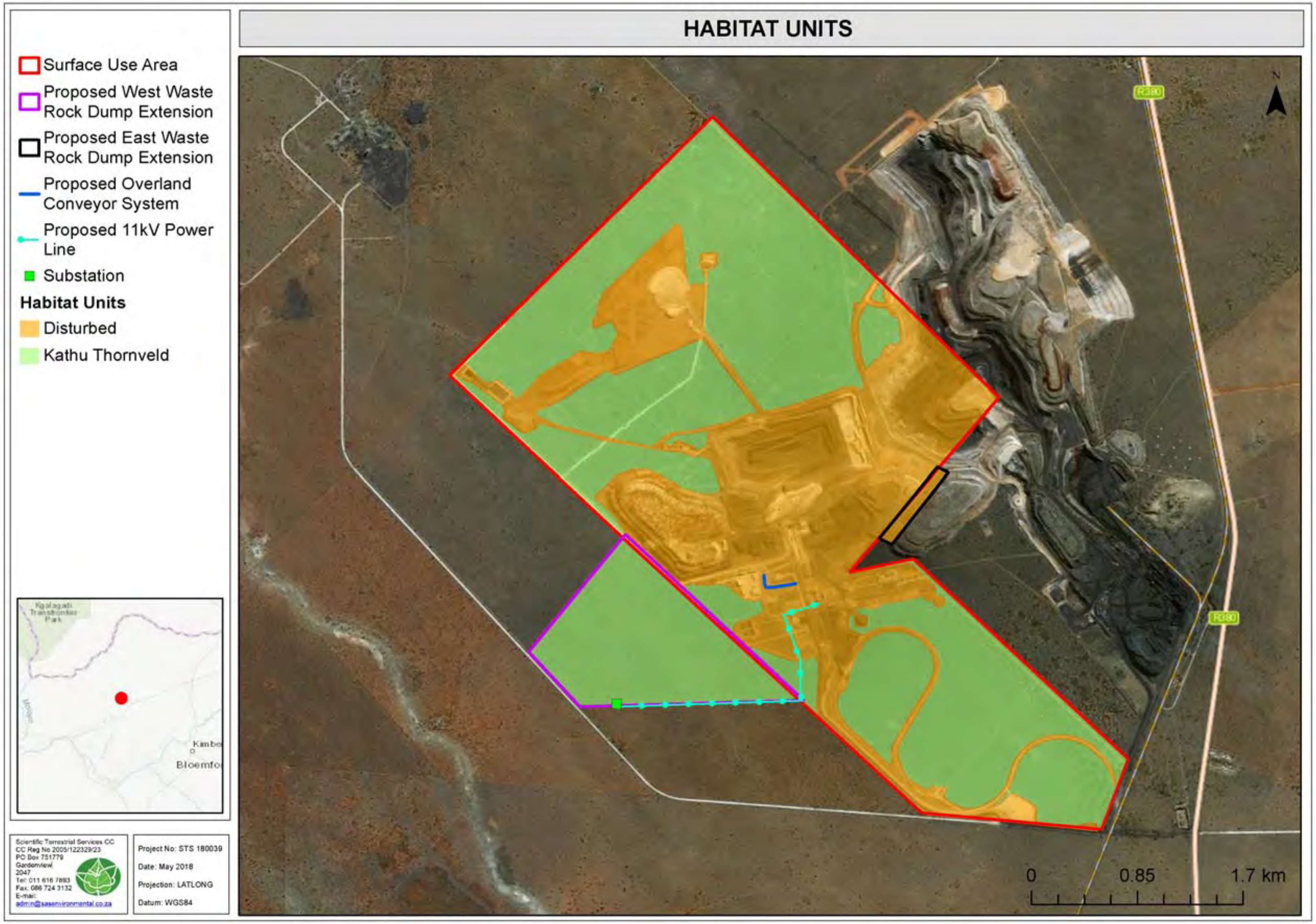
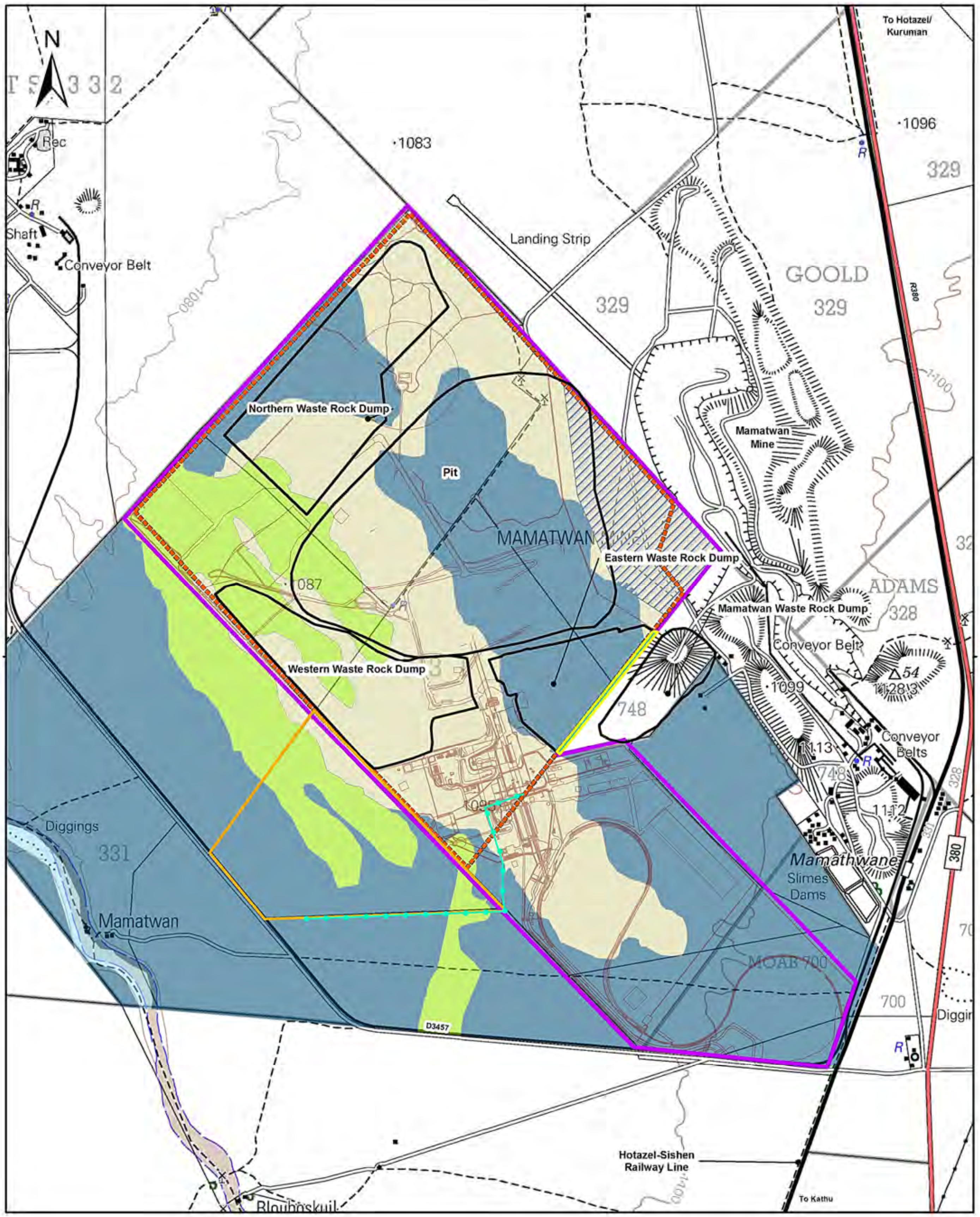


FIGURE 6-6: TERRESTRIAL HABITAT UNITS WITHIN THE STUDY AREA (TERRA AFRICA, 2017)

FIGURE 6-7: PHOTOGRAPHS DEPICTING THE KATHU THORNVELD OBSERVED WITHIN THE STUDY AREA (TERRA AFRICA, 2017)

FIGURE 6-8: PHOTOGRAPHS DEPICTING THE DISTURBED HABITAT UNIT WITHIN THE MINING AREA (TERRA AFRICA, 2017)

FIGURE 6-9: DISTRIBUTION OF VEGETATION TYPES WITHIN THE MINE AREA (EMS, 2017)



Legend

- Mine Infracture
- Proposed 11kV Power Line
- Proposed West Waste Rock Dump Extension
- Proposed East Waste Rock Dump Extension
- Surface Use Area
- Approved Mining Right Area
- Barrier Pillar

Vegetation Types

- *Vachellia haematoxlylon* Savannah
- Grewia Flava Scrub
- Mixed *Vachellia* Savannah

0 500 1 000 Meters

Scale: 1:25 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

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Figure 6-9

Vegetation Types (EMS, February 2017)

SLR

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FLORAL SPECIES OF CONSERVATION CONCERN

Several species of concern were identified at the Tshipi Borwa Mine during (STS, 2018 and EMS, 2017). These included the Camel Thorn (*Vachellia erioloba)* and the Grey Camel Thorn (*Vachellia haematoxylon)* which are protected under the National Forest Act (No. 84 of 1998) (NFA). In addition to this, two other species were identifies within the Tshipi Borwa Mine area, namely Goldblatt (*Moraea longistyla) and Harpagophytum procumbens*, which are listed as specially protected under the Northern Cape Nature Conservation Act (No. 9 of 2009) (NCNCA). Other species of concern that are likely to occur at the Tshipi Borwa Mine are included in Table 6-14 below.

The removal, relocation or destruction of these species will require permits as stipulated within the National Forest Act (1998) (as amended), and as such development activities cannot commence until such permits are in place.

TABLE 6-14: SPECIES OF CONCERN LIKELY TO OCCUR AT THE TSHIPI BORWA MINE (EMS, FEBRUARY 2017)

Species	Common Name	Legislation	Conservational status*
Vachellia erioloba	Camel Thorn	NFA	Protected
Vachellia haematoxylon	Grey Camel Thorn		Protected
Moraea longistyla	Goldblatt	NCNCA	Schedule 2
Moraea pallida	Geeltulp		Schedule 2
Babiana hypogaea	Bobbejaankalkoentjie		Schedule 2
Harpagophytum procumbens	Devil's claw		Schedule 1
Boophone Disticha	Poison bulb		Schedule 2
Brunsvigia radula	Limestone hedgehogs		Schedule 2
Orthanthera jasminiflora	Sandmelktou, Moerwortel		Schedule 2
Boscia albitrunca	Shepherd's Tree		Schedule 2
Crassula capitella	Aanteelrosie		Schedule 2
Kalanchoe brachyloba	Gelobde plakkie		Schedule 2
Ruschia griquensis	-		Schedule 2
Olea europaea	African olive		Schedule 2
Oxalis haedulipes	-		Schedule 2

* Endangered (Schedule 1), Protected (Schedule 2)

FLORAL ALIEN INVASIVE SPECIES

Alien invaders are plants that are of exotic origin and invade previously pristine areas or ecological niches. Alien invasive species cause a decline in species diversity, local extinction of indigenous species, ecological imbalance, decreased productivity of grazing pastures and increased agricultural costs. Alien invasive species likely to occur at the Tshipi Borwa Mine in terms of Regulation 15 and Regulation 16 of the Conservation of Agricultural Resources Act, 1983 (No. 43 of 1983) (CARA) are outlined in Table 6-15 below.

According to the Regulation 15 and Regulation 16 CARA, Category 1 species must be removed and destroyed immediately. Category 2 species include alien invasive species that may only be grown under controlled conditions. In other areas, these species must be eradicated and controlled.

TABLE 6-15: ALIEN INVASIVE SPECIES LIKELY TO OCCUR AT THE TSHIPI BORWA MINE (TST, JUNE 2018; EMS, FEBRUARY 2017)

Scientific name	Common name	NEMBA Category
Argemone mexicana	Yellow flowered Mexican Poppy	1b
Atriplex nummularia	Old Man Salt Bush	2
Pennisetum setaceum	Fountain Grass	1b
Prosopis cf. glandulosa	Mesquite	2
Opuntia humifusa	Large flowered prickly pear	1b
Achyranthes aspera	Burweed	N/L
Xanthium spinosum	Spiny cocklebur	1b
Argemone ochroleuca	White flowered Mexican poppy	1b

N/L: Not listed and not categorised.

Category 1b: Invasive species that require control by means of an invasive species management programme.

Category 2: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.

FAUNAL SPECIES OF CONSERVATION CONCERN

A full list of fauna species observed and those of Species of Conservation Concern (SCC) that have known distribution ranges and habitat preferences that overlap with existing mine operations and the proposed extension footprint study area is presented in the biodiversity study undertaken for this EIA (see Appendix E). The SCC species listed in Table 6-16 below are considered to have an increased probability of occurring (POC) within the study area.

Although none of these SCC faunal species were observed within the existing mine operation and the proposed extension footprint, they are known to occur within the region, favouring the Kathu Thornveld habitat that is presented within the study area. This habitat unit provides suitable breeding and foraging resources for these species and as such the loss of habitat within the proposed extension footprint may result in a disruption of breeding activities with the net result being a possible decrease in population numbers.

Currently there is similar suitable habitat in the areas surrounding the study area, which may provide viable alternative foraging and breeding sites. Overall, existing mine operations and the proposed project will result in the loss of habitat and emigration of faunal SCC from the site, with knock on ecological effects such as increased resource stress in the remaining and neighbouring natural areas due to more concentrated species numbers, or in the unfortunate cases, increased mortality rates.

TABLE 6-16: FAUNAL SCC CONSIDERED LIKELY TO OCCUR IN THE KATHU THORNVELD OF THE STUDY AREA (TST, JUNE 2018)

Scientific Name	Common Name	POC %
Otocyon megalotis	Bat-eared fox	70%
Vulpes chama	Cape fox	60%
Ardeotis kori	Kori Bustard	70%
Neotis ludwigii	Ludwig's Bustard	60%
Python natalensis	African Rock Python	60%

Scientific Name	Common Name	POC %
Mellivora capensis	Honey Badger	70%
Atelerix frontalis	South African Hedgehog	70%
Genus: *Ceratogyrus, Harpactira* and *Pterinochilus*	Baboon Spiders	80%

Note: The previous biodiversity study (EMS, February 2017) also listed the following SCC species:

- Dent's Horseshoe Bat (*Rhinolophus denti):* Near Threatened.
- Honey badger (*Mellivora capensis):* Near Threatened.
- South African Hedgehog (*Atelerix frontalis):* Near Threatened.
- Secretary bird (*Sagittarius serpentarius):* Vulnerable.
- Martial Eagle *(Polemaetus bellicoses):* Endangered, Vulnerable.

ECOLOGICAL SENSITIVITY

National and provincial databases

The NEM:BA provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered, endangered, vulnerable or protected. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing threatened ecosystems is primarily to conserve sites of exceptionally high conservation value (SANBI, BGIS). According to the National List of Threatened Terrestrial Ecosystems (2011) the Tshipi Borwa Mine is not located in any threatened ecosystems.

The goal of the National Protected Areas Expansion Strategy 2008 (NPAES) is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. According to the NPAES database, the Tshipi Borwa Mine is not affected by areas earmarked as part of the NPAES.

The Mining and Biodiversity Guideline (2012) provides explicit direction in terms of where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining. According to the Mining and Biodiversity Guidelines, the Tshipi Borwa Mine is not ranked as a priority area, nor is it located near (within 10 km) an area considered to be of biodiversity importance.

The Tshipi Borwa Mine falls within the Griqualand West Centre of Endemism (EMS, February, 2017). A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions, known as endemics. Centres of endemism are important because it is these areas, which if conserved, would safeguard the greatest number of plant species. According to EMS (EMS, 2017), the Griqualand West Centre of Endemism is considered a priority in the Northern Cape, as the number of threats to the area is increasing rapidly and it is poorly understood. Furthermore, this centre of endemism is extremely poorly conserved, and is a national conservation priority (EMS, 2017).

The National Freshwater Ecosystem Priority Areas 2011 (NFEPA) database was consulted to define the aquatic ecology of the wetlands or river systems close to the Tshipi Borwa Mine that may be of ecological importance. The Vlermuisleegte River is located approximately 1 km to the west of the proposed West WRD extension area (see Figure 6-11). The Vlermuisleegte River is considered to be a Class B (largely natural) river. A NFEPA wetland (depression) is located approximately 1.7 km west of the Tshipi Borwa Mine. In addition, the Tshipi Borwa Mine is classified as an Upstream Management Area, which is a sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river Freshwater Ecosystem Priority Areas and Fish Support Areas.

SANBI has defined CBAs in the Northern Cape Province. These are areas required to meet biodiversity targets for ecosystems, species and ecological processes, as identified in a systematic biodiversity plan. The Tshipi Borwa Mine does not fall within any CBA areas; the majority of the project area falls within an area considered to be Other Natural Areas (ONA) (see Figure 6-10). The Vlermuisleegte River, located approximately 1 km to the west of the proposed West WRD extension area, is located in an Ecological Support Area (see Figure 6-11). An Ecological Support Area is considered important as these areas are associated with high diversity and topographic diversity.

Important Bird Areas (IBA) are sites of international significance for the conservation of the world's birds and other biodiversity. The Tshipi Borwa Mine does not fall within an IBA.

Site sensitivity

The ecological sensitivity of the Tshipi Borwa Mine area and proposed extension footprint is linked to the two habitat units described above, specifically the presence or potential for floral and faunal SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. The Kathu Thornveld Habitat Unit is deemed to be of **Moderately High** sensitivity, while the Disturbed Habitat Unit is **Moderately Low** (see Figure 6-11). As such the conservation objective for the Kathu Thornveld habitat is to preserve and enhance the biodiversity of the habitat unit, and limit development and disturbance, while the objective for the Disturbed Habitat is to optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects (STS, 2018).

Aquifer Dependent Ecosystems

Aquifer Dependent Ecosystems (ADEs) occur throughout the South African landscape in areas where aquifer flows and discharge influence ecological patterns and processes. They are ecosystems, which require groundwater from aquifers for all or part of their life-cycle (EMS, 2017). ADEs provide habitats for an array of species, especially in arid areas, and are considered important in ecological processes and making available resources for the biodiversity in an area that would otherwise not be available. A study conducted by David Hoare Consulting (2013) showed that Camel Thorn (*Vachellia erioloba*) trees occurred as scattered to more concentrated individuals throughout the region. However, there appeared to be higher densities along the banks of the main channel of the Kuruman and Ga-Mogara Rivers in the area around Hotazel, and this could show that an ADE relationship exists between the ephemeral Rivers and the Camel Thorn *Vachellia erioloba* tree. No information is currently available on the fine scale distribution of ADEs, type of plant association, (singly, in stands or gallery forests), aquifer association, condition of vegetation etc. and, therefore, a precautionary approach should be taken when developing in and around these systems.

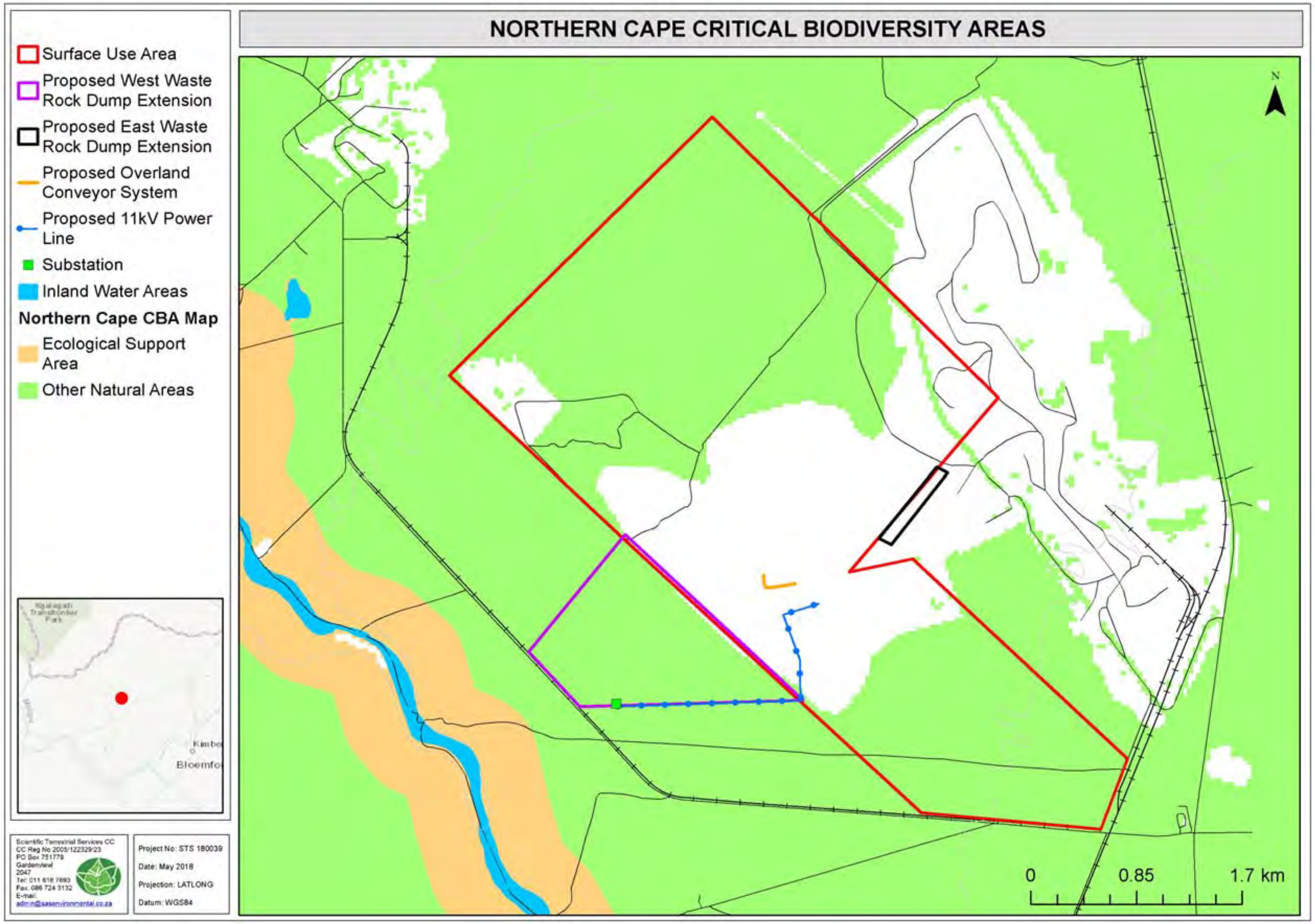

FIGURE 6-10: NORTHERN CAPE CBA MAPPING (TERRA AFRICA, 2017)

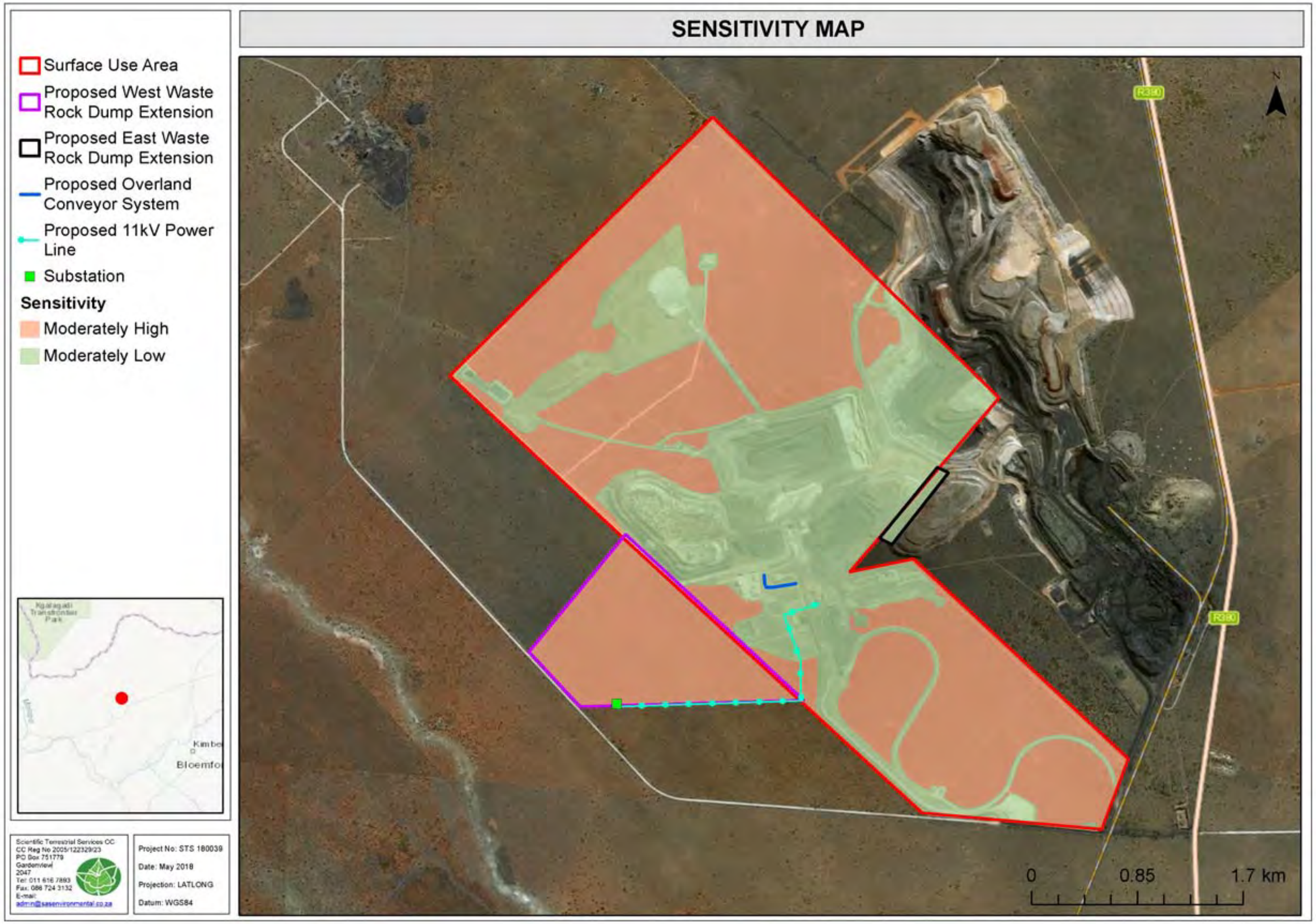

FIGURE 6-11: SENSITIVITY MAP OF THE STUDY AREA (STS, JUNE 2018)

CONCLUSION

Existing mine operations and the establishment of the proposed project have the potential to disturb and/or destroy vegetation, habitat units and related ecosystem functionality including the loss or disturbance of protected species. The proposed East WRD footprint lies within disturbed habitat with no significant biodiversity present. The proposed West WRD extension footprint and a portion of the proposed powerline lie within the Kathu Thornveld habitat, which has a moderate to high sensitivity and contains protected species.

When clearing the proposed West WRD extension footprint and powerline servitude, the necessary permits must to be obtained from DAFF should protected trees need to be removed. Management actions need to be formulated to reduce the impacts that the proposed project may have on the Kathu Thornveld habitat.

6.4.1.7 Surface Water

INTRODUCTION AND LINK TO IMPACT

Surface water resources include drainage patterns and paths of preferential flow of storm water runoff. Mine related activities have the potential to alter the drainage of surface water through the establishment of infrastructure and/or result in the contamination of the surface water resources through seepage and/or spillage of process materials, non-mineralised (general and hazardous) and mineralised wastes.

DATA SOURCES

Information in this section was sourced from the hydrology study undertaken for this EIA (see Appendix F), the original EMPr (Metago, 2009) and the 2017 storm water management plan (SLR, 2017a).

Information pertaining to catchments, mean annual runoff and water management areas was sourced from the Water Resources of South Africa Manual WR2012 (WR 2012). Information regarding the relevant rivers surrounding the mine was sourced from the review of topographical data and on-site observations.

DESCRIPTION

<u>Catchments within the context of South Africa</u>

The project area is located within the Lower Vaal Water Management Area. The major rivers associated with this water management area include the Molopo River, Harts River and the Vaal River, which ultimately drain into the Orange River (SLR, 2017d).

<u>Regional hydrology</u>

The project area falls within the quaternary catchment D41K (see Figure 6-12) which has a gross total catchment area of 4 216 km^2, with a net mean annual runoff (MAR) of 6.53 million cubic meters (mcm) (SLR, 2017a).

The major river within quaternary catchment D41K is the Ga-Mogara drainage channel, which is located approximately 6 km north-west of the Tshipi Borwa Mine (see Figure 6-12). The Ga-Mogara drainage channel forms a tributary of the Kuruman River. The Kuruman River flows west joining the Molopo River approximately 250 km from the confluence of the Ga-Mogara drainage channel and Kuruman River. The Molopo River drains in a southerly direction eventually joining the Orange River (SLR, 2017a).

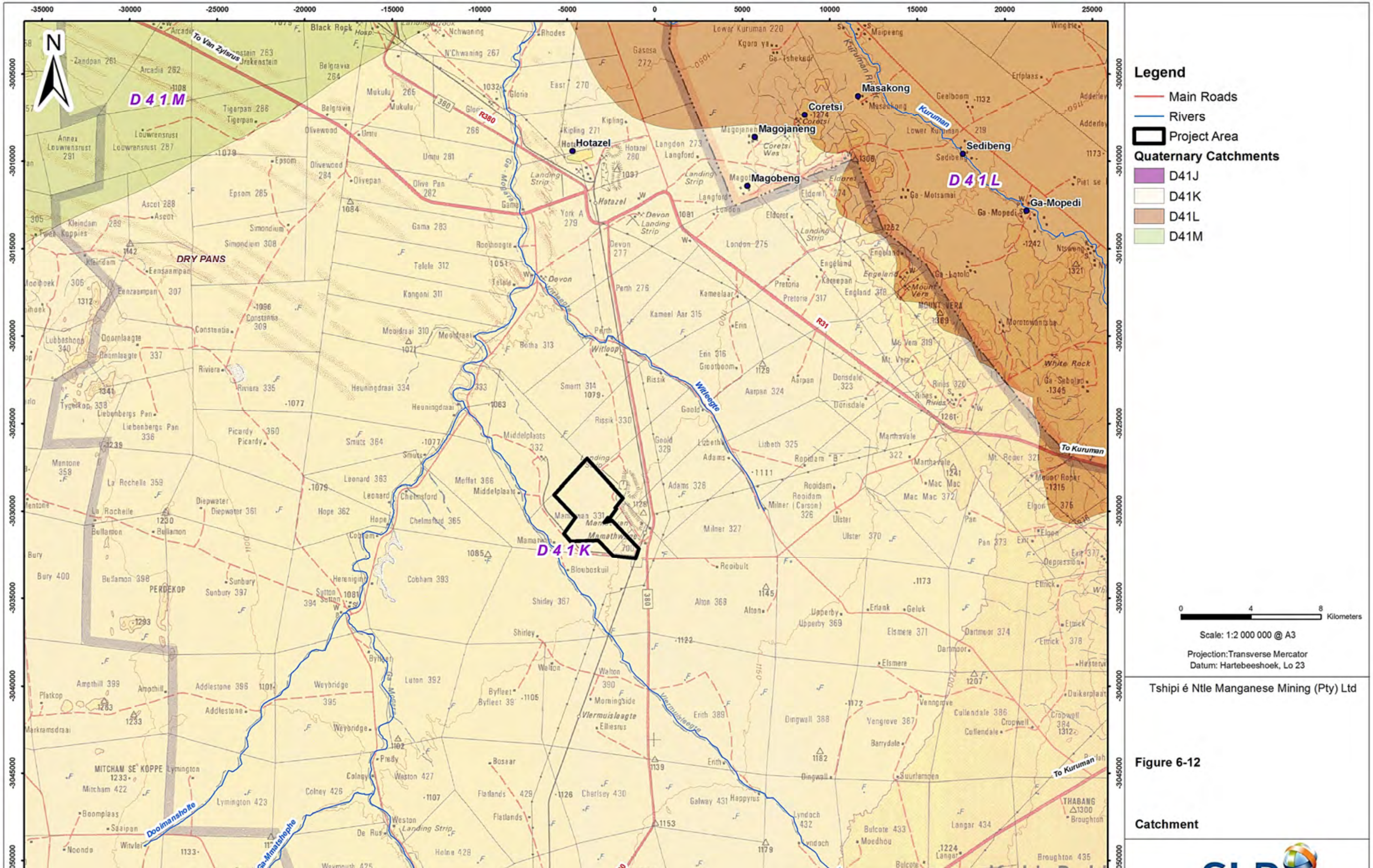

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Figure 6-12

Catchment

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Local hydrology

There are no watercourses within the project area and natural drainage across the project area is via sheet flow. The nearest watercourses are the ephemeral Vlermuisleegte River (approximately 1 km west) and the ephemeral Witleegte River (approximately 10 km northeast) (see Figure 6-11 and Figure 6-12). Both the Vlermuisleegte and the Witleegte Rivers are tributaries of the Ga-Mogara River. The catchment characteristics of the Witleegte and the Vlermuisleegte Rivers are provided in Table 6-17 below. Any natural runoff from the project area will drain in a westerly direction towards the Vlermuisleegte River.

The normal dry weather flow of watercourses in the region is no flow.

TABLE 6-17: CATCHMENT CHARACTERISTICS (METAGO, 2009)

Catchment	Catchment area (km^2)	MAR (nett) (million m^3/annum)	Watercourse length (km)	Drainage density (km/km^2)
Witleegte catchment	661	0.73	70 350	106.4
Vlermuisleegte catchment	487	0.54	47 250	97

Surface water quality

No water sampling within the project area has been conducted because there are no permanent surface water features. Thus, no surface water quality data is available.

Surface water use

Due to the ephemeral nature of Witleegte and Vlermuisleegte Rivers, there is no third party reliance on surface water.

Floodlines

No floodlines were determined, as no watercourses are located within the project area.

Wetlands

No wetlands are located within the project area.

CONCLUSION

Mining and infrastructural changes that have already taken place at the Tshipi Borwa Mine present sources of contaminates that present a potential for the pollution of surface water resources. Further to this, natural runoff is collected in all areas that have been designed with water diversion and water containment infrastructure as required by legislation. It follows that the natural runoff to the catchment has already been influenced by infrastructural changes that have already taken place. The continued operation of the Tshipi Borwa Mine and the establishment of the proposed WRD extensions must be managed / implemented in a way that pollution of water resources is prevented. Moreover, care is required to ensure that surface runoff patterns are disturbed as little as possible to promote the continued flow of water and nutrients.

6.4.1.8 Groundwater

Groundwater is a valuable resource and is defined as water which is located beneath the ground surface in soil/rock pore spaces and in the fractures of lithological formations. Activities such as the handling and storage of waste rock have the potential to result in the loss of groundwater resources, both to the environment and third party users, through pollution.

DATA SOURCES

Information in this section was sourced from the groundwater study undertaken for this EIA (see Appendix G), the 2017 groundwater study (SLR, 2017c) and data from the on-going groundwater monitoring programme (SLR, 2017b).

Information pertaining to aquifer characteristics was sourced from the Aquifer Classification Map of South Africa.

DESCRIPTION

Hydrogeology

Two aquifers are present beneath the project area. This includes a shallow aquifer comprising the Kalahari sands and calcrete and a deeper fractured aquifer comprising Dwyka clay and Mooidraai dolomite formation (Metago, 2009). The aquifers are classified as poor to minor aquifers. These can be fractured or potentially fractured rocks, which do not have a high primary permeability or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although those aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying base flow for rivers. These aquifers are moderately yielding aquifers (1-5 L/s) of acceptable quality or high yielding aquifer (5-20 L/s) of poor water quality (SLR, 2017c).

Based on the Aquifer Vulnerability Map of South Africa (Conrad *et al.,* 1999c), the Tshipi Borwa area is classified as least to moderately vulnerable which implies the following:

- Least vulnerable: only vulnerable to conservative pollutants in the long-term when continuously discharged or leached; and
- Moderately vulnerable: vulnerable to some pollutants, but only when continuously discharged or leached.

Groundwater levels and flow

Groundwater flows across the mine area in accordance with the topography from the south-east to north-west. Average groundwater levels recorded as part of the original EMPr (Metago, 2009) ranged from 20 m to 45 meters below ground level (mbgl). Groundwater levels are currently being monitored as part of Tshipi's ongoing groundwater monitoring programme. In this regard, the groundwater levels within and around the project area range between 35 mbgl to 75 mbgl below groundwater level (SLR, 2018b). Since the commencement of the mine, there has been a decrease in the groundwater levels potentially due to dewatering of the open pit.

Groundwater use

The majority of the groundwater is used to supply drinking water for cattle and in some instances supply water for domestic use. The hydrocensus survey indicates that the two neighbours who farm immediately adjacent to the mine rely entirely on groundwater for their water requirements.

Groundwater quality

Borehole samples collected during the 2009 hydrocensus undertaken as part of the original EMPr (Metago, 2009) were analysed and the results were compared to the South African National Standards (SANS) standard for domestic use (SANS 241:2005). The results were also classified in terms of their suitability for domestic water supplies based on the classification compiled by the Water Research Commission (WRC) together with DWS (previously DWAF) and the Department of Health. Table 6-18 presents the various classes defined.

The sampling results showed that the groundwater quality in the area ranged from marginal to dangerous (DWAF classification of Class 2 and 4). This was mainly due to elevated nitrate levels (see Table 6-19). These trends are most probably linked to anthropogenic pollution from farming or mining activities.

TABLE 6-18: WATER CLASS GUIDELINE VALUE

Class 0	Ideal water quality - suitable for lifetime use
Class 1	Good water quality - suitable for use, rare instances of negative effects
Class 2	Marginal water quality - conditionally acceptable. Negative effects may occur in some sensitive groups.
Class 3	Poor water quality - unsuitable for use without treatment. Chronic effects may occur.
Class 4	Dangerous water quality - totally unsuitable for use. Acute effects may occur.

Groundwater and surface water monitoring has been undertaken at the mine on a quarterly basis since 2012 (refer to Figure 6-13 for the groundwater monitoring points). When comparing results against relevant water quality standards, chemicals of concern that were identified include:

- Electrical Conductivity (EC): Concentrations in boreholes NT15 and TSH05 generally exceed the SANS 241:2015 Aesthetics limit. The baseline EC concentration measured in 2009 (Metago, 2009) in NT15 also exceeded the SANS 241:2015 Aesthetics limit;
- Total Dissolved Solids (TDS): Concentrations in NT15 exceeded the DWAF Target Water Quality Guideline (TWQR) for Livestock Watering and SANS 241:2015 Aesthetic limit. The baseline TDS concentration (Metago, 2009) in NT15 already exceeded both of these limits;
- Nitrate (NO_3): Concentrations in NT15 exceeded the SANS 241:2015 Acute health and the SANS and the DWAF TWQR for Livestock Watering limits. The baseline NO_3 concentration measured in 2009 (Metago, 2009) in NT15 already exceeded these limits;
- Chloride (Cl): Concentrations in NT15 exceeded the SANS 241:2015 Aesthetic limit (300 mg/L). The baseline Cl concentration measured in 2009 (Metago, 2009) in NT15 already exceeded this limit;
- Manganese (Mn): Concentrations in NT15, NT8, TSH01, TSH02, TSH03, TSH05, TSH06 exceeded the SANS 241:2015 Chronic health limit. The baseline Mn concentration was measured in NT15 to be 0.3 mg/L;
- Molybdenum (Mo): Concentrations in NT8 exceeded the SANS 241:2015 Aesthetic limit. NT15 and TSH06 also exceeded this limit at times. No baseline Mo information is available; and

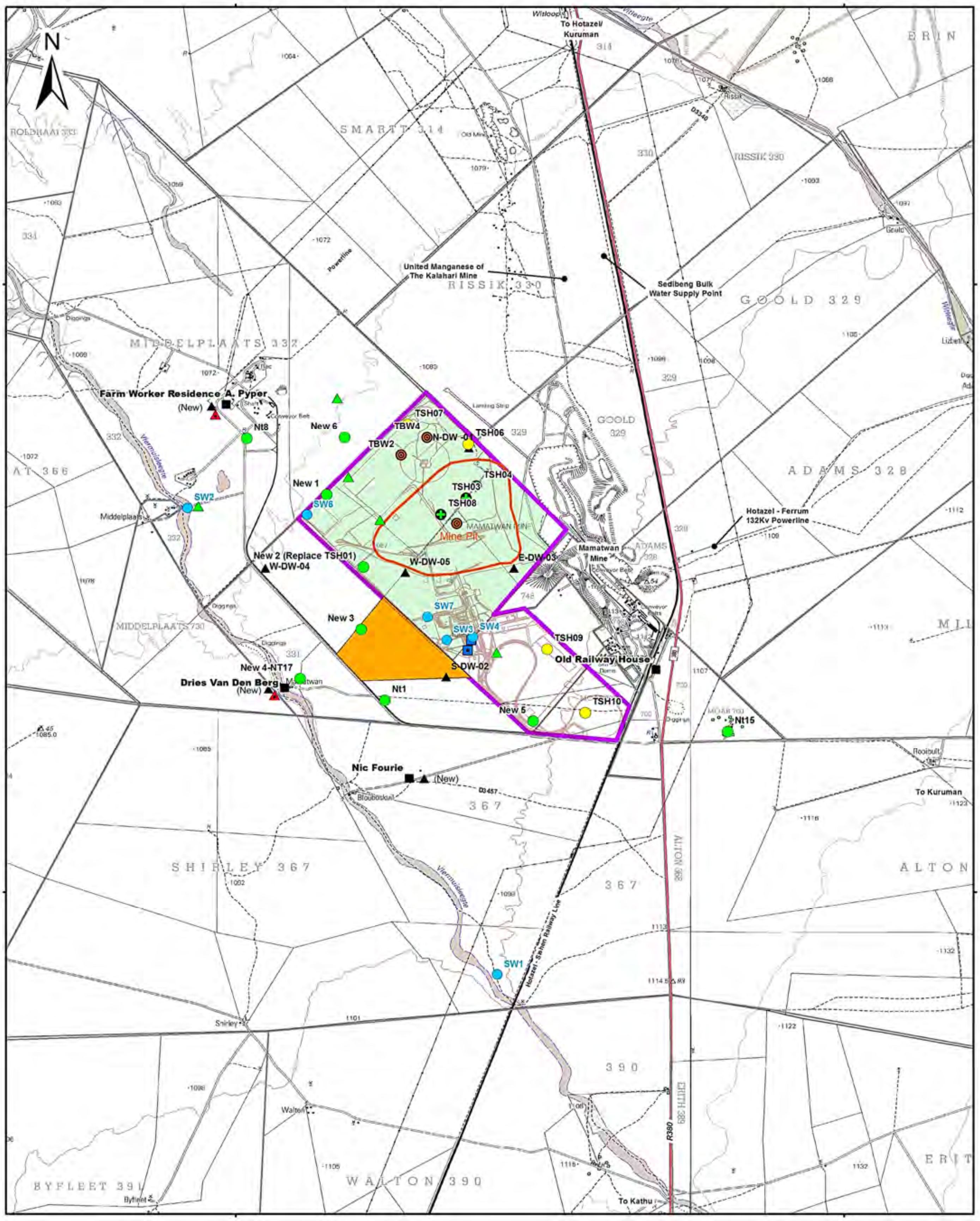
- Lead (Pb) Concentrations in TSH03, TSH01 and TSH06 exceeded the SANS 241:2015 Chronic health limit at times, while TSH01 also exceeded the DWAF TWQR for Livestock Watering limit once. No baseline Pb data is available.

Groundwater yield

- The groundwater yield from the underlying aquifer is anticipated to be 2 L/s.

TABLE 6-19: SUMMARY OF GROUNDWATER QUALITY (METAGO, 2009)

Analyses in mg/l	SANS water quality guidelines for domestic use		Site Reference							
	Class 1	Class 2	Nt6	Nt8	Nt9	Nt14	Nt15	Nt17	Nt18	WGC2
pH Value at 25°C	5.0 – 9.0	4 – 10	7.3	7.7	7.9	7.5	7.0	7.4	7.2	8.2
EC in mS/m	<150	150 – 370 (7yrs)	96.6	179	82.0	101	396	186	243	95.6
Total Dissolved Solids at 180°C	<1000	1 000 – 2 400 (7 yrs.)	696	1208	420	592	2910	1340	1650	622
Total Alkalinity as $CaCO_3$	N/A	N/A	392	264	316	380	264	304	292	240
Nitrate as N	<10	10–20 (7 yrs.)	11	0.2	14	16	175	111	101	21
Chloride as Cl	<200	200–600 (7 yrs.)	50	176	40	56	743	172	304	88
Sulphate as SO_4	<400	400–600 (7 yrs.)	16	481	25	47	51	52	126	45
Fluoride as F	<1.0	1 – 1.5 (1 yr.)	0.5	0.6	0.2	0.2	<0.2	0.4	0.4	0.5
Calcium as Ca	<150	150-300 (7 yrs.)	83	132	48	84	377	141	175	23
Magnesium as Mg	<70	70-100 (7 yrs.)	52	59	36	45	184	104	123	48
Sodium as Na	<200	200–400(7 yrs.)	46	152	74	45	62	85	88	100
Potassium as K	<50	50-100 (7 yrs.)	4.4	2.6	3.0	2.8	6.0	6.6	7.0	5.7
Classification of the water (the parameter listed are those responsible for the class of the water)			Nitrate	EC, TDS, SO4	Nitrate	Nitrate	Nitrate	Nitrate	Nitrate	Nitrate



Legend

- Surface Use Area
- Approved Mining Right Area
- Proposed West Waste Rock Dump Extension
- Surface Water Monitoring and River Biomonitoring Points

Air Quality Sampling Points

- Dust Fallout
- PM10
- Gas Monitoring Points (When Sinter Plant Operational)

Groundwater Monitoring Points

- Background Monitoring
- Plume Monitoring
- Source Monitoring
- Volume Monitoring Points
- Water Storage Facilities
- Third Party Ground Water Users

0 1 000 2 000 Meters

Scale: 1:60 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

TSHIPI E' NTLE MANGANESE MINING

Figure 6-13

Monitoring Programme

SLR

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710.20008.00041

05/09/2018

CONCLUSION

The nature of mining infrastructure and the activities proposed are such that they present potential for pollution of groundwater resources. Baseline groundwater quality results indicate that prior to the establishment of the Tshipi Borwa Mine, groundwater quality had been influenced by anthropogenic pollution from farming and surrounding mining activities. The project must be implemented / managed in a way that pollution of groundwater resources is taken into consideration.

6.4.1.9 Air Quality

INTRODUCTION AND LINK TO IMPACT

Existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance and/or health impacts to nearby receptors. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the air quality study undertaken for this EIA (see Appendix J), as well as the air quality study (Airshed, 2009) undertaken as part of the original EMPr (Metago, 2009). Dust fallout monitoring data was sourced from the annual monitoring report compiled by Boletshe Trading Enterprise CC (Boletshe, 2016).

DESCRIPTION

<u>Ambient air quality within the region</u>

The following regional sources of emissions were identified:

- Fugitive dust: Occur as a result of vehicle entrainment of dust from local paved and unpaved roads, wind erosion from open areas and dust generated by agricultural activities. Given that the agriculture in the area is primarily restricted to livestock and game farming, agriculture is not anticipated to contribute significantly to ambient dust rates. Vehicle entrainment from the various unpaved farm and public roads is anticipated to be a significant, but localised source of dust;
- Current mining operations in the area: Particulates represent the main pollutant of concern at mining operations, whether it is underground or opencast. The amount of dust emitted by these activities depends on the physical characteristics of the material, the way in which the material is handled and the weather conditions. Current mining operations in relatively close proximity to the mining area include Kalagadi, Mamatwan, Black Rock, Gloria, Wessels, Sebilo, United Manganese of Kalahari (UMK) and Kudumane (see Figure 6-16);
- Biomass burning: Biomass burning emissions include with carbon monoxide (CO), methane (CH_4) and nitrogen dioxide (NO_2) gases;
- Veld burning: represent significant sources of combustion-related emissions in many areas of the country;

- Rail related emissions: Emissions from diesel generated locomotives include particulates, nitrogen oxides (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and various volatile organic compounds including polycyclic aromatic hydrocarbons;
- Household fuel combustion: It is likely that households within the district municipality utilise coal or wood for cooking and space heating (during winter) purposes. Emissions from domestic burning include PM_{10}, nitrogen dioxide (NO_2), carbon dioxide (CO_2), carbon monoxide (CO), polycyclic aromatic hydrocarbons, particulate benzo(a)pyrene and formaldehyde; and
- Vehicle tailpipe emissions: Significant primary pollutants include carbon dioxide (CO_2), carbon monoxide (CO), hydrocarbons (HCs), sulphur dioxide (SO^2), oxides of nitrogen (mainly NO_x), particulates. Secondary pollutants include NO^2, photochemical oxidants (ozone), sulphur acid, sulphates and nitric acid.

Emission sources associated with the Tshipi Borwa Mine

The activities associated with the Tshipi Borwa Mine that contribute to ambient air quality include:

- Diesel generators;
- Vehicle tail pipe emissions;
- Material handling such as crushing, tipping of waste rock and ore, conveying of ore, stockpiles;
- Dust generation from open pit operations (blasting and material handling);
- Vehicle activity on paved and unpaved roads;
- Wind erosion from exposed working surfaces;
- Excavations;
- Earthworks; and
- Removal of soil.

These emissions contribute towards both nuisance value, mainly in the immediate area of the source (large particle deposition or PM_{10}) and potential increased health impacts.

The main findings air quality study (Airshed, 2009) are be summarised as follows:

- **PM_{10} ground level concentrations**: The modelled annual average and highest daily average incremental and cumulative unmitigated PM_{10} concentrations at the mine boundary were well above the South African Daily National Ambient Air Quality Standards (NAAQSs). The annual NAAQS of 40 µg/m³ was exceeded at the mine boundary and the old Middelplaats mine located to the west. The daily NAAQS of 75 µg/m³ was exceeded at the mine boundary and a number of identified sensitive receptors (A. Pyper[4], N. Fourie and the old Middelplaats mine). Mitigation of fugitive dust sources resulted in an average reduction of 87% in predicted PM_{10} concentrations, with only exceedances of the annual and daily PM_{10} NAAQS at the mine boundary and not at any of the sensitive receptors.

  Vehicle entrained dust from unpaved roads were the main source resulting in unmitigated and mitigated PM_{10} concentrations contributing, on average, 88% and 67% respectively to the total PM_{10} ground level concentrations.

- **Manganese (Mn) ground level concentrations**: The modelled annual average incremental unmitigated Mn

[4] A. Pyper and N. Fourie are surrounding landowners / farmers.

concentration at the mine boundary was 20.1 µg/m³ and the cumulative concentration was 20.7 µg/m³ compared to the annual World health Organisation (WHO) guideline of 0.15 µg/m³. Exceedances were also predicted at the farms of A. Pyper and N. Fourie, the old railway housing and the old Middelplaats mine. With mitigation in place the impact reduced on average by 69%.

Manganese dust as a result of crushing and screening operations contributed most significantly, 61%, to the predicted unmitigated Mn concentrations. With mitigation measures in place, emissions from the sinter plant (approved, but not yet established) contributed most significantly to predicted manganese concentrations. The sinter plant has not been established.

- **SO_2 ground level concentrations**: The modelled annual, highest daily and highest hourly average incremental and cumulative SO_2 concentrations at the mine boundary were below the NAAQSs for annual and daily averages but exceeded the hourly limit at the mine boundary but not at any of the sensitive receptors.

  Sinter plant (not yet established) emissions were estimated to be the most significant contributor, contributing on average 89%, to predicted incremental SO_2 concentrations.

- **NO_2 ground level concentrations**: The modelled annual and highest hourly average incremental and cumulative NO_2 concentrations at the mine boundary was below the NAAQS for annual averages but marginally exceeded the hourly limit at the mine boundary but not at any of the sensitive receptors.

  Sinter plant (not yet established) emissions were estimated to be the most significant contributor, contributing on average 39%, to predicted incremental NO_2 concentrations.

- **Diesel Particulate Matter (DPM) ground level concentrations**: The modelled annual average incremental DPM concentration at the mine boundary was above the SANS annual limit of 5 µg/m³, but not at the sensitive receptors.

- **CO ground level concentrations**: Modelled highest hourly average incremental CO concentration at the mine boundary and at any of the discreet receptors was well below the NAAQS.

- **Dust fallout**: The modelled maximum daily incremental unmitigated dustfall level at the mine boundary was above the NDCR residential dustfall limit, but within the non-residential limit. With mitigation in place the impacts reduced.

Dust fallout data

Tshipi has a monthly dust fallout monitoring programme that commenced in February 2012 and consists of five directional dust buckets. Annual dust fallout monitoring results for the period January 2016 to December 2016 is provided in Table 6-20 below. Dust fallout monitoring results are compared to the industrial dust fallout limits (600<D<1200) for DW-01, DW-02 and DW-03 in accordance with the National Dust Control Regulations (NDCR). DW-04 is located outside of the Tshipi Borwa Mine and as such its monitoring results are compared to the residential dust fallout limits (< 600) in accordance with the NDCR.

Based on the results provided below, dust fallout limits for DW-01, DW-02 and DW-04 remain within the prescribed NDCR industrial and residential acceptable dust fall rates. Dust fallout for DW-03 and DW-05 exceeded the NDCR non-residential rates six times during 2016. The NDCR allows for the exceedance of the non-residential limits (600 <D< 1 200) two times in a year with no sequential months. It follows that DW-03 and DW-05 are in exceedance of the alert dust fall threshold rate of 1 200 mg/m^2/day and the permitted frequency of the non-residential dust fall rate.

TABLE 6-20: DUST FALLOUT MONITORING DATA FOR 2016 (BOLETSHE, 2016)

Direction	Months											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
DW-01 – Northern mine boundary												
North	57	56	61	531.0	531.0	541.3	244.8	280.7	ND	273.3	177	72
East	140.0	55.0	9.0	428.0	428.1	168.9	178.2	63.8	ND	214.6	91.0	64.0
South	64.0	57.0	74.0	278.0	278.4	171.2	179.9	122.6	ND	167.3	380.8	ND
West	79.0	323.0	47.0	585.0	584.5	444.3	93.5	397.1	ND	380.8	111.0	74.0
DW-02 – Southern mine boundary												
North	81.0	54.0	126.0	436.0	435.7	237.0	297.7	246.9	ND	148.0	219.0	74.0
East	96.0	84.0	167.0	412.0	411.9	406.6	147.4	206.2	ND	213.4	117.0	62.0
South	73.0	99.0	88.0	421.0	421.1	317.7	428.6	295.1	ND	198.9	168.0	70.0
West	70.0	113.0	113.0	147.0	147.4	209.0	142.4	156.0	ND	177.3	191.0	70.0
DW-03 – Eastern mine boundary												
North	673.0	1964.0	879.0	2438.0	2437.7	1079.3	1632.2	5603.7	ND	423.1	370.0	91.0
East	1165.0	2028.0	370.0	1745.0	1744.8	1348.3	1308.9	5176.4	ND	483.4	175.0	168.0
South	717.0	1067.0	783.0	1696.0	1696.0	251.5	1113.2	4246.4	ND	663.9	177.0	148.0
West	592.0	982.0	1148.0	1218.0	1217.8	852.3	943.2	5535.9	ND	441.4	742.0	187.0
DW-04 – Western mine boundary												
North	37.0	51.0	62.0	349.0	349.4	185.8	134.5	160.6	ND	131.0	104.0	94.0
East	63.0	57.0	15.0	196.0	196.3	306.4	51.2	134.7	ND	69.7	78.0	56.0
South	68.0	57.0	50.0	253.0	252.7	224.5	141.5	212.8	ND	72.3	41.0	54.0
West	69.0	65.0	28.0	294.0	294.3	221.0	92.4	86.3	ND	84.2	41.0	117.0
DW-05 – Central location												
North	388	4360.0	639.0	639.0	1367.5	2960.5	1803.9	ND	ND	1863.5	ND	185.0
East	298	3264.0	522.0	1370.0	1370.2	1727.0	1343.6	ND	ND	2290.2	ND	180.0
South	469	3064.0	832.0	1118.0	1118.1	2031.5	1613.6	ND	ND	2494.8	ND	51.0
West	602	3027.0	736.0	1151.0	1151.5	2171.9	1536.5	ND	ND	2274.5	ND	109.0

* No data

The most recent dust fallout and PM10 monitoring reported by Boletsche in May 2018 showed the following (refer to Figure 6-13 for the location of the monitoring points):

- <u>Dust fallout</u>
  - > All of the single dust buckets recorded a dust fall-out rate above the Non-residential Area limit value of 1 200 mg/m^2/day.
  - > Wind direction was predominantly north-north-east.
- <u>PM10:</u>
  - > Five of the six PM10 sampling points recorded concentrations above Unacceptable Concentration Limit of 120 ug/m^3.

> The highest PM10 concentration recorded was 708.33 ug/m^3 at the South dust bucket (S-DW in Figure 6-13).
> Silo sampling point (SL-SB in Figure 6-13) recorded concentrations of 625 ug/m^3.
> The South, East (DW-03) and Silo sampling points showed exceedances of more than 5 in the 24 hour sampling period.

Potential air receptors

Potential receptors include the isolated residences and farmhouses on the surrounding farms, ranging between 1 and 2.5 km from the mine (refer to Figure 6-17). These are owned and/or occupied by farmers and farm workers.

CONCLUSION

Air quality within and surrounding the Tshipi Borwa Mine has already been influenced through the presence of mining activities and associated infrastructure. In this regard, monitoring results indicate that mining and surrounding activities and infrastructure contribute towards sources of emissions such as dust fallout that occasionally exceed relevant NAAQS and NDCR limits. The establishment of the proposed WRD extensions and associated activities presents additional sources of pollutants that may influence existing pollutant concentrations. The activities should, therefore, be carefully managed to ensure that contributions from the project remain within acceptable limits with associated acceptable impacts.

6.4.1.10 Noise

INTRODUCTION AND LINK TO IMPACT

Certain noise generating activities associated with the mine and proposed establishment of the WRD extensions could cause an increase in ambient noise levels in and around the mining area. This may cause a disturbance to nearby receptors. Land uses surrounding the mine are described in Section 6.4.2. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCE

Information in this section was sourced from the approved EMPr amendment (SLR, 2017d).

DESCRIPTION

The greater area is generally defined by rural features and is not subjected to elevated noise levels. Noise in the vicinity of the project area is mainly caused by surrounding farming activities, localised traffic, train movements and mining operations. Previously measured pre-Tshipi ambient noise levels varied from 39 dBA during the day to 33 dBA during the night. These levels are typical of ambient noise levels for rural areas as defined by SANS 10103:2008, which range between 45 dBA during the day and 35 dBA at night.

Potential noise receptors include the isolated residences and farmhouses on the surrounding farms, ranging between 1 and 2.5 km from the West WRD extension area. These are owned and/or occupied by farmers and farm workers.

CONCLUSION

The proposed WRD extensions have the potential to increase ambient noise levels within and surrounding the project area. It is, however, important to note that the current mining activities at the Tshipi Borwa Mine already generate noise. Potential human noise receptors include the isolated residences and farmhouses within 1 and 2.5 km of the West WRD extension area. Careful planning should therefore be taken into consideration for the project in order to minimise increasing disturbing noise levels.

6.4.1.11 Visual Aspects

INTRODUCTION AND LINK

Mining infrastructure has the potential to alter the landscape character in the project area and surrounding area through the establishment of both temporary and permanent infrastructure. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCE

Information in this section was sourced from on-site observations by the SLR project team and the review of relevant maps.

DESCRIPTION

Landscape character

The landscape character within the project area has been transformed due to Tshipi's current approved mining infrastructure and activities. The landscape character towards the south-east, south and west of the project area is characterised by flat open areas associated with semi-arid vegetation, the ephemeral drainage line (Vlermuisleegte River), isolated farmsteads, the regional road (R380), a gravel road (D3457) and the regional powerline. The landscape character directly to the east of the project area has been extensively disturbed by existing mining operations associated with the Mamatwan Mine, the regional road (R380), a gravel road (D3457), railway line and powerline infrastructure. The landscape character to the north and north west of the project area consists of a combination of open flat areas associated with semi-arid vegetation and ephemeral drainage patterns (Witleegte River), existing mining operations (UMK and the old Middelplaats mine), the regional road (R380) and powerline infrastructure.

Scenic quality

The scenic quality of the project area and surrounding area is linked to the type of landscapes that occur within an area. In this regard, scenic quality can range from high to low as follows:

- High – these include the natural features such as mountains and koppies and drainage systems;
- Moderate – these include agricultural activities, smallholdings, and recreational areas; and
- Low – these include towns, communities, roads, railway line, industries and existing mines.

The scenic quality within the project area is considered to be low due the presence of existing mining activities.

Although the area surrounding the project area has been influenced by the presence of existing mining operations, road infrastructure, powerline infrastructure and isolated residences and farmhouses, the overall scenic quality is considered to be moderate given the presence of undisturbed areas that provide open views of the natural bushveld and the Vlermuisleegte River.

Sensitivity of Visual Resource

It follows that the highest value visual resource described above is also the most sensitive to changes. In contrast, areas that are not considered to have a high scenic value are expected to be the least sensitive to change such as the mining and infrastructure areas.

Sense of place

The sense of place results from the combined influence of landscape diversity and distinctive features. The primary informant of these qualities is the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area. The project area is located within a "mining belt". Surrounding existing mining operations and the infrastructure that supports these mines dominates the area to the east, north and north-west of the project area. It follows that the immediate area within and surrounding the project area has a relatively weak sense of place (when the viewer is within the mining belt). However, seen in context with the site surrounded by large open spaces of arid vegetation, the harsh nature of the mining activities is "softened". When the viewer views the area from outside the "mining belt", the larger area has a stronger sense of place.

Visual receptors

When viewed from the perspective of tourists and residences within the area, mining operations could be associated with a sense of disenchantment. People who benefit from the project (employees, contractors, service providers etc.) may not experience this disenchantment, but rather see the mine with a sense of excitement and anticipation.

It follows that the sensitive viewer locations are located towards the west and southwest of the project area (isolated residences and farmhouses) and third parties travelling along the R380 and D3457.

CONCLUSION

When considering landscape character, scenic quality, visual resource, sense of place and visual receptors, the area to the south-west and west of the project area has a high visual value. Locations within the project area, as well as those located to the north, north-west and east of the surface use area that have been disturbed, have a low visual value. This indicates that mining and infrastructure activities impact on the available visual resources and that visual resource management must be considered for the current activities at Tshipi, as well as for the establishment of the proposed WRD extensions as part of the project.

6.4.1.12 Traffic

INTRODUCTION AND LINK

Traffic from mining operations has the potential to affect the capacity of existing road networks, as well as result in noise, air quality and public road safety issues. This section provides an overview of the current road network, conditions and road use. Understanding the layout, use and conditions of transport systems relevant to the mine provides a basis for understanding a change as a result of project contributions.

DATA COLLECTION

Information was sourced from the traffic specialist study (Siyazi, 2017) supporting the approved EMPr amendment (SLR, 2017d).

DESCRIPTION

Existing road network

No public roads traverse the mining area or the proposed extension footprint. The following public roads are located in the general project area:

- The provincial R30 lies to the west of the Tshipi Borwa Mine and Mamatwan Mine and proceeds in a northern direction to Hotazel (see Figure 6-16);
- The D3457 lies to the south of Tshipi Borwa Mine towards Kuruman in an easterly direction. The D3457 provides access to both the Tshipi and Mamatwan mines (see Figure 6-17); and
- The R31 crosses the R380 north of Tshipi Borwa Mine and provides access to the UMK and Kudumane Mines (see Figure 6-16).

Existing traffic data

Manual 12-hour traffic counts were undertaken at the following intersections (refer to Figure 6-14 and Table 6-21):

- Point A: Intersection of R380 and R31;
- Point B: Intersection of R380 and UMK Mine access road;
- Point C: Intersection of R380 and D3457;
- Point D: Intersection of D3457 and Mamatwan Mine access road;
- Point E1: Intersection of D3457 and Tshipi Borwa Mine Access Gate 1; and
- Point E2: Intersection of D3457 and Tshipi Borwa Mine Access Gate 2.

Based on the results of the manual traffic counts, the peak traffic hours occur between 06h00 and 07h15 in the morning, and 13h00 and 16h30 in the afternoons. The current level of service for all intersections that were investigated were considered to be operating at a good level of service. The result of the traffic study, however, did indicate that the intersection at the railway crossing on D3457 to the Tshipi Borwa Mine is not adequate from a road safety perspective.

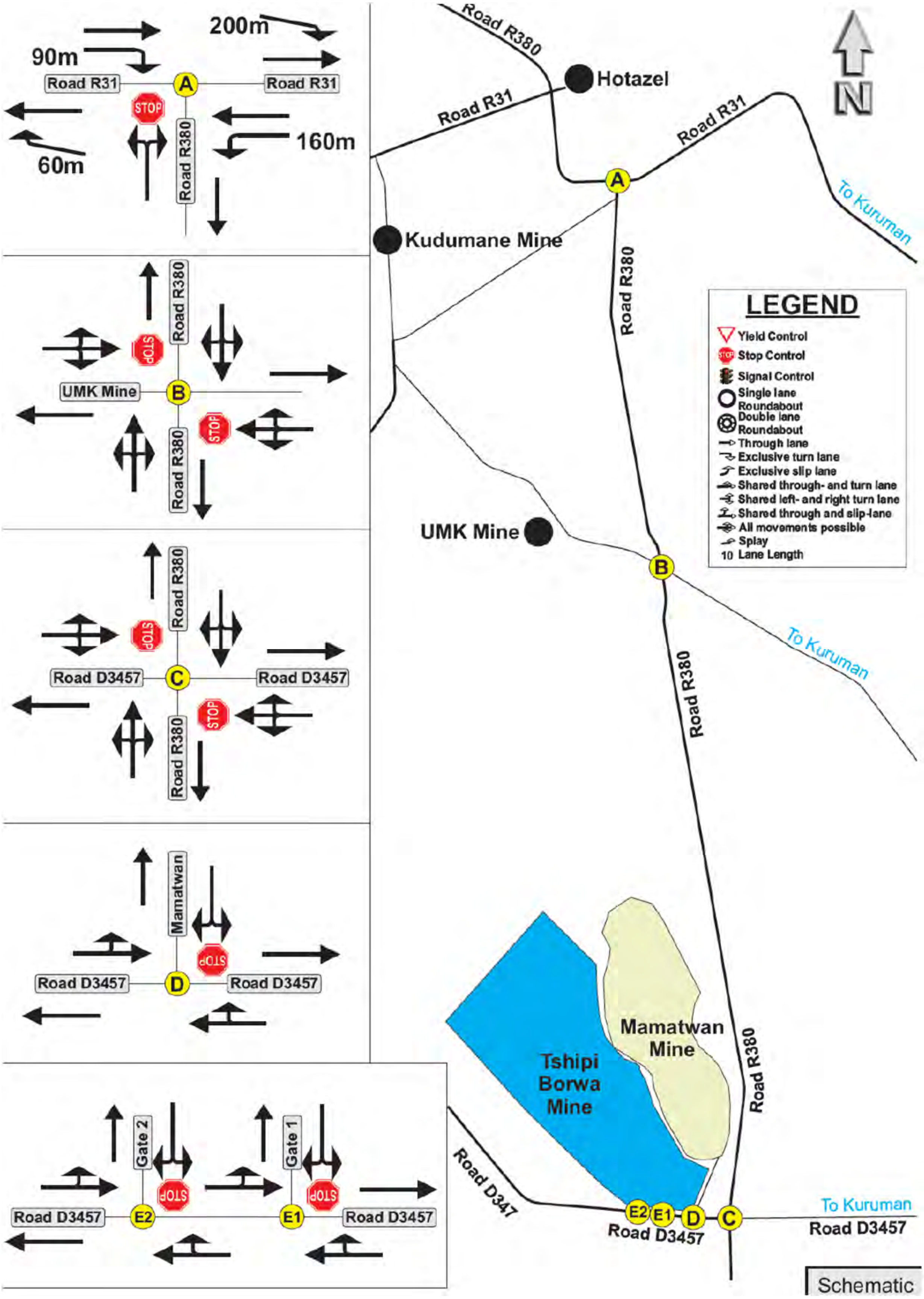


FIGURE 6-14: EXISTING ROAD NETWORK AND TRAFFIC COUNT INTERSECTIONS (SIYAZI, 2017)

TABLE 6-21: TRAFFIC COUNT INFORMATION (SIYAZI, 2017)

Point	Intersection	AM peak		PM Peak	
		Time interval	Number of vehicles	Time interval	Number of vehicles
A	R380 and R31	06h00 – 07h00	466	15h30 – 16h30	378
B	R380 and UMK Mine access road	06h15 – 07h15	133	13h15 – 14h15	142
C	R380 and D3457	06h00 – 07h00	258	13h00 – 14h00	193
D	D3457 and Mamatwan Mine access road	06h00 – 07h00	181	13h00 – 14h00	112
E1	D3457 and Tshipi Borwa Mine Access Gate 1	06h00 – 07h00	141	13h00 – 14h00	76
E2	D3457 and Tshipi Borwa Mine Access Gate 2	06h00 – 07h00	53	13h00 – 14h00	43

CONCLUSION

The existing road network provides a fair level of service. The establishment of the proposed WRD extensions will not alter the level of service, given that the project will not result in an increase in traffic volumes as existing contractors will be used.

However, as indicated in the approved EMP amendment (SLR, 2017d), the intersection at the D3457 and R380 to the Tshipi Borwa Mine is not adequate from a road safety perspective. The approved EMPR amendment (SLR, 2017d) recommended that Tshipi provide data to Transnet regarding the number of vehicles making use of the railway crossing on the D3457 in order for Transnet to comment on the related safety issues and whether there is a need to upgrade this crossing. If the need to upgrade the crossing if confirmed, all relevant role players will have to work together to implement the upgrade.

6.4.1.13 Heritage / Cultural and Palaeontological Resources

INTRODUCTION AND LINK

This section describes the existing status of the heritage and cultural environment that may be affected by the proposed project. Heritage (and cultural) resources include all human-made phenomena and intangible products that are the result of the human mind. Natural, technological or industrial features may also be part of heritage resources as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people of South Africa.

Palaeontological resources are fossils, the remains or traces of prehistoric life preserved in the geological (rock stratigraphic) record. They range from the well-known and well publicised (such as dinosaur and mammoth bones) to the more obscure but nevertheless scientifically important fossils (such as palaeobotanical remains, trace fossils, and microfossils). Palaeontological resources include the casts or impressions of ancient animals and plants, their trace remains (for example, burrows and trackways), microfossils (for example, fossil pollen, ostracodes, and diatoms), and unmineralised remains (for example, bones of Ice Age mammals).

DATA SOURCE

Information in this section was sourced from the heritage study undertaken for this EIA (see Appendix I) and the original EMPr (PGS, 2009) and EMPr amendment (PGS, 2017). In addition to this, information was also sourced from the palaeontological study undertaken by Banzai Environmental (Pty) Ltd (Banzani, 2017).

DESCRIPTION

The mine is situated in an area that as a whole has a relatively low human presence due to the dryness of the region, and as such if there were human settlements they tended to be located on or near watercourses.

As part of the 2009 heritage study (PGS, 2009), a single site of low heritage/cultural significance was identified at the Tshipi Borwa Mine. The heritage/cultural site consisted of a large scatter of calcrete excavated during historical prospecting activities. This heritage site has been destroyed due to current activities at the mine. The destruction of the low significance heritage site was in accordance with the recommendation set out in the heritage study undertaken in March 2009 (PGS, 2017) and SAHRA classification standards. As part of the heritage study (PGS, 2018) undertaken for the current EIA process, no heritage resources were found within the proposed Tshipi Borwa WRD extension area.

According to the palaeontological sensitivity map accessed via the SAHRIS service, the study area falls within a ‘moderate’ rated sensitivity zone (see Figure 6-15; red = very high; orange = high; green = moderate; blue = low; grey = insignificant; white = unknown). However, previous palaeontological impact reports from the area have shown that the site is completely underlain by the Late Caenozoic Kalahari Formation (Cretaceous to Tertiary). No literature record could be found of fossils from the Kalahari Formation close to Hotazel. Palaeontological evidence is restricted to a few pseudo-bone structures that are preserved in the limestone (Groenewald, 2014). No proof of any fossil material was collected from the rest of the Kalahari Formation (Banzani, 2017).

CONCLUSION

There is a low possibility of palaeontological resources occurring in the project area. In addition to this, no heritage/cultural resources are associated with the Tshipi Borwa Mine, the proposed WRD extension areas and other approved project activities.

Palaeontological and heritage resources are important to the history of South Africa and are protected by national legislation. It follows that in the event on any chance finds, South African Heritage Resources Agency (SAHRA) needs to be notified and where necessary permits need to be obtained prior to disturbance.

6.4.1.14 Socio-Economic

INTRODUCTION AND LINK

Mining operations have the potential to result in both positive and negative socio-economic impacts. The positive impacts are usually economic in nature with mines contributing directly towards employment, procurement, skills development and taxes on a local, regional and national scale. In addition, mines indirectly contribute to economic growth in the national, local and regional economies by strengthening the national economy and because the increase in the number of income earning people has a multiplying effect on the trade of other goods and services in other sectors.

FIGURE 6-15: PALAEONTOLOGICAL SENSITIVITY (PGS, 2017).

The negative impacts can be both social and economic in nature. In this regard, mines can cause:

- Influx of people seeking job opportunities which can lead to increased pressure on basic infrastructure and services (housing, health, sanitation and education), informal settlement development, increased trespassing, increased crime, introduction of diseases and disruption to the existing social structures within communities; and
- A change to not only pre-existing land uses, but also the associated social structure and meaning associated with these land uses and way of life. This is particularly relevant in the closure phase when the economic support provided by mines ends, the natural resources that were available to the pre-mining society are reduced, and the social structure that has been transformed to deal with the threats and opportunities associated with mining finds it difficult to readapt.

Data Source

Information in this section was sourced from the Joe Morolong Local Municipality Integrated Development Plan of 2016 and StatsSA.

Description

Population

The Northern Cape Province has a population of 1 145 861. The John Taolo Gaetsewe District Municipality has a population of 224 797 and Joe Morolong Local Municipality has 89 531 people. The Hotazel community has a total of 1 755 people.

Dwellings

The most dominant type of dwelling utilized within the Northern Cape Province, the John Taolo Gaetsewe District Municipality, the Joe Morolong Local Municipality and Hotazel is a formally constructed house or brick structure. Such dwelling structures make up 76% of the dwellings in the Northern Cape Province, 73% within the John Taolo Gaetsewe District Municipality, 71% within the Joe Morolong Local Municipality and 82% within Hotazel. Traditional dwellings (e.g. huts/ structures made of traditional material) are the second highest used dwelling type with percentages ranging from 12% to 22% within the John Taolo Gaetsewe District Municipality and the Joe Morolong Local Municipality respectively. No traditional dwellings are located within the town of Hotazel, rather the second highest used dwelling type is flats. The second highest dwelling type within the Northern Cape Province is informal dwellings (e.g. shacks).

The population profile of the Northern Cape Province, John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality demonstrates a consistent average household size of four people per household (see Table 6-22) despite the significant decline in population numbers between the regional levels. The local community of Hotazel has a slightly more favourable household size with an average of three members per household. These results are relatively typical of rural or semi-rural developing communities, however the low household density within Hotazel may be attributed to the fact that the town is largely a mining community established for and servicing surrounding mines.

TABLE 6-22: SOCIO ECONOMIC PROFILE – POPULATION (SLR, 2017D)

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
Number of households	301 405	61 330	23 707	600
Average number of people per household	4	4	4	3

Basic services

In general, despite the relatively formalized housing infrastructure, basic services infrastructure appears to be far less formalized. Majority of the Northern Cape Province have access to flush toilets and Hotazel primarily utilising flush toilets, however the John Taolo Gaetsewe District Municipality and the Joe Morolong Local Municipality mostly make use of pit toilets (see Table 6-23). Similarly, while in general the Northern Cape Province and Hotazel have access to piped water inside dwellings and yards, a large percentage of households rely on piped water to community stands at varying distances from their dwellings in both the John Taolo Gaetsewe District Municipality and the Joe Morolong Local Municipality (see Table 6-24). A total of 64% of the households in the Northern Cape Province have their waste removed by the local municipality or a private company once a week. This depicts that basic services are not provided to the whole province, with 36% of the province not receiving refuse removal services (see Table 6-25). The occurrence of refuse removal by the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality constitutes only 26% and 6% of households respectively, however Hotazel is largely (96%) receiving the required services.

In general, Hotazel is well formalised in terms of basic services. This may be attributed to the Hotazel area being more urbanized having been developed and supported by surrounding mines in recent years.

TABLE 6-23: SOCIO-ECONOMIC PROFILE – TOILET FACILITIES (SLR, 2017D)

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
None	8%	9%	10%	1%
Flush toilet (connected to sewerage system)	60%	26%	6%	97%
Flush toilet (with septic tank)	6%	3%	1%	1%
Chemical toilet	1%	1%	2%	0%
Pit toilet with ventilation (VIP)	9%	22%	40%	0%
Pit toilet without ventilation	11%	34%	37%	1%
Bucket toilet	4%	2%	2%	0%
Other	2%	2%	2%	1%

TABLE 6-24: SOCIO-ECONOMIC PROFILE– POTABLE WATER ACCESS (SLR, 2017D)

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
Piped (tap) water inside dwelling/institution	46%	23%	9%	89%
Piped (tap) water inside yard	32%	18%	7%	11%
Piped (tap) water on community stand: distance less than 200m from dwelling/institution	13%	35%	50%	0%
Piped (tap) water on community stand: distance between 200m and 500m from dwelling/institution	4%	13%	18%	0%
Piped (tap) water on community stand: distance between 500m and 1000m (1km) from dwelling /institution	2%	5%	5%	0%
Piped (tap) water on community stand: distance greater than 1000m (1km) from dwelling/institution	1%	3%	4%	0%
No access to piped (tap) water	3%	4%	8%	0%

TABLE 6-25: SOCIO-ECONOMIC PROFILE – REFUSE REMOVAL (SLR, 2017D)

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
Removed by local authority/private company at least once a week	64%	26%	6%	96%
Removed by local authority/private company less often	2%	1%	1%	1%
Communal refuse dump	2%	2%	1%	0%
Own refuse dump	25%	59%	80%	2%
No rubbish disposal	5%	7%	11%	1%
Other	2%	4%	1%	0%
Unspecified	0%	0%	0%	0%
Not applicable	0%	0%	0%	0%

Education

In general, statistics throughout the identified regions indicate poor educational profiles. Significant numbers of the population have received no schooling (9% of John Taolo Gaetsewe District Municipality, 13% of Joe Morolong Local Municipality and 8% of the Northern Cape Province) or only limited primary education (35% of John Taolo Gaetsewe District Municipality, 42% of Joe Morolong Local Municipality, 33% of Northern Cape Province and 22% of Hotazel) (see Table 6-26). The average number across the regions profiled of people completing high school education were relatively consistent (on average 25%); however, there is greater disparity when considering Grade 12 education, further education and training and tertiary education. The education profile within Hotazel is more positive in terms of the percentage of the population that have received further education and tertiary education when compared to the Northern Cape Province, the John Taolo Gaetsewe District Municipality and the Joe Morolong Local Municipality.

TABLE 6-26: SOCIO-ECONOMIC PROFILE – EDUCATION (SLR, 2017D)

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
No Schooling	8%	9%	13%	3%
Primary School	33%	35%	42%	22%
High School	28%	24%	21%	27%
Grade 12 / Std 10 / Form 5	14%	12%	7%	17%
Further Education and Training	1%	2%	0%	5%
Tertiary Education	4%	4%	2%	14%
Not applicable	12%	14%	15%	13%
Other	0%	0%	0%	0 %

Economic profile

Majority of the population within the Northern Cape, John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality are not economically active, while 48% of the Hotazel population is employed (see Table 6-27). A general indication of the job scarcity is provided in Table 6-27.

TABLE 6-27: SOCIO-ECONOMIC PROFILE – EMPLOYMENT (SLR, 2017D)

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
Employed	25%	19%	9%	48%
Unemployed	9%	8%	5%	5%
Discouraged work-seeker	3%	5%	7%	2%
Other not economically active	27%	29%	33%	23%
Not applicable	36%	39%	46%	23%

CONCLUSION

In general mining activities have the potential to influence socio-economic conditions both positively and negatively to which the approved mine already contributes. In the context of the approved mine, positive socio-economic influences include contributions in various ways to the local and regional economies while negative socio-economic influences include inward migration of people with the resultant pressure on basic infrastructure and services. As part of the project care should be taken to avoid influencing negative socio-economic impacts further and allowing for the continuation of the positive socio-economic conditions.

6.4.2 CURRENT LAND USES

INTRODUCTION AND LINK

Mining activities have the potential to affect land uses both within the mine area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. The key related potential environmental impacts are: loss of soil, loss of biodiversity, pollution of water, dewatering, air pollution, noise pollution, damage from blasting, visual impacts and the influx of job seekers with related social ills. To understand the basis of the potential land use impacts, a baseline situational analysis is described below.

DATA SOURCE

Mining Right and land ownership details were sourced from Tshipi and a deed search undertaken by SLR as part of the 2017 EMPR amendment (SLR, 2017d). On-site and surrounding land use data was sourced from site observations, specialist studies conducted for the mine and the review of topographical maps and satellite imagery.

DESCRIPTION – MINING AND PROSPECTING RIGHTS

Tshipi holds an approved Mining Right (Reference number NC/30/5/1/2/2/0206MR) on Portion 16 (Portion of Portion 1) and Portion 17 (Portion of Portion 2) of the Farm Mamatwan 331. The Mining Right was granted on 7 April 2010 to Ntsimbintle Mining (Pty) Ltd and transferred to Tshipi, via a Section 11 MPRDA process, on 17 March 2011.

Mamatwan holds prospecting rights on the Remainder of Portion 3 (which includes Portion 18) of the Farm Mamatwan 331. Mamatwan also has a pending Mining Right application on Portion 20 and Portion 8 of the Farm Mamatwan 331.

Samancor Hotazel Manganese Mining (Pty) Ltd holds a Mining Right (NC 252 MR) on Portion 3 of the Farm Moab 700.

DESCRIPTION - LAND OWNERS WITHIN AND SURROUNDING THE TSHIPI BORWA MINE AREA

The surface right owners and corresponding title deeds numbers of the land in and adjacent to the Tshipi Borwa Mine surface use and Mining Rights areas is listed in Table 6-28 and Table 6-29, respectively.

TABLE 6-28: LAND OWNERSHIP WITHIN THE TSHIPI BORWA MINE SURFACE USE AND MINING RIGHTS AREAS

Portion	Landowner	Title deed number
Mamatwan 331		
Portion 16 (Portion of Portion 1)	Tshipi	T416/2014
Portion 17 (Portion of Portion 2)	Tshipi	T416/2014
Portion 18 (Portion of Portion 3)	Tshipi	T416/2014
Moab 700		
Remaining extent	Machiel Andries Kruger	T594/1987

TABLE 6-29: LANDOWNERS ADJACENT TO THE TSHIPI BORWA MINE SURFACE USE AND MINING RIGHTS AREAS

Portion	Landowner	Title deed number
Mamatwan 331		
Remaining extent	Andries Mathys Van Den Berg	T594/ 1987
Portion 1	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Portion 2		T2426/2010
Portion 3		T953/2009
Portion 7	Transnet	T666/1965
Portion 8	Tshipi (proposed WRD site)	T515/1992
Moab 700		
Portion 1	Transnet	T250/1983
Portion 3	Hotazel Manganese Mines (Pty) Ltd	T953/2009
Sinterfontein 748		
Portion 0	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Middelplaats 332		
Remaining Extent	Saltrim Ranches (Pty) Ltd	T2297/2006
Portion 1	Terra Nominees (Samancor Manganese)	T2397/1996
Portion 4	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Middleplaats 184		
Whole farm	Abraham Johannes De Klerk	T1135/1965
Adams 328		
Remaining Extent	Saltrim Ranches (Pty) Ltd	T2297/2006
Portion 1	Eskom Holdings	T347/1971
Portion 2		T1162/1982
Portion 3	Transnet	T1107/1992
Portion 4	Hotazel Manganese Mines (Pty) Ltd	T338/2009
Rissik 330		
Portion 0	Gideon Poolman Familie Trust	T3211/2015
Portion 1	Terra Nominees (Samancor Manganese)	T2395/1996
Portion 2	Transnet	T515/1992
Portion 3	United Manganese of Kalahari Pty Ltd	T2092/2009
Goold 329		
Portion 1	Kruger Machiel Andries	T399/1977
Portion 2	Kruger Nicolaas Philippus Fourie	T455/2010
Portion 5	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Portion 6	Gideon Poolman Familietrust	T3211/2015
Portion 8	Transnet	T515/1992
Portion 9	Hotazel Manganese Mines (Pty) Ltd	T2821/2011
Shirley 367		
Portion 0	Leatitia Penny Trust	T3464/1997
Portion 1	Annalien Elizabeth Fourie	T730/1984
Portion 2	Pretorius Hester Johannes	T718/1979
Portion 3	Transnet	T43/1993

Portion	Landowner	Title deed number
Smartt 314		
Portion 0	Terra Nominees (Samancor Manganese)	T2396/1996
Portion 1	Transnet	T221/1966
Alton 368		
Portion 0	Booysen Jacomina Maria	T285/1979
Portion 1	Andries Matthys Duvenhage Testamentere	T905/2009
Milner 327		
Whole Farm	Kruger Machiel Andries	T26/1931

DESCRIPTION - LAND CLAIMS

According to the Department of Rural Development and Land Reform no land claims have been lodged on the farms Mamatwan 331 and Moab 700. Refer to Appendix C6 for the proof of consultation with the Department of Rural Development and Land Reform.

DESCRIPTION – LAND USE WITHIN THE PROJECT AREA

Land use within the project area includes existing mining activities and infrastructure associated with the mine within the Tshipi Borwa Mining Rights area. Portion 8 of Mamatwan 331 where the proposed West WRD extension will be located is fenced off; therefore, ad-hoc livestock grazing would no longer be able to occur within this area.

Third party prospecting activities (Mamatwan Mining) and mining activities (Samancor Hotazel Manganese Mining (Pty) Ltd) within the surface use area may take place. These will be subject to separate environmental authorisation processes where required.

DESCRIPTION – LAND USE SURROUNDING THE TSHIPI BORWA MINE AREA

Land use surrounding the Tshipi Borwa Mine is a mixture of agriculture, isolated residence/ residential areas, infrastructure/servitudes and mining activities. More detail is provided below:

6.4.2.1 Agriculture

Agricultural activities currently undertaken within the areas surrounding the project area includes game farming and ad-hoc livestock grazing.

Stock and/or game farming is considered to be a viable post mining land use of the study area, as long as the field quality is maintained by keeping within the grazing capacity of the land.

6.4.2.2 Isolated residence/ residential area

With reference to Figure 6-16, the nearest towns / residential areas to the project area include:

- The Black Rock mining community located approximately 26 km north west of the Tshipi Borwa Mine;
- Hotazel situated approximately 18 km north of the Tshipi Borwa Mine;
- Kuruman located approximately 50 km south-east of the Tshipi Borwa Mine; and
- Kathu located approximately 42 km to the south of the Tshipi Borwa Mine.

Due to the lack of available surface water resources in the area, no informal settlements are located in immediate proximity to the project area. There are sparsely situated residences and farmhouses on the surrounding farms. These are owned and/or occupied by farmers and farm workers and include:

- Farm workers residence located on the Farm Middelplaats 332 located approximately 2 km and 4 km north-west from the mine and proposed West WRD extension, respectively (see Figure 6-17);
- A permanent farm homestead (A. Pyper) located on the Farm Middelplaats 332 approximately 2 km west and 3 km north-west of the mine and proposed West WRD extension, respectively (see Figure 6-17);
- A permanent farm homestead (Andries van den Berg) located on the Farm Mamatwan 331 approximately 2 km and 1 km south-west from the mine and proposed West WRD extension, respectively (see Figure 6-17); and
- A permanent farm homestead (Nic Fourie) located on the Farm Shirley 367 slightly less than 2 km and 1.5 km south from the mine and proposed West WRD extension, respectively (see Figure 6-17).

6.4.2.3 Infrastructure and servitudes

A 132 kV powerline passes to the east of the site, alongside the R380 Hotazel to Kathu road (see Figure 6-16). In addition, approved Eskom infrastructure will be located on the Portion 8 of Farm Mamatwan 331 boundary, which includes a 132 kV overhead powerline, a 132/11/kV substation and the proposed 11 kV overhead line.

Eskom also propose to procure a 400 kV overhead powerline servitude along the western boundary of Portion 8 of Farm Mamatwan 331, from Tshipi.

The Sedibeng Vaal-Gamagara water supply pipeline supplies the Tshipi Borwa Mine with process and potable water. A pipeline connection to the Sedibeng Vaal-Gamagara reservoir is located approximately 500m east of the Tshipi Borwa Mine (see Figure 6-17).

The Transnet railway line that services the mines of the Kalahari Basin, from Black Rock in the north to Mamatwan and Tshipi in the south passes to the east of Tshipi with a private siding onto the mine form where ore is loaded and despatched for export, mostly to Port Elizabeth (see Figure 6-16).

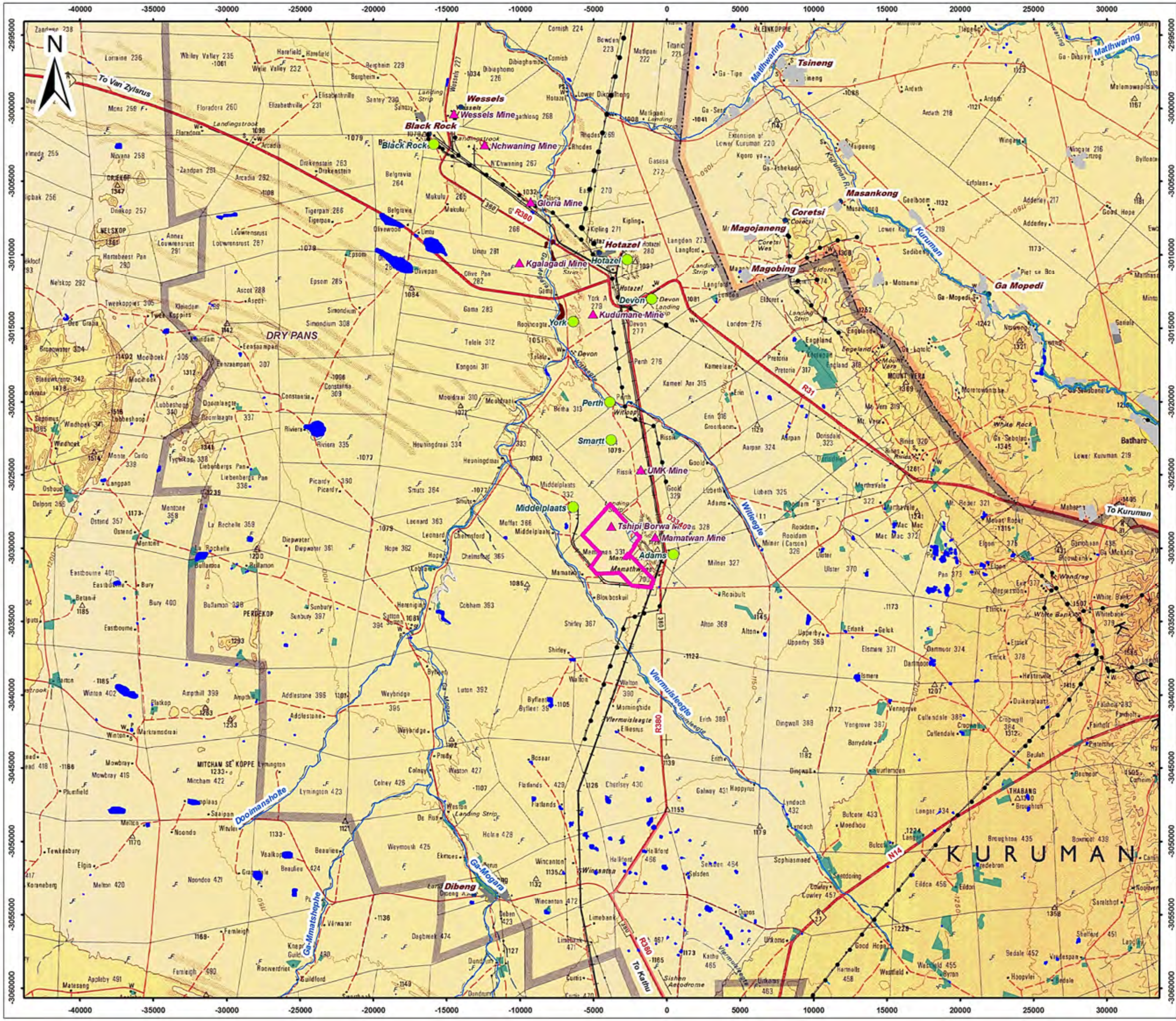
6.4.2.4 Surrounding mines

Various other mining operations located in the immediate vicinity of the project area include (see Figure 6-17):

- UMK Mine (Pty) Ltd) – located approximately 2 km north east of the mine;
- The Mamatwan Mine (South 32 (Pty) Ltd) – located directly adjacent to the eastern boundary of the mine;
- The dormant / temporarily closed Middelplaats Mine – located approximately 1.6 km north-west from the mine;
- The old Adams Mine (dormant/closed) – located within a kilometre east of the mine; and
- The Sebilo Mine (Sebilo Resources (Pty) Ltd) – located approximately 7.6 km north from the mine.

Mining operations located further afield from the project area mine include the:

- The Gloria Mine (Assmang (Pty) Ltd) – located approximately 20 km north from mine;
- The Kalagadi Mine (Kalagadi Manganese (Pty) Ltd) – located approximately 18 km north-west from the mine;



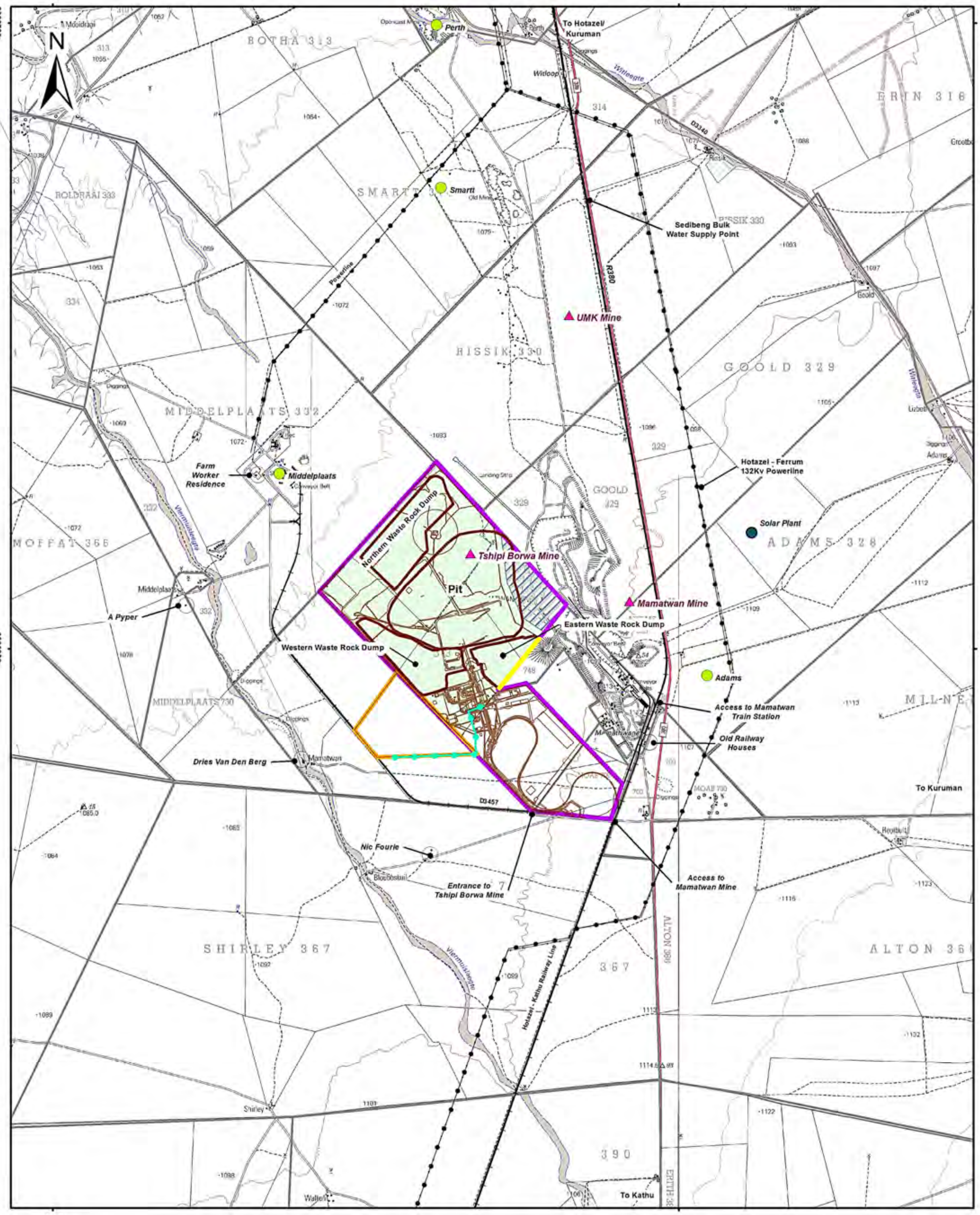
Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 6-16

Regional Land Use Map

SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.20008.00041 | 22/06/2018



Legend

- Operating Manganese Mines
- Closed/Dormant Mines
- Main Roads
- Secondary Roads
- Power Line
- Rivers and Streams
- Railway Lines
- Proposed 11kV Power Line
- Proposed West Waste Rock Dump Extension
- Proposed East Waste Rock Dump Extension
- Surface Use Area
- Approved Mining Right Area
- Barrier Pillar

0 1 000 2 000 Meters

Scale: 1:60 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 6-17

Local Land Use

SLR

SLR Consulting (Africa) (Pty) Ltd
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710.20008.00041

22/06/2018

- The Kudumane Mine (Kudumane Manganese (Pty) Ltd) – located approximately 12 km north from the mine;
- The old Hotazel Mine (dormant/closed) – located approximately 15 km north-east from the mine;
- The old York Mine (dormant/closed) – located approximately 12.8 km north from the mine; and
- The old Devon mine (dormant/closed) – located approximately 14.7 km north-east from the mine.

6.4.2.5 Solar plant

The Adams Solar Plant (Adams Solar PV Project Two (Pty) Ltd), owned by Enel Green Power (Pty) Ltd, is situated approximately 30 km south-east from the mine and is located on the Farm Adams 328. The Adams Solar Plant will aid the new renewable generation capacity of the national grid and contribute to the 42% share targeted by the Department of Energy for renewable energy (Integrated Resource Plan, 2010-2030). According to the strategy, 8.4 GW of new generation capacity in South Africa will be obtained from the Adams Solar Plant over the next twenty years.

CONCLUSION

There are a number of land uses within and surrounding the project area which may be influenced by the proposed WRD extension and associated potential environmental impacts. It should, however, be noted that land has already been significantly influenced through mining and agricultural activities and associated infrastructure and servitudes.

6.4.3 DESCRIPTION OF SPECIFIC ENVIRONMENTAL FEATURES AND INFRASTRUCTURE ON THE SITE

The environmental features and infrastructure in the study area are described in Section 6.4.1 and Section 6.4.2, respectively. In summary:

- The Hutton and Clovelly soil forms found in the proposed WRD extension area are well-drained sandy soils, which allow for high infiltration rates and low organic content. These soils are therefore highly erodible. The rapid drainage nature of the Hutton and Clovelly soil forms reduces the dryland production potential, as well as the irrigation potential. The soil fertility is low due to a deficiency in key nutrients, such as phosphorus.
- The proposed East WRD footprint lies within disturbed habitat with no significant biodiversity present. The proposed West WRD extension footprint lies within the Kathu Thornveld habitat, which has a moderate to high sensitivity and contains protected species.
- The proposed extension footprints are not located in a threatened ecosystem, CBAs or IBAs, an area earmarked as part of the NPAES, or an area ranked as a priority area by the Mining and Biodiversity Guideline (2012).
- No watercourses or wetlands are located within the project area.
- Groundwater quality had been influenced by anthropogenic pollution from farming and surrounding mining activities.
- Air quality, noise and aesthetics within and surrounding the Tshipi Borwa Mine has already been influenced through the presence of mining activities and associated infrastructure.
- There is a low possibility of palaeontological resources occurring in the project area. No heritage/cultural resources were identified within the Tshipi Borwa Mine and proposed WRD extension areas.

- The notable infrastructure within the surface use area includes roads, a railway line, powerline and a water pipeline. The existing road network provides a fair level of service. The establishment of the proposed WRD extensions will not alter the level of service.

6.4.4 ENVIRONMENT AND CURRENT LAND USE MAP

A conceptual map showing topographical information as well as land uses on and immediately surrounding the Tshipi Borwa Mine area is provided in Figure 6-16 and Figure 6-17.

6.5 ENVIRONMENTAL IMPACTS AND RISKS OF PROJECT ALTERNATIVES

As noted in Section 6.1, no site layout or infrastructure locational alternatives are being considered and as such an assessment of alternatives is not applicable to the project.

6.6 METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The method used for the assessment of environmental issues is set out in Table 6-30. This assessment methodology enables the assessment of environmental issues including: cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

TABLE 6-30: IMPACT ASSESSMENT METHODOLOGY APPLIED IN SCOPING

Note: Part A provides the definition for determining impact consequence (combining intensity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity, spatial extent and duration**
Criteria for ranking of the SEVERITY of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.

Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national

PART B: DETERMINING CONSEQUENCE

SEVERITY = L

DURATION	Long term	**H**	Medium	Medium	Medium
	Medium term	**M**	**Low**	**Low**	Medium
	Short term	**L**	**Low**	**Low**	Medium

SEVERITY = M

DURATION	Long term	**H**	Medium	**High**	**High**
	Medium term	**M**	Medium	Medium	**High**
	Short term	**L**	**Low**	Medium	Medium

SEVERITY = H

DURATION	Long term	**H**	**High**	High	High
	Medium term	**M**	**Medium**	Medium	High
	Short term	**L**	**Medium**	Medium	**High**
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/ national
			SPATIAL SCALE		

PART C: DETERMINING SIGNIFICANCE

PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**	Medium	Medium	High
	Possible/ frequent	**M**	Medium	Medium	High
	Unlikely/ seldom	**L**	**Low**	**Low**	Medium
			L	**M**	**H**
			CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE

Significance	**Decision guideline**
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

***H = high, M= medium and L= low and + denotes a positive impact.**

6.7 POSITIVE AND NEGATIVE IMPACTS OF THE PROPOSED ACTIVITY AND ALTERNATIVES

As noted in Section 6.1, no site layout or infrastructure locational alternatives are being considered and as such an assessment of alternatives is not applicable to the project. The preferred project alternative is assessed in Section 8.

6.8 POSSIBLE MANAGEMENT ACTIONS THAT COULD BE APPLIED AND THE LEVEL OF RESIDUAL RISK

A summary of issues and concerns raised by I&APs during the EIA process is provided in Table 6-3.

A list of the potential impacts identified by SLR and/or raised by I&APs, as well as the possible management and mitigation measures, is provided in Table 6-31. The level of residual risk after management or mitigation is also estimated.

TABLE 6-31: MITIGATION MEASURES AND ANTICIPATED LEVEL OF RESIDUAL RISK

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
Mineralised waste management	Loss and sterilization of mineral resources	• Implement best mining practices during all mine phases to ensure that mineral sterilisation is minimised as far as possible. This includes diligent planning based upon available technical data and other information e.g. economic factors.	**LOW**
Mineralised waste management Maintenance and aftercare	Altering topography	• Minimise the area of disturbance by designing and constructing the most compact infrastructure practically possible; and • Restore the natural topography where possible and rehabilitate in accordance with an approved mine closure plan that ensures a suitable and sustainable post-closure land use is achieved.	**MEDIUM**
Site preparation Earthworks Transport systems Mineralised waste management Support services General site management Rehabilitation Maintenance and aftercare	Loss of soil resources through contamination and physical disturbance	Implement the following management actions during all mine phases: • Conduct potentially polluting activities (i.e. loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants (such as fuels, oils, hazardous chemicals (new and used), dirty water, mineralized wastes and non-mineralised wastes) are contained at source and do not pollute soils. In this regard: o Service all vehicles and mobile equipment regularly in workshops, service bays and washbays with contained impermeable, floors, dirty water collection facilities and oil traps; o Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment; o Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up	**MEDIUM**

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		and/or remediate immediately; o Implement and maintain a dirty water management system, as set out in the respective section; o Implement the waste management practices, as set out in Table 27-2; o Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and o Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents. • Determine and implement specifications for post rehabilitation audits to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures; • Take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring in the design of any permanent and potentially polluting structures (such as the waste rock dumps, ore stockpiles and tailings dam); • Limit land disturbance to those activities and areas that are described in the EMPr. In this respect, clear instructions will be included in relevant contracts that will restrict construction work and construction workers to clearly defined areas, and compliance to these instructions will be monitored; • Implement the soil conservation procedure as set out in Table 27-3; • Rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved; • Use existing established roads wherever possible; • Locate new roads that will carry heavy-duty traffic in areas that have been previously disturbed rather than clearing new areas; • Design new roads with a camber to avoid ponding and to encourage drainage to side drains; where necessary, install culverts to allow free drainage; • Protect the side drains on the roads with sediment traps and/or gabions to reduce the erosive velocity of water during storm events and where necessary use geo-membrane lining;	

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		• Manage the terrain within the mine surface use area to prevent erosion by implementing the following measures: • Implement best practice for erosion prevention or minimisation during excavation as follows: • Restrict excavation to areas where it is absolutely necessary; • Use geo-textiles or other suitable means where required to prevent soil erosion; • Use tracked excavation equipment where possible to reduce soil compaction that leads to higher run-off rates and increased erosion risk. • Reduce permanent slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces; and • Use recognised drainage control measures e.g. side-drains and culverts to manage the natural flow of surface runoff. • Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, and in the designs of any permanent landforms e.g. waste rock dumps, approved tailings dam); and • Implement the emergency response procedure in Section 30.2.2 in the event any major spillage incident.	
Site preparation Earthworks Transport systems Mineralised waste management Support services General site management Rehabilitation Maintenance and aftercare	Physical destruction and general disturbance of biodiversity	Implement the following management actions during all mine phases: • implement and refine (as needed) the biodiversity action plan, in consultation with DAFF and a suitably experienced and qualified specialist; • Limit mine infrastructure, activities and disturbance areas to those specifically identified and described in this EMPr, with controlled access and zero tolerance of unnecessary disturbances to the identified sensitive habitats and associated species; • Retain corridors of naturally occurring vegetation within the disturbed areas as far as practicably possible, to provide a corridor for fauna to move out of the disturbed areas; • Limit vegetation clearing along the powerline servitude to prevent the powerline from being overgrown and/or affected by veld fire; in accordance with the DAFF guideline (protected trees may only be cleared directly underneath and within 4	**MEDIUM**

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		metres of the powerline). • Implement phased vegetation clearing of the WRD extension areas, in a uniform direction from one side to the other so as to ensure that, as far as possible, faunal species can naturally disperse out of the area ahead of activities; • Collect pods of the Camel Thorn (Vachellia erioloba) and the Grey Camel Thorn (Vachellia haematoxylon) in order to aid in the re-establishment of these species. Take the necessary steps (such as artificial scarring/acid washing) in order to aid in germination of these species, with guidance from a qualified and experienced specialist; • Plan and implement plans for the removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities. This includes planning on the preservation, cultivation and re-use of these species in ongoing rehabilitation. Take the soil conservation procedure and required actions into account when implementing removal plans. Undertake harvesting of seeds in a controlled manner from similar areas within the mine surface use area to aid in rehabilitation of the mining areas. Ensure that all rescue and relocation plans are overseen by a suitably qualified and experienced specialist, who will also advise on the potential for establishing a nursery of plants to be used for rehabilitation; • Obtain the relevant permits prior to removal of protected plant and/or trees and comply with the requirements thereof; • Obtain guidance from a suitably qualified and experienced specialist to develop and implement an effective monitoring programme of protected trees in the area of operation, on an individual tree basis and at a community level. Implement additional management actions that may be recommended by the specialist, depending on the results of the monitoring programme; • Re-vegetate disturbed and cleared areas once no longer in use with indigenous species of flora to help stabilise the soil surface; • Develop and implement an "after care" programme to manage rehabilitated areas which will aid in ensuring that the correct species are able to re-establish; • Implement a biodiversity offset, should this be requested by DAFF, in accordance	

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		with the relevant biodiversity offset guidelines. Consider the following issues in the biodiversity offset with guidance from DAFF: o the size of the potentially affected area; o the conservation status of the potentially affected area; o the offset ratio (in terms of the required size of the offset site) to be applied; o evaluation of alternative offset sites on the basis of: compensation for the mine's negative impact on biodiversity, long term functionality, long term viability, contribution to biodiversity conservation in the Northern Cape including linkages to areas of conservation importance, acceptability to I&APs, management of negative impacts on local communities, distances from other mines in relation to dust fallout and other impacts, and biodiversity condition scores as compared to that at the UMK site; o land ownership now and in the future; o status/security of the offset site, i.e. will it receive conservation status; o measures to guarantee the security, management, monitoring and auditing of the offset; o capacity of Tshipi to implement and manage the offset o collaboration with surrounding mine's offsets may be an option; o identification of unacceptable risks associated with the offset; and o the start-up and ongoing costs associated with the offset for the life of the project. • Implement the emergency response procedure in Section 30.2.2 in the event of major spillage incidents. • Implement an alien/invasive/weed management programme (Section 0) in collaboration with the DENC and DAFF to control the spread of these plants onto and from disturbed areas. Take care to prevent the encroachment of these species into rehabilitated areas; • Use appropriate fencing where feasible to keep vertebrates away from illuminated areas; • Train workers on the value of biodiversity and the need to conserve the species and	

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		systems that occur in the mine surface use area; • Implement a zero tolerance policy with regard to the killing or collecting of any fauna and/or flora by any Tshipi employees and/or contractors or visitors; • Implement steps to prevent the propagation and/or spread of veld fires e.g. cutting/burning fire-breaks and put in place as part of the emergency plan a programme, trained individuals and equipment for fire-fighting • Implement active speed control measures for any vehicles driving within the mine surface use area; • Maintain noisy and/or vibrating equipment to limit noise and vibration emission levels; • Implement dust control measures as discussed under the air quality section in this table; • Prevent pollution and litter as outlined in Table 27-2 and Table 27-3; and • Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, including in the designs of potentially polluting structures (mine residue facilities).	
Site preparation Earthworks Transport systems Mineralised waste management Support services Rehabilitation Maintenance and aftercare	Alteration of natural drainage patterns	Implement the following management actions during all mine phases: • Construct, operate and maintain mine infrastructure in a manner that ensures compliance with the provisions of the Regulation 704 of 1999 in terms of the NWA. These include: o Separate clean and dirty water systems; o Minimise the size and extent of dirty water areas; and o Divert clean water (run-off and rainfall) around the mine/dirty areas and back into its normal flow paths in the environment; • Regularly update and refine the site wide water balance with the input of actual flow volumes to enable the water balance to be used as a decision-making tool for water management and impact management actions (Section 0).	**LOW**
Site preparation Earthworks Transport systems Mineralised waste	Contamination of surface water resources	Implement the following management actions during all mine phases: • Handle all hazardous fuels, oils, chemicals (new and used), mineralized waste and non-mineralised waste in a manner such that they will not pollute surface water. This will be achieved by means of the following actions:	**LOW**

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
management Support services General site management Rehabilitation Maintenance and aftercare		o Prevent pollution prevention through appropriate infrastructure design. In this regard the WRD extensions will be constructed according to approved designs; o Prevent pollution through maintenance of infrastructure and equipment; o Prevent pollution through education and training of Tshipi employees and contractors (permanent and temporary); o Prevent pollution prevention through appropriate management of hazardous materials as outlined in Table 27-2; o Implement appropriate steps to enable containment and remediation of pollution incidents; and o Develop post rehabilitation audit criteria to ascertain whether the remediation has been successful. Implement further measures should post rehabilitation audits show rehabilitation has not been successful. • Implement the Storm water Management Plan as per the design report; • Manage WRD slope failures which could reduce the capacity of the WRD and/or reduce the effectiveness of WRD paddocks and berms. Rehabilitate any slope failures without delay and recover dislodged/displaced material and return to the WRDs. This also applies to the paddocks and/or berms surrounding the WRDs; • Maintain relevant data sheets for chemical and hazardous substances to provide guidance on the clean-up of chemical and/or hazardous spills; • Conduct regular inspections and maintenance of water management facilities throughout the life of mine, including inspection of drainage structures and liners for; o any in-channel erosion or cracks; o de-silt silt traps/sumps and dirty water containment dams; and o maintain pumps and pipelines according to manufacturer's specifications; • Service vehicles and plant equipment within suitably equipped facilities, either within workshops, or within bunded areas, from which any storm water is conveyed to a collection facility, after passing through an oil and silt interceptor; • Monitor surface water quality within and outside the vicinity of mining operations. The surface water monitoring programme must also focus on surface water sampling of different mine dirty water streams, any unplanned discharges, and monitoring	

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		both up and downstream of the Vlermuisleegte of the mining operations when possible (the possibility of monitoring water in the Vlermuisleegte River may only arise during heavy periods of rain). Details of the surface water monitoring programme are outlined in Section 0; • Regularly review design measures and mitigation measures for identified impacts as per best practice requirements and in compliance with relevant authorisations, including the WUL; • Immediately notify the DWS should any surface water resource contamination be detected. Implement any required actions to stop the contamination of downstream water. • Notify potentially affected users in the event of surface water contamination, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures, in consultation with DWS and an appropriately qualified person. Address any related proven loss caused by the mine (in the short and long term) through appropriate compensation, which may include an alternative water supply of equivalent quality and quantity; • Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources (TSF, open pit and WRDs) indicate that these sources are causing pollution which is migrating off-site; and • Implement the emergency response procedure in Section 30.2.2 in the event of a potentially polluting discharge incident.	
Site preparation Earthworks Transport systems Mineralised waste Support services General site management	Contamination of groundwater	Implement the following management actions during all mine phases: • Implement the Storm water Management Plan as per the design report; • Monitor groundwater quality (refer to Section 0 for the monitoring programme). Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater contamination impacts; • Immediately notify the DWS should any groundwater resource contamination be	**LOW**

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
Rehabilitation Maintenance and aftercare		detected off-site; • Notify potentially affected users in the event of groundwater contamination, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures, in consultation with DWS and an appropriately qualified person; • Address any water loss proven to be caused by the mine (in the short and long term) through appropriate compensation, which may include an alternative water supply of equivalent quality and quantity. In the event that Tshipi is proven to be partially responsible for water loss from third party water users, the compensation costs will be shared by all responsible parties; • Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources (TSF, open pit and WRDs) indicate that these sources are causing pollution which is migrating off-site; • Prevent pollution through appropriate infrastructure design. In this regard the WRD extensions will be constructed according to approved designs; • Rehabilitate the footprints of temporary waste rock dumps by ripping the underlying subsoil, then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period. This will apply to any WRDs that are removed during decommissioning and closure through backfill into the open pit; • Re-run the groundwater model periodically during the operational phase as and when additional relevant data becomes available, in order to consider potential pollution impacts without the retardation effect of pit dewatering. If necessary, make for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning; • Implement the emergency response procedure in Section 30.2.2 in the event of a potentially polluting discharge incident; and • Conduct further source term studies to be used for groundwater modelling updates.	
Site preparation Earthworks Transport systems	Air pollution	Implement the following management actions during all mine phases: • Maintain an active and strict (vehicle) speed limit policy; • Apply suitable dust binding agent and/or water suppression on mine roads. Where	**MEDIUM (HIGH FOR MN)**

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
Mineralised waste Support services General site management Rehabilitation Maintenance and aftercare		dust binding agents are used, this must be limited to the roads only. Should water be used, it is recommended that water be applied at a rate >2 litre/m^2/hour. • Sweep paved road surfaces as needed to limit dust generation. • Use effective water sprays at waste rock/ore loading points e.g. tips and conveyor transfer points and during train-loading. • Use drills fitted with cyclone-type dust extraction systems in the mining pit. • Construct the WRD extension in phases thereby limiting the size and extent of pre-stripped ground from which dust can be generated. . • Dump waste rock on the WRDs in a manner that prevents material from migrating down the WRD slope i.e. dump waste rock before the WRD crest and doze the waste rock into position. • Use dust allaying measures, such as water sprays or equivalent controls to limit the generation of dust, at waste rock tipping points on the WRDs; • Allow topsoil stockpiles and WRD side slopes to re-vegetate naturally. Should re-vegetation cover be insufficient after a rainy season, implement additional dust management measures, such as the use of geotextiles and wind breaks or other methods that are proven to be effective. • Maintain a complaints register that is available at the mine. The date and time noted on the complaints register will be the date and time that the reported problem is observed, not the date and time that the complaint is logged. Compare the complaints register to air quality monitoring data, as well as recorded meteorological data, to identify problem areas and then iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources; • Apply for an air emissions licence for the sinter plant prior to operation. • Develop and implement an air quality control system which includes inter alia: o Monitor air quality in accordance with Section 0. Three additional dust buckets will be located at the farms of N. Fourie, D. van den Berg and A. Pyper and additional PM10 monitors will be located at D. van den Berg and A. Pyper; o Follow the ASTM D1739 (1970) method as required by the National Dust Control Regulations, with regard to the dustfall unit design, dust collection and analysis;	

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		and o Report dustfall results annually to the District Municipality Air Quality officer. o Apply the following criteria with regard to dust and PM10 monitoring at receptors closest to the West WRD extension: o Dustfall rates must be below 600 mg/m²/day at the identified receptors (farms of N Fourie, D van den Berg and A Pyper) and if exceeded for two consecutive months, action will be taken by identifying the source of dust and applying additional mitigation measures. o Daily (24-hour) PM10 concentrations will not exceed 75 µg/m³ for more than four (4) days per year at these receptors and should these concentrations be above the limit, immediate action will be taken by identifying the source of dust and applying additional mitigation measures. A possible additional management measure to be considered should it be required, is the wetting of waste rock material prior to tipping onto the WRDs. • Commission a health risk assessment if monitoring determines that third parties will be exposed to unacceptable cumulative concentrations of manganese or PM_{10} which will focus on the receptors where exceedances are found. Commissioning this health risk assessment, including the implementation of any related management actions, will be the responsibility of both Tshipi and other contributing mines.	
Site preparation Earthworks Transport systems Mineralised waste management Support services General site management Rehabilitation Maintenance and aftercare	Noise pollution	Implement the following management actions during all mine phases prior to closure: • Do not blast at night and on Sundays; • Maintain all diesel-powered earth moving equipment in order to limit noise, including the checking and replacement of exhaust and intake silencers; • Maintain all haul roads in a good state of repair at all times to avoid unwanted rattle and "body-slap" from vehicles; • Operate plant and equipment in a proper manner with respect to minimising noise emissions, for example, minimisation of drop heights when loading and no un-necessary revving of engines; • Locate pumps, generators and compressors behind screening mounds, where possible, and use electrically powered equipment where possible, and/or fit	**LOW (DAY-TIME)** **MEDIUM (NIGHT-TIME)**

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		equipment with acoustic covers, as necessary. Install diesel powered pumps, generators and compressors within acoustic enclosures if necessary; • Record and respond immediately to complaints about disturbing noise. Document and recorded such complaints as incidents, and document the measures taken to address these. Keep these records for the life of mine; • Undertake noise monitoring following the receipt of a complaint (see Section 0). Where necessary, implement additional management actions to avoid repeat occurrences; and Conduct a once off sampling exercise with input from a specialist at the closest receptors during dumping activities at the West WRD extension. Depending on the outcome of the sampling exercise, implement additional management actions if required.	
Site preparation Earthworks Transport systems Mineralised waste management Support services General site management Rehabilitation Maintenance and aftercare	Visual impact	Implement the following management actions during all mine phases: • Clear the absolute minimum amount of vegetation during construction and operation (phased clearing). This is important on the boundaries of the mine where vegetation can assist with screening; • Clear and expose only the footprint area as defined by the approved layout in this EMPr. In all other areas, retain the natural vegetation to the extent that of these areas are under the mine’s control; • The air pollution control system will be implemented to avoid plumes of dust; • Paint and buildings in colours that reflect and compliment the natural landscape where possible; • Rehabilitate all mined out areas in accordance with the principles of ongoing rehabilitation that includes: backfilling, placement of topsoil and re-establishment of vegetation, as far as is reasonably practicable; • Effectively rehabilitate the tailings and WRDs which is critical because these will be a permanent post closure features. In this regard, the appropriate mix of waste rock and vegetation could soften the impact of these facilities; • Ensure that all vegetation that is planted as part of rehabilitation will reflect the natural vegetation of the area, as far as is practicable; • Fit lighting with fixtures to minimise light spillage and focus the light on precise mine	**MEDIUM (PRE-CLOSURE)** **LOW (AT CLOSURE)**

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		activities and infrastructure; • Shape any residual WRDs left on surface; and Manage final rehabilitated areas and landforms remaining in perpetuity through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts.	
Site preparation Earthworks Transport systems Support services	Loss of heritage resources	• Consult a professionally registered heritage and/or palaeontological specialist to make associated recommendations that will be complied with prior to the removal or destruction of any heritage/cultural and palaeontological resources that may be discovered by chance at the mine; and • Implement the emergency response procedure (Section 30.2.2) if there are any chance finds of heritage/ cultural or paleontological sites	**INSIGNIFICANT**
Site preparation Earthworks Transport systems Mineralised waste management Support services General site management Rehabilitation Maintenance and aftercare	Inward migration	Implement the following management actions during all mine phases: • Monitor the location and living conditions of mine employees during the operation of the mine; • Ensure good recruitment practices are implemented in managing mine staff and contractor staff. It should also be stressed that these measures must not impede the free movement of labour or infringe on the rights of individuals to look for work. Rather, they must be used to prevent job seekers from illegally occupying land and establishing impromptu informal settlements where no services currently exist; • Inform the relevant authorities at the first sign of an informal settlement developing close to the mine; • Ensure contractors and sub-contractors implement a suitable recruitment process: o Adhere to the following requirements in the mine's recruitment process: o Do not recruit at the mine site. Recruitment will take place on set dates and at an arranged venue-preferably a formal gathering place in a nearby community/town; o Do not hire temporary casual labour on an ad hoc basis, no matter how small and temporary the job (washing of vehicles or litter clearance). Erect a sign clearly indicating that there will be no recruitment at the mine site at the entrance to the site.	**LOW**

Project Activity	Potential Impact	Possible Mitigation	Level of Residual Risk
		o Draw up and maintain a list of available temporary workers in the area in the event that temporary labour is required. If it is not possible to draw up such a list, put up notices in local communities/towns stating the precise demand for temporary labour and a date and venue at which recruitment will take place; o Implement recruitment practices in accordance with Tshipi company policy; o Clearly inform unsuccessful job seekers as such; o Do not allow worker accommodation at the mine site. • Communicate with the local police force particularly in the context of developing strategies for combating crime near the mine, surrounding communities and surrounding land users/owners; • Ensure that mine employees and contractors are made aware of the issues surrounding the spread of HIV and AIDS in the area. Promote this awareness by initiatives such as training and development, peer education, community interventions and visual awareness campaigns. Introduce prevention and management strategies such as voluntary Counselling and HIV/AIDS Testing (VCT). Encourage all employees to participate in the VCT programme. Once a high level of VCT is taking place, it is possible to define the magnitude of the problem and begin to develop appropriate strategies for dealing with it. It is noted that disease and particularly HIV/AIDS is not a problem only for Tshipi, its employees and contractors, but it is also a local community problem. As a result, successful management actions of this impact will also depend on the intensity in which it is addressed by other structures such as the provincial health department, the local municipality, education departments, etc. • Become part of a local economic development forum that, together with the relevant local authorities, finds solutions to these social problems; and • Implement the emergency procedure included in Section 30.2.2 in the event of the establishment of informal settlements in the area.	

<table>
<tr><th>Project Activity</th><th>Potential Impact</th><th>Possible Mitigation</th><th>Level of Residual Risk</th></tr>
<tr><td>Site preparation
Earthworks
Transport systems
Mineralised waste management
Support services
General site management
Rehabilitation
Maintenance and aftercare</td><td>Economic impact (positive impact)</td><td>Implement the following management actions during all mine phases:
• Communication to local communities clearly that employment of exclusively local people for the mine cannot be guaranteed, but that where possible the employment opportunities will go to local people, where applicable;
• Communicate effectively and timeously with community leaders who can attest to a fair and transparent process amongst the community, rather than challenging Tshipi on the community's behalf over jobs and recruitment, where applicable;
• Develop a skills register prior to employee selection processes;
• Communicate with all job seekers throughout the recruitment process. The process will be fair;
• Urge potential employees to get all their documents and certificates, including valid driving licences in order, prior to recruitment;
• Notify unsuccessful job applicants once the recruitment process is complete;
• Comply with the requirements of the Mining Charter. In this regard procurement will, where possible:
o Promote the development of small and medium enterprises;
o Focus on local business; and
• Promote businesses owned by historically disadvantaged South Africans.</td><td>MEDIUM-HIGH +</td></tr>
<tr><td>Site preparation
Earthworks
Transport systems
Mineralised waste management
Support services
General site management
Rehabilitation
Maintenance and aftercare</td><td>Land use</td><td>• Liaise with Eskom regarding the tie in of the 11 kV powerline into the 132/11kV Eskom sub-station;
• Communicate with neighbouring communities including land users and owners and other key stakeholders as required to facilitate information sharing and environmental impact management relevant to the mine and its associated infrastructure and activities;
• Repair any damage to Openserve infrastructure as a result of Tshipi's operations;
• Contact Openserve in the event that any Openserve infrastructure needs to be altered or relocated two weeks prior to the commencement of any work. Submit as built plans within 30 days of completion of construction.
• Rehabilitate the overall site in accordance with an approved mine closure plan that ensures that a sustainable post-closure land use is achieved.</td><td>LOW</td></tr>
</table>

6.9 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

No site layout or infrastructure locational alternatives are being considered in this EIA. This is discussed further below.

The location of the proposed West WRD extension relied on the identification of a property of sufficient size to accommodate the required volume of waste rock. The area also needed to be located in close proximity to the open pit to optimize the haul distance. It follows that no locality alternatives, other than Portion 8 of Farm Mamatwan 331, meets these criteria. Furthermore, there is no commercial activity i.e. farming being undertaken on this property and the surface rights are owned by Tshipi.

The proposed East WRD extension area has already been impacted by the waste rock dumping activities and therefore no other site alternatives were considered.

In terms of surface environmental features, an effort was made to avoid locating the East WRD and West WRD extensions within close proximity to the Vlermuisleegte River, approximately one kilometre west of Tshipi Borwa Mine, and within close proximity to the nearest local farm residences, the closest of which is located approximately one kilometre of the of the proposed West WRD extension area.

The proposed 11 kV powerline alignment was dictated to a large extent by the location of the approved Eskom sub-station on the southern boundary of Portion 8 of Farm Mamatwan 331, and as such was aligned to follow the West WRD property boundary, alongside the edge of the West WRD extension.

The proposed conveyor infrastructure is located within the current mining area, the location of which is ultimately determined by the location of the secondary crushing and screening plant and the stockpiles.

Thus, no other infrastructure locational alternatives are considered in this EIA. In addition to this, operational and technology alternatives are not applicable to the proposed project.

6.10 STATEMENT MOTIVATING THE PREFERRED ALTERNATIVE

With reference to Sections 6.1 and 6.9, no site layout or infrastructure locational alternatives were considered and as such this section is not applicable.

7. FULL DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY, ASSESS AND RANK THE IMPACTS AND RISKS THE ACTIVITY WILL IMPOSE ON THE PREFERRED SITE THROUGH THE LIFE OF THE ACTIVITY

7.1 DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY IMPACTS

Biophysical and socio-economic impacts associated with the proposed project were identified through a review of original EMPR (Metago, 2009) and the EMPr amendment (SLR, 2017d), site visits undertaken by SLR and specialists, and the specialist studies.

As part of the public participation process, I&APs and commenting authorities (see Section 6.2) were provided with various opportunities to provide input into the EIA process and comment on the proposed project, including the identification of environmental and socio-economic impacts.

7.2 DESCRIPTION OF THE PROCESS UNDERTAKEN TO ASSESS AND RANK THE IMPACTS AND RISKS

A description of the assessment methodology use to assess the severity of identified impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated is provided in Section 6.6.

7.3 A DESCRIPTION OF THE ENVIRONMENTAL IMPACTS AND RISKS IDENTIFIED DURING THE ENVIRONMENTAL ASSESSMENT PROCESS

Table 7-1 provides a description of the impacts on environmental and socio-economic aspects in respect of each of the main project actions / activities and processes that will be assessed in Section 8.

TABLE 7-1: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO THE PROPOSED PROJECT

No.	Potential impact	Activity	Alternative	Project phases
1	Loss and sterilization of mineral resources	Mineralised waste Final land forms	East and West WRD	Operational Decommissioning Closure
2	Altering topography	Earthworks Mineralised waste Water use and management Final land forms	East and West WRD	Construction Operation Decommissioning Closure
3	Loss of soil resources and land capability through contamination and physical disturbance	Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Final land forms	East and West WRD Powerline	Construction Operational Decommissioning Closure

No.	Potential impact	Activity	Alternative	Project phases
4	Physical destruction and general disturbance of biodiversity	Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Final land forms	West WRD Powerline	Construction Operational Decommissioning Closure
5	Alteration of natural drainage patterns	Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Final land forms	East and West WRD	Construction Operation Decommissioning Closure
6	Contamination of surface water resources	Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Final land forms	East and West WRD Powerline Conveyor	Construction Operation Decommissioning Closure
7	Contamination of groundwater resources	Earthworks Mineralised waste Water use and management Support services Transportation system Final land forms	East and West WRD	Construction Operation Decommissioning Closure
8	Pollution from emissions to air	Site preparation Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Final land forms	East and West WRD Powerline Conveyor	Construction Operational Decommissioning Closure
9	Increase in disturbing noise levels	Site preparation Earthworks Mineralised waste Support services Transportation system	East and West WRD Powerline Conveyor	Construction Operation Decommissioning
10	Negative visual impacts	Site preparation Earthworks Mineralised waste Support services Final land forms	East and West WRD Powerline Conveyor	Construction Operation Decommissioning Closure

No.	Potential impact	Activity	Alternative	Project phases
13	Loss of or damage to heritage and/or palaeontological resources	Construction works Earthworks Mineralised waste Support services	East and West WRD Powerline	Construction Operational Decommissioning
15	Negative socio-economic impact (Inward migration)	Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system	East and West WRD Powerline Conveyor	Construction Operational Decommissioning Closure
14	Positive socio-economic impact (Economic impact)	Site preparation Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Closure activities in line with closure plan	East and West WRD Powerline Conveyor	Construction Operational Decommissioning Closure
15	Change in land use	Earthworks Mineralised waste Water use and management Support services Transportation system Final land forms	East and West WRD Powerline Conveyor	Construction Operation Decommissioning Closure

7.4 ASSESSMENT OF THE SIGNIFICANCE OF EACH IMPACT AND RISK AND AN INDICATION OF THE EXTENT OF TO WHICH THE ISSUE AND RISK CAN BE AVOIDED OR ADDRESSED BY THE ADOPTION OF MANAGEMENT ACTIONS

The assessment of the significance of potential impacts, including the extent to which impacts can be avoided or mitigated, is included in Section 8 and Appendix D.

8. ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

A summary of the assessment of the biophysical and socio-economic impacts associated with the proposed project is provided in Table 8-1 below. A full description of the assessment is included in Appendix D.

The impacts presented below are considered cumulatively in the context of the existing Tshipi mining activities and infrastructure. Any changes to the original EMPr (Metago, 2009) or EMPr amendment (SLR, 2017d) are indicated in ***italics***.

TABLE 8-1: ASSESSMENT OF SIGNIFICANT IMPACTS AND RISKS

No.	Activity	Potential impact	Aspects affected	Phase	Cumulative impact significance (unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
1	Mineralised waste Continued use of approved facilities and services Open pit mining Final land forms	Loss and sterilisation of mineral resources	Geology	Operational Decommissioning Closure	**High**	• Management through best practises to prevent unacceptable mineral sterilisation	**LOW**	Can be managed/ mitigated to acceptable levels
2	Earthworks Mineralised waste Water use and management Open pit mining Final land forms	*Altering topography*	Topography	Construction Operational Decommissioning Closure	***Medium***	• Minimise the area of disturbance • Restore natural topography as far as practically possible upon closure	***MEDIUM***	Can be managed at an acceptable level

No.	Activity	Potential impact	Aspects affected	Phase	Cumulative impact significance (unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
3	*Site preparation* Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Loss of soil resources and land capability through contamination and physical disturbance	Soil and land capability	Construction Operational Decommissioning Closure	**High**	• Limit project footprint • Soil conservation procedures • Control through waste management practices • Control through appropriate design (incl. access roads) • Closure planning and rehabilitation • Erosion control • Remedy through emergency response procedures (see Section 30.2.2)	***MEDIUM***	Can be managed/ mitigated to acceptable levels
4	*Site preparation* Earthworks Mineralised waste Water use and management Support services Transportation system Open pit mining Final land forms	Physical destruction and general disturbance of biodiversity	Biodiversity	Construction Operational Decommissioning Closure	**High**	• Control through appropriate design (incl. access roads) • Implement biodiversity action plan and offset (if relevant) • Limit project footprint • Phase vegetation clearing	**MEDIUM**	Can be managed/ mitigated to acceptable levels

No.	Activity	Potential impact	Aspects affected	Phase	Cumulative impact significance (unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
						• Search and rescue of flora and fauna • Implement comprehensive monitoring programme for protected trees • Manage alien invasive species • Manage through training and monitoring • Rehabilitation • Control through permits for removal • Remedy through emergency response procedures (see Section 30.2.2)		
5	*Site preparation* Earthworks Mineralised waste Water use and management Support services Transportation system	Alteration of natural drainage patterns	Surface water	Construction Operational Decommissioning Closure	**Medium**	• Manage through storm water control • Surface water monitoring • Update water balance	**LOW**	Can be managed/ mitigated to acceptable levels
6		Contamination of surface			**Medium**	• Manage through appropriate design	**LOW**	Can be managed/

No.	Activity	Potential impact	Aspects affected	Phase	Cumulative impact significance (unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
	Continued use of approved facilities and services Open pit mining Final land forms	water resources				• Implement Storm water Management Plan • Manage through waste management practises • Surface water monitoring • Manage through compensation • Remedy through emergency response procedures (see Section 30.2.2)		mitigated to acceptable levels

No.	Activity	Potential impact	Aspects affected	Phase	Cumulative impact significance (unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
7	Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining (including backfilling) Final land forms	Contamination of groundwater resources	Groundwater	Construction Operational Decommissioning Closure	**Low**	• Groundwater monitoring • Implement Storm water Management Plan • Manage through compensation • Manage through appropriate design • Remedy through emergency response procedures (see Section 30.2.2)	**LOW**	Can be managed/ mitigated to acceptable levels
8	Open pit mining (through dewatering) *Note: the proposed project does not include any additional dewatering activities*	Lowering of groundwater levels and reducing availability		Operational	**Medium**	• Groundwater monitoring • Manage through compensation	**LOW**	Can be managed/ mitigated to acceptable levels

No.	Activity	Potential impact	Aspects affected	Phase	Cumulative impact significance (unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
9	*Site preparation* Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Air pollution	Air quality	Construction Operational Decommissioning Closure	**High**	• Manage through appropriate design (incl. screens) • Dust control and dust fall out monitoring • Air quality monitoring • Complaints register	**MEDIUM (HIGH FOR MN)**	Can be managed/ mitigated to acceptable levels
10	*Site preparation* Earthworks Mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining	Increase in disturbing noise levels	Noise	Construction Operational Decommissioning	**Medium**	• Manage through noise controls and once off sampling at closest receptors • Conduct noise monitoring in the unlikely event that Tshipi receives noise related complaints	**LOW (DAY-TIME)** **MEDIUM (NIGHT-TIME)**	Can be managed/ mitigated to acceptable levels

No.	Activity	Potential impact	Aspects affected	Phase	Cumulative impact significance (unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
11	*Site preparation* Earthworks Mineralised waste Support services Continued use of approved facilities and services Open pit mining Final land forms	Negative visual views	Visual	Construction Operational Decommissioning Closure	***High***	• Limit project footprint • Phase vegetation clearing • Dust control • Manage through visual controls • Rehabilitation	***MEDIUM (PRE-CLOSURE)*** **LOW (AT CLOSURE)**	Can be managed/ mitigated to acceptable levels
12	Continued use of approved facilities and services	Road disturbance and traffic safety	Traffic	Construction Operational Decommissioning	**Medium**	• Road maintenance • Remedy through emergency response procedures (see Section 30.2.2)	**LOW**	Can be managed/ mitigated to acceptable levels
13	Continued use of approved facilities and services Open pit mining *Note: the project does not include any additional blasting activities*	Ground vibration, air blasts and fly rock	Blasting	Operational	**High**	• Manage through blast design • Remedy through emergency response procedures (see Section 30.2.2)	**MEDIUM**	Can be managed/ mitigated to acceptable levels

No.	Activity	Potential impact	Aspects affected	Phase	Cumulative impact significance (unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
14	*Site preparation* Earthworks Mineralised waste Water use and management Support services Transportation system Open pit mining	Loss of heritage/ cultural and palaeontolo-gical resources	Heritage/ cultural and palaeontologic al resources	Construction Operational Decommissioning	***Insignificant***	• Control through avoidance • Remedy through emergency response procedures (see Section 30.2.2)	***INSIGNIFI-CANT***	Can be avoided
15	*Site preparation* Earthworks Mineralised waste Water use and management Support services Open pit mining Closure activities in line with closure plan	Inward migration	Socio-economic	Construction Operational Decommissioning Closure	**High**	• Control through the monitoring of living conditions of employees, recruitment processes, disease management • Remedy through emergency response procedures (see Section 30.2.2)	**LOW**	Can be managed/ mitigated to acceptable levels
16	*Site preparation* Earthworks Mineralised waste Non-mineralised waste Water use and management	Economic impact		Construction Operational Decommissioning Closure	**Medium-high +**	• Control through good communication, recruitment and procurement processes	**MEDIUM-HIGH +**	Can be managed/ mitigated to acceptable levels

No.	Activity	Potential impact	Aspects affected	Phase	Cumulative impact significance (unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
	Support services Transportation system Continued use of approved facilities and services Open pit mining Closure activities in line with closure plan							
17	Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Change in land use	Land use	Construction Operational Decommissioning Closure	**Medium**	• Communication with neighbours and land users • Repair any damaged infrastructure • Rehabilitation	**LOW**	Can be managed/ mitigated to acceptable levels

9. SUMMARY OF SPECIALIST REPORT FINDINGS

The recommendations made by the specialist in support of the proposed project are summarised in Table 9-1 below. The complete specialist reports have been attached in the appendices to this EIR (see Appendix E to Appendix J).

TABLE 9-1: SUMMARY OF SPECIALIST RECOMMENDATIONS

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
Biodiversity	• A walk down of the proposed new infrastructure areas should be undertaken, if not already undertaken, prior to the commencement of construction / operational activities in order to assess the site for the presence of *Harpagophytum procumbens* and other faunal SCC, as well as to mark individual *Vachellia erioloba* and *Vachellia haematoxylon* for permitting purposes. • The necessary permits need to be acquired pertaining to the removal of floral and faunal SCC that are located within the study area, and the following should be ensured: > Where feasible, effective relocation of individuals to suitable similar habitat in the vicinity of the study area; and > All rescue and relocation plans should be overseen by a suitably qualified specialist. • Faunal SCC encountered within the study area to be relocated by a suitably qualified specialist to suitable habitat in the vicinity of the study area following the application of all the relevant permits. • It is recommended that vegetation clearing and other mine related operational activities take place in a phased manner, in a uniform direction from one side to the other of the mine footprint so as to ensure that as far as possible faunal species can naturally disperse out of the area ahead of activities. • The operational footprint must be kept as small as possible in order to minimise impact on the surrounding environment. • Edge effects of operational activities need to be actively managed to minimise further impacts to the receiving environment, with specific consideration to erosion control and alien floral species	X	Appendix E and Section 27

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	management. • Restrict vehicles to travelling only on designated roadways to limit the ecological footprint. • No uncontrolled fires whatsoever should be allowed on site. • No dumping of waste should take place. • If any spills occur, they should be immediately cleaned up. • In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced preventing the ingress of hydrocarbons into the topsoil. • No trapping or hunting of any faunal species is to take place. • Alien vegetation must be removed from the study area during both the construction and operational phases, in line with the NEM:BA Alien and Invasive Species Regulations (2016). • Rehabilitation Plan: > Disturbed and cleared areas must be revegetated with indigenous grass species to help stabilise the soil surface. > All alien plants within the study area must be cleared, with follow up activities running concurrently for one year. > Soils that have been compacted must be ripped and profiled in line with the surrounding area.		
Hydrology	• Stormwater management which overall includes, prevention of clean water from entering dirty catchments by perimeter berms, collection and conveyance of dirty storm water by concrete lined drainage channels and containment of dirty runoff water into the various dirty water dams, and containment of runoff from the RWD and side slopes within containment berms and allowed to evaporate. • The reuse of dirty water will be prioritised as much as is practical and through planning for discharge of excess mine water and storing for use in low water supply periods • Design standards should be followed as presented in the two design reports: o Waste Rock Dumps detailed design for EMP 2, SLR June 2018.	X	Appendix F and Section 27

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	o Integrated Storm Water Management Design for WULA Purposes, SLR January 2018. • Good housekeeping practices should be maintained by clean-up of dislodged or any slope failures materials that accumulate and reduce the capacity of containment berms compartments for runoff collection. • In addition clean-up material and materials safety data sheets for chemical and hazardous substances should be kept on site for immediate clean-up of accidental spillages of pollutants. • Water management facilities inspection and maintenance should be undertaken throughout the life of mine, to include inspection of drainage structures and liners for any in channel erosion or cracks; de-silting of silt traps/sumps and dirty water containment dams; and any pumps and pipelines should be maintained according to manufacturer's specifications. • Vehicles or plant equipment servicing should be undertaken within suitably equipped facilities, either within workshops, or within bunded areas, from which any storm water is conveyed to a pollution control dam, preferably after passing through an oil and silt interceptor. • All measures implemented for the mitigation of impacts should be regularly reviewed, as best practice, and in compliance with various licences (including WULs).		
Groundwater	• Tshipi will continue to monitor groundwater quality. Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater contamination impacts. • Groundwater quality monitoring is conducted on a quarterly basis and groundwater levels on a monthly basis, which is considered to be adequate. However, if contaminants are detected during a monitoring round, a detailed analysis should be performed, and monitoring frequency increased to monthly, for the required monitoring point. • If borehole users experience any mine related water contamination or loss of water supply, Tshipi will, in conjunction with other mines in the area that are contributors to the cumulative impact, provide compensation, which could include an alternative water supply of equivalent water quality and	X	Appendix G and Section 27

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	quantity. • *In the event that water quality monitoring around any pollution sources (TSF, open pit and WRDs) indicates that these sources are causing pollution, additional management measures will be investigated in consultation with a qualified specialist.* • Should any off-site contamination be detected, the mine will immediately notify DWS. The mine, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures. • Should waste rock dumps be removed through backfill into the pit, the footprint area will be rehabilitated by ripping the underlying subsoil, then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period. • The groundwater model will be re-run periodically during the operational phase to consider potential pollution impacts without the retardation effect of pit dewatering. If necessary, provision will be made by the mine for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning. • In case of a major discharge incident that may result in the pollution of groundwater resources the Tshipi emergency response procedure will be followed.		
Soil, Land Use and Land Capability	Soil management during the construction phase: • Minimise the development footprint. • Management and supervision of construction teams. • Implement best practice for erosion prevention or minimisation during excavation. • Locate stockpiles where they will not become contaminated. • Topsoil stripping and stockpile specifications • Management of access and haul roads. • Prevention of soil contamination.	X	Appendix H and Section 27

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	Soil management during the operational phase: • Topsoil stripping, stockpiling and management should follow the guidelines as stipulated under the construction phase above. • Three months after new stockpiles have been created, they should be examined to determine whether vegetation has naturally established itself on the stockpiles. In the case of no or sparse vegetation establishment, it is recommended that geo-textiles be used on the topsoil stockpiles to prevent wind erosion. It is recommended that vegetation removed during land clearance be composted during the operational phase and that this compost be used as a soil ameliorant for soil rehabilitation purposes. • Soil management during the decommissioning phase: • Management and supervision of decommissioning teams • Site preparation • Seeding and re-vegetation • Prevention of soil contamination • Soil management during the closure phase: • Maintenance and aftercare of final rehabilitated land • Frequent visual observations should be undertaken to confirm if vegetation has re-established and if any erosion gullies have developed. In the event that vegetation has not re-established, and erosion gullies have developed, remedial action should be taken.		
Heritage	• In the event that heritage resources are discovered during site clearance, construction activities must stop and a qualified archaeologist appointed to evaluate and make recommendations on mitigation measures. • Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the Environmental Control Officer (ECO) responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in	X	Appendix I and Section 27

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	situ) and the ECO should alert SAHRA so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.		
Air Quality	<u>Construction phase</u> • Air quality impacts during construction would be reduced through basic control measures, such as limiting the speed of haul trucks and applying water sprays regularly on the newly constructed (graded) haul roads. • Limit the size of the WRD areas as per the proposed design and clear areas in stages (construction of cells in the WRD extension). This will reduce dust generation from land clearing activities and will result in less handling of topsoil and fewer trucks on the roads, as well as minimise the areas prone to windblown dust, reducing the potential for wind erosion. • Provide water sprays or other dust management measures at all tipping points. <u>Operational phases</u> • A comprehensive dust management plan is required for the mine with specific mitigation measures, the frequency of application and the responsible divisions and persons indicated. • The dustfall network as is currently in place should be continued, with three additional dust buckets to be located at the farms of N. Fourie, D. van den Berg and A. Pyper before any changes or additions to the mine infrastructure are allowed. It is further recommended that the dust fallout monitoring should follow the ASTM D1739 (1970) method, as required by the NDCR, on the dustfall unit design, the dust collection and analysis. Dustfall results should be reported annually to the District Municipality Air Quality officer. It is further recommended that these two locations, D van den Berg and A Pyper, be added to the PM_{10} monitoring campaigns. • For the control of vehicle entrained dust (50% control efficient), it is recommended that water be applied (at an application rate >2 litre/m^2/hour). Applying chemical suppressants on the regular used unpaved haul roads between the pit and the WRD extensions could result in a control efficiency of more than 90%.	X	Appendix J and Section 27

Specialist study	Recommendation of specialist	Specialist recommendations that have been included in the EIR (mark with an x)	Reference to applicable section in this report
	• Literature indicates that fitting a roof on the conveyor and covering one side (west side and south side) should have a mitigation efficiency of 65%. Alternatively, the material can be sprayed as it enters the conveyer to reduce the potential for windblown dust. • Mitigation of materials transfer points could be done using water sprays or equivalent controls at the tip points. Tipping of waste rock should also be done within the crest of the WRD, if possible, to ensure the material does not migrate down the WRD slope. Should the dumping of waste rock be a significant source of dust deposition and ambient concentrations at the identified nearest air quality receptors, additional mitigation measures will have to be applied, such as the development of a 3-5 m high grassed berm on the western side of the West WRD could be considered to act as a screen. In this respect : o Dustfall rates should be below 600 mg/m²/day at the identified receptors (farms of N Fourie, D van den Berg and A Pyper) and if exceeded for two consecutive months, action should be taken by identifying the source of dust and applying additional mitigation measures. o Daily (24-hour) PM10 concentrations should not exceed 75 µg/m³ for more than 4 days per year at these receptors and should these concentrations be above the limit, immediate action should be taken by identifying the source of dust and applying additional mitigation measures. • In minimising windblown dust from stockpile areas, water sprays should be used to keep surface material moist and wind breaks installed to reduce wind speeds over the area. Even though high wind speeds are limited, given that this is a dry environment, wind breaks are advised. • Any binding properties would reduce the potential for wind erosion from the WRDs and topsoil piles. One of the most effective measures of minimizing wind erosion emissions is re-vegetation. Decommissioning and Closure • Basic control measures such as limiting the speed of trucks and vehicles and applying water sprays regularly on the unpaved roads used is recommended.		

10. ENVIRONMENTAL IMPACT STATEMENT

10.1 SUMMARY OF KEY FINDINGS OF THE EIA

This section provides a summary of the findings of identified and assessed potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts. A summary of the potential impacts (as per Section 8), associated with the preferred alternatives (as per Section 6), in the unmitigated and mitigated scenarios for all project phases is included in Table 10-1 below.

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the biophysical, cultural and socio-economic environments both on the project site and in the surrounding area. With management actions these potential impacts can be prevented or reduced to acceptable levels.

It follows that provided the EMPr is effectively implemented there is no biophysical, social or economic reason why the project should not proceed.

TABLE 10-1: SUMMARY OF POTENTIAL CUMULATIVE IMPACTS

Aspect	Potential impact	Cumulative impact significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
Geology	Loss and sterilisation of mineral resources	High	LOW
Topography	Altering topography	**Medium**	**MEDIUM**
Soil and land capability	Loss of soil resources and land capability through contamination and physical disturbance	**High**	**MEDIUM**
Biodiversity	Physical destruction of biodiversity	**High**	**MEDIUM**
Surface water	Alteration of natural drainage patterns	**Medium**	**LOW**
	Contamination of surface water resources	**Medium**	**LOW**
Groundwater	Contamination of groundwater resources	**Low**	**LOW**
	Lowering of groundwater levels and reducing availability	**Medium**	**LOW**
Air quality	Air pollution	**High**	**MEDIUM (HIGH FOR MN)**
Noise	Increase in disturbing noise levels	**Medium**	**LOW (DAY-TIME) MEDIUM (NIGH-TIME)**
Visual	Negative visual views	**High**	**MEDIUM (PRE-CLOSURE) LOW (AT CLOSURE)**
Traffic	Road disturbance and traffic safety	**Medium**	**LOW**
Blasting	Ground vibration, air blasts and fly rock	**High**	**MEDIUM**
Heritage/cultural and palaeontological resources	Loss of heritage/cultural resources	**Insignificant**	**INSIGNIFICANT**

Aspect	Potential impact	Cumulative impact significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
Socio-economic	Inward migration	**High**	**LOW**
	Economic impact	**Medium-high +**	**MEDIUM-HIGH +**
Land use	Change in land use	**Medium**	**LOW**

10.2 FINAL SITE MAP

The final preferred site layout plan is included in Figure 3-1 and Figure 3-2.

10.3 SUMMARY OF THE POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS OF THE PROPOSED ACTIVITY AND IDENTIFIED ALTERNATIVES

With reference to Sections 6.1 and 6.9, no site layout or infrastructure locational alternatives were considered and as such this section is not applicable.

11. IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES FOR INCLUSION IN THE EMPR

Based on the outcome of the impact assessment and where applicable the recommendations from specialists the proposed management objectives and outcomes specific to the proposed changes and for inclusion into the environmental management programme are detailed in this section.

11.1 PROPOSED MANAGEMENT OBJECTIVES AND OUTCOMES FOR ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

Specific environmental objectives to control, remedy or prevent potential impacts emanating from the proposed project are provided in Table 11-1 below.

TABLE 11-1: ENVIRONMENTAL OBJECTIVES AND OUTCOMES

Aspect	Environmental objective	Outcome
Geology	To prevent unacceptable mineral sterilisation.	Minimise the sterilisation of economic minerals as far as possible.
Topography	To minimise changes to natural topography.	Limit the alteration of the topography during mining and through rehabilitation.
Soil and land capability	To minimise the loss of soil resources and related land capability through physical disturbance, erosion, compaction and soil pollution.	Handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.
Biodiversity	To prevent the unacceptable disturbance and loss of biodiversity and related ecosystem functionality through physical and general disturbance.	Limit the area of disturbance as far as practically possible.
Surface water	To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow and to prevent pollution of surface water resources.	Ensure surface water quality remains within acceptable limits for both domestic and agricultural purposes to prevent pollution of surface water resources and related harm to surface water users. Ensure that the reduction of the volume of runoff into the downstream catchment is limited to what is necessary and that natural drainage patterns are re-established as part of rehabilitation in order to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.
Groundwater	To prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users.	Ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes. To ensure that groundwater continues to be available to current users.

Aspect	Environmental objective	Outcome
Air	To prevent air pollution health impacts.	Ensure that any pollutants emitted as a result of the project remains within acceptable limits so as to prevent health related impacts.
Noise	To prevent public exposure to disturbing noise.	Ensure that any noise generated as a result of the project remains within acceptable limits to avoid the disturbance of third parties.
Visual	To limit negative visual impacts.	Limit negative visual views.
Traffic	To prevent transport related accidents and/or injury to people and livestock.	Ensure the mine's use of public roads is done in a responsible manner to reduce the potential for safety and vehicle related impacts on road users.
Blasting	To prevent harm to people, animals and structures.	Protect third party property from mine-related activities. Where damage is unavoidable, to work together with the third parties to achieve a favourable outcome. Ensure public safety.
Heritage and cultural	To minimise the disturbance of heritage resources.	Protect heritage resources where possible. If disturbance is unavoidable, then mitigate impact in consultation with a specialist and the SAHRA and in line with regulatory requirements.
Socio-economic	To limit inward migration and related social impacts and enhance positive economic impacts.	Work with existing structures and organisations to establish and maintain a good working relationship with surrounding communities, local authorities and landowners in order to limit the impacts associated with inward migration. Enhance the positive economic impacts by working together with existing structures and organisations.
Land uses	To prevent unacceptable negative impacts on surrounding land uses.	Minimise the impact on land uses as little as possible in order to prevent unacceptable impacts on surrounding land uses and their economic activity.

11.1.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Outcomes of the environmental objectives are the implementation of monitoring programmes. Impacts that require monitoring include:

- Alteration of natural drainage patterns;
- surface water quality;
- groundwater quality;
- Dewatering and abstraction of groundwater resources;
- Physical destruction and general disturbance of biodiversity;
- Air quality;
- Noise levels; and

- Blasting.

Environmental impacts requiring monitoring are discussed future in Table 29-1.

11.1.2 ACTIVITIES AND INFRASTRUCTURE

The source activities of potential impacts which require management are detailed in Section 3.2 and include:

- Earthworks;
- Transport system;
- Mineralised ore and waste;
- Supporting services;
- Water use and management;
- Non-mineralised waste;
- Open pit mining; and
- Continued use of approved facilities and activities.

11.1.3 MANAGEMENT ACTIONS

Management actions which will be implemented to control the project activities or processes which have the potential to pollute or result in environmental degradation are detailed in Section 27.

11.1.4 ROLES AND RESPONSIBILITIES

The key personnel to ensure compliance to this EIR and EMPr are the operations executive and the Environmental Department Manager and officers. As a minimum, their roles, as they relate to the implementation of monitoring programmes and management activities, include:

- ensuring that monitoring programmes and audits are scoped to be fit for purpose and included in the annual mine budget;
- identifying and appointing appropriately qualified specialists/engineers to undertake the monitoring programmes;
- appointing specialists in a timeous manner to ensure work can be carried out to acceptable standards;
- liaising with the relevant company, municipal and community structures in terms of the commitments in the Social and Labour Plan (SLP);
- ensuring that commitments in the SLP are developed and implemented timeously;
- establishing and maintaining good working relations with surrounding communities and landowners; and
- facilitating stakeholder communication, information sharing and a grievance mechanism.

12. FINAL PROPOSED ALTERNATIVES

With reference to Sections 6.1 and 6.9, no site layout or infrastructure locational alternatives were considered and as such this section is not applicable.

13. ASPECTS FOR INCLUSION AS CONDITIONS OF THE AUTHORISATION

Management actions including monitoring requirements, as outlined in Sections 27 and 0, should form part of the conditions of the environmental authorisation. With reference to Regulation 26 of GNR 982 of NEMA, additional conditions that should form part of the environmental authorisation that are not specifically included in the EMPr report include compliance with all applicable environmental legislation whether specifically mentioned in this document or not and which may be amended from time to time.

14. ASSUMPTIONS, UNCERTAINTIES, LIMITATIONS AND GAPS IN KNOWLEDGE

Assumptions, uncertainties and limitations associated with the proposed project are included below.

14.1 ENVIRONMENTAL ASSESSMENT LIMIT

The EIA focuses on third parties only and does not assess health and safety impacts on employees and contractors because the assumption is made that these aspects are separately regulated by health and safety legislation, policies and standards, and that Tshipi will adhere to these.

14.2 PREDICTIVE MODELS IN GENERAL

All predictive models are only as accurate as the input data provided to the modellers. If any of the input data is found to be inaccurate or is not applicable because of project design changes that occur over time, then the model predictions will be less accurate.

14.3 GEOCHEMISTRY STUDY

As part of the geochemical assessment (SLR, 2014), Synthetic Precipitation Leaching Procedure (SPLP) tests were undertaken using distilled water to represent neutral drainage conditions. Although the SPLP can determine the leachability of determinants, the liquid-to-solid ratio does not represent actual field conditions; therefore, resultant concentrations should not be considered representative of runoff that could emanate from site. The tests are commonly used as a preliminary screening process to identify potential chemicals of concern (CoCs) based on a comparison against relevant water quality and effluent standards.

In addition to the above, assumptions that were made as part of geochemical modelling to predict water quality includes the following:

- The water chemistries used in the modelling are representative of input sources. It is not possible to model water quality without this essential assumption. Input water qualities are derived from the results of the geochemical characterisation programme. Therefore, the water compositions used in the modelling do not represent actual water samples but “theoretical” compositions;
- Predicting field-scale leaching from lab-scale leach tests is an approximation. Metal leaching at the field scale is variable through time and controlled by factors not fully applied at the lab scale. These factors include temperature, nature of the leaching solution, the solution to solid ratio, solution-solid contact time, particle size of the solid; and
- Modelled waters are in full thermodynamic equilibrium. Equilibrium is the computational basis of PHREEQC. Equilibrium is unlikely to be the case for all chemical components throughout all mine waters. However, geochemical research has shown that assuming equilibrium conditions may usefully describe the composition of natural and mine waters. The PHREEQC model simulates chemical reactions and contains the appropriate thermodynamic constants.

Due to the assumptions and inherent limitations of predictive modelling, the model results are order of magnitude estimates. Therefore, results do not indicate modelled concentrations less than 0.01 mg/L.

14.4 BIODIVERSITY STUDY

The following assumptions apply to the biodiversity study undertaken for the proposed project (STS, 2018):

- The assessment was confined to the study area and does not include the neighbouring and adjacent properties. These were, however, considered as part of the desktop assessment;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral and faunal communities have been accurately assessed and considered;
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities and the time (season) of the assessment, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the study area may have been missed during the assessment; and
- The data presented in this report are based on two, two-day site visits, undertaken in the middle of May 2017 (moving into the winter season) and in the middle of November 2017 (spring). A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data and previous studies. As such the findings of this assessment are considered to be an accurate reflection of the current ecological characteristics of the study area.

14.5 SURFACE WATER

The following assumptions and limitations apply to the updated water balance undertaken for the project (SLR, 2018a):

- The sinter plant and tailings facility will only become operational later in the mine's life.
- Rainfall related inflows and evaporation related losses for the wet and dry season scenarios were estimated based on: (1) average values during the three driest months of the year; and (2) average values during the three wettest months of the year;
- Runoff and evaporation coefficients for each surface were fixed and not influenced by antecedent climatic conditions, likewise all catchment areas are constant;
- Under normal / average conditions there will be no overflow of storm water from the dirty water dam or workshop dirty water collection dam into the storm water dam.
- There will be no inflow of storm water from the Mamatwan pit, during mining of the boundary pillar; and
- The water balance model is run for only steady state average wet season and average dry season conditions and no consideration is given to storage of water at any aspect of the infrastructure modelled (i.e. flow in = flow out).
- Tshipi are licenced to abstract water from two boreholes at up to 12 612m^3/year per borehole, which would reduce reliance on Sedibeng water. This supply option has not been included in the water balance as further work is required to confirm the sustainable yield of these boreholes and to estimate the cost and benefit of equipping these boreholes to supply water.

- This study makes use of various assumed and estimated parameters, and should be updated whenever additional information becomes available.
- Groundwater inflow to the open pit forms a critical part of the mine's water circuit and is the main source of water in later years of mining. Groundwater inflows are based on the available modelled data and it is recommended that measurements of water pumped out of the pit are collected and used to calibrate the water balance model presented herewith.

14.6 GROUNDWATER

The following assumptions and limitations apply to the groundwater study undertaken for the proposed project (SLR, 2018b):

- A numerical groundwater flow and transport model is a representation of some or all characteristics of a real system on an appropriate scale. It is a management tool that is typically used to understand why a system is behaving in a particular observed manner or to predict how it will behave in the future. Its precision depends on chosen simplifications (in a conceptual model), as well as on the completeness and accuracy of input parameters. In particular, data on input parameters like water levels and aquifer properties is often scarce and limits the precision and confidence of numerical groundwater models. Impact predictions are based on numerical model results, the precision of which depends obviously on the chosen simplifications, as well as the accuracy of input parameters like hydraulic conductivities, porosities or source concentrations.
- The groundwater model simulated the UMK and Mamatwan Mines, using their existing pits and did not take into account future mining or backfilling at these mines. An improved groundwater simulation of hydraulic heads (cone of drawdown) and a more realistic contaminant plume could be modelled through information sharing between Tshipi, Mamatwan and UMK.
- The source term (i.e. type and amounts of hazardous material released to the environment) used for groundwater modelling is considered to be conservative and may overestimate the potential pollution impacts. Further source term modelling should be carried out on waste samples collected from site and incorporated in the future groundwater model updates.
- It should be noted that no significant faults, fractures or other lineaments were observed at the Tshipi Borwa Mine (Metago, 2009) and, therefore, no geological structures have been included in the model. Should such structures be encountered, further hydrogeological work will be needed and the groundwater model will need to be updated.

14.7 AIR QUALITY

The air quality study (Airshed, 2018) followed a qualitative approach, with no emissions quantified for the proposed changes or additions to the mine infrastructure layout plan. The following was assumed:

- The mining rate would remain the same; and
- The modelled impacts from the 2009 study were used to qualitatively assess the potential for any increases in ground level concentrations.

14.8 NOISE

The change in the operations crushing and screening and train loading activities from day-time only to day-time and night-time including weekends is not expected to significantly add to ambient noise levels due to other noise generating activities in the area.

14.9 TRAFFIC STUDY

The following assumptions and limitations apply to the traffic study undertaken for the project (Siyazi, 2017):

- The average rate of growth of non-Tshipi related vehicle traffic (i.e. background traffic) in the area under investigation between the 2017 manual traffic counts and the 2027 scenarios was anticipated at 3% per annum;
- The vehicle traffic absorption rate (rate at which existing developments attract vehicular traffic) by all other types of completed developments will maintain the same status for the next ten years;
- Vehicle traffic currently generated by the existing mining development will remain unchanged; and
- The traffic study does not comment on pavement layer attributes in terms of the relevant road sections.

14.10 HERITAGE/ CULTURAL AND PALAEONTOLOGICAL RESOURCES

The following assumptions apply to the groundwater study undertaken for the proposed project (PGS, 2018):

- Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.
- Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

14.11 CLOSURE COST ESTIMATE

The following assumptions are made for the development of the Preliminary Closure Plan at this stage of the mining operations (Section 4.7 of the Preliminary Closure Plan in APPENDIX K):

- Tshipi will follow and adhere to the commitments made in the EIAR/EMPr reports, and any amendments thereto;
- Tshipi will follow the mine plan and design / layout to minimise the potential for additional disturbed areas;
- The volume of stockpiled topsoil that has been stripped from infrastructure and operational areas will be sufficient for closure activities;
- Groundwater in the deeper BIF aquifer will not be negatively impacted by the mine workings;

- Runoff water quality from rehabilitated areas will be acceptable and will not require any further treatment;
- No allowance for salvage and / or recycling scrap material has been considered in the estimation procedure;
- Inert building and demolition rubble can be safely disposed and buried on site;
- Hazardous material can be safely disposed of offsite at a nearby appropriate facility;
- Reagent, fuel, lubricant and explosive manufacturers/suppliers will accept returned product at the end of the mine life;
- No consideration of the social closure costs has been included in this report;
- No assessment of any socio-economic/shared value/ community based programmes being implemented and whether these would continue post-closure of the operation; and
- All costs associated with pre-closure monitoring, auditing and reporting are presumed to be covered under the operations expenditure of the mine, and have not been included in this preliminary closure plan.

The closure cost liability was calculated as per the methodology of the DMR guideline document (DMR, 2005). Post closure supervision and monitoring costs; and time, fee and contingency costs were included in order to improve the accuracy of the DMR guideline closure cost liability estimate, and to comply with the requirements of the Environmental Impact Assessment Regulations, 2014.

The closure cost liability associated with the backfilling of the final pit void has not been considered at this stage. Backfilling of the pit void (including in-pit dumping during operations) should therefore be separately accounted for by Tshipi in the operations expenditure of the Tshipi Borwa Mine.

In the context of evolving technical, commercial, socio-economic, environmental, legal and cumulative considerations, Tshipi has commenced the process of re-evaluating its mine closure solution. While a measure of pit backfilling is still envisaged, it is probable that the preferred long-term sustainable closure solution will not incorporate complete backfill.

15. REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

15.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORIZED OR NOT

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the biophysical and socio-economic environments both on the project sites and in the surrounding area. With management actions, these potential impacts can be prevented or reduced to acceptable levels. It follows that provided the EMPr is effectively implemented there is no biophysical, social or economic reason why the project should not proceed.

15.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

15.2.1 SPECIFIC CONDITIONS FOR INCLUSION IN THE EMPR

Refer to Section 13.

15.2.2 REHABILITATION REQUIREMENTS

Refer to Section 28.

16. PERIOD FOR WHICH AUTHORISATION IS REQUIRED

The estimated remaining life of mine is 25 years. The mine has been operational for 7 years.

17. UNDERTAKING

I, Marline Medallie, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- the information provided herein is correct;
- comments and inputs from stakeholders and I&APs have been included and correctly recorded in this report;
- inputs and recommendations from the specialist reports have been included where relevant; and
- any information provided to I&APs and any responses to comments or inputs made is correct or was correct at that time.

Signature of EAP

Date

Signature of commissioner of oath

Date

18. FINANCIAL PROVISION

18.1 METHOD TO DERIVE THE FINANCIAL PROVISION

The financial provision for the project is based on a preliminary mine closure plan compiled for Tshipi Borwa Mine in accordance with the relevant legislation (SLR, 2018c) (see Appendix K).

The closure cost liability was calculated as per the methodology of the DMR guideline document of January 2005. As per the DMR guideline, Tshipi Borwa Mine is classified as a Class C (low risk) mine, with a medium environmental sensitivity based on the pre-mining environment of the mining area, the proximity of the mine to local communities and the surrounding area's existing economic activity.

The amount determined for financial provision for the project is provided in Section 28.

18.2 CONFIRM THAT THE AMOUNT CAN BE PROVIDED FOR FROM OPERATING EXPENDITURE

The amount required in order to manage and rehabilitate the environmental disturbance (as a result of Tshipi's mining activities) is provided for in the operating costs.

19. DEVIATIONS FROM SCOPING REPORT AND APPROVED PLAN OF STUDY

19.1 DEVIATION FROM THE METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

This section is not applicable; the assessment methodology used in the assessment of potential impacts (see Section 6.6) is as per the approved Plan of Study for EIA presented in the final Scoping Report.

19.2 MOTIVATIONS FOR DEVIATION

With reference to Section 19.1 above, this section is not applicable.

20. SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

The following documentation forms part of the EIR as request by the competent authority :

- The draft letter of agreement in terms of rehabilitation and responsibility between Hotazel Manganese Mines Proprietary Limited (Mamatwan) and Tshipi for the merging of two waste rock dumps – Mamatwan Sinterfontein WRD and Tshipi East WRD (see APPENDIX L).
- The draft rehabilitation strategy for the combined Tshipi/ Mamatwan WRD (see APPENDIX L).

20.1 IMPACT ON THE SOCIO-ECONOMIC CONDITIONS OF ANY DIRECTLY AFFECTED PERSON

The impacts associated with socio-economic conditions are discussed in Appendix D. Management and management actions identified to address any socio-economic impacts are included in Section 27.

No person will be directly affected by the project given that no I&APs currently reside within the proposed extension footprint area. However, other direct impacts include:

- Road and traffic safety (**LOW** significance with mitigation);
- Influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security (**LOW** significance with mitigation); and
- Employment and procurement of goods and services (**MEDIUM-HIGH +** significance with mitigation).

Indirect socio-economic impacts include:

- Alteration of drainage patterns by reducing the volume of runoff into the downstream catchments (**LOW** significance with mitigation);
- Contamination of ground and surface water resources through long term seepage and/or runoff (**LOW** significance with mitigation);
- Lowering of groundwater levels and reducing availability (**LOW** significance with mitigation);
- Air pollution sources that can have a negative impact on ambient air quality (**LOW** significance with mitigation, except Mn which is considered to be **HIGH** significance with mitigation);
- Increase in disturbing noise levels (**LOW** significance during the day and **MEDIUM** at night with mitigation); and
- Visual impacts on this receiving environment may be caused by activities and infrastructure (**MEDIUM** significance with mitigation prior to closure and **LOW** significance with mitigation at closure).

20.2 IMPACT ON ANY NATIONAL ESTATE REFERRED TO IN SECTION 3(2) OF THE NATIONAL HERITAGE RESOURCES ACT

Not applicable. No national estate will be affected as part of the project.

21. OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

No other matters are required in terms of Section 24(4)(A) and (B) of the Act.

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

22. DETAILS OF THE EAP

The details of the EAPs who undertook the EIA process and prepared this EIR are provided in Part A, Section 0.

23. DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

The activities covered by this EIR are fully described in Part A, Section .

24. COMPOSITE MAP

A composite map including all surface infrastructure (existing and proposed) superimposed on the environmental sensitive areas of the preferred site is included in Figure 24-1.

FIGURE 24-1: COMPOSITE MAP

25. DESCRIPTION OF THE IMPACT MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENT

25.1 DETERMINATION OF CLOSURE OBJECTIVES

The closure objectives for the project were determined taking into account the existing type of environment as described in Section 6.4.1, in order to ensure that the closure objectives strive to achieve a condition approximating its natural state as far as possible. Further information pertaining to the closure objectives identified for the project in provided in Section 28.1.1.

25.2 THE PROCESS FOR MANAGING ENVIRONMENTAL DAMAGE AS A RESULT OF UNDERTAKING THE ACTIVITY

The management actions outlined in Section 27 have been identified in order to manage and reduce impacts associated with the proposed project in order to prevent unnecessary damage to the environment. In the event that incidents occur that may result in environmental damages the emergency response procedure as outlined in Section 30.2 will be implemented to avoid pollution or degradation.

25.3 POTENTIAL RISK OF ACID MINE DRAINAGE

With reference to Section 6.4.1.1, geochemical tests and analysis indicate that waste rock at the Tshipi Borwa Mine has a negligible potential to generate acid drainage due to non-detectable sulphur content.

25.4 STEPS TAKEN TO INVESTIGATE, ASSESS AND EVALUATE THE IMPACT OF ACID MINE DRAINAGE

With reference to Section 25.3, waste rock is not acid generating and as such this section is not applicable.

25.5 ENGINEERING OR MINE DESIGN SOLUTIONS TO AVOID OR REMEDY ACID MINE DRAINAGE

With reference to Section 25.3, waste rock is not acid generating and as such this section is not applicable.

25.6 MEASURES IN PLACE TO REMEDY RESIDUAL OR CUMULATIVE IMPACT FROM ACID MINE DRAINAGE

With reference to Section 25.3, waste rock is not acid generating and as such this section is not applicable.

25.7 VOLUMES AND RATE OF WATER USE FOR MINING

An overview of the existing water supply and management is provided in Section 3.2.2.6. In summary:

- Potable water for the mine is sourced from the Sedibeng Vaal Gamagara Water Supply pipeline. Tshipi requires a maximum of 27 387 m^3/month of water from the Sedibeng Vaal Gamagara Water Supply pipeline. The proposed project will not require an additional potable water supply.
- Process water is currently provided by a combination of water from the Sedibeng Vaal Gamagara Water Supply pipeline (when make-up water is required), dewatering from the open pit, the collection of storm water runoff and from planned water supply boreholes within the Mining Right area. Tshipi requires a

total of 9 432 m^3/month. When the tailings dam and sinter plant are in operation, the process water requirements will increase to 15 004 m^3/month.

25.8 HAS A WATER USE LICENCE BEEN APPLIED FOR?

Tshipi currently holds a WUL (reference number 10/D41K/AGJ/1735) authorising water uses in terms of Section 21 of the NWA.

A WUL is required for the proposed WRD expansion project, as it triggers a water use activity listed in Section 21 of the NWA (refer to Table 3-3). Thus, a WUL will be applied for as part of the proposed project. It should be noted that a WUL application process was initiated with the DWS in 2017, for undertaking water uses related to the changes to mine infrastructure as per the previous Tshipi EMPr amendment (SLR, 2017d). The water uses related to the current project will be included in the WUL application still to be submitted to DWS.

25.9 IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

The assessment of potential impacts is included in Section 8 and Appendix D. Management actions which will be implemented to avoid and minimise potential impacts are detailed in Section 27.

26. IMPACT MANAGEMENT OUTCOMES

Table 26-1 below provides a description of the outcomes and objective of management actions in order to manage, remedy, control or modify potential impacts. The management actions identified to achieve these outcomes and objectives are described in Section 27.

TABLE 26-1: DESCRIPTION OF IMPACT MANAGEMENT OUTCOMES

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Mineralised waste Continued use of approved facilities and services Open pit mining Final land forms	Loss and sterilisation of mineral resources	Geology	Operational Decommissioning Closure	• Management through best practises to prevent unacceptable mineral sterilisation	Avoid sterilisation of mineral resources.
Earthworks Mineralised waste Water use and management Open pit mining Final land forms	Altering topography	Topography	Construction Operational Decommissioning Closure	• Minimise the area of disturbance • Restore natural topography as far as practically possible upon closure	To limit the alteration of the topography during mining and through rehabilitation.
Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and	Loss of soil resources and land capability through contamination and physical disturbance	Soil and land capability	Construction Operational Decommissioning Closure	• Limit project footprint • Soil conservation procedures • Control through waste management practices • Control through appropriate design (incl. access roads) • Closure planning and rehabilitation	To handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
services Open pit mining Final land forms				• Erosion control • Remedy through emergency response procedures (see Section 30.2.2)	
Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Open pit mining Final land forms	Physical destruction and general disturbance of biodiversity	Biodiversity	Construction Operational Decommissioning Closure	• Control through appropriate design (incl. access roads) • Implement biodiversity action plan and offset (if relevant) • Limit project footprint • Phase vegetation clearing • Search and rescue of flora and fauna • Comprehensive monitoring programme for protected trees • Alien invasive species management programme • Management through training and monitoring • Rehabilitation • Control through permits for removal • Remedy through emergency response procedures (see Section 30.2.2)	To limit the area of disturbance as far as practically possible.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Alteration of natural drainage patterns	Surface water	Construction Operational Decommissioning Closure	• Management through storm water control (Storm water Management Plan) • Surface water monitoring • Update water balance	To ensure that the reduction of the volume of runoff into the downstream catchment is limited to what is necessary and that natural drainage patterns are re-established as part of rehabilitation in order to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.
	Contamination of surface water resources			• Management through appropriate design • Implementation of Storm water Management Plan • Management through waste management practises • Surface water monitoring • Management through compensation • Remedy through emergency response procedures (see Section 30.2.2)	To ensure surface water quality remains within acceptable limits for both domestic and agricultural purposes to prevent pollution of surface water resources and related harm to surface water users.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining (including backfilling) Final land forms	Contamination of groundwater resources	Groundwater	Construction Operational Decommissioning Closure	• Groundwater monitoring • Implementation of Storm water Management Plan • Management through compensation • Management through appropriate design • Remedy through emergency response procedures (see Section 30.2.2)	To ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes to prevent harm to water users.
Continued use of approved facilities and services Open pit mining	Lowering of groundwater levels and reducing availability		Operational	• Groundwater monitoring • Management through compensation	To avoid loss of groundwater for third party use.
Site preparation Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Air pollution	Air quality	Construction Operational Decommissioning Closure	• Management through appropriate design (incl. screens) • Dust control and dust fall out monitoring • Air quality monitoring • Complaints register	To ensure that any pollutants emitted as a result of the project remain with acceptable limits so as to prevent health related impacts.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Site preparation Earthworks Mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining	Increase in disturbing noise levels	Noise	Construction Operational Decommissioning Closure	• Manage through noise controls and once off sampling • Conduct noise monitoring in the unlikely event that Tshipi receives noise related complaints	To ensure that any noise generated as a result of the project remains within acceptable limits to avoid the disturbance of third parties.
Site preparation Earthworks Mineralised waste Support services Continued use of approved facilities and services Open pit mining Final land forms	Negative visual views	Visual	Construction Operational Decommissioning Closure	• Limit project footprint • Phase vegetation clearing • Dust control • Manage through visual controls • Rehabilitation	To ensure visual views that complements the surrounding environment to limit negative visual views.
Continued use of approved facilities and services	Road disturbance and traffic safety	Traffic	Construction Operational Decommissioning	• Road maintenance • Remedy through emergency response procedures (see Section 30.2.2))	To ensure the mine's use of public roads is done in a responsible manner to reduce the potential for safety and vehicle related impacts on road users.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Continued use of approved facilities and services Open pit mining	Ground vibration, air blasts and fly rock	Blasting	Operational	• Management through blast design • Remedy through emergency response procedures (see Section 30.2.2)	To protect third party property from mine-related activities. Where damage is unavoidable, to work together with the third parties to achieve a favourable outcome. To ensure public safety.
Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Open pit mining	Loss of heritage/ cultural and palaeontological resources	Heritage/cultural and palaeontological resources	Construction Operational Decommissioning	• Control through avoidance • Remedy through emergency response procedures (see Section 30.2.2))	To protect heritage resources where possible. If disturbance is unavoidable, then mitigate impact in consultation with a specialist and the SAHRA and in line with regulatory requirements.
Site preparation Earthworks Mineralised waste Water use and management Support services Open pit mining Closure activities in line with closure plan	Inward migration	Socio-economic	Construction Operational Decommissioning Closure	• Control through the monitoring of living conditions of employees, recruitment processes, health management • Remedy through emergency response procedures (see Section 30.2.2)	To establish and maintain a good working relationship with surrounding communities, local authorities and land owners in order to limit the impacts associated with inward migration.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Site preparation Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Closure activities in line with closure plan	Economic impact		Construction Operational Decommissioning Closure	• Control through good communication, recruitment and procurement processes	To enhance the positive economic impacts by working together with existing structures and organisations.
Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Change in land use	Land use	Construction Operational Decommissioning Closure	• Communication with neighbours and land users • Repairs any damaged infrastructure • Rehabilitation	To minimise the impact on land uses as little as possible in order to prevent unacceptable impacts on surrounding land uses and their economic activity.

27. IMPACT MANAGEMENT ACTIONS

Management actions identified to prevent, reduce, control or remedy the assessed impacts are presented in Table 27-1 below.

It is important to note that management actions will include any measures outlined in the original EMPr (Metago, 2009), EMPR amendment (SLR, 2017d) and any additional management actions identified as part of the current project, where relevant. Any additional management actions are indicated in ***italics***. The action plans include the timeframes for implementing the management actions together with a description of how management actions comply with relevant standards. Management actions and recommendations identified by specialists have been summarised and are included in the table below.

TABLE 27-1: DESCRIPTION OF IMPACT MANAGEMENT ACTIONS

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
1	Mineralised waste Continued use of approved facilities and services Open pit mining Final land forms	Loss and sterilisation of mineral resources	• Implement best mining practices during all mine phases to ensure that mineral sterilisation is minimised as far as possible. This includes diligent planning based upon available technical data and other information e.g. economic factors.	On-going, as required for any new infrastructure	Not applicable
2	Earthworks Mineralised waste Final land forms	Altering topography	• Minimise the area of disturbance by designing and constructing the most compact infrastructure practically possible; and • Restore the natural topography where possible and rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved.	On-going, as required for any new infrastructure	Not applicable

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
3	*Site preparation* Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Loss of soil resources and land capability through contamination	Implement the following management actions during all mine phases: • Conduct potentially polluting activities (i.e. loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants (such as fuels, oils, hazardous chemicals (new and used), dirty water, mineralized wastes and non-mineralised wastes) are contained at source and do not pollute soils. In this regard: o Service all vehicles and mobile equipment regularly in workshops, service bays and washbays with contained impermeable, floors, dirty water collection facilities and oil traps; o Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment; o Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up and/or remediate immediately; o Implement and maintain a dirty water management system, as set out in the respective section; o Implement the waste management practices, as set out in Table 27-2; o Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and o Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents. • Determine and implement specifications for post rehabilitation audits to ascertain whether the remediation of any polluted soils	On-going	Not applicable

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures; • Take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring in the design of any permanent and potentially polluting structures (such as the waste rock dumps, ore stockpiles and tailings dam) and • Implement the emergency response procedure in Section 30.2.2 in the event any major spillage incident.		
4	*Site preparation* Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Loss of soil resources and land capability through physical disturbance	Implement the following management actions during all mine phases: • Limit land disturbance to those activities and areas that are described in the EMPr. *In this respect, clear instructions will be included in relevant contracts that will restrict construction work and construction workers to clearly defined areas, and compliance to these instructions will be monitored*; • Implement the soil conservation procedure as set out in Table 27-3; • Rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved; • *Use existing established roads wherever possible;* • *Locate new roads that will carry heavy-duty traffic in areas that have been previously disturbed rather than clearing new areas;* • *Design new roads with a camber to avoid ponding and to encourage drainage to side drains; where necessary, install culverts to allow free drainage;* • *Protect the side drains on the roads with sediment traps and/or gabions to reduce the erosive velocity of water during storm events and where necessary use geo-membrane lining;* • *Manage the terrain within the mine surface use area to prevent*	On-going	Not applicable

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			erosion by implementing the following measures: o *Implement best practice for erosion prevention or minimisation during excavation as follows:* - *Restrict excavation to areas where it is absolutely necessary;* - *Use geo-textiles or other suitable means where required to prevent soil erosion;* - *Use tracked excavation equipment where possible to reduce soil compaction that leads to higher run-off rates and increased erosion risk.* o *Reduce permanent slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces; and* o *Use recognised drainage control measures e.g. side-drains and culverts to manage the natural flow of surface runoff.*		
			• Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, and in the designs of any permanent landforms e.g. waste rock dumps, approved tailings dam).	On-going	
5	*Site preparation* Earthworks Mineralised waste Water use and management Support services Transportation system Open pit mining Final land forms	Physical destruction of biodiversity	Implement the following management actions during all mine phases: • implement and refine (as needed) the biodiversity action plan, in consultation with DAFF and a suitably experienced and qualified specialist; • Limit mine infrastructure, activities and disturbance areas to those specifically identified and described in this EMPr, with controlled access and zero tolerance of unnecessary disturbances to the identified sensitive habitats and associated species; • Retain corridors of naturally occurring vegetation within the disturbed areas as far as practicably possible, to provide a corridor for fauna to move out of the disturbed areas;	On-going	Permit applications must made to the DAFF and DENC to obtain the required permission to remove and/or translocate protected species in terms of the NFA and

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			• *Limit vegetation clearing along the powerline servitude to prevent the powerline from being overgrown and/or affected by veld fire; in accordance with the DAFF guideline (protected trees may only be cleared directly underneath and within 4 metres of the powerline).* • *Implement phased vegetation clearing of the WRD extension areas, in a uniform direction from one side to the other so as to ensure that, as far as possible, faunal species can naturally disperse out of the area ahead of activities;* • Collect pods of the Camel Thorn (*Vachellia erioloba*) and the Grey Camel Thorn (*Vachellia haematoxylon*) in order to aid in the re-establishment of these species. Take the necessary steps (such as artificial scarring/acid washing) in order to aid in germination of these species, with guidance from a qualified and experienced specialist; • Plan and implement plans for the removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities. This includes planning on the preservation, cultivation and re-use of these species in ongoing rehabilitation. Take the soil conservation procedure and required actions into account when implementing removal plans. Undertake harvesting of seeds in a controlled manner from similar areas within the mine surface use area to aid in rehabilitation of the mining areas. Ensure that all rescue and relocation plans are overseen by a suitably qualified and experienced specialist, who will also advise on the potential for establishing a nursery of plants to be used for rehabilitation; • Obtain the relevant permits prior to removal of protected plant and/or trees and comply with the requirements thereof; • Obtain guidance from a suitably qualified and experienced specialist to develop and implement an effective monitoring		the NCNCA, respectively. Only for new areas to be disturbed.

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			programme of protected trees in the area of operation, on an individual tree basis and at a community level. Implement additional management actions that may be recommended by the specialist, depending on the results of the monitoring programme; • Re-vegetate disturbed and cleared areas once no longer in use with indigenous species of flora to help stabilise the soil surface; • Develop and implement an "after care" programme to manage rehabilitated areas which will aid in ensuring that the correct species are able to re-establish;		
			• Implement a biodiversity offset, should this be requested by DAFF, in accordance with the relevant biodiversity offset guidelines. Consider the following issues in the biodiversity offset with guidance from DAFF: o the size of the potentially affected area; o the conservation status of the potentially affected area; o the offset ratio (in terms of the required size of the offset site) to be applied; o evaluation of alternative offset sites on the basis of: compensation for the mine's negative impact on biodiversity, long term functionality, long term viability, contribution to biodiversity conservation in the Northern Cape including linkages to areas of conservation importance, acceptability to I&APs, management of negative impacts on local communities, distances from other mines in relation to dust fallout and other impacts, and biodiversity condition scores as compared to that at the UMK site; o land ownership now and in the future; o status/security of the offset site, i.e. will it receive conservation status;	As required	

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			o measures to guarantee the security, management, monitoring and auditing of the offset; o capacity of Tshipi to implement and manage the offset o collaboration with surrounding mine's offsets may be an option; o identification of unacceptable risks associated with the offset; and o the start-up and ongoing costs associated with the offset for the life of the project. • Implement the emergency response procedure in Section 30.2.2 in the event of major spillage incidents.		
6	*Site preparation* Earthworks Mineralised waste Water use and management Support services Transportation system Open pit mining Final land forms	General disturbance of biodiversity	Implement the following management actions during all mine phases: • Implement an alien/invasive/weed management programme (Section 0) in collaboration with the DENC and DAFF to control the spread of these plants onto and from disturbed areas. Take care to prevent the encroachment of these species into rehabilitated areas; • Use appropriate fencing where feasible to keep vertebrates away from illuminated areas; • Train workers on the value of biodiversity and the need to conserve the species and systems that occur in the mine surface use area; • Implement a zero tolerance policy with regard to the killing or collecting of any fauna and/or flora by any Tshipi employees and/or contractors or visitors; • *Implement steps to prevent the propagation and/or spread of veld fires e.g. cutting/burning fire-breaks and put in place as part of the emergency plan a programme, trained individuals and equipment for fire-fighting*	On-going	The management action to implement an alien invasive species programme is in accordance with the NEM:BA Alien and Invasive Species Regulations (2014) that requires the control of invasive species.

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			• Implement active speed control measures for any vehicles driving within the mine surface use area; • Maintain noisy and/or vibrating equipment to limit noise and vibration emission levels; • Implement dust control measures as discussed under the air quality section in this table; • Prevent pollution and litter as outlined in Table 27-2 and Table 27-3; and		
			• Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, including in the designs of potentially polluting structures (mine residue facilities).	As required	
7	Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Alteration of natural drainage patterns	Implement the following management actions during all mine phases: • Construct, operate and maintain mine infrastructure in a *manner* that ensures compliance with the provisions of the Regulation 704 of 1999 in terms of the NWA. These include: o Separate clean and dirty water systems; o Minimise the size and extent of dirty water areas; and o Divert clean water (run-off and rainfall) around the mine/dirty areas and back into its normal flow paths in the environment; • Regularly update and refine the site wide water balance with the input of actual flow volumes to enable the water balance to be used as a decision-making tool for water management and impact management actions (Section 0).	On-going	Construct, operate and maintain storm water management facilities in in a manner that ensures compliance with Regulation 704 of 1999 in terms of the NWA. Submit a water use licence application for authorisation in terms of the

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
					NWA for dirty water containment facilities. Comply with the requirements of the WUL.

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
8	Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Contamination of surface water resources	Implement the following management actions during all mine phases: • Handle all hazardous fuels, oils, chemicals (new and used), mineralized waste and non-mineralised waste in a manner such that they will not pollute surface water. This will be achieved by means of the following actions: o Prevent pollution prevention through appropriate infrastructure design. In this regard the WRD extensions will be constructed according to approved designs; o Prevent pollution through maintenance of infrastructure and equipment; o Prevent pollution through education and training of Tshipi employees and contractors (permanent and temporary); o Prevent pollution prevention through appropriate management of hazardous materials as outlined in Table 27-2; o Implement appropriate steps to enable containment and remediation of pollution incidents; and o Develop post rehabilitation audit criteria to ascertain whether the remediation has been successful. Implement further measures should post rehabilitation audits show rehabilitation has not been successful. • *Implement the Storm water Management Plan as per the design report;* • *Manage WRD slope failures which could reduce the capacity of the WRD and/or reduce the effectiveness of WRD paddocks and berms. Rehabilitate any slope failures without delay and recover dislodged/displaced material and return to the WRDs. This also applies to the paddocks and/or berms surrounding the WRDs;* • *Maintain relevant data sheets for chemical and hazardous substances to provide guidance on the clean-up of chemical*	On-going	Construct, operate and maintain storm water management facilities in in a manner that ensures compliance with Regulation 704 of 1999 in terms of the NWA. Submit a water use licence application for authorisation in terms of the NWA for dirty water containment facilities. Comply with the requirements of the WUL.

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			and/or hazardous spills; • *Conduct regular inspections and maintenance of water management facilities throughout the life of mine, including inspection of drainage structures and liners for;* o *any in-channel erosion or cracks;* o *de-silt silt traps/sumps and dirty water containment dams; and* o *maintain pumps and pipelines according to manufacturer's specifications;* • *Service vehicles and plant equipment within suitably equipped facilities, either within workshops, or within bunded areas, from which any storm water is conveyed to a collection facility, after passing through an oil and silt interceptor;* • Monitor surface water quality within and outside the vicinity of mining operations. The surface water monitoring programme must also focus on surface water sampling of different mine dirty water streams, any unplanned discharges, and monitoring both up and downstream of the Vlermuisleegte of the mining operations when possible (the possibility of monitoring water in the Vlermuisleegte River may only arise during heavy periods of rain). Details of the surface water monitoring programme are outlined in Section 0; • *Regularly review design measures and mitigation measures for identified impacts as per best practice requirements and in compliance with relevant authorisations, including the WUL;*		
			• Immediately notify the DWS should any surface water resource contamination be detected. Implement any required actions to stop the contamination of downstream water. • Notify potentially affected users in the event of surface water contamination, identify the source of contamination, identify measures for the prevention of this contamination (in the short	As required	

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			term and the long term) and then implement these measures, in consultation with DWS and an appropriately qualified person. Address any related proven loss caused by the mine (in the short and long term) through appropriate compensation, which may include an alternative water supply of equivalent quality and quantity; • *Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources (TSF, open pit and WRDs) indicate that these sources are causing pollution which is migrating off-site; and*		
			• Implement the emergency response procedure in Section 30.2.2 in the event of a potentially polluting discharge incident.	As required	
9	Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining (including backfilling) Final land forms	Contamination of groundwater resources	Implement the following management actions during all mine phases: • *Implement the Storm water Management Plan as per the design report;* • Monitor groundwater quality (refer to Section 0 for the monitoring programme). *Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater contamination impacts;* • Immediately notify the DWS should any groundwater resource contamination be detected off-site; • Notify potentially affected users in the event of groundwater contamination, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures, in consultation with DWS and an appropriately qualified person; • Address any water loss proven to be caused by the mine (in the short and long term) through appropriate compensation, which	On-going	Construct, operate and maintain storm water management facilities in in a manner that ensures compliance with Regulation 704 of 1999 in terms of the NWA. Submit a water use licence application for authorisation in terms of the

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			may include an alternative water supply of equivalent quality and quantity. In the event that Tshipi is proven to be partially responsible for water loss from third party water users, the compensation costs will be shared by all responsible parties; • *Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources (TSF, open pit and WRDs) indicate that these sources are causing pollution which is migrating off-site;* • Prevent pollution through appropriate infrastructure design. In this regard the WRD extensions will be constructed according to approved designs; • Rehabilitate the footprints of temporary waste rock dumps by ripping the underlying subsoil, then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period. This will apply to any WRDs that are removed during decommissioning and closure through backfill into the open pit; • Re-run the groundwater model periodically during the operational phase as and when additional relevant data becomes available, in order to consider potential pollution impacts without the retardation effect of pit dewatering. If necessary, make for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning; • Implement the emergency response procedure in Section 30.2.2 in the event of a potentially polluting discharge incident; • Conduct further source term studies to be used for groundwater modelling updates.		NWA for dirty water containment facilities. Comply with the requirements of the WUL.

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
10	Open pit mining (Pit dewatering) Recovery of groundwater levels	Lowering of groundwater levels and reducing availability	Implement the following management actions during all mine phases: • Monitor groundwater levels (refer to Section 0 for the monitoring programme). *Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater impacts;* • Address any water loss proven to be caused by the mine (in the short and long term) through appropriate compensation, which may include an alternative water supply of equivalent quality and quantity. In the event that Tshipi is proven to be partially responsible for water loss from third party water users, the compensation costs will be shared by all responsible parties; Commission a specialist team comprising DWS and biodiversity and groundwater experts to investigate the significance of the impacts and the specific management actions that must be implemented by all contributing mines should monitoring show that the base flow of the Vlermuisleegte River is affected by mine dewatering activities.	On-going	Submit a water use licence application for authorisation in terms of the NWA for dirty water containment facilities. Comply with the requirements of the WUL.
11	*Site preparation* Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities	Air pollution	Implement the following management actions during all mine phases: • Maintain an active and strict (vehicle) speed limit policy; • Apply suitable dust binding agent and/or water suppression on mine roads. Where dust binding agents are used, this must be limited to the roads only. Should water be used, it is recommended that water be applied at a rate >2 litre/m^2/hour. • Sweep paved road surfaces as needed to limit dust generation. • Use effective water sprays at waste rock/ore loading points e.g. tips and conveyor transfer points and during train-loading. • Use drills fitted with cyclone-type dust extraction systems in the mining pit. • *Construct the WRD extension in phases thereby limiting the size*	On-going	National Atmospheric Emission Reporting Regulations in terms of the National Environmental Management: Air Quality Act (No. 39 of 2004) requires that holders of Mining

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
	and services Open pit mining Final land forms		*and extent of pre-stripped ground from which dust can be generated. .* • *Dump waste rock on the WRDs in a manner that prevents material from migrating down the WRD slope i.e. dump waste rock before the WRD crest and doze the waste rock into position.* • *Use dust allaying measures, such as water sprays or equivalent controls to limit the generation of dust, at waste rock tipping points on the WRDs;* • *Allow topsoil stockpiles and WRD side slopes to re-vegetate naturally. Should re-vegetation cover be insufficient after a rainy season, implement additional dust management measures, such as the use of geotextiles and wind breaks or other methods that are proven to be effective.* • Maintain a complaints register that is available at the mine. The date and time noted on the complaints register will be the date and time that the reported problem is observed, not the date and time that the complaint is logged. Compare the complaints register to air quality monitoring data, as well as recorded meteorological data, to identify problem areas and then iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources; • Apply for an air emissions licence for the sinter plant prior to operation.		Rights register on the National Atmospheric Emissions Inventory System (NAEIS) and to ensure that annual monitoring reports are uploaded onto the NAEIS. *Dust fallout monitoring will follow the ASTM D1739 (1970) method as required by the National Dust Control Regulations.*
			• Develop and implement an air quality control system which includes inter alia: o *Monitor air quality in accordance with Section 0. Three additional dust buckets will be located at the farms of N. Fourie, D. van den Berg and A. Pyper and additional PM10 monitors will be located at D. van den Berg and A. Pyper;* o *Follow the ASTM D1739 (1970) method as required by the National Dust Control Regulations, with regard to the*	On-going	

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			dustfall unit design, dust collection and analysis; and o *Report dustfall results annually to the District Municipality Air Quality officer.* o *Apply the following criteria with regard to dust and PM10 monitoring at receptors closest to the West WRD extension:* o *Dustfall rates must be below 600 mg/m²/day at the identified receptors (farms of N Fourie, D van den Berg and A Pyper) and if exceeded for two consecutive months, action will be taken by identifying the source of dust and applying additional mitigation measures.* o *Daily (24-hour) PM10 concentrations will not exceed 75 µg/m³ for more than four (4) days per year at these receptors and should these concentrations be above the limit, immediate action will be taken by identifying the source of dust and applying additional mitigation measures.* *A possible additional management measure to be considered should it be required, is the wetting of waste rock material prior to tipping onto the WRDs.* • Commission a health risk assessment if monitoring determines that third parties will be exposed to unacceptable cumulative concentrations of manganese or PM_{10} which will focus on the receptors where exceedances are found. Commissioning this health risk assessment, including the implementation of any related management actions, will be the responsibility of both Tshipi and other contributing mines.		
12	Site preparation Earthworks Mineralised waste Support services	Increase in disturbing noise levels	Implement the following management actions during all mine phases prior to closure: • Do not blast at night and on Sundays; • Maintain all diesel-powered earth moving equipment in order to limit noise, including the checking and replacement of exhaust	On-going	Not applicable

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
	Transportation system Continued use of approved facilities and services Open pit mining		and intake silencers; • Maintain all haul roads in a good state of repair at all times to avoid unwanted rattle and "body-slap" from vehicles; • Operate plant and equipment in a proper manner with respect to minimising noise emissions, for example, minimisation of drop heights when loading and no un-necessary revving of engines; • Locate pumps, generators and compressors behind screening mounds, where possible, and use electrically powered equipment where possible, and/or fit equipment with acoustic covers, as necessary. Install diesel powered pumps, generators and compressors within acoustic enclosures if necessary; • Record and respond immediately to complaints about disturbing noise. Document and recorded such complaints as incidents, and document the measures taken to address these. Keep these records for the life of mine; • Undertake noise monitoring following the receipt of a complaint (see Section 0). Where necessary, implement additional management actions to avoid repeat occurrences; and		
			• *Conduct a once off sampling exercise with input from a specialist at the closest receptors during dumping activities at the West WRD extension. Depending on the outcome of the sampling exercise, implement additional management actions if required.*	As required	
13	Site preparation Earthworks Mineralised waste Support services Continued use of approved facilities and services Open pit mining	Negative visual views	Implement the following management actions during all mine phases: • Clear the absolute minimum amount of vegetation during construction and operation (phased clearing). This is important on the boundaries of the mine where vegetation can assist with screening; • Clear and expose only the footprint area as defined by the approved layout in this EMPr. In all other areas, retain the natural vegetation to the extent that of these areas are under	On-going	Not applicable

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
	Final land forms		the mine's control; • The air pollution control system will be implemented to avoid plumes of dust; • Paint and buildings in colours that reflect and compliment the natural landscape where possible; • Rehabilitate all mined out areas in accordance with the principles of ongoing rehabilitation that includes: backfilling, placement of topsoil and re-establishment of vegetation; • Effectively rehabilitate the tailings and WRDs which is critical because these will be a permanent post closure features. In this regard, the appropriate mix of waste rock and vegetation could soften the impact of these facilities; • Ensure that all vegetation that is planted as part of rehabilitation will reflect the natural vegetation of the area, as far as is practicable; • Fit lighting with fixtures to minimise light spillage and focus the light on precise mine activities and infrastructure; • Shape any residual WRDs left on surface; and		
			• Manage final rehabilitated areas and landforms remaining in perpetuity through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts.	As required	
14	Continued use of approved facilities and services Open pit mining	Road disturbance and traffic safety	Implement the following management actions during all mine phases prior to closure: • Monitor the quality and lifespan of the public roads used by the mine in conjunction with the relevant road authorities and other role players in the area s and determine if a road maintenance plan should be implemented; • Record and respond appropriately and immediately, to any complaints about usage of roads by mine vehicles; and • Provide data to Transnet when requested to do so, regarding the	On-going	Not applicable

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			number Tshipi company, staff and contractor vehicles making use of the railway crossing on the D3457. Ask Transnet to comment on the related safety issues and whether there is a need to upgrade this crossing. If there is a need to upgrade the crossing all relevant role players will have to work together to implement the upgrade.		
			• Implement the emergency response procedure in Section 30.2.2 in the event of a person or animal being injured by transport activities.	As required	

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
15	Continued use of approved facilities and services Open pit mining	Ground vibration, air blasts and fly rock	Implement the following specific actions during the operational phase, which are required in addition to compliance with the relevant blasting and explosives legislation including the Explosives Act, 2003 (No. 15 of 2003) and the Mine Health and Safety Act, 1996 (No. 29 of 1996): • As a minimum standard, ensure that the blast design peak particle velocity from all blasts is less than 12 mm/s at all vulnerable third party structures, • Ensure that fly-rock is contained within 500 m of each blast and that the airblast is less than 130 dB for all blasts. This will be tracked through the monitoring of blasts. Further detail is provided in Section 0; • Mark all structures within 1 500 m of the blast on a site plan and survey these structures photographically in the presence of the owner before blasting commences. Inform all parties that exist and/or that have property and/or that provide services within 1500 m of the blast sites, prior to mining, about the blast programme and associated safety precautions; • Develop a procedure to take temperature inversions, low cloud cover, and wind direction into account when deciding whether or not to set off blasts, • Observe the following procedural safety steps before each blast: o Delineate the fly-rock danger zone associated with each blast and clear people and animals from this zone before every blast; o Close the D3457 temporarily if it lies within this zone at least five (5) minutes before the blast until the blast has been set off and the area declared safe; and o Sound an audible warning at least three (3) minutes before the blast is fired.	On-going	Compliance with Explosives Act, 2003(No. 15 of 2003) and the Mine Health and Safety Act, 1996 (No. 29 of 1996)

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			• Respond immediately to any blast related complaints. Document these complaints and the follow up actions, and keep as records for the life of mine. Provide appropriate compensation where Tshipi has caused blast related damage.		
			• Implement the emergency response procedure in Section 30.2.2 in the event of a person or animal being injured by blasting activities.	As required	
16	Site preparation Earthworks Mineralised waste Water use and management Support services Transportation system Open pit mining	Loss of heritage/cultural and palaeontological resources	• Consult a professionally registered heritage and/or palaeontological specialist to make associated recommendations that will be complied with prior to the removal or destruction of any heritage/cultural and palaeontological resources that may be discovered by chance at the mine.	As required	Compliance with the National Heritage Resource Act, 1999 (No. 25 of 1999) in the event of any chance finds.
			• Implement the emergency response procedure (Section 30.2.2) if there are any chance finds of heritage/ cultural or paleontological sites.	As required	
17	Site preparation Earthworks Mineralised waste Water use and management Support services Open pit mining Closure activities in line with closure plan	Inward migration	Implement the following management actions during all mine phases: • Monitor the location and living conditions of mine employees during the operation of the mine; • Ensure good recruitment practices are implemented in managing mine staff and contractor staff. It should also be stressed that these measures must not impede the free movement of labour or infringe on the rights of individuals to look for work. Rather, they must be used to prevent job seekers from illegally occupying land and establishing impromptu informal settlements where no services currently exist; • Inform the relevant authorities at the first sign of an informal settlement developing close to the mine; • Ensure contractors and sub-contractors implement a suitable	On-going	Not applicable

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			recruitment process: o Adhere to the following requirements in the mine's recruitment process: o Do not recruit at the mine site. Recruitment will take place on set dates and at an arranged venue-preferably a formal gathering place in a nearby community/town; o Do not hire temporary casual labour on an ad hoc basis, no matter how small and temporary the job (washing of vehicles or litter clearance). Erect a sign clearly indicating that there will be no recruitment at the mine site at the entrance to the site. o Draw up and maintain a list of available temporary workers in the area in the event that temporary labour is required. If it is not possible to draw up such a list, put up notices in local communities/towns stating the precise demand for temporary labour and a date and venue at which recruitment will take place; o Implement recruitment practices in accordance with Tshipi company policy; o Clearly inform unsuccessful job seekers as such; o Do not allow worker accommodation at the mine site. • Communicate with the local police force particularly in the context of developing strategies for combating crime near the mine, surrounding communities and surrounding land users/owners; • Ensure that mine employees and contractors are made aware of the issues surrounding the spread of HIV and AIDS in the area. Promote this awareness by initiatives such as training and development, peer education, community interventions and visual awareness campaigns. Introduce prevention and management strategies such as voluntary Counselling and		

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
			HIV/AIDS Testing (VCT). Encourage all employees to participate in the VCT programme. Once a high level of VCT is taking place, it is possible to define the magnitude of the problem and begin to develop appropriate strategies for dealing with it. It is noted that disease and particularly HIV/AIDS is not a problem only for Tshipi, its employees and contractors, but it is also a local community problem. As a result, successful management actions of this impact will also depend on the intensity in which it is addressed by other structures such as the provincial health department, the local municipality, education departments, etc. • Become part of a local economic development forum that, together with the relevant local authorities, finds solutions to these social problems.		
			• Implement the emergency procedure included in Section 30.2.2 in the event of the establishment of informal settlements in the area.	As required	

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
18	*Site preparation* Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Closure activities in line with closure plan	Economic impact	Implement the following management actions during all mine phases: • Communication to local communities clearly that employment of exclusively local people for the mine cannot be guaranteed, but that where possible the employment opportunities will go to local people, where applicable; • Communicate effectively and timeously with community leaders who can attest to a fair and transparent process amongst the community, rather than challenging Tshipi on the community's behalf over jobs and recruitment, where applicable; • Develop a skills register prior to employee selection processes; • Communicate with all job seekers throughout the recruitment process. The process will be fair; • Urge potential employees to get all their documents and certificates, including valid driving licences in order, prior to recruitment; • Notify unsuccessful job applicants once the recruitment process is complete; • Comply with the requirements of the Mining Charter. In this regard procurement will, where possible: o Promote the development of small and medium enterprises; o Focus on local business; and o Promote businesses owned by historically disadvantaged South Africans.	On-going	Not applicable

No.	Activity	Potential Impact	Management actions	Time Period for Implementation	Compliance with Standards
19	Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Change in land use	• *Liaise with Eskom regarding the tie in of the 11 kV powerline into the 132/11kV Eskom sub-station;* • Communicate with neighbouring communities including land users and owners and other key stakeholders as required to facilitate information sharing and environmental impact management relevant to the mine and its associated infrastructure and activities; • Repair any damage to Openserve infrastructure as a result of Tshipi's operations; • Contact Openserve in the event that any Openserve infrastructure needs to be altered or relocated two weeks prior to the commencement of any work. Submit as built plans within 30 days of completion of construction. • *Rehabilitate the overall site to provide for the post closure land use in accordance with the mine Closure Plan.*	On-going	Not applicable

The waste management and soil conservation procedures applicable to the Tshipi Borwa Mine are included in Table 27-2 and Table 27-3 below. It should be noted that the soil conservation procedure has been revised with input from Terra Africa. The key changes are as follows:

- Separation of C-horizon:

  The soil layers consist of the A, B and C horizons. There is no clear transition between the A and B horizon and these horizons can be stockpiled together (red and yellowish soil). The soft and hardpan carbonate C-horizons underlie the A and B horizons and are encountered at depths below 150cm (the depths at which it occur will differ over the entire site area). These horizons consist of hardened calcium carbonate (often in combination with magnesium carbonate) with pH levels often above eight (8), with the base complex being saturated with magnesium and calcium. It is important that the carbonate horizons are stockpiled separately from the soil material that overlie it because the carbonate materials will raise the pH of the soil material and increase the cation content of the soil significantly (salinisation). The soil salinisation will cause difficulty for germination of grass roots and will require the establishment of indigenous species that are highly salt tolerant for the purpose of land rehabilitation. This, in turn, will lead to lower post-rehabilitation grazing capacity than is possible when proper soil management is implemented. Mixing of the carbonate hardpan with the overlying soils would therefore result in significant issues and additional cost during the rehabilitation phase.

- Height restriction on topsoil stockpiles:

  According to Terra Africa, although a number of soil reports that are in circulation have reported certain height limitations to topsoil stockpiles, these statements have not been verified with supporting literature from the newest research available. While some reports indicate that limiting stockpile height reduces the risk of soil compaction as a result of reducing the total weight of the stockpile, others have claimed that low stockpile height somehow preserves the soil nutrient cycles. However, limiting the stockpile height to five metres results in large areas of topsoil being sterilised. According to Terra Africa, a number of publications have indicated that soil fertility cycles are compromised after three to six months, no matter the height of the topsoil stockpiles. Terra Africa has therefore recommended that stockpile stabilisation should be the focus of planning the areas of topsoil stockpiles and using all practical measures to prevent and limit soil erosion, is the first priority and not the topsoil stockpile height. The height restriction of topsoil stockpiles has therefore been removed.

TABLE 27-2: WASTE MANAGEMENT PROCEDURES FOR GENERAL AND HAZARDOUS WASTE

Items to be considered		Intentions
General	Specific	
Classification and record keeping	General	Tshipi's general and hazardous waste management procedure will cover the collection, storage, handling, transportation and disposal of waste to and from the mine. Tshipi will ensure that the responsible contractor(s) are made aware of these procedures.
	Waste opportunity analysis	In line with the Department of Water and Environmental Affairs' (DWEA) strategy to eliminate waste streams in the longer term, Tshipi will assess each waste type to see whether there are alternative uses for the material. This will be done as a priority before the disposal option.

Items to be considered		Intentions
General	**Specific**	
	Classification	Wastes (except those listed in Annexure 1 of the new Waste Regulations) will be classified in accordance with SANS 10234 within one hundred and eighty (180) days of generation. Waste will be re-classified every five (5) years, or within 30 days of modification to the process or activity that generated the waste, changes in raw materials or other inputs, or any other variation of relevant factors.
	Safety data sheets	Tshipi will maintain, where required in terms of the regulations, the safety data sheets for hazardous waste (prepared in accordance with SANS 10234).
	Inventory of wastes produced	Tshipi will keep an accurate and up to date record of the waste that is generated, which records must reflect: • The classification of the wastes; • The quantity of each waste generated, expressed in tons or cubic metres per month; • The quantities of each waste that has either been re-used, recycled, recovered, treated or disposed of; and • By whom the waste was managed.
	Labelling and inventory of waste produced	Any container or storage impoundment holding waste must be labelled, or where labelling is not possible, records must be kept, reflecting: • The specific category or categories of waste in the container or storage impoundment as identified in terms of the National Waste Information Regulations, 2012; and • The classification of the waste in terms of Regulation 4 once it has been completed (if required).
	Disposal record	Written evidence of safe disposal of waste will be kept.
	Record keeping	Records will be retained for a period of at least five (5) years and will be made available to the DWEA on request.
Waste management	Collection points	Designated waste collection points will be established on site. Care will be taken to ensure that there will be sufficient collection points with adequate capacity and that these are serviced frequently.
	Laydown/ salvage areas	During construction, operations, decommissioning and closure, lay down areas for re-usable non-hazardous materials will be established.
	General (Non-hazardous) waste	Will be stored in designated skips and removed by an approved contractor for disposal at a licenced facility.
	Scrap metal and building rubble	Care will be taken to ensure that scrap metal and building rubble does not become polluted or mixed with any other waste. The scrap metal will be collected in a designated area and sold to reputable scrap dealers. Building rubble will either be disposed off-site, on the WRDs or buried in the pit.
	Hazardous wastes	Medical waste, laboratory chemicals and related packaging, used chemicals and chemical containers will be temporarily stored in sealed containers in a bunded store before removal by an approved waste contractor and disposed of in a licenced facility.
	Old explosives waste	Explosives waste will be stored in an old explosives storage box prior to being destroyed at the on-site destruction bay.

Items to be considered		Intentions
General	Specific	
	Used and/or spilled hydrocarbons such as oil and grease	Used and/or spilt oil and grease will be collected in suitable containers at designated collection points. The designated collection points will be bunded and underlain by impervious materials to ensure that any spills are contained. In general areas used and/or spilt oil and grease will be collected in suitable containers and deposited in a designated storage area. Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor will remove oil from site.
	Any soil polluted by a spill	If soil (whether stockpiled or in its undisturbed natural state) is polluted, the first management priority is to treat the pollution by means of in situ bio-remediation at the designated site. In situ remediation is generally considered to be the preferred option because with successful in situ remediation the soil resource will be retained in the correct place. The in situ options include bio-remediation at the point of pollution, or removal of soils for washing and/or bio remediation at a designated area after which the soils are returned.
		If remediation of the soil in situ is not possible, the soils will be classified as a waste in terms of the Waste Regulations and will be disposed of at an appropriate permitted waste facility.
	Mixing of wastes	Waste will not be mixed or treated where this would reduce the potential for re-use, recycling or recovery; or result in treatment that is not controlled and not permanent.
	Particles and salts from the sinter scrubbers and reverse osmosis plant	This material will either be recycled into the process through the thickeners or there is the option of storage in sealed drums and removal to an appropriately licenced waste site.
Disposal	Offsite waste disposal facilities	Waste will be disposed of at appropriate permitted waste disposal facilities. For general waste the closest permitted site is in Kuruman. For hazardous waste, the closest permitted site is at Holfontein.
		Unless collected by the municipality, Tshipi must ensure that the waste is assessed in accordance with the Norms and Standards for Assessment of Waste for Landfill Disposal set in terms of Section 7(1) of the NEM:WA prior to the disposal of the waste to landfill.
		Unless collected by the municipality, the mine must ensure that the disposal of their waste to landfill is in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of Section 7(1) of the NEM:WA.
Waste transport	Contractor	A qualified, reputable waste management subcontractor will undertake the waste transport. The contractor will provide an inventory of each load collected and of proof of disposal at a licenced facility.
Banned practices	Long-term stockpiling of waste	Stockpiling of waste is a temporary measure. Waste stockpiling sites must have an impervious floor, be bunded and have a drainage system for collection and containment of water on the site.
	Burying of waste	No wastes will be placed on site, other than non-hazardous building rubble disposed of onto WRDs or in the pit.

TABLE 27-3: SOIL CONSERVATION PROCEDURE

Steps	Factors to consider	Detail
Delineation of areas to be stripped		Stripping will only occur where soils are to be disturbed by activities that are described in the EIR, and where a clearly defined end rehabilitation use for the stripped soil has been identified.
Reference to biodiversity action plan		All requirements for moving and preserving fauna and flora according to the biodiversity action plan will be adhered to.
Stripping	*Planning*	*Even though the Tshipi Borwa Mine is situated in a semi-arid area, soil stripping will not commence or be continued directly after a significant rainfall event as this will drastically increase soil compaction. Soil will be allowed to dry out sufficiently and compaction is minimised.* *Wherever possible, stripping and replacing of soils will be done in a single action. This is both to reduce compaction and to increase the viability of the seed bank contained in the stripped surface soil horizons.* *All machines will be in efficient and safe working condition and only operated when ground conditions enable their maximum operating efficiency.* *Stripping will be conducted a suitable distance ahead of the placement of waste rock to avoid loss and contamination. As a norm, soil stripping should be kept within 3-9 months ahead of development, or between 50-100 m ahead of the active operations.*
	Topsoil	*A thickness of 150 cm of topsoil will be stripped.*
	Soft and hardpan carbonate horizons (new requirement from 2018 for East and West WRD extensions)	*Soft and hardpan carbonate horizons (deeper than 150cm) will be stripped separately and not mixed with the A and B horizons.*
Delineation of stockpiling areas	Location	Stockpiling areas will be identified in close proximity to the source of the soil to limit handling and to promote reuse of soils in the correct areas. *However where possible, stripped soil will be stockpiled upslope of areas of mining activities to prevent contamination of stockpiled soil by dirty runoff or seepage.*
	Designation of the areas	Soil stockpiles will be clearly marked to identify both the soil type and the intended area of rehabilitation. All topsoil will be stockpiled in areas clearly demarcated on the infrastructure layout and should be defined as no-go areas. Topsoil stockpiles must be located outside of areas susceptible to erosion.
Stockpile management	Vegetation establishment and erosion control	Rapid growth of vegetation on the topsoil stockpiles will be promoted (e.g. by means of watering or fertilisation). The purpose of this exercise will be to encourage vegetation growth on soil stockpiles and to combat erosion by water and wind. *Stockpiles will be examined after a reasonable rainy period/season, and then annually to determine whether vegetation has naturally established itself on the stockpiles. In the case of no or sparse vegetation establishment, geo-textiles or other methods will be used on the topsoil stockpiles to prevent wind erosion.*

Steps	Factors to consider	Detail
	Storm water controls	Stockpiles will be established with storm water diversion berms to prevent run off erosion.
	Slope	The stockpile side slopes should be flat enough to promote vegetation growth and reduce runoff related erosion. In addition to this, the topsoil stockpiles need to be established on a gradual slope if possible. *Should erosion be noted, the slopes should be stabilised with geotextiles or other appropriate methods.*
	Waste	No waste material will be placed on the soil stockpiles.
	Vehicles	Equipment movement on top of the soil stockpiles will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank.
Management of disturbed land	Erosion control	To prevent the erosion of topsoil, management actions may include one or more of the following; vegetation, berms, soil traps, hessians and storm water diversions away from areas susceptible to erosion.
Rehabilitation of disturbed land: restoration of land capability	*Minimise areas of disturbance*	*The activities of decommissioning contractors or employees will be restricted to the planned areas. Instructions must be included in contracts that will restrict decommissioning workers to the areas demarcated for decommissioning. In addition, compliance to these instructions must be monitored.*
	Placement of soil	Once the site has been cleared on infrastructure, the area to be rehabilitated should be ripped in order to reduce soil compaction. As a general rule, a minimum layer of 50 cm of topsoil must be replaced unless a soils expert advises otherwise.
	Fertilisation	A few samples of stripped soils will be analysed to determine the nutrient status of the soil before rehabilitation commences. As a minimum, the following elements will be tested for cation exchange capacity, pH, and phosphate. These elements provide the basis for determining the fertility of soil. Based on the analysis, fertilisers will be applied if necessary.
	Restore land function and capability	Apply landscape function analysis and restoration interventions to areas where soil has been replaced as part of rehabilitation, but the land function and capability has not been effectively restored.

28. FINANCIAL PROVISION

28.1 DETERMINATION OF THE AMOUNT OF THE FINANCIAL PROVISION

28.1.1 DESCRIPTION OF THE CLOSURE OBJECTIVES AND THE ALIGNMENT WITH THE BASELINE ENVIRONMENT

The preliminary closure plan objectives and principles have been developed against the background of the mine location in the Kuruman region of the Northern Cape Province, and include the following (Section 4.2.2 of the Preliminary Closure Plan in APPENDIX K):

- that environmental damage is minimised to the extent that it is acceptable to all parties involved;
- that all surface infrastructure will be removed from site after closure;
- that contamination beyond the mine site by surface run-off, groundwater movement and wind will be prevented;
- that mine closure is achieved efficiently, cost effectively and in compliance with the law; and
- that the social and economic impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised.

The current EMPr mine closure commitments further commits Tshipi Borwa Mine to:

- rehabilitate the land to achieve an end use of wilderness and/or grazing to the extent reasonably possible;
- backfill the open pit; and
- shape any remaining waste rock dumps shaped to 1V:3H (18°) to create stable landforms.

The closure target outcomes for the site are therefore assumed to be as follows (Section 4.2.3 of the Preliminary Closure Plan in APPENDIX K):

- to achieve chemical, physical and biological stability for an indefinite, extended time period over all disturbed landscapes and residual mining infrastructure;
- to protect surrounding surface water, groundwater, soils and other natural resources from loss of current utility value or environmental functioning;
- to limit the rate of emissions to the atmosphere of particulate matter and salts to the extent that degradation of the surrounding areas' land capability or environmental functioning does not occur;
- to maximise visual 'harmony' with the surrounding landscape; and
- to create a final land use that has economic, environmental and social benefits for future generations that outweigh the long term aftercare costs associated with the mine.

Not withstanding the above, a Tshipi Concept Study has proven the techno-economic viability of an underground mine on that portion of the Tshipi Mining Right area that is too deep for economic opencast mining. The mine design includes on-seam adits or declines from the final open-pit high-wall as the optimal means of access to the deeper manganese resources.

Should the pit be back-filled it is quite likely that these resources will be sterilised by virtue of the capital cost and lead-time that will be required to access the underground resources by a shaft complex that would have to be established from surface.

Moreover, with the approved removal of the boundary pillar between the Borwa and Mamatwan mines complete backfill cannot practically be achieved between the open-pits, for a number of technical and environmental reasons. Tshipi has, therefore, commenced the process of re-evaluating its mine closure solution and closure objectives.

28.1.2 CONFIRMATION THAT THE CLOSURE OBJECTIVES HAVE BEEN CONSULTED WITH LANDOWNERS AND I&APS

The closure objectives are outlined in this report and the related specialist study which will be made available to I&APs, including landowners for review and comment (Section 6.2).

To date no comments regarding the closure objectives (see Section 28.1.1) have been received from I&APs, including landowners (see Section 6.2 for the details of the public participation process).

28.1.3 REHABILITATION PLAN

The scale and aerial extent of the main mining activities at closure is indicated on the site infrastructure plan (see Figure 3-1).

The rehabilitation plan caters for the following (Section 6 of the Preliminary Closure Plan in APPENDIX K):

- Surface infrastructure will be demolished and removed;
- Pit void will be backfilled (as far as reasonably practical) and the area rehabilitated;
- Areas where infrastructure has been removed will be levelled and restored in terms of soil horizons (as far as reasonably practical), vegetation and drainage; and
- Remaining overburden/ waste rock dumps will be shaped to 1V:3H (i.e. 18°) and rehabilitated.

Generally accepted closure methods have been used as the basis for determining the closure cost liability. The closure cost liability was calculated as per the methodology of the DMR guideline document (DMR, 2005). Post closure supervision and monitoring costs; and time, fee and contingency costs were included in order to improve the accuracy of the DMR guideline closure cost liability estimate, and to comply with the requirements of the Environmental Impact Assessment Regulations, 2014.

The closure cost liability associated with the backfilling of the final pit void has not been considered at this stage. Backfilling of the pit void (including in-pit dumping during operations) should therefore be separately accounted for by Tshipi in the operations expenditure of the Tshipi Borwa Mine.

28.1.4 COMPATIBILITY OF THE REHABILITATION PLAN WITH THE CLOSURE OBJECTIVES

It can be confirmed that the rehabilitation plan is compatible with the closure objectives given that the closure objectives were taken into account during the determination of the financial provision.

28.1.5 CALCULATE AND STATE THE QUANTUM OF THE FINANCIAL PROVISION

The closure cost calculations have been determined for the following periods, namely (Section 12.6 of the Preliminary Closure Plan in APPENDIX K):

- Total current closure cost liability (as at August 2018);
- Future closure cost liability, 5 years from now (as at August 2023);
- Future closure cost liability, 10 years from now (as at August 2028);
- Total LOM closure cost liability, 25 years from now (as at August 2043).

TABLE 28-1: CALCULATED QUANTUM OF FINANCIAL PROVISION (SLR, 2018C)

Time-frame	Date	Closure Cost Liability incurred during the period (incl. VAT)	Progressive Closure Cost Liability (incl. VAT)	Progressive Closure Cost Liability as a % of LOM liability
Current	August 2018	n/a	R 136 451 086	59.5%
+ 5 years	August 2023	R 53 576 374	R 190 027 460	82.9%
+ 10 years	August 2028	R 9 701 063	R 199 728 523	87.1%
+ 25 years (LOM)	**August 2043**	**R 29 532 507**	**R 229 261 030**	**100%**

28.1.6 CONFIRMATION THAT THE FINANCIAL PROVISION WILL BE PROVIDED

The financial provision is provided in the form of a specialist insurance policy.

29. MECHANISMS FOR MONITORING COMPLIANCE AND PERFORMANCE AGAINST THE EMPR

Environmental impacts requiring monitoring are listed in Table 29-1 below. It is important to note that the monitoring programme below includes requirements as outlined in the original EMPr (Metago, 2009), EMPR amendment (SLR, 2017d) and any additional requirements identified as part of the current project, where relevant. Any additional monitoring requirements are indicated in ***italics***.

As a general approach, Tshipi will ensure that the monitoring programmes comprise the following:

- adherence to a formal monitoring procedure;
- use of appropriately calibrated equipment by personnel trained to use the equipment;
- the preservation of samples according to laboratory specifications - by personnel trained to use the equipment, where samples require analysis;
- the identification of monitoring parameters in consultation with a specialist in the relevant field and/or the relevant authority;
- the amendment of monitoring parameters, where necessary, following the initial monitoring results and in consultation with a specialist and/or the relevant authority; and
- the interpretation of data and reporting of trends will be undertaken by an appropriately qualified person.

TABLE 29-1: MONITORING OF COMPLIANCE AND PERFORMANCE IN TERMS OF EMPR

No.	Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
1	Mineralised waste	Residue facilities – groundwater impacts	In terms of the tailings dam and the return water dam, as a minimum and where applicable (in certain instances low hazard facilities do not require the same level of monitoring as medium and high hazard facilities), the following will be monitored: • phreatic surface, slope stability, adequacy of freeboard, integrity of walls, the position of the pools, silt trap sediment, presence of seepage, and functioning of drains; • the success of vegetation establishment on the outer side walls; and • erosion damage. The waste rock dumps and storm water/process dams will be monitored to ensure stability, safety and prevention of environmental impacts. Monitoring results will be documented for record-keeping and auditing purposes and addressed where relevant to achieve the stated objective.	Qualified engineer	In terms of the tailings dam and the return water dam, monitoring will be done on a quarterly basis. Tailings management and risk reports must be submitted annually to the DMR. The frequency of waste rock dump and storm water/process dam monitoring will be determined on an infrastructure specific basis. Monitoring reports will be made available on request. Monitoring will be undertaken when the facilities are in operation for the duration of the mine.

No.	Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
2	Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Alteration of natural drainage patterns	An operational water balance for the mine will be developed and updated from recorded flow measurements and production figures. The water balance is used to check on an on-going basis that the capacity of the storm water dam facilities is adequate. In addition to the above, the Integrated Water use licence (IWUL) requires that Tshipi will update the water balance on an annual basis to determine the loads of waste emanating from the activities. Tshipi will determine the contribution of their activities to the mass balance for water resources and must furthermore co-operate with other water users in the catchment to determine the mass balance for the water resources reserve compliance point.	Environmental Department	Operational water balance will be updated on a monthly basis for the duration of the mine. This information must be made available on request. Mass water balance will be updated on an annual basis for the duration of the mine. This information will be submitted to the DWS on an annual basis.

<table>
<tr><th>No.</th><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td>3</td><td>Earthworks
Mineralised waste
Non-mineralised waste
Water use and management
Support services
Transportation system
Continued use of approved facilities and services</td><td>Contamination of surface water resources</td><td>Monitoring of surface water quality will be undertaken in the event that surface water flow is present in the Vlermuisleegte River. In this regard, samples will be taken from both upstream and downstream of the Vlermuisleegte River. Refer to Figure 6-13 for the location of the surface water monitoring points.

Monitoring of surface water within storm water dam facilities will be undertaken on a quarterly basis. This includes the storm water dam, the return water dam, dirty water dams (combined), workshop dirty collection dam and the temporary construction dam. Monitoring point co-ordinates are provided below:

<table><tr><th>Site ID</th><th>Latitude</th><th>Longitude</th></tr><tr><td>SW1</td><td>27° 26' 29.63" S</td><td>22° 58' 16.98" E</td></tr><tr><td>SW2</td><td>27° 22' 21.10" S</td><td>22° 55' 32.10" E</td></tr><tr><td>SW3</td><td>27° 23' 33.73" S</td><td>22° 57' 49.20" E</td></tr><tr><td>SW4</td><td>27° 23' 27.60" S</td><td>22° 58' 1.20" E</td></tr><tr><td>SW5</td><td>27° 23' 27.60" S</td><td>22° 58' 1.20" E</td></tr><tr><td>SW6</td><td>27° 22' 21.46" S</td><td>22° 56' 56.10" E</td></tr><tr><td>SW6</td><td>27° 22' 19.20" S</td><td>22° 56' 9.60" E</td></tr><tr><td>SW7</td><td>27° 23' 18.20" S</td><td>22° 58' 11.30" E</td></tr><tr><td>SW8</td><td>27° 23' 23.84" S</td><td>22° 57' 45.25" E</td></tr></table>
Water quality analyses results will be classified in terms of the SANS 241 (2015) Water Quality Standards and the DWAF Target Quality Range for Livestock Watering (1996), or whichever is applicable at the time. The monitoring results should be assessed by a suitably-qualified professional registered with the South African Council for Natural Scientific Professional (SACNASP). The parameters that will be analysed are summarised in the table below.</td><td>Environmental Department</td><td>Monitoring will be undertaken when the Vlermuisleegte River is in flow.

Monitoring of the storm water dam facilities will be undertaken on a quarterly basis.

Monitoring reports will be submitted to the DWS as per the conditions of the Integrated Water use licence (IWUL), on an annual basis. Monitoring reports need to cater for any reporting requirements stipulated in the IWUL.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td></td><td></td><td></td><td><table>
<tr><td>pH</td></tr>
<tr><td>Conductivity in mS/m at 25 ° c</td></tr>
<tr><td>Total dissolved solids (TDS) at 180 ° c</td></tr>
<tr><td>Alkalinity as $CaCO_3$</td></tr>
<tr><td>Carbonate as CO_3</td></tr>
<tr><td>Bicarbonate as HCO_3</td></tr>
<tr><td>Boron as B</td></tr>
<tr><td>Nitrate as N</td></tr>
<tr><td>Chloride as Cl</td></tr>
<tr><td>Sulphate as SO_4</td></tr>
<tr><td>Fluoride as F</td></tr>
<tr><td>Sodium as Na *</td></tr>
<tr><td>Potassium as K *</td></tr>
<tr><td>Calcium as Ca *</td></tr>
<tr><td>Magnesium as Mg *</td></tr>
<tr><td>Manganese as Mn *</td></tr>
<tr><td>Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS)</td></tr>
</table>
In the event that the IWUL is amended and changes to the surface water monitoring programme as outlined in this report are made, the requirements as per the IWUL will be adhered to.</td><td></td><td></td></tr>
<tr><td>7</td><td>Earthworks
Mineralised waste
Non-mineralised waste</td><td>Water consumption and internal water circuit</td><td>In order to properly manage the mine’s internal water circuit, a water metering system and regular reporting process will be established. The following will be undertaken at the mine:
• Water meters will be installed on each of the main water distribution pipelines at the mine to measure inflow volumes, consumption and any spillages or discharges.</td><td>Environmental Department</td><td>Continuous monitoring</td></tr>
</table>

<table>
<tr><th>No.</th><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td></td><td>Water use and management
Support services
Transportation system
Continued use of approved facilities and services</td><td></td><td>

Water truck filling at each of the fill points will be recorded to measure usage for dust suppression on roads.
Water level gauging boards will be installed within each of the dams to measure changes in water level, from which storage will be estimated.

The table below provides more detail.
<table>
<tr><th>Ref</th><th>Location</th><th>Purpose</th></tr>
<tr><td colspan="3">Water Meters</td></tr>
<tr><td>1</td><td>Intake from Sedibeng Water</td><td>For independent verification of water consumption and respective charges.</td></tr>
<tr><td>2</td><td>Inflow to potable water reticulation system</td><td>To identify any leakage from the 4km long pipe from the Sedibeng intake.</td></tr>
<tr><td>3</td><td>Main pipeline to Contractors Yard</td><td>To monitor potable water consumption at mining office, contractors' yard, washdown bay and change house.</td></tr>
<tr><td>4</td><td>Main pipeline to Plant Area</td><td>To monitor potable water consumption at plant office, stores and maintenance workshop.</td></tr>
<tr><td>5</td><td>Main pipeline to Admin Offices & Loadout Station</td><td>To monitor potable water consumption at admin offices, laboratory, engineering workshop, and loadout station.</td></tr>
<tr><td>6</td><td>Pit water pipeline</td><td>To monitor storm water and groundwater collected in the pit and pumped for re-use.</td></tr>
<tr><td>7</td><td>Sewage plant outflow</td><td>To monitor treated sewage water collected re-used.</td></tr>
<tr><td>8</td><td>Process water pipeline</td><td>To monitor potable and recycled</td></tr>
</table>
</td><td></td><td></td></tr>
</table>

No.	Activity	Impacts requiring monitoring	Functional requirements for monitoring			Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
					water consumption at the processing areas including Benmarc sprinkler systems at conveyor belt and washdown facilities at the end of the conveyor belt.		
			9	*Main pipeline to Dirty Water Dam*	*To monitor potable water consumption used as makeup for process water when all sources of recycled water are finished.*		
			10	*RO plant brine outflow*	*To monitor brine effluent from the RO plant which will be recycled as process water.*		
			11	*Production Boreholes*	*To monitor water supplied from network of production boreholes (if these are commissioned).*		
			12	*Discharge*	*Any discharge from the mine should be monitored (if mine becomes water positive in future).*		
			Water Trucks				
			WT1	*Water Truck – Fill Point 1*	*To monitor dust suppression water abstracted from the Dirty Water Dam.*		
			WT2	*Water Truck – Fill Point 2*	*To monitor dust suppression water abstracted from the Dirty Water Dam.*		
			WT3	*Water Truck – Fill Point 3*	*To monitor dust suppression water abstracted from the potable water reticulation system.*		
			WT4	*Water Truck – Fill Point 4*	*To monitor dust suppression water abstracted from the pit.*		

No.	Activity	Impacts requiring monitoring	Functional requirements for monitoring			Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
			WT5	*Water Truck – Fill Point 5*	*To monitor dust suppression water abstracted from the Contractor's Dam.*		
			Water Levels – Dams				
			TCD	*Temporary Construction Dam (TCD)*	*To monitor changes in storage within the dam.*		
			DWD	*Dirty Water Dam (DWD)*	*To monitor changes in storage within the dam.*		
			WD	*Workshop Dam (WD)*	*To monitor changes in storage within the dam.*		
			SWD	*Stormwater Dam (SWD)*	*To monitor changes in storage within the dam.*		

<table>
<tr><th>No.</th><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr>
<td>4</td>
<td>Earthworks
Mineralised waste
Non-mineralised waste
Water use and management
Support services
Transportation system
Continued use of approved facilities and services</td>
<td>Dewatering and abstraction of groundwater</td>
<td>Dewatering volumes and abstraction volumes will be monitored at the following points, as per the WUL against the approved dewatering and abstraction volumes:
<table>
<tr><th>Monitoring point</th><th>Maximum abstraction authorised</th><th>Co-ordinates</th></tr>
<tr><td>Open pit</td><td>57 720 m^3/annum</td><td>27° 22’ 47.4” S
22° 57’ 55.0” E
Note the dewatering point will change as mining progresses</td></tr>
<tr><td>Borehole TSH01</td><td>12 612 m^3/annum</td><td>27° 22’ 52.2” S
22° 56’ 58.8” E</td></tr>
<tr><td>Borehole TSH02</td><td>12 612 m^3/annum</td><td>27° 22’ 36.7” S
22° 57’ 20.3” E</td></tr>
</table>
Groundwater will be monitored at the monitoring points indicated in Figure 6-13. The co-ordinates of these monitoring points are presented below.
<table>
<tr><th>Borehole ID</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>New 1</td><td>27° 21' 17.93" S</td><td>22° 57' 29.80" E</td></tr>
<tr><td>New 2 (replace TSH01)</td><td>27° 21' 54.79" S</td><td>22° 56' 54.31" E</td></tr>
<tr><td>New 3</td><td>27° 22' 17.52" S</td><td>22° 56' 20.49" E</td></tr>
<tr><td>New 4</td><td>27° 23' 57.29" S</td><td>22° 56' 27.95" E</td></tr>
<tr><td>New 5</td><td>27° 23' 43.62" S</td><td>22° 58' 23.62" E</td></tr>
<tr><td>New 6</td><td>27° 21' 42.89" S</td><td>22° 57' 59.01" E</td></tr>
<tr><td>TSH06/NEX108</td><td>27° 21' 47.47" S</td><td>22° 58' 4.86" E</td></tr>
<tr><td>TSH04</td><td>27° 22' 6.44" S</td><td>22° 58' 7.84" E</td></tr>
<tr><td>TSH03</td><td>27° 22' 10.10" S</td><td>22° 58' 5.19" E</td></tr>
</table>
</td>
<td>Environmental Department</td>
<td>Monitoring of groundwater will be undertaken monthly.
Monitoring reports will be submitted to DWS as per the IWUL requirements.</td>
</tr>
</table>

<table>
<tr><th>No.</th><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td></td><td></td><td></td><td><table><tr><td>TSH01</td><td>27° 22' 48.76" S</td><td>22° 56' 56.58" E</td></tr><tr><td>TSH02</td><td>27° 22' 34.37" S</td><td>22° 57' 19.69" E</td></tr><tr><td>NT8</td><td>27° 21' 43.74" S</td><td>22° 56' 4.60" E</td></tr><tr><td>NT1</td><td>27° 23' 45.91" S</td><td>22° 56' 37.67" E</td></tr><tr><td>NT15</td><td>27°24'20.147"S</td><td>23°0'20.637"E</td></tr><tr><td>TBW2</td><td>27°21'52.95"S</td><td>22°57'25.93"E</td></tr><tr><td>TBW4</td><td>27°21'43.50"S</td><td>22°57'39.76"E</td></tr></table>It should be noted that the exact positions of the new boreholes will be updated once drilled and will be influenced by aspects such as access, land ownership and geophysics.</td><td></td><td></td></tr>
<tr><td>5</td><td>Earthworks
Mineralised waste
Non-mineralised waste
Water use and management
Support services
Transportation system
Continued use of approved facilities and services</td><td>Integrated Water use licence (IWUL) compliance monitoring (points not covered under other surface and groundwater monitoring points in this table)</td><td>Water volume entering and leaving the following storage facilities will be measured and recorded:<table><tr><th>Water storage facility</th><th>Latitude</th><th>Longitude</th></tr><tr><td>Storing potable water from Sedibeng Water Board in a water tank for domestic use</td><td>27°23'37.0"S</td><td>22°58'01.3"E</td></tr><tr><td>Storing water in a temporary dam for construction activities</td><td>27°23'31.6"S</td><td>22°58'03.1"E</td></tr></table></td><td>Environmental Department</td><td>Continuous monitoring</td></tr>
</table>

<table>
<tr><th>No.</th><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td>6</td><td>Earthworks
Mineralised waste
Non-mineralised waste
Water use and management
Support services
Transportation system
Continued use of approved facilities and services</td><td>Contamination of groundwater resources</td><td>Monitoring of groundwater quality and quantity will be undertaken on a quarterly and monthly basis respectively. Refer to Figure 6-13 for the location of the groundwater monitoring points. The co-ordinates of these monitoring points are presented below.
<table>
<tr><th>Borehole ID</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>New 1</td><td>27° 21' 17.93" S</td><td>22° 57' 29.80" E</td></tr>
<tr><td>New 2 (replace TSH01)</td><td>27° 21' 54.79" S</td><td>22° 56' 54.31" E</td></tr>
<tr><td>New 3</td><td>27° 22' 17.52" S</td><td>22° 56' 20.49" E</td></tr>
<tr><td>New 4</td><td>27° 23' 57.29" S</td><td>22° 56' 27.95" E</td></tr>
<tr><td>New 5</td><td>27° 23' 43.62" S</td><td>22° 58' 23.62" E</td></tr>
<tr><td>New 6</td><td>27° 21' 42.89" S</td><td>22° 57' 59.01" E</td></tr>
<tr><td>TSH06/NEX108</td><td>27° 21' 47.47" S</td><td>22° 58' 4.86" E</td></tr>
<tr><td>TSH04</td><td>27° 22' 6.44" S</td><td>22° 58' 7.84" E</td></tr>
<tr><td>TSH03</td><td>27° 22' 10.10" S</td><td>22° 58' 5.19" E</td></tr>
<tr><td>TSH01</td><td>27° 22' 48.76" S</td><td>22° 56' 56.58" E</td></tr>
<tr><td>TSH02</td><td>27° 22' 34.37" S</td><td>22° 57' 19.69" E</td></tr>
<tr><td>NT8</td><td>27° 21' 43.74" S</td><td>22° 56' 4.60" E</td></tr>
<tr><td>NT1</td><td>27° 23' 45.91" S</td><td>22° 56' 37.67" E</td></tr>
<tr><td>NT15</td><td>27°24'20.147"S</td><td>23°0'20.637"E</td></tr>
<tr><td>TBW2</td><td>27°21'52.95"S</td><td>22°57'25.93"E</td></tr>
<tr><td>TBW4</td><td>27°21'43.50"S</td><td>22°57'39.76"E</td></tr>
</table>
It should be noted that the exact positions of the new boreholes will be updated once drilled and will be influenced by aspects such as access, land ownership and geophysics.

Water quality analyses results will be classified in terms of the SANS 241 (2015)</td><td>Environmental Department</td><td>Groundwater quality and quantity will be monitored on a monthly basis as stipulated in the Integrated Water use licence (IWUL).

Monitoring reports will be submitted to the DWS as per the conditions of the IWUL, on an annual basis. Monitoring reports need to cater for any reporting requirements stipulated in the IWUL.</td></tr>
</table>

No.	Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
			Water Quality Standards and the DWAF Target Quality Range for Livestock Watering (1996) or whichever is applicable at the time. The monitoring results will be assessed by a suitably-qualified professional registered with the South African Council for Natural Scientific Professional (SACNASP). The parameters that will be analysed are summarised in the table below. pH Conductivity in mS/m at 25 ° c Total dissolved solids (TDS) at 180 ° c Alkalinity as $CaCO_3$ Carbonate as CO_3 Bicarbonate as HCO_3 Boron as B Nitrate as N Chloride as Cl Sulphate as SO_4 Fluoride as F Sodium as Na Potassium as K Calcium as Ca Magnesium as Mg Manganese as Mn Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS) In the event that the IWUL is amended and changes to the groundwater monitoring programme as outlined in this report are made, the requirements as per the IWUL will be adhered to.		

<table>
<tr><th>No.</th><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td>7</td><td>Earthworks
Mineralised waste
Non-mineralised waste
Water use and management
Support services
Transportation system
Continued use of approved facilities and services</td><td>Physical destruction and general disturbance of biodiversity</td><td>Tshipi will implement an alien/invasive/weed management programme to control the spread of these plants onto and from disturbed areas. This will be achieved by active eradication and the establishment of natural species and through on-going monitoring and assessment. The use of herbicides will be limited and focussed and will only be used under strict controls. Herbicides will be selected to ensure least residual harm. Herbicides will be administered by suitably qualified people.

Continued monitoring will be undertaken to ensure that the alien invasive species have been eradicated and are controlled for both controlled sites as well as rehabilitated areas.

For each area requiring rehabilitation specific landscape functionality objectives will be set with specialist input and the associated targets and monitoring program will follow accordingly.

A comprehensive monitoring programme of the protected trees within the area will be undertaken. This monitoring will be conducted on an individual tree basis as well as monitoring on a community level.

In terms of the WUL, biomonitoring will be undertaken at points upstream and downstream of the following facilities:
<table>
<tr><th>Waste/water storage facility</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>Tailings storage facility return water dam</td><td>27°22'25.1"S</td><td>22°56'35.7"E</td></tr>
<tr><td>Dirty water dam</td><td>27°23'30.9"S</td><td>22°57'48.1"E</td></tr>
<tr><td>Workshop Collection dam</td><td>27°23'20.1"S</td><td>22°57'38.2"E</td></tr>
<tr><td>Tailings/Slimes dam</td><td>27°22'28.7"S</td><td>22°56'42.7"E</td></tr>
<tr><td>ROM primary stockpile</td><td>27°23'07.5"S</td><td>22°58'06.8"E</td></tr>
<tr><td>Low grade product stockpile</td><td>27°23'14.1"S</td><td>22°57'44.9"E</td></tr>
<tr><td>Lumpy product stockpile</td><td>27°23'32.1"S</td><td>22°58'09.1"E</td></tr>
<tr><td>Fines product stockpile</td><td>27°23'31.7"S</td><td>22°58'10.8"E</td></tr>
<tr><td>Eastern waste rock dump</td><td>27°23'48.9"S</td><td>22°58'24.8"E</td></tr>
</table></td><td>Environmental Department</td><td>The alien/invasive/weed management programme will be undertaken on an annual basis for the duration of the mine. This information should be made available to DAFF on request, unless otherwise specified.

After closure, repeat surveys will be carried out annually for at least the first three years post-rehabilitation.

Monitoring of protected trees should take place on an annual basis. The result must be submitted to DAFF on an annual basis.

Biomonitoring will be undertaken annually during summer and winter.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td></td><td></td><td></td><td><table><tr><td>Western waste rock dump</td><td>27°22'52.0"S</td><td>22°57'16.8"E</td></tr></table>The biomonitoring must include: Invertebrate Habitat Assessment using the latest South African Scoring System.

The nearest river is the Vlermuisleegte and biomonitoring should, therefore, be conducted at the points indicated in Figure 6-13 to be in the river.</td><td></td><td></td></tr>
<tr><td>8</td><td>Earthworks
Mineralised waste
Non-mineralised waste
Water use and management
Support services
Transportation system
Continued use of approved facilities and services</td><td>Air pollution</td><td>Dust monitoring will comprise the following:
five directional dust fallout buckets;
one PM_{10} ambient concentration monitoring station;
provision to analyse the PM_{10} for manganese concentrations over a period of two operational years;
three passive samplers for NO_2 and SO_2 (this is only applicable when the sinter plant is operational); and
one meteorological station.
It is further recommended that Tshipi, UMK and Mamatwan mine work together to establish and maintain an optimal monitoring network.

The location of the dust fallout buckets is illustrated in Figure 6-13 and the co-ordinates are provided below.<table><tr><th>Sampling point ID</th><th>Latitude</th><th>Longitude</th></tr><tr><td>N-DW -01</td><td>27° 21' 49.08" S</td><td>22° 58' 2.00" E</td></tr><tr><td>S-DW-02</td><td>27° 23' 51.04" S</td><td>22° 57' 49.98" E</td></tr><tr><td>E-DW-03</td><td>27° 22' 53.00" S</td><td>22° 58' 25.90" E</td></tr><tr><td>W-DW-04</td><td>27° 22' 53.05" S</td><td>22° 56' 13.57" E</td></tr><tr><td>C-DW-05</td><td>27° 22' 55.22" S</td><td>22° 57' 28.18" E</td></tr><tr><td>Passive sampling dust bucket</td><td>27° 23' 38.14" S</td><td>22° 58' 16.80" E</td></tr><tr><td>Passive sampling dust bucket</td><td>27° 22' 27.47" S</td><td>22° 57' 14.76" E</td></tr><tr><td>Passive sampling dust bucket</td><td>27° 21' 22.62" S</td><td>22° 56' 51.95" E</td></tr></table></td><td>Environmental Department</td><td>Monitoring reports will be uploaded onto the National Emissions Inventory System on annual basis.

Dust fallout monitoring will be undertaken on a monthly basis for the duration of the mine.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td></td><td></td><td></td><td><table>
<tr><td>Passive sampling ambient monitoring dust bucket</td><td>27° 22' 20.17" S</td><td>22° 55' 37.94" E</td></tr>
<tr><td>Dust bucket</td><td>27° 22' 4.66" S</td><td>22° 56' 57.85" E</td></tr>
<tr><td>Dust Fallout</td><td>27° 21' 26.92" S</td><td>22° 55' 45.00" E</td></tr>
<tr><td>Dust Fallout</td><td>27° 23' 57.54" S</td><td>22° 56' 15.34" E</td></tr>
<tr><td>Dust Fallout</td><td>27° 24' 45.37" S</td><td>22° 57' 38.15" E</td></tr>
<tr><td>PM10</td><td>27° 21' 31.20" S</td><td>22° 55' 47.15" E</td></tr>
<tr><td>PM10</td><td>27° 24' 0.75" S</td><td>22° 56' 18.55" E</td></tr>
</table>
* Note the co-ordinates will be finalised once the monitors are put in place and may differ slightly form the table above.

Dust fallout monitoring will use the ASTM D1739 (1970) method as required, by the South African National Dust Control Regulations (NDCR), with regard to the dustfall unit design, dust collection and analysis.</td><td></td><td></td></tr>
<tr><td>9</td><td>Earthworks
Mineralised waste
Non-mineralised waste
Water use and management
Support services
Transportation system
Continued use of approved facilities and</td><td>Increase in disturbing noise levels</td><td>Conduct a once-off monitoring campaign at nearest receptors at night during waste rock dumping at the West WRD extension.

In the event that Tshipi receives noise related complaints during either construction or operation, Tshipi will conduct short term (24-hour) ambient noise measurements as part of investigating the complaints. The results of the measurements should be used to inform any follow up interventions.</td><td>Environmental Department with input from qualified specialist</td><td>If and when a complaint is raised.</td></tr>
</table>

No.	Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
	services				
10	Continued use of approved facilities and services (boundary pillar)	Blasting	Monitoring will be done for each blast to verify that fly rock is being contained within 500m from the blast. On a monthly basis monitoring will be undertaken to verify that the air blast is less than or equal to 130 dB at the mine boundary and that the ground vibration is less than or equal to a peak particle velocity of 12.5 mm/s at the mine boundary.	*Qualified engineer*	Monitoring of each blast will be undertaken for the duration of operational phase of the mine. Monthly monitoring of air blasts and ground vibrations will be undertaken for the duration of the operational phase of the mine.

29.1 FREQUENCY OF PERFORMANCE ASSESSMENT REPORT

Tshipi will for the period during which the environmental authorisation and the EMPr is valid, submit environmental audit reports to the DMR.

These audits will focus on the mines compliance with the conditions of the environmental authorisation and the commitments in the EMPr. These audits will be undertaken by a qualified independent person and will comply with the relevant NEMA Regulations 2014 (as amended).

The environmental manager will conduct internal management audits against the commitments in the EMPr in accordance with an annual audit plan. During the operational phase, these audits will be conducted on a quarterly basis. The audit findings will be documented for both record keeping purposes and for informing continual improvement.

29.2 CLOSURE COST REPORTING

The financial provision for the mine will be updated on an annual basis and submitted to the DMR for the duration of the operation in accordance of the relevant legislation.

29.3 AFTERCARE AND MAINTENANCE OF THE TAILINGS DAM

On completion of the final closure measures an aftercare programme will be implemented to ensure that the closure measures are robust, have performed adequately and that no further liabilities arise. The aftercare period is normally not less than five years, but can be extended into decades depending on the physical and chemical characteristics of the facility. In the case of the relatively inert manganese tailings at Tshipi a period of five years is considered reasonable.

The typical aftercare requirements will be:

- the monitoring of closure activities to ascertain that side slope vegetation has been successfully established (where required), earthworks have not been impaired in any way, failing which some remediation work would be required; and
- repair areas which have degraded since closure and which require minor remediation work.

30. ENVIRONMENTAL AWARENESS PLAN

30.1 MANNER IN WHICH APPLICANT INTENDS TO INFORM EMPLOYEES OF THE ENVIRONMENTAL RISKS

This section includes the environmental awareness plan for the Tshipi Borwa Mine, as detailed in the approved EMPr amendment (SLR, 2017d). The plan describes how employees are informed of:

- environmental risks, which may result from their work and the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment;
- the training required for general environmental awareness; and
- the dealing of emergency situations and remediation measures for such emergencies.

All contractors that conduct work on behalf of Tshipi are bound by the content of the EMPr and a contractual condition to this effect will be included in all such contracts entered into by the mine. The responsibility for ensuring contractor compliance with the EMPr will remain with Tshipi.

The purpose of the environmental awareness plan is to ensure that all personnel and management understand the general environmental requirements of the site. In addition, greater environmental awareness must be communicated to personnel involved in specific activities, which can have a significant impact on the environment, and ensure that they are competent to carry out their tasks on the basis of appropriate education, training and/or experience. The environmental awareness plan should enable Tshipi to achieve the objectives of the environmental policy.

30.1.1 ENVIRONMENTAL POLICY

To achieve best practice environmental performance in a sustainable manner Tshipi is currently committed to:

- integrating environmental management into all aspects of the business, including the entire product life cycle;
- complying with all applicable legislation and other requirement to which Tshipi subscribes;
- practising responsible stewardship by adopting world class standards;
- proactively identifying and managing significant environmental aspects in order to:
    - minimise emissions to atmosphere;
    - minimise the release of effluent;
    - optimise resource consumption;
    - mitigate our impacts on climate change;
    - minimise waste;
    - rehabilitate disturbed land; and
    - protect cultural heritage resources (where relevant).
- ensuring environmental awareness and appropriate competency among employees and promoting environmental awareness in the community;
- setting objectives and, where possible, quantitative targets, to determine continual improvement in environmental performance and the prevention of pollution;
- to participate in environmental forums with neighbouring mines and the Kalagadi catchment forum with neighbouring mines, farmers and commenting authorities (primarily DWS); and

- to provide relevant and constructive consultation/public participation on the management of the potential environmental impacts posed by the mine in the future. In addition to this, Tshipi will also participate with the any relevant farmers' association.

30.1.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

Tshipi's environmental policy is realised by setting specific and measurable objectives. It is proposed that new objectives are set throughout the life of mine, but initial objectives are as follows:

- Management of environmental responsibilities:
  - Tshipi will establish and appoint Managers at senior mine management level at each site, who will be provided with all necessary resources to carry out the management of all environmental aspects of the site irrespective of other responsibilities, for example:
    - Compliance with environmental legislation and EMPr commitments;
    - Implementing and maintaining an environmental management system with the assistance of the appointed environmental officer and SHE manager and officers;
    - Developing environmental emergency response procedures and coordinating personnel during incidents;
    - Manage routine environmental monitoring and data interpretation;
    - Environmental trouble shooting and implementation of remediation strategies; and
    - Closure planning.
- Communication of environmental issues and information:
  - Meetings, consultations and progress reviews will be carried out, specifically:
    - Discussions of environmental issues and feedback on environmental projects will form part of the annual work plan of the social and ethics committee who will report periodically to the board of the company;
    - Progress reports on the achievement of policy objectives and level of compliance with the approved EMPr will be provided to the DMR;
    - Ensuring environmental issues are raised at monthly mine management executive committee meetings and all relevant mine wide meetings at all levels; and
    - Ensuring environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties, where possible.
- Environmental awareness training:
  - Tshipi will provide environmental awareness training to individuals at a level of detail specific to the requirements of their job, but will generally comprise:
    - Basic awareness training for all prior to granting access to site (e.g. short video presentation requiring registration once completed). Employees and contractors who have not attended the training will not be allowed on site;
    - General environmental awareness training will be given to all employees and contractors as part of the Safety, Health and Environment (SHE) induction programme. All non-Tshipi personnel who will be on site for more than three days will undergo the SHE induction training; and

    - Specific environmental awareness training will be provided to personnel whose work activities can have a significant impact on the environment (e.g. workshops, waste handling and disposal, sanitation, etc.).
- Review and update the environmental topics already identified in the EMPr, which currently includes the following purpose:
  - Soil and land capability management (loss of soil resource);
  - Management of biodiversity (loss of biodiversity);
  - Surface water management (alteration of surface drainage and surface water contamination);
  - Groundwater management (reduction in groundwater levels/availability and groundwater contamination);
  - Management of air quality (dust generation);
  - Noise (specifically management of disturbing noise);
  - Visual aspects (reduction of negative visual impacts);
  - Surrounding land use (traffic management and land use loss);
  - Heritage resources (management of sites where needed); and
  - Socio-economic impacts (management of positive and negative impacts).
- The mine will be designed to minimise the impact on the environment and to accomplish closure/rehabilitation objectives; and
- Tshipi will maintain records of all environmental training, monitoring, incidents, corrective actions and reports.

30.1.3 TRAINING OBJECTIVES OF THE ENVIRONMENTAL AWARENESS PLAN

The environmental awareness plan ensures that training needs are identified and that appropriate training is provided. The environmental awareness plan communicates:

- the importance of conformance with the environmental policy, procedures and other requirements of good environmental management;
- the significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance;
- the individuals roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- the potential consequences of not complying with environmental procedures.

30.1.3.1 GENERAL CONTENTS OF THE ENVIRONMENTAL AWARENESS PLAN

To achieve the objectives of the environmental awareness plan, the general contents of the training plans are as follows:

- Module 1 – Basic training plan applicable to all personnel entering the site:
  - Short (15 min) presentation to indicate the site layout and activities at specific business units together with their environmental aspects and potential impacts; and
  - Individuals to sign off with site security on completion in order to gain access to the site.

- Module 2 – General training plan applicable to all personnel at the site for longer than 3 days:
  - General understanding of the environmental setting of the mine (e.g. local communities, nearby towns, isolated farmsteads and proximity to natural resources such as rivers);
  - Understanding the environmental impact of individuals activities on site (e.g. excessive production of waste, poor housekeeping, energy consumption, water use, noise, etc.);
  - Indicate potential site specific environmental aspects and their impacts;
  - Tshipi's environmental management strategy;
  - Identifying poor environmental management and stopping work which presents significant risks;
  - Reporting incidents;
  - Examples of poor environmental management and environmental incidents; and
  - Procedures for emergency response and cleaning up minor leaks and spills.
- Module 3 – Specific training plan:
  - Environmental setting of the workplace (e.g. proximity of watercourses, vulnerability of groundwater, proximity of local communities, towns and isolated farmsteads etc.);
  - Specific environmental aspects such as:
    - Spillage of hydrocarbons at workshops;
    - Poor waste management such as mixing hazardous and general wastes, inappropriate storage and stockpiling large amounts of waste;
    - Poor housekeeping practices;
    - Poor working practices (e.g. not carrying out oil changes in designated bunded areas);
    - Excessive noise generation and unnecessary use of hooters; and
    - Protection of heritage resources (including palaeontological resources).
  - Impact of environmental aspects, for example:
    - Hydrocarbon contamination resulting in loss of resource (e.g. soil and water) to downstream users;
    - Groundwater contamination also resulting in loss of resource due to potential adverse aesthetic, taste and health effects; and
    - Dust impacts on local communities (nuisance and health implications).
- Tshipi's duty of care (specifically with respect to waste management); and
- Purpose and function of Tshipi's environmental management system.

Individuals required to complete Module 3 (Specific training module) will need to complete Modules 1 and 2 first. On completion of the Module 3, individuals will be subject to a short test (written or verbal) to ensure the level of competence has been achieved. Individuals who fail the test will be allowed to re-sit the test after further training by the training department.

The actual contents of the training modules will be developed based on a training needs analysis.

Key personnel will be required to undergo formal, external environmental management training (e.g. how to operate the environmental management system, waste management and legal compliance).

In addition to the above Tshipi will:

- conduct refresher training/presentations on environmental issues for mine employees (permanent and contractors) at regular intervals;

- promote environmental awareness using relevant environmental topic posters displayed at strategic locations on the mine. These topics will be changed monthly, and will be reviewed annually by the Environmental Department Manager to ensure relevance; and
- participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Arbour Week, World Environment Day and National Water Week.

30.2 MANNER IN WHICH RISKS WILL BE DEALT WITH TO AVOID POLLUTION OR DEGRADATION

30.2.1 ON-GOING MONITORING AND MANAGEMENT ACTIONS

The monitoring programme as described in Section 0 will be undertaken to provide early warning systems necessary to avoid environmental emergencies.

30.2.2 PROCEDURES IN CASE OF ENVIRONMENTAL EMERGENCIES

Emergency procedures apply to incidents that are unexpected and that may be sudden, and which lead to serious danger to employees/contractors, the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). Procedures to be followed in case of environmental emergencies are described in Table 30-1 below.

30.2.2.1 GENERAL EMERGENCY PROCEDURE

The general procedure that should be followed in the event of all emergency situations is as follows.

- An applicable incident controller defined in emergency plans must be notified of an incident upon discovery;
- An area to be cordoned off to prevent unauthorised access and tampering of evidence;
- To undertake actions defined in emergency plant to limit/contain the impact of the emergency;
- If residue facilities/dams, storm water diversions, etc. are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available). After hours the Operations Engineer on shift must be notified;
- To take photographs and samples as necessary to assist in investigation;
- To report the incident immediately to the environmental department for emergencies involving environmental impacts or to the safely department in the case of injury;
- The Environment department must comply with Section 30 of the NEMA such that:
    - o the environment department must immediately notify the Director-General (DWS, DMR and Inspectorate of Mines, as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DMR, the head of the local municipality, the head of the regional DWS office and any persons whose health may be affected of:
        - the nature of the incident;
        - any risks posed to public health, safety and property;
        - the toxicity of the substances or by-products released by the incident; and
        - any steps taken to avoid or minimise the effects of the incident on public health and the environment.

- The environment department must as soon as is practical after the incident:
  - Take all reasonable measures to contain and minimise the effects of the incident including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
  - Undertake clean up procedures;
  - Remedy the effects of the incident; and
  - Assess the immediate and long term effects of the incident (environment and public health).
  - Within 14 days the environment department must report to the Director-General DWS and DEA, the provincial head of DMR, the regional manager of the DMR, the head of the local and district municipality, the head of the regional DWS office such information as is available to enable an initial evaluation of the incident, including:
    - The nature of the incident;
    - The substances involved and an estimation of the quantity released;
    - The possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects);
    - Initial measures taken to minimise the impacts;
    - Causes of the incident, whether direct or indirect, including equipment, technology, system or management failure; and
    - Measures taken to avoid a recurrence of the incident.

30.2.2.2 IDENTIFICATION OF EMERGENCY SITUATIONS

The site wide emergency situations that have been identified together with specific emergency response procedures are outlined in Table 30-1).

30.2.3 TECHNICAL, MANAGEMENT AND FINANCIAL OPTIONS

Technical, management and financial options that will be put into place to deal with the remediation of impacts in cases of environmental emergencies are described below.

- The applicant will appoint a competent management team with the appropriate skills to develop and manage a mine of this scale and nature;
- To prevent the occurrence of emergency situations, the mine will implement as a minimum the mine plan and management actions as included in this EMPr;
- The mine has an environmental management system in place where all operation identify, report, investigate, address and close out environmental incidents;
- As part of its annual budget, the mine will allow a contingency for handling of any risks identified and/or emergency situations; and
- Where required, the mine will seek input from appropriately qualified people.

TABLE 30-1: EMERGENCY RESPONSE PROCEDURES

Item	Emergency situation	Response in addition to general procedures
1	Spillage of chemicals, engineering substances and waste	• Where there is a risk that contamination will contaminate the land (leading to a loss of resource), surface water and/or groundwater, Tshipi will: o notify residents/users downstream of the pollution incident; o identify and provide alternative resources should contamination impact adversely on the existing environment; o cut off the source if the spill is originating from a pump, pipeline or valve (e.g. refuelling bays) and the infrastructure 'made safe'; o contain the spill (e.g. construct temporary earth bund around source such as road tanker); o pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal; and o remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repaired.
2	Discharge of dirty water to the environment	• Apply the principals listed for Item 1 above. • To stop spillage from the dirty water system the mine will: o redirect excess water to other dirty water facilities where possible; o pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system; o carry out an emergency discharge of clean water and redirect the spillage to the emptied facility; and o apply for emergency discharge as a last resort.
3	Pollution of surface water (where relevant)	• Personnel discovering the incident will inform the Environment department of the location and contaminant source. • Apply the principals listed for Item 1 above. • Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants. • Contamination entering the surface water drainage system will be redirected into the dirty water system. • The Environment department will collect in-stream water samples downstream of the incident to assess the immediate risk posed by contamination.
4	Groundwater contamination	• Use the groundwater monitoring boreholes as scavenger wells to pump out the polluted groundwater for re-use in the process water circuit (hence containing the contamination and preventing further migration). • Investigate the source of contamination and implement control/management actions.

Item	Emergency situation	Response in addition to general procedures
5	Burst water pipes (loss of resource and erosion)	• Notify authority responsible for the pipeline (if not mine responsibility). • Shut off the water flowing through the damaged area and repair the damage. • Apply the principals listed for Item 1 above if spill is from the dirty/process water circuit.
6	Flooding from failure of surface water control infrastructure	• Evacuate the area downstream of the failure. • Using the emergency response team, rescue/recover and medically treat any injured personnel. • Temporarily reinstate/repair storm water diversions during the storm event (e.g. emergency supply of sandbags). • Close the roads affected by localised flooding or where a storm water surge has destroyed crossings/bridges.
7	Risk of drowning from falling into water dams	• Attempt rescue of individuals from land by throwing lifeline/lifesaving ring. • Get assistance from emergency response team whilst attempting rescue or to carry out rescue of animals and or people as relevant. • Ensure medical assistance is available to recovered individual.
8	Veld fire	• Evacuate mine employees from areas at risk. • Notify downwind residents and industries of the danger. • Assist those in imminent danger/less-able individuals to evacuate until danger has passed. • Provide emergency firefighting assistance with available trained mine personnel and equipment.
9	Falling into hazardous excavations	• Personnel discovering a fallen individual or animal will mobilise the emergency response team to the location of the incident and provide a general appraisal of the situation (e.g. human or animal, conscious or unconscious, etc.). • Trained professionals such as the mine emergency response team should preferably recover the injured party. • A doctor (or appropriate medical practitioner)/ambulance should be present at the scene to provide first aid and transport individual to hospital.
10	Road traffic accidents (on site)	• The individual discovering the accident (be it bystander or able casualty) will raise the alarm giving the location of the incident. Able personnel at the scene should shut down vehicles where it is safe to do so. • Access to the area will be restricted and access roads cleared for the emergency response team. • Vehicles will be made safe first by trained professionals (e.g. crushed or overturned vehicles). • Casualties will be moved to safety by trained professionals and provided with medical assistance. • Medical centres in the vicinity with appropriate medical capabilities will be notified if multiple seriously injured casualties are expected. • A nearby vet will be consulted in the case of animal injury

Item	Emergency situation	Response in addition to general procedures
11	Development of informal settlements	• The mine will inform the local authorities (municipality and police) that people are illegally occupying the land and ensure that action is taken within 24hrs.
12	Uncovering of graves and sites and fossils	• Personnel discovering a grave or site will inform the environment department immediately and all work in the vicinity will be stopped immediately. • The environmental department will inform the South African Heritage Recourse Agency (SAHRA) and contact an archaeologist and/or palaeontologist, depending on the nature of the find, to assess the importance and rescue them if necessary (with the relevant SAHRA permit). No work will resume in this area without the permission from the Environmental Control Officer (ECO) and SAHRA. • If the newly discovered heritage resource is considered significant a Phase 2 assessment may be required. • Historical buildings older than 60 years fall under the jurisdiction of the Free State Provincial Heritage Authority. If any sites are affected this provincial authority will be contacted. • Should further burial grounds, graves or graveyards be found, the SAHRA Burial Grounds and Graves Unit will be contacted. • Prior to damaging or destroying any of the identified graves, permission for the exhumation and relocation of graves will be obtained from the relevant descendants (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local Police. • The exhumation process will comply with the requirements of the relevant Ordinance on Exhumations and the Human Tissues Act, 1983 (No. 65 of 1983).

31. SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

The following documents will be submitted to the DMR from the start of construction until mine closure:

- As noted in Section 29.1, an environmental audit report, prepared by an independent person, will be submitted to the DMR at intervals indicated in the environmental authorisation. The purpose of the environmental audit report is to ensure compliance with the conditions of the environmental authorisation and the EMP; and
- The financial provision will be updated on an annual basis and submitted to the DMR.

32.UNDERTAKING

I, Marline Medallie, the Environmental Assessment Practitioner responsible for compiling this EMPr, undertake that:

- the information provided herein is correct;
- comments and inputs from stakeholders and I&APs have been included and correctly recorded in this report;
- inputs and recommendations from the specialist reports have been included where relevant; and
- any information provided to I&APs and any responses to comments or inputs made is correct or was correct at that time.

Signature of EAP	Date
Signature of commissioner of oath	Date

33. REFERENCES

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APPENDIX A: EXISTING ENVIRONMENTAL AUTHORISATIONS

APPENDIX B: EAP CURRICULA VITAE AND REGISTRATIONS

APPENDIX C: STAKEHOLDER ENGAGEMENT

APPENDIX C1: DMR MEETING MINUTES

APPENDIX C2: I&AP DATABASE

APPENDIX C3: I&AP NOTIFICATION LETTERS (BID AND DRAFT SCOPING REPORT)

APPENDIX C4: ADVERTISEMENTS AND SITE NOTICES

APPENDIX C5: INFORMATION-SHARING MEETING MINUTES

APPENDIX C6: LAND CLAIMS CORRESPONDENCE

APPENDIX C7: DMR ACCEPTANCE OF SCOPING REPORT

APPENDIX D: DETAILED ASSESSMENT OF POTENTIAL IMPACTS

Potential environmental and socio-economic impacts were identified by SLR and stakeholders. All identified impacts are considered both incrementally and cumulatively in the context of the existing and approved Tshipi mining infrastructure and activities. The criteria used to rate each impact is outlined in Section 6.6.

The potential impacts are rated with the assumption that no management actions are applied and then again with management actions. An indication of the phases in which the impact will occur including the project specific activity associated with each impact is provided below. A summary of the impact assessment is provided in Section 8 of the main report.

Management actions identified to prevent, reduce, control or remedy the assessed impacts are provided under the relevant impact discussions sections below. A summary of the management actions is provided in Section 27 of this report. It is important to note that the management actions include all measures outlined in the approved EMPr (SLR, 2017d) and any additional management actions identified as part of the proposed project. <u>All additional management actions are indicated in ***italics***.</u>

Biophysical and social impacts associated with the project that will be assessed in this section include the following:

1. The loss and sterilisation of a mineral resource;
2. The loss of soil resources and land capability through contamination and physical disturbance;
3. The physical destruction and general disturbance of biodiversity;
4. The alteration of natural drainage patterns;
5. The contamination of surface water resources;
6. The contamination of groundwater resources;
7. Air pollution through dust generation;
8. Increase in disturbing noise levels;
9. Negative visual views;
10. Road disturbance and traffic safety;
11. The loss of heritage, cultural and palaeontological resources;
12. Inward migration impact;
13. Economic impact; and
14. A change in land use.

D1. GEOLOGY

ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCES

Information in this section was sourced from the project team.

<u>Introduction</u>

By the nature of mining projects, mineral deposits in the natural geology are exploited for the target minerals; thereby impacting the local geology. It is also possible that mineral resources can become sterilised through the placement of surface infrastructure and waste. These activities already take place on site as the mine is an existing operation. However, the proposed WRD extensions could present the potential for sterilisation of mineral resources.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
N/A	Mineralised waste	Mineralised waste	Final land forms

Rating of impact

The impact of the loss and sterilisation of mineral resources was assessed as part of the original EMPr (Metago, 2009) and found that the placement of surface infrastructure would not sterilise any mineral resources. The EMPr amendment (SLR, 2017d) did, however, indicate that following detailed work undertaken by Tshipi, it was found that some economically mineable mineral resources had been sterilised by the placement of the northern WRD. The cumulative impact was rated as **high** and reduced to **LOW** with mitigation.

It is understood from Tshipi that the sub-outcrop of the currently economically mineralised resource is located beyond the areas where the East and West WRD extensions are planned. The manganese ore resources underlying Mamatwan portion 8 has been identified as uneconomic by both opencast and underground mining methods through exploration by Mamatwan Mining (Pty) Ltd – who held the Exploration Right and have subsequently applied for the Mining Right, and have concluded a contract(1)[5] with Tshipi to abandon their Mining Right application on the lower portion of portion 8 immediately when granted, in favour of Tshipi in consideration of Tshipi selling the surface rights of the upper portion of portion 8 to Mamatwan Mining, who are planning infrastructure on the northern portion of portion 8. This impact has, therefore, been rated as **insignificant**.

The cumulative impact rating therefore remains unchanged for the overall mine as per the approved EMPr (SLR, 2017d) as follows:

Unmitigated – summary of the rated loss and sterilisation of mineral resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation, decommissioning and closure						
Unmitigated	H	H	M	H	H	**H**

Mitigated – summary of the rated loss and sterilisation of mineral resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation, decommissioning and closure						
Mitigated	M	M	M	M	L	**L**

[5] Memorandum of Agreement entered into by and between Tshipi é Ntle Manganese Mining Proprietary Limited and Mamatwan Manganese Proprietary Limited, signed on 8 May 2015 and 29 April 2015 respectively.

Management objective

To prevent unacceptable mineral sterilisation or mineral resources.

Management actions

The mine will continue to implement management measures for the overall mine as per the approved EMPr (refer to Section 27) which includes:

- Implement best mining practices during all mine phases to ensure that mineral sterilisation is minimised as far as possible. This includes diligent planning based upon available technical data and other information e.g. economic factors.

D2. TOPOGRAPHY

ISSUE: Altering Topography

Information in this section was sourced from site visits undertaken by the project team and topographical data.

Introduction

The existing mining operation has altered the natural topography of the area. The establishment of the proposed WRD extensions will further alter the natural topography of the project area. This in turn may impact on surface water drainage (discussed in Section D5) and visual aspects (discussed in Section D7). The proposed powerline and conveyor will not impact on topography and will not be discussed further.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste	Mineralised waste	Final land forms

Rating of impact

Severity/ nature

The majority of the natural topography at the Tshipi Borwa Mine has been disturbed as a result of the existing mining infrastructure and activities. The establishment of the proposed WRD extensions will further alter natural topography and cannot be mitigated. However, this impact is considered to be of moderate severity due to the limited areas for the WRD extensions. The cumulative severity is medium for the overall mine and cannot be mitigated to reduce severity.

Duration

Waste rock residue will likely remain on surface in perpetuity.

Spatial scale/ extent

The spatial scale will be limited to the project area.

Consequence

The consequence is medium.

Probability

The impact of a change in topography is definite.

Cumulative impact significance

The significance of this potential impact is medium and cannot be mitigated as the waste rock residue will likely remain on surface in perpetuity.

Unmitigated – summary of the rated cumulative impact of altering natural topography

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	L	M	H	M

Mitigated – summary of the rated cumulative impact of altering natural topography

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	H	L	M	H	M

Management objectives

The objective is to minimise changes to natural topography.

Management actions

Implement the following management actions during all mine phases:

- Minimise the area of disturbance by designing and constructing the most compact infrastructure practically possible; and
- Restore the natural topography where possible and rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved.

D3. SOIL AND LAND CAPABILITY

ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE AND CONTAMINATION

Information in this section is based on the soil study undertaken by TerraAfrica (2018) for the proposed project (refer to Appendix H).

Introduction

Soil is a valuable resource that supports a variety of ecological functions and is the key to re-establishing post closure land capability. Soil resources can be disturbed through removal, erosion and compaction, as well as pollution during accidental spills and leaks which can result in a loss of soil functionality as an ecological driver. Existing mining activities have already disturbed soils and related land capability through the establishment of related surface infrastructure and mining activities. The proposed WRD extensions, proposed powerline and conveyor infrastructure will require the disturbance of additional soils and associated activities could present additional pollution risks.

A number of activities/infrastructure and sources in all phases have the potential to disturb and pollute soils and related land capability through removal, compaction and/or erosion, accidental spills and leaks. In the construction and decommissioning phases these activities and sources are temporary in nature, usually existing from a few weeks to a few months. The operational phase will present more long-term activities and sources and the closure phase will present final land forms (waste residue that remains on surface).

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

Severity/ nature

The approved infrastructure and activities presents numerous sources of activities soil pollutants that can result in a loss of soils (and associated land capability) as a resource. This in turn can result in a loss of soils as an ecological driver because it can create a toxic environment for vegetation and ecosystems that rely on the soil. The cumulative impact was assessed as part of the approved EMPr amendment (SLR, 2017) as having a **high** overall significance, reducing to **LOW** with mitigation.

The East WRD and conveyors will be established within mining areas and, therefore, not result in significant impacts on soils and land capability. However, the West WRD extension and the powerline will be constructed on land suitable for grazing. When considering the proposed project, the most significant impact on soils will occur during the construction of the West WRD extension and powerline. Topsoil will be stripped from the areas where the powerline and West WRD extension will be developed, which will result in the mixing of natural soil layers or horizons, a loss of topsoil fertility and soil compaction. Land capability will be changed from natural veld suitable for grazing to mining, and this impact is long-term. Soil erosion can occur in areas that have been cleared and accidental spills and leaks can contaminate soil during all mine phases until closure. The severity of this impact has been rated as high.

While successful mine rehabilitation may result in revegetation of affected areas, soil horizons cannot be returned to their original positions and deep soil compaction is difficult to alleviate. Similarly, the change in land capability can only be partially mitigated once the land has been rehabilitated. However, soil erosion and soil chemical pollution can be prevented or successfully mitigated when implementing the soil management plan diligently. Soil erosion and chemical pollution impacts should become negligible once the site has been successfully revegetated and vehicles and equipment are removed. The severity of this impact has been rated as low in the mitigated scenario.

The cumulative impact on soils is therefore rated as having a high severity, reducing to medium with mitigation. The mitigated scenario rating has therefore been changed from the approved EMPr rating (SLR, 2017d) due to the fact that according to TerraAfrica, soil horizons cannot be returned to their original positions and deep soil compaction is difficult to alleviate.

<u>Duration</u>

In the unmitigated scenario, most pollution impacts and associated loss in land capability will remain long after closure. In the mitigated scenario most of these potential impacts should either be avoided or be remedied to within the life of mine. This should be achieved by the effective reaction time of the clean-up team and the chosen remediation methods.

<u>Spatial scale/extent</u>

In the unmitigated scenario for all phases the potential loss of soil resources and associated land capability could extend beyond the site boundary. With management actions, the potential loss of soil resources and associated land capabilities will be restricted to within the site boundary.

<u>Consequence</u>

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is reduced to medium.

<u>Probability</u>

Without any management actions the probability of impacting on soils and land capability is definite. With management actions, the probability will be significantly reduced to low.

<u>Cumulative impact significance</u>

In the unmitigated scenario, the significance of this potential impact is **high**. In the mitigated scenario, the significance reduces to **MEDIUM** because with management actions the severity, duration and probability associated with the potential impact all reduce.

<u>Unmitigated – summary of the rated cumulative loss of soil resources and land capability through physical disturbance and contamination impact per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	**H**

Mitigated – summary of the rated cumulative loss of soil resources and land capability through physical disturbance and soil contamination impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	L	M	M	**M**

Management objective

The objective is to minimise the loss of soil resources and related land capability from physical disturbance, erosion, compaction and soil pollution.

Management actions

Implement the following management actions during all mine phases:

- Implement the following management actions during all mine phases:
- Limit land disturbance to those activities and areas that are described in the EMPr. *In this respect, clear instructions will be included in relevant contracts that will restrict construction work and construction workers to clearly defined areas, and compliance to these instructions will be monitored;*
- Implement the soil conservation procedure as set out in Table 27 3;
- Rehabilitate in accordance with an approved mine closure plan that ensures a suitable post-closure land use is achieved;
- *Use existing established roads wherever possible;*
- *Locate new roads that will carry heavy-duty traffic in areas that have been previously disturbed rather than clearing new areas;*
- *Design new roads with a camber to avoid ponding and to encourage drainage to side drains; where necessary, install culverts to allow free drainage;*
- *Protect the side drains on the roads with sediment traps and/or gabions to reduce the erosive velocity of water during storm events and where necessary use geo-membrane lining;*
- *Manage the terrain within the mine surface use area to prevent erosion by implementing the following measures:*
    - *Restrict excavation to areas where it is absolutely necessary;*
    - *Use geo-textiles or other suitable means where required to prevent soil erosion;*
    - *Use tracked excavation equipment where possible to reduce soil compaction that leads to higher run-off rates and increased erosion risk.*
    - *Reduce permanent slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces; and*
    - *Use recognised drainage control measures e.g. side-drains and culverts to manage the natural flow of surface runoff.*
- Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, and in the designs of any permanent landforms e.g. waste rock dumps, approved tailings dam).
- Conduct potentially polluting activities (i.e. loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants (such as fuels, oils, hazardous chemicals (new and used), dirty water,

mineralized wastes and non-mineralised wastes) are contained at source and do not pollute soils. In this regard:
  - Service all vehicles and mobile equipment regularly in workshops, service bays and washbays with contained impermeable, floors, dirty water collection facilities and oil traps;
  - Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment;
  - Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up and/or remediate immediately;
  - Implement and maintain a dirty water management system, as set out in the respective section;
  - Implement the waste management practices, as set out in Table 27-2;
  - Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and
  - Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents.
- Determine and implement specifications for post rehabilitation audits to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures;
- Take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring in the design of any permanent and potentially polluting structures (such as the waste rock dumps, ore stockpiles and tailings dam); and
- Implement the emergency response procedure in Section 30.2.2 in the event any major spillage incident.

D4. BIODIVERSITY

ISSUE: PHYSICAL DESTRUCTION AND GENERAL DISTURBANCE OF BIODIVERSITY

Information in this section was sourced from the biodiversity study undertaken by STS (2018) (see Appendix E)

Introduction

A number of activities/infrastructure in all phases that have the potential to destroy or disturb biodiversity in the broadest sense, particularly in the unmitigated scenario. In the construction and decommissioning phases these activities are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long-term occurrences and the closure phase will present final land forms (residual waste rock dumps) that may have pollution potential through long term seepage and/or runoff.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of	Final land forms

Construction	Operational	Decommissioning	Closure
	approved facilities and services Open pit mining	approved facilities and services	

<u>Rating of impact</u>

<u>Severity/nature</u>

Areas of high ecological sensitivity include functioning biodiversity areas with species diversity and associated intrinsic value. In addition, some of these areas host protected species. The linking areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas, which is a key function for the broader ecosystem. The transformation of land for any purpose, including mining and associated activities, increases the destruction of the site specific biodiversity, the fragmentation of habitats, reduces its intrinsic functionality and reduces the linkage role that undeveloped land fulfils between different areas of biodiversity importance.

The cumulative impact associated with the physical destruction and general disturbance of biodiversity was assessed as part of the approved EMPr amendment (SLR, 2017d) as having a **high** overall significance in the unmitigated scenario, reducing to **MEDIUM** with management actions.

When considering the proposed project, the proposed Eastern WRD extension and conveyor are located in already disturbed areas. Therefore, no significant biodiversity impacts are expected with regard to the proposed Eastern WRD extension and conveyor.

The proposed West WRD extension and powerline will require clearing of vegetation within the Kathu Thornveld habitat unit, which has a moderately high ecological sensitivity. The clearing of vegetation will result in the loss of additional protected trees such as the Camel Thorn (*Vachellia erioloba)* and Grey Camel Thorn (*Vachellia haematoxylon),* as well as as well as several other faunal and floral species of conservation concern. A survey conducted in the West WRD extension area found approximately 4 365 Grey Camel Thorn trees and approximately 1 140 Camel Thorn trees.

In addition to the loss of habitat, biodiversity may be disturbed in the following ways:

- Lighting can attract large numbers of invertebrates which become easy prey for predators. This can upset the invertebrate population balances;
- People may kill various types of species for food, for sport, for fire wood etc.;
- People may illegally collect and remove vegetation, vertebrate and invertebrate species;
- Excessive dust fallout from various dust sources (exposed areas, soil stockpiles, etc.) may have adverse effects on the growth of some vegetation, and it may cause varying stress on the teeth of vertebrates that have to graze soiled vegetation;
- Noise and vibration pollution (from vehicle movement, materials handling, etc.) may scare off vertebrates and invertebrates. In some instances the animals may be deterred from passing close to noisy activities which can effectively block some of their migration paths. In other instances, vertebrates and invertebrates that rely on vibration and noise senses to locate for, and hunt, prey may be forced to leave the vicinity of noisy, vibrating activities;
- An increased presence of vehicles in the area can cause road kills especially if drivers speed;

- Vegetation clearing activities will create an ideal scenario for the proliferation of alien invasive plant species, which will result in a further disturbance of terrestrial habitat; and
- An increase in pollution emissions and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

When considered incrementally, this has a medium to high severity in the unmitigated and mitigated scenarios. This will not change the cumulative severity rating of high in the unmitigated scenario, reducing to medium with mitigation.

Duration

In the unmitigated scenario the loss of biodiversity and related functionality is long-term and will continue after the life of the mine. With management actions, biodiversity and related functionality may be partially restored during the operational, decommissioning and closure phases. The duration is, therefore, high in the unmitigated scenario, reducing to medium in the mitigated scenario.

Spatial scale / extent

Given that biodiversity processes are not confined to the mine site, the spatial scale of impacts will extend beyond this boundary in both the mitigated and unmitigated scenarios. The spatial scale is therefore medium in both the unmitigated and mitigated scenarios.

Consequence

In the unmitigated scenario the consequence is high and reduces to medium with management actions.

Probability

Without management actions the probability is definite. With management actions, the probability may be reduced with correct management actions and concurrent rehabilitation.

Cumulative impact significance

The significance of this impact is **high** without management actions, reducing to **MEDIUM** with the correct management actions.

Unmitigated – summary of the cumulatively rated loss of biodiversity through physical destruction and general disturbance impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	**H**

Mitigated – summary of the cumulatively rated loss of biodiversity through physical destruction and general disturbance impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	M	M	M	**M**

Management objective

The objective is to prevent the unacceptable loss and disturbance of biodiversity, species of conservation concern and related ecosystem functionality through physical disturbance.

Management actions

Implement the following management actions during all mine phases:

- implement and refine (as needed) the biodiversity action plan, in consultation with DAFF and a suitably experienced and qualified specialist;
- Limit mine infrastructure, activities and disturbance areas to those specifically identified and described in this EMPr, with controlled access and zero tolerance of unnecessary disturbances to the identified sensitive habitats and associated species;
- Retain corridors of naturally occurring vegetation within the disturbed areas as far as practicably possible, to provide a corridor for fauna to move out of the disturbed areas;
- *Limit vegetation clearing along the powerline servitude to prevent the powerline from being overgrown and/or affected by veld fire; in accordance with the DAFF guideline (protected trees may only be cleared directly underneath and within 4 metres of the powerline).*
- *Implement phased vegetation clearing of the WRD extension areas, in a uniform direction from one side to the other so as to ensure that, as far as possible, faunal species can naturally disperse out of the area ahead of activities;*
- Collect pods of the Camel Thorn (*Vachellia erioloba*) and the Grey Camel Thorn (*Vachellia haematoxylon*) in order to aid in the re-establishment of these species. Take the necessary steps (such as artificial scarring/acid washing) in order to aid in germination of these species, with guidance from a qualified and experienced specialist;
- Plan and implement plans for the removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities. This includes planning on the preservation, cultivation and re-use of these species in ongoing rehabilitation. Take the soil conservation procedure and required actions into account when implementing removal plans. Undertake harvesting of seeds in a controlled manner from similar areas within the mine surface use area to aid in rehabilitation of the mining areas. Ensure that all rescue and relocation plans are overseen by a suitably qualified and experienced specialist, who will also advise on the potential for establishing a nursery of plants to be used for rehabilitation;
- Obtain the relevant permits prior to removal of protected plant and/or trees and comply with the requirements thereof;
- Obtain guidance from a suitably qualified and experienced specialist to develop and implement an effective monitoring programme of protected trees in the area of operation, on an individual tree basis and at a community level. Implement additional management actions that may be recommended by the specialist, depending on the results of the monitoring programme;
- Re-vegetate disturbed and cleared areas once no longer in use with indigenous species of flora to help stabilise the soil surface;
- Develop and implement an “after care” programme to manage rehabilitated areas which will aid in ensuring that the correct species are able to re-establish;
- Implement a biodiversity offset, should this be requested by DAFF, in accordance with the relevant biodiversity offset guidelines. Consider the following issues in the biodiversity offset with guidance from DAFF:
    - the size of the potentially affected area;

  - the conservation status of the potentially affected area;
  - the offset ratio (in terms of the required size of the offset site) to be applied;
  - evaluation of alternative offset sites on the basis of: compensation for the mine's negative impact on biodiversity, long term functionality, long term viability, contribution to biodiversity conservation in the Northern Cape including linkages to areas of conservation importance, acceptability to I&APs, management of negative impacts on local communities, distances from other mines in relation to dust fallout and other impacts, and biodiversity condition scores as compared to that at the UMK site;
  - land ownership now and in the future;
  - status/security of the offset site, i.e. will it receive conservation status;
  - measures to guarantee the security, management, monitoring and auditing of the offset;
  - capacity of Tshipi to implement and manage the offset
  - collaboration with surrounding mine's offsets may be an option;
  - identification of unacceptable risks associated with the offset; and
  - the start-up and ongoing costs associated with the offset for the life of the project.
- Implement the emergency response procedure in Section 30.2.2 in the event of major spillage incidents.
- Implement an alien/invasive/weed management programme (Section 0) in collaboration with the DENC and DAFF to control the spread of these plants onto and from disturbed areas. Take care to prevent the encroachment of these species into rehabilitated areas;
- Use appropriate fencing where feasible to keep vertebrates away from illuminated areas;
- Train workers on the value of biodiversity and the need to conserve the species and systems that occur in the mine surface use area;
- Implement a zero tolerance policy with regard to the killing or collecting of any fauna and/or flora by any Tshipi employees and/or contractors or visitors;
- *Implement steps to prevent the propagation and/or spread of veld fires e.g. cutting/burning fire-breaks and put in place as part of the emergency plan a programme, trained individuals and equipment for fire-fighting*
- Implement active speed control measures for any vehicles driving within the mine surface use area;
- Maintain noisy and/or vibrating equipment to limit noise and vibration emission levels;
- Implement dust control measures as discussed under the air quality section in this table;
- Prevent pollution and litter as outlined in Table 27-2 and Table 27-3; and
- Take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring as part of closure planning, including in the designs of potentially polluting structures (mine residue facilities).

D5. SURFACE WATER

ISSUES: ALTERATION OF NATURAL DRAINAGE PATTERNS

The information in this section was sourced from the hydrology study completed by SLR (SLR, 2018a) (refer to Appendix G).

Introduction

With reference to the table below, there are a number of activities/infrastructure that will alter drainage patterns by reducing the volume of runoff into the downstream catchments at the mine. During the construction, operational and decommissioning phase, these activities will continue until such time as infrastructure can be removed and/or the mining areas are rehabilitated. During the closure phase, rehabilitation will allow for the restoration of drainage patterns. Rainfall and surface water runoff will be collected in all areas that have been designed with water containment infrastructure as required by legislation. The collected runoff will, therefore, be lost to the catchment and can result in the alteration of drainage patterns. The existing operation has already had an impact on the natural drainage of the area, and the proposed infrastructure will further alter the natural drainage.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Water use management	Mineralised waste Water management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Water management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impacts

Severity/nature

Natural drainage across the project area is via sheet flow and the nearest watercourse is approximately 1 km away from the West WRD extension area. No mining activities take place within the floodlines of this watercourse and this watercourse will not be altered as part of the proposed project.

During all mine phases, rainfall and surface water runoff is collected in all areas that have been designed with water containment infrastructure in order to contain dirty water in compliance with R704 of the NWA. The collected runoff is, therefore, lost to the catchment and can result in the alteration of drainage patterns. The cumulative impact was assessed in the 2017 EMPr amendment (SLR, 2017d) as reducing the runoff to quaternary catchment D41K by 0.152%. This cumulative impact was rated as **medium**, reducing to **LOW** in the mitigated scenario.

The proposed WRD extension will require the collection of additional storm water and reduce the runoff to the quaternary catchment D41K by a further 0.04%. The severity of the loss of runoff to the catchment of the proposed WRD extensions containment infrastructure is expected to be low. This will not change the cumulative impact assessment rating of medium in the unmitigated scenario and low in the mitigated scenario for the overall mine with the re-establishment of runoff patterns as far as practically possible.

Duration

The alteration of drainage patterns will extend beyond closure as the WRDs are likely to remain in perpetuity.

Spatial scale / extent

In the mitigated and unmitigated scenario the physical alteration of drainage patterns will extend beyond the site boundary as flow reduction impacts could extend further downstream.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is medium.

Probability

The probability of the alteration of drainage patterns is definite, but the magnitude of the reduced flows is unlikely to result in substantial deterioration and related flow impacts downstream due to the relatively flat topography, low rainfall and high infiltration rates, therefore the probability is low in both the mitigated and unmitigated scenarios.

Cumulative impact significance

The significance is **medium** without management actions. With management actions the significance reduces to **LOW**.

Unmitigated – summary of the cumulative rated alteration of natural drainage patterns impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	M	H	L	**M**

Mitigated – summary of the cumulative rated alteration of natural drainage patterns impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	H	M	M	L	**L**

Management objective

The objective is to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow or to minimise where this could not be prevented.

Management actions

Implement the following management actions during all mine phases:

- Construct, operate and maintain mine infrastructure in a *manner* that ensures compliance with the provisions of the Regulation 704 of 1999 in terms of the NWA. These include:
    - Separate clean and dirty water systems;
    - Minimise the size and extent of dirty water areas; and
    - Divert clean water (run-off and rainfall) around the mine/dirty areas and back into its normal flow paths in the environment;
- Regularly update and refine the site wide water balance with the input of actual flow volumes to enable the water balance to be used as a decision-making tool for water management and impact management actions (Section 0).

ISSUE: CONTAMINATION OF SURFACE WATER RESOURCES

The information in this section was sourced from the hydrology study completed by SLR (SLR, 2018a) (refer to Appendix G).

Introduction

A number of pollution sources in all phases have the potential to pollute surface water, particularly in the unmitigated scenario. In the construction and decommissioning phases these potential pollution sources are temporary in nature. Although these sources may be temporary, the potential pollution may be long term. The operational phase presents more long-term potential sources and the closure phase will present final land forms such as residual waste rock dumps (where applicable) that may have the potential to contaminate surface water through long term seepage and/or runoff. The proposed infrastructure presents additional pollution sources.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Water use management	Mineralised waste Water management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Water management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impacts

Severity/nature

Mining projects generally present a number of pollution sources that can have a negative impact on surface water quality if unmanaged in all project phases. Various pollution sources during the operational phase include: fuel and lubricants, sewage, mine residue (TSFs and WRDs), dirty water circuit, chemicals, non-mineralised waste (hazardous, general), and erosion of particles from exposed soils in the form of suspended solids. The proposed WRD extensions present additional potential pollution sources as runoff from the WRD extensions could contain contaminants. The construction of the proposed powerline and conveyor infrastructure could present temporary pollution sources through accidental spills and leaks.

The cumulative impact of surface water contamination was assessed as part of the approved EMPr amendment (SLR, 2017d) as having a **medium** overall significance. The mitigated scenario was assessed as having a **LOW** overall significance with key mitigation factors including the diversion of clean water away from dirty areas and the containment and re-use of contaminated runoff and process water.

The establishment of the proposed WRD extensions, powerline and conveyor will present additional pollution sources albeit similar in nature to what has already been assessed for the mine. In the unmitigated scenario, potential construction and decommissioning phase pollution sources associated with the establishment of proposed infrastructure include:

- Sedimentation from erosion; and
- Spillage of operational fuel, lubricants and leaks from vehicles and equipment.

Potential operational phase pollution sources include:

- Spillage of operational fuel, lubricants and leaks from vehicles and equipment;
- Runoff from the WRDs; and
- Sedimentation from erosion.

At elevated concentrations contaminants can exceed the relevant surface water quality limits imposed by DWS and can be harmful to humans and livestock if ingested directly and possibly even indirectly through contaminated vegetation, vertebrates and invertebrates (refer to the biodiversity section in this appendix for the potential biodiversity impacts. This impact will not be assessed in this section).

When considered incrementally the WRD extensions, powerline and conveyor potential pollution impact has a severity of low in both the unmitigated and mitigated scenarios. A key mitigation factor is that the WRDs will have runoff containment infrastructure. This will not change the cumulative impact assessment rating of **medium** in the unmitigated scenario and **LOW** in the mitigated scenario for the overall mine with the continued implementation of mitigation measures.

<u>Duration</u>

The contamination of surface water resources will occur for the life of the mine in the unmitigated scenario. With management actions, pollution can be prevented and/or managed and as such the impacts can be reduced to less than the mine life.

<u>Spatial scale / extent</u>

In the mitigated and unmitigated scenarios the spatial scale is limited to the mining area given that the nearest river is located 1 km west of the mine and is ephemeral in nature.

<u>Consequence</u>

In the unmitigated scenario the consequence is medium and in the mitigated scenario it is low.

<u>Probability</u>

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach surface water resources;
- Will people and livestock utilise this contaminated water; and
- Is the contamination level harmful?

The first element is that contamination reaches the surface water resources. Due to the distance of the Tshipi Borwa Mine to the closest surface water resource, the Vlermuisleegte River, which is located 1 km west of the mine, it is unlikely that pollution sources will reach surface water resources. It should also be noted that the Vlermuisleegte is ephemeral in nature and therefore is associated with long periods of no flow.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There is a limited possibility that this will occur given that there is no reliance on surface water resources in the area, for domestic use or livestock watering.

The third element is that it is likely that only some contaminants will be at a level which is harmful to humans and livestock. This is influenced both by the quality of any discharged water and by the diluting effect of any rainwater particularly in the rainy season.

As a combination, when considering the nature and location of the mine in proximity to the Vlermuisleegte River, the unmitigated probability is medium, reducing to low with management actions.

Cumulative impact significance

In the unmitigated scenario, the significance of this potential impact is **medium**. In the mitigated scenario, the significance is reduced to **LOW** because of the reduction in severity, duration and probability.

Unmitigated – summary of the rated cumulative contamination of surface water resources impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	M	L	M	M	**M**

Mitigated – summary of the rated cumulative contamination of surface water resources impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	L	L	L	L	**L**

Management objective

The objective is to prevent pollution of surface water resources.

Management actions

Implement the following management actions during all mine phases:

- Handle all hazardous fuels, oils, chemicals (new and used), mineralized waste and non-mineralised waste in a manner such that they will not pollute surface water. This will be achieved by means of the following actions:
  - Prevent pollution prevention through appropriate infrastructure design. In this regard the WRD extensions will be constructed according to recognised standards;
  - Prevent pollution through considered maintenance of infrastructure and equipment;
  - Prevent pollution through education and training of Tshipi employees and contractors (permanent and temporary);
  - Prevent pollution prevention through appropriate management of hazardous materials as outlined in Table 27-2;
  - Implement appropriate steps to enable containment and remediation of pollution incidents; and
  - Develop post rehabilitation audit criteria to ascertain whether the remediation has been successful. Implement further measures should post rehabilitation audits show rehabilitation has not been successful.
- *Implement the Storm water Management Plan as per the design report;*
- *Manage WRD slope failures which could reduce the capacity of the WRD and/or reduce the effectiveness of WRD paddocks and berms. Rehabilitate any slope failures without delay and recover dislodged/displaced material and return to the WRDs. This also applies to the paddocks and/or berms surrounding the WRDs;*
- *Maintain relevant data sheets for chemical and hazardous substances to provide guidance on the clean-up of chemical and/or hazardous spills;*
- *Conduct regular inspections and maintenance of water management facilities throughout the life of mine, including inspection of drainage structures and liners for;*
  - *any in-channel erosion or cracks;*
  - *de-silt silt traps/sumps and dirty water containment dams; and*
  - *maintain pumps and pipelines according to manufacturer's specifications;*
- *Service vehicles and plant equipment within suitably equipped facilities, either within workshops, or within bunded areas, from which any storm water is conveyed to a collection facility, after passing through an oil and silt interceptor;*
- Monitor surface water quality within and outside the vicinity of mining operations. The surface water monitoring programme must also focus on surface water sampling of different mine dirty water streams, any unplanned discharges, and monitoring both up and downstream of the Vlermuisleegte of the mining operations when possible (the possibility of monitoring water in the Vlermuisleegte River may only arise during heavy periods of rain). Details of the surface water monitoring programme are outlined in Section 0;
- *Regularly review design measures and mitigation measures for identified impacts as per best practice requirements and in compliance with relevant authorisations, including the WUL;*
- Immediately notify the DWS should any surface water resource contamination be detected. Implement any required actions to stop the contamination of downstream water.
- Notify potentially affected users in the event of surface water contamination, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures, in consultation with DWS and an appropriately qualified person. Address any related proven loss caused by the mine (in the short and long term) through appropriate compensation, which may include an alternative water supply of equivalent quality and quantity;

- *Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources (TSF, open pit and WRDs) indicate that these sources are causing pollution which is migrating off-site; and*
- Implement the emergency response procedure in Section 30.2.2 in the event of a potentially polluting discharge incident.

D6. GROUNDWATER

Information in this section was sourced from the groundwater study undertaken by SLR (2018b) (refer to Appendix G).

The proposed project does not include any dewatering activities; therefore, dewatering impacts assessed in the approved EMPr amendment (SLR, 2017d) will remain valid and will not be discussed in this report. The relevant dewatering management measures are however included in Section 27.

This section focusses on the potential groundwater contamination impacts of the proposed project. The contamination modelling included all existing and proposed sources of pollution in order to provide a cumulative assessment for the mine.

ISSUE: CONTAMINATION OF GROUNDWATER RESOURCES

Introduction

There are a number of sources in all mine phases that have the potential to pollute groundwater. Some existing sources are permanent (approved tailings dam) and some sources are transient (starting later and at different time-steps) and becoming permanent (pit backfilling). Proposed sources include the WRD extensions which are likely to be permanent sources. Even though some sources are temporary in nature, related potential pollution can be long-term. The operational phase will present more long-term potential sources (existing WRDs and proposed WRD extensions) and the closure phase will present final land forms, such as the backfilled open pit and the tailings dam that may have the potential to pollute water resources through long term seepage and/or runoff.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste (existing and proposed sources) Open pit mining (including backfilling)	Mineralised waste (existing and proposed sources) Backfilling of open pit	Final land forms

Rating of impacts

Severity / nature

Groundwater contamination was assessed as part of the original EMPr (Metago, May 2009). The groundwater study supporting the 2009 EMPr found that there would be no significant offsite migration of contaminants and, therefore, the related impact was rated as having a **LOW** significance in the unmitigated and mitigated scenarios. The key contributing factors included:

- Low seepage rates from the TSF and WRDs;
- Limited hydraulic conductivity of the material underlying the TSF and WRDs; and
- The retardation effect of the pit dewatering on parts of the modelled pollution plume.

The relocation of surface infrastructure was modelled for the EMPr amendment (SLR, 2017d) using two scenarios:

- <u>Unlined Scenario (unmitigated)</u>
  This scenario modelled the current situation where the WRDs on site are not lined; however, the TSF is lined and was modelled as such.
- <u>Lined Scenario (mitigated)</u>
  In accordance with GNR 635 and GNR 636 waste rock samples tested for Tshipi were classified as Type 1 waste, which would require disposal on a facility with a Class A barrier system. A Class A barrier is designed in such a way to avoid any seepage from the waste facility. A very low hydraulic conductivity was assumed for the areas under the WRDs in this scenario.

The groundwater model was run to simulate a period of 100 years, which included 25 years of mining and 75 years post-mining, and included all existing and potential pollution sources. A chloride source concentration of 2 200 mg/ℓ was simulated for pollution sources. The groundwater model showed a maximum chloride plume would extend up to 990 m from the Mining Right area to the south-west in the unlined scenario, and 840 m in the lined scenario at the end of the simulation (year 100). The assessment found that the changes would not present significantly different contaminants or source types to those previously assessed for all project phases and assessed the cumulative impact as being **low** in the unmitigated scenario because the migration of the pollution plume was expected to be limited and was not expected to impact on third party water users using boreholes for water supply.

The proposed East WRD and West WRD extensions were also modelled using an unlined and lined scenario for a period of 100 years and included all existing and potential pollution sources. The maximum chloride plume is predicted to extend a little over 1.1 km from the West WRD extension area in a western direction (refer to Figure 1) at the end of the simulation (year 100) in the unlined scenario. This results in a plume of low concentration outside of the Mining Right area. However, the only third party borehole which falls within the predicted pollution plume is NT13 which is a Mamatwan Mine monitoring borehole and is not used for abstraction for water supply.

The lined scenario shows a plume that that does not extend as far out from the West WRD extension area when compared to the unlined scenario. The maximum distance the plume extends is approximately 770 m to the west. There are no known third parties using boreholes for water supply within the predicted plumes.

Considering that both scenarios result in a plume of low concentration outside of the Mining Right area and that there are no known third parties using boreholes for water supply within the predicted plumes, there is no significant difference in the impact severity rating in the unlined and lined scenarios.

When adding the East and West WRD extensions, modelling shows that the addition of the pollution sources do not materially change the overall impact of the mine as assessed in the approved EMPr amendment (SLR, 2017d), which remains rated at a low severity.

Duration

Groundwater contamination is long-term in nature, occurring for periods longer than the life of mine in both the unmitigated and mitigated scenarios.

Spatial scale / extent

The pollution plume will extend beyond the Mining Right area in both the unmitigated and mitigated scenarios.

Consequence

The consequence is medium in the unmitigated and mitigated scenarios.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach groundwater resources;
- Will people and animals utilise this contaminated water; and
- Is the contamination level harmful?

The first element is that contamination reaches the groundwater resources underneath or adjacent to the mining area. Pollution plume modelling shows that contaminants could reach groundwater resources in the unmitigated and mitigated scenarios. The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There are no known third party boreholes located within the simulated contaminant plume in the unmitigated and mitigated scenarios using boreholes for water supply. The third element is whether contamination is at concentrations which are harmful to users. Based on predicted groundwater modelling, mine related contamination will be at low concentrations outside of the Mining Right area in both the unmitigated and mitigated scenarios. As a combination, the unmitigated and mitigated scenario probability is low.

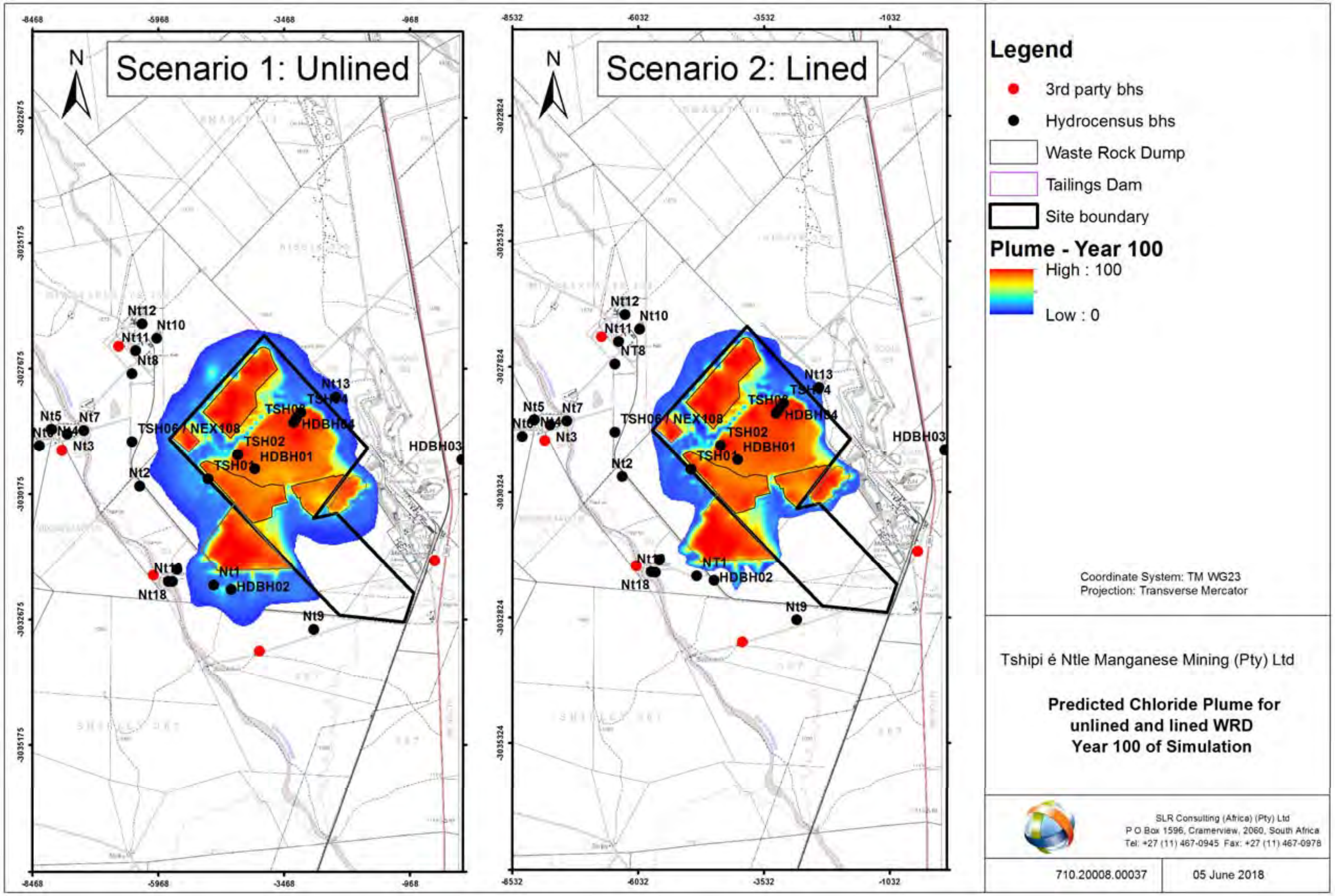

FIGURE 1: PREDICTED CHLORIDE PLUME – YEAR 100 OF SIMULATION (SLR, 2018B)

Cumulative impact significance

The unmitigated and mitigated scenario significance is **LOW**.

Unmitigated – summary of the rated cumulative contamination of groundwater impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	L	H	M	M	L	L

Mitigated – summary of the rated cumulative contamination of groundwater impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	H	M	M	L	L

Management objective

The objective is to prevent pollution of groundwater resources and related harm to other water users.

Management actions

Implement the following management actions during all mine phases:

- *Implement the Storm water Management Plan as per the design report;*
- Monitor groundwater quality (refer to Section 0 for the monitoring programme). *Additional monitoring points have been added to the monitoring programme in order to more effectively monitor potential groundwater contamination impacts;*
- Immediately notify the DWS should any groundwater resource contamination be detected off-site;
- Notify potentially affected users in the event of groundwater contamination, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures, in consultation with DWS and an appropriately qualified person;
- Address any water loss proven to be caused by the mine (in the short and long term) through appropriate compensation, which may include an alternative water supply of equivalent quality and quantity. In the event that Tshipi is proven to be partially responsible for water loss from third party water users, the compensation costs will be shared by all responsible parties;
- *Investigate additional management measures in consultation with a qualified specialist should water quality monitoring around any pollution sources (TSF, open pit and WRDs) indicate that these sources are causing pollution which is migrating off-site;*
- Prevent pollution through appropriate infrastructure design. In this regard the WRD extensions will be constructed according to approved designs;
- Rehabilitate the footprints of temporary waste rock dumps by ripping the underlying subsoil, then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period. This will apply to any WRDs that are removed during decommissioning and closure through backfill into the open pit;
- Re-run the groundwater model periodically during the operational phase as and when additional relevant data becomes available, in order to consider potential pollution impacts without the retardation effect of

pit dewatering. If necessary, make for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning;

- Implement the emergency response procedure in Section 30.2.2 in the event of a potentially polluting discharge incident;
- Conduct further source term studies to be used for groundwater modelling updates.

D7. AIR QUALITY

ISSUE: AIR POLLUTION

Information in this section was sourced from the air quality study undertaken by Airshed (2018) (see Appendix J), as well as the previous air quality studies (Airshed, 2009 and Airshed, 2017).

Introduction

Mining projects present a number of air pollution sources that can have a negative impact on ambient air quality and surrounding land uses in all phases. Pollution sources include land clearing activities, materials handling, wind erosion from stockpiles, wind erosion of disturbed areas, vehicle movement along unpaved roads and gas emissions mainly from vehicles and generators. These activities already take place on site as the mine is in operation; however, the establishment and operation of the proposed WRD extensions, powerline and conveyor could present additional dust generation sources.

Air pollution related impacts on biodiversity are discussed in the biodiversity section of this appendix and therefore this section focuses on the potential for human health impacts.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Construction works	Mineralised waste Support services Continued use of approved facilities and services Open pit mining	Mineralised waste Support services Continued use of approved facilities and services	Final land forms

Rating of impact

Severity / nature

The main contaminants associated with the mine includes: inhalable particulate matter less than 10 microns in size (PM_{10}) (including a manganese component), larger total suspended particulates (TSP) that relate to dust fallout, SO_2, NO_2 and gaseous emissions mainly from vehicles and generators. The inhalable components can cause human health impacts at high concentrations over extended periods, while the larger particulate component can cause nuisance dust impacts such as soiling of grazing veld at high fallout quantities over extended periods.

Existing mine components that have the potential to contribute to existing ambient emission sources within the area include:

- Diesel generators;
- Vehicle tail pipe emissions;
- Material handling such as crushing, tipping of waste rock and ore;
- Dust generation from open pit operations (blasting and material handling);
- Vehicle activity on paved and unpaved roads;
- Wind erosion from exposed working surfaces;
- Earthworks; and
- Removal of soil.

The prevailing wind field at the mine is from the south-south-east and south with most of strong winds from the west. Frequent winds also occur from the north. During the day winds are more frequent from the westerly and the northerly sectors, with the strongest winds directly from the west. The wind shifts during the night to south-south-easterly and southerly winds (Airshed, 2018).

The cumulative air pollution impact was assessed for the overall mine in the approved EMPr amendment (SLR, 2017d) as having a high significance. With mitigation the Mn concentrations were predicted to exceed World Health Organisation (WHO) guidelines at a number of residence and farm houses (A. Pyper, Middelplaats and Nic Fourie (refer to Figure 6-17). Dustfall collected at five locations at and around the mine over a period of 16 months indicate high dust fallout levels, exceeding the National Dust Control Regulation (NDCR) limit for non-residential areas of 1 200 mg/m²/day regularly. Ambient PM10 concentrations regularly exceeded the National Ambient Air Quality 24-hour limit of 75 µg/m³, indicating the likelihood of non-compliance with the National Ambient Air Quality Standards (Airshed, 2018). While manganese is an essential trace element that is required for good health, exposure to high levels of manganese can cause neuro-toxic health effects in susceptible individuals – generally referred to as Manganism. This cumulative impact was rated as HIGH in the mitigated scenario for Mn concentrations.

When considering the proposed project, an increase in gaseous emissions is not foreseen. The main contaminant would be dust, which is discussed below.

During the construction phase, dust will be generated during site clearing activities and topsoil stockpiling for the proposed WRD extensions, powerline and conveyor. The extension of the West WRD is likely to have the most significant impact on air quality due to its size of 142 ha. Windblown dust from the new topsoil stockpiles and cleared areas would only occur when winds exceed 5.4 m/s as a minimum. The planned phased construction method (construction of cells in the WRD extension) will reduce dust generation from land clearing significantly, resulting in less topsoil to be handled and fewer trucks on the roads. Air quality impacts from the construction of the proposed infrastructure are likely to be localised except under stronger winds, which only occur for about 2 % when the dust plume could be carried to the nearby receptors.

During the operational phase, the West WRD extension is likely to be the most significant additional source of air pollution to current mining operations, although the East WRD extension will also generate dust. Additional sources are will mainly due to haul trucks transporting waste rock. Vehicle entrained dust from unpaved roads were the main source of PM_{10} ground level concentrations in the Airshed, 2009 study. Although the mining and waste rock dumping rate will not increase, the travel distances to the WRD extension areas will be longer (further from the pit), resulting in more dust generation due to vehicle entrainment. Dumping of waste rock could also be a significant source of dust.

During the operational phase, dust emissions from conventional conveyors will be wind speed dependent with stronger wind speeds causing dust particles to be entrained by the wind. This could be a significant local source of dust when stronger westerly winds blow during the day, both due to the entrainment potential of the material on the conveyor as well as the spilled material along the conveyor. The conveyor transfer point could also be significant sources of dust generation if not controlled.

During decommissioning, the WRDs will be rehabilitated with the only foreseen source of dust emissions to be truck activity, and tipping and levelling of topsoil on the WRD side slopes.

Taking the above into account, there is potential for increased PM_{10} and $PM_{2.5}$ ground level concentrations and dust fallout rates off-site and at nearby receptors. The receptors most likely to be impacted on by the changes to the infrastructure are N. Fourie to the south and D. van den Berg to the west of the West WRD extension, and to a lesser extent A. Pyper to the north-west of the West WRD extension. This impact is, therefore, rated as having a high severity. With mitigation measures in place these impacts should be limited, and reduce the severity to low.

Increased impacts from the East WRD extension, powerline and the overland conveyor are likely to be insignificant.

The proposed project will therefore not change the cumulative impact of the mine, rated as having a high severity in the unmitigated scenario. The Mn concentrations predicted to exceed World Health Organisation (WHO) guidelines at nearby receptors maintains the high severity in the mitigated scenario.

<u>Duration</u>

Health related impacts could extend beyond closure. With mitigation, the duration of impacts will be limited to the life of the mine. This remains high in the mitigated scenario for Mn concentrations as health related impacts will extend beyond closure.

<u>Spatial scale / extent</u>

The spatial scale of the potential impact could be beyond the immediate mining area in both the unmitigated and mitigated scenarios.

<u>Consequence</u>

Without mitigation the consequence is high. With mitigation the consequence reduces to medium. However, the consequence for Mn remains high in the mitigated scenario.

<u>Probability</u>

The health impact probability is linked to the probability of ambient concentrations exceeding the evaluation criteria in relation to potential receptors. In the unmitigated scenario this is high. With mitigation the probability reduces to medium given that the probability of exceedance at potential receptors reduces.

<u>Cumulative impact significance</u>

The significance of this impact is **high** in the unmitigated scenario. With mitigation, the significance of reduces to **MEDIUM**. However, the mitigated scenario remains **HIGH** for Mn concentrations.

<u>Unmitigated – summary of the cumulatively rated air pollution impact per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	**H**

Mitigated – summary of the cumulatively rated air pollution impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M (H for Mn)	M (H for Mn)	M	M (H for Mn)	M	**M (H for Mn)**

Management objective

The objective is to prevent air pollution health impacts.

Management action

Implement the following management actions during all mine phases:

- Maintain an active and strict (vehicle) speed limit policy;
- Apply suitable dust binding agent and/or water suppression on mine roads. Where dust binding agents are used, this must be limited to the roads only. Should water be used, it is recommended that water be applied at a rate >2 litre/m^2/hour.
- Sweep paved road surfaces as needed to limit dust generation.
- Use effective water sprays at waste rock/ore loading points e.g. tips and conveyor transfer points and during train-loading.
- Use drills fitted with cyclone-type dust extraction systems in the mining pit.
- *Construct the WRD extension in phases thereby limiting the size and extent of pre-stripped ground from which dust can be generated. .*
- *Dump waste rock on the WRDs in a manner that prevents material from migrating down the WRD slope i.e. dump waste rock before the WRD crest and doze the waste rock into position.*
- *Use dust allaying measures, such as water sprays or equivalent controls to limit the generation of dust, at waste rock tipping points on the WRDs;*
- *Allow topsoil stockpiles and WRD side slopes to re-vegetate naturally. Should re-vegetation cover be insufficient after a rainy season, implement additional dust management measures, such as the use of geotextiles and wind breaks or other methods that are proven to be effective.*
- Maintain a complaints register that is available at the mine. The date and time noted on the complaints register will be the date and time that the reported problem is observed, not the date and time that the complaint is logged. Compare the complaints register to air quality monitoring data, as well as recorded meteorological data, to identify problem areas and then iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources;
- Apply for an air emissions licence for the sinter plant prior to operation;
- Develop and implement an air quality control system which includes inter alia:
    - o *Monitor air quality in accordance with Section 0. Three additional dust buckets will be located at the farms of N. Fourie, D. van den Berg and A. Pyper and additional PM10 monitors will be located at D. van den Berg and A. Pyper;*

- o *Follow the ASTM D1739 (1970) method as required by the National Dust Control Regulations, with regard to the dustfall unit design, dust collection and analysis; and*
- o *Report dustfall results annually to the District Municipality Air Quality officer.*
- o *Apply the following criteria with regard to dust and PM10 monitoring at receptors closest to the West WRD extension:*
  - o *Dustfall rates must be below 600 mg/m²/day at the identified receptors (farms of N Fourie, D van den Berg and A Pyper) and if exceeded for two consecutive months, action will be taken by identifying the source of dust and applying additional mitigation measures.*
  - o *Daily (24-hour) PM10 concentrations will not exceed 75 µg/m³ for more than four (4) days per year at these receptors and should these concentrations be above the limit, immediate action will be taken by identifying the source of dust and applying additional mitigation measures.*

  A possible additional management measure to be considered should it be required, is the wetting of waste rock material prior to tipping onto the WRDs.
- Commission a health risk assessment if monitoring determines that third parties will be exposed to unacceptable cumulative concentrations of manganese or PM_{10} which will focus on the receptors where exceedances are found. Commissioning this health risk assessment, including the implementation of any related management actions, will be the responsibility of both Tshipi and other contributing mines.

D8. NOISE

ISSUES: INCREASE IN DISTURBING NOISE LEVELS

Information in this section is based on the original EMPr (Metago, 2009).

Introduction

Two types of noise are distinguished: noise disturbance and noise nuisance. Noise can be registered as a discernible reading on a sound level meter, while nuisance noise may not register as a discernible reading on a sound level meter, may cause nuisance because of its tonal character (egg. distant humming noises).

Mine activities/infrastructure present the possibility of generating both noise disturbances and noise nuisance in all phases prior to closure. The existing operation generates noise and the proposed construction and operation of the proposed infrastructure presents additional noise sources and locations. Refer to the biodiversity section in this appendix for the potential noise impacts on biodiversity. This section will only focus on the potential human related noise impacts.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Earthworks Construction works	Mineralised waste Support services	Mineralised waste Support services	N/A

Rating of impact

Severity / nature

Noise pollution can create nuisance that will have different impacts on different receptors because some are very sensitive to noise and others are not. Potential human noise receptors include the isolated residences and farmhouses between 1 km and 2.5 km radius of the Tshipi Borwa Mine (refer to Figure 6-17).

The impact associated with an increase in disturbing noise levels was assessed as part of the original EMPr (Metago, 2009). In this regard, the assessment predicted that unmitigated construction noise would be insignificant both during the day and at night due to the small population density in the area and that significant night time construction work activities were not expected to occur. During operations, in the unmitigated scenario, the assessment predicted that noise impacts would be **insignificant** during the day but greater at night although still **low** due to reduced activities taking place at night.

The development and disposal of waste rock on the WRDs has the potential to increase both day-time and night-time noise levels as operations would occur closer to receptors located in the west. When considered incrementally, this has a medium severity in the unmitigated and mitigated scenarios given the small population density in the area and related distance to potential noise receptors.

It is anticipated that the construction phase will consist of one shift per day for conventional construction activities from 06:00 to 18:00 from Monday to Saturday. Should construction fall behind, or emergency work must be undertaken then working hours may be extended as Tshipi has permission to operate for twenty-four hours per day, seven days per week. Shift rotation will be implemented to ensure work hours do not exceed that permissible by law.

The cumulative severity rating assessing the impact of the changes to the operations within the context of the approved mining operations is medium for day-time noise impacts and medium to high for night-time noise impacts in the unmitigated and mitigated scenarios. The night-time rating is dependent on the sensitivity of noise receptors; which is expected to differ between receptors.

Duration

In both the unmitigated and mitigated scenarios the noise pollution impacts will generally occur until the closure phase of the mine when the noise generating activities are stopped. This is a medium duration.

Spatial scale / extent

The noise footprint of any construction noise is expected to be restricted to the immediate vicinities of construction activities. This is a low spatial scale. In the operational phase, in both the unmitigated and mitigated scenarios the noise impacts will extend beyond the mining area. This is a medium spatial scale.

Consequence

The unmitigated consequence is medium and the mitigated consequence is medium to low for day-time noise impacts and medium for night-time noise impacts.

Probability

The unmitigated probability of the predicted noise increases causing a noise related disturbance at the nearest sensitive receptors is considered to be medium without management actions. With management actions the probability reduces to low for day-time noise impacts and remains medium for night-time noise impacts.

Cumulative impact significance

The unmitigated significance is **medium** and can be reduced to **LOW** for day-time noise impacts. For night-time noise impacts the mitigated significance remains **MEDIUM** given the presence of potentially sensitive noise receptors in areas surrounding the mine.

Unmitigated – summary of the rated cumulative increase in disturbing noise levels impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Unmitigated	H to M	M	M	M	M	**M**

Mitigated – summary of the rated cumulative increase in disturbing noise levels impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M to L (day-time) H to M (night-time)	M	M	M to L (day-time) M (night-time)	L (day-time) M (night-time)	**L (day-time)** **M (night-time)**

Management objective

To prevent public exposure to disturbing noise.

Management actions

Implement the following management actions during all mine phases prior to closure:

- Do not blast at night and on Sundays;
- Maintain all diesel-powered earth moving equipment in order to limit noise, including the checking and replacement of exhaust and intake silencers;
- Maintain all haul roads in a good state of repair at all times to avoid unwanted rattle and “body-slap” from vehicles;
- Operate plant and equipment in a proper manner with respect to minimising noise emissions, for example, minimisation of drop heights when loading and no un-necessary revving of engines;
- Locate pumps, generators and compressors behind screening mounds, where possible, and use electrically powered equipment where possible, and/or fit equipment with acoustic covers, as necessary. Install diesel powered pumps, generators and compressors within acoustic enclosures if necessary;
- Record and respond immediately to complaints about disturbing noise. Document and recorded such complaints as incidents, and document the measures taken to address these. Keep these records for the life of mine;
- Undertake noise monitoring following the receipt of a complaint (see Section 0). Where necessary, implement additional management actions to avoid repeat occurrences; and
- *Conduct a once off sampling exercise with input from a specialist at the closest receptors during dumping activities at the West WRD extension. Depending on the outcome of the sampling exercise, implement additional management actions if required.*

D9. VISUAL

ISSUE: NEGATIVE VISUAL VIEWS

Information in this section was sourced from on-site observations by the SLR project team and the review of relevant maps.

Introduction

Visual impacts on this receiving environment may be caused by activities and infrastructure in all mine phases. The more significant visual impacts relate to the larger infrastructure components (such as the waste rock dumps) and the long term infrastructure (waste rock dumps which are likely to remain post closure).

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *Construction works*	Mineralised waste Support services Continued use of approved facilities and services	Mineralised waste Support services Continued use of approved facilities and services	Final land forms

Rating of impact

Severity / nature

The severity of visual impacts is determined by assessing the change to the visual landscape as a result of mine related infrastructure and activities. The visual landscape within the Tshipi Borwa Mine area has been transformed due to the presence of approved mining infrastructure and activities. The visual impact was assessed as part of the approved EMPr amendment (SLR, 2017d) as having a **high** overall significance without mitigation and **MEDIUM** with mitigation, reducing to **LOW** at closure.

The proposed WRD extensions, conveyor and powerline are not expected to influence existing negative visual impacts as these facilities will be established within and adjacent to existing mine infrastructure and will therefore be absorbed by this infrastructure to some extent. When considered incrementally, this has a medium severity in the unmitigated and mitigated scenarios.

The cumulative severity rating assesses the impact of the changes to the visual landscape within the context of the current approved mining operation where there is already similar infrastructure. It follows that this has a medium severity in the unmitigated scenario when considered cumulatively within the context of the current approved operations. The severity is unlikely to reduce with management actions until the closure phase when the site has been rehabilitated (in the mitigated scenario).

Duration

In the unmitigated scenario the duration is high because the impacts will continue post closure. In the mitigated scenario the impact is unlikely to extend post closure because any remaining WRDs will have been rehabilitated.

Spatial scale / extent

In all phases visual impacts are likely to extend beyond the mine in both the unmitigated and mitigated scenarios. This is a medium spatial scale.

Consequence

The unmitigated consequence is high. With management actions, prior to closure, this reduces to medium. After closure the consequence reduces to low.

Probability

In the unmitigated and mitigated scenarios the probability of visual impacts occurring is definite because of the nature of the existing landscape. At closure when the mine site has been rehabilitated, the probability will be reduced to low.

Cumulative impact significance

The unmitigated significance is **high**. The mitigated significance is medium. The mitigated significance reduces **MEDIUM** with mitigation, reducing to **LOW** at closure.

Unmitigated – summary of the rated cumulative negative visual views impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	M	H	H	H

Mitigated – summary of the cumulative rated negative visual views impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	M	M	M	M	M
Closure						
Mitigated	L	L	M	L	L	L

Management objective

The objective is to limit negative visual impacts.

Management actions

Implement the following management actions during all mine phases:

- Clear the absolute minimum amount of vegetation during construction and operation (phased clearing). This is important on the boundaries of the mine where vegetation can assist with screening;
- Clear and expose only the footprint area as defined by the approved layout in this EMPr. In all other areas, retain the natural vegetation to the extent that of these areas are under the mine's control;
- The air pollution control system will be implemented to avoid plumes of dust;
- Paint and buildings in colours that reflect and compliment the natural landscape where possible;

- Rehabilitate all mined out areas in accordance with the principles of ongoing rehabilitation that includes: backfilling, placement of topsoil and re-establishment of vegetation;
- Effectively rehabilitate the tailings and WRDs which is critical because these will be a permanent post closure features. In this regard, the appropriate mix of waste rock and vegetation could soften the impact of these facilities;
- Ensure that all vegetation that is planted as part of rehabilitation will reflect the natural vegetation of the area, as far as is practicable;
- Fit lighting with fixtures to minimise light spillage and focus the light on precise mine activities and infrastructure;
- Shape any residual WRDs left on surface; and
- Manage final rehabilitated areas and landforms remaining in perpetuity through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts.

D10. TRAFFIC

ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY

Information was sourced from the traffic specialist study (Siyazi, 2017) and the approved EMPr amendment (SLR, 2017).

Rating of impact

Traffic impacts can occur during the construction, operational and decommissioning phases when trucks, buses, and private vehicles make use of the private and public transport network in and adjacent to the Tshipi Borwa Mine. The key potential traffic related impacts relate to road capacity and public safety.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Continued use of approved facilities and services	Continued use of approved facilities and services	Continued use of approved facilities and services	

Discussion

Existing traffic volumes comprising public traffic and traffic from nearby mines that utilise the R380 and D3457 are associated with an acceptable level of service in the context of the existing public and private road infrastructure. However, the traffic study (Siyazi, 2017) did indicate that the intersection at the railway crossing on D3457 to the Tshipi Borwa Mine was not adequate from a road safety perspective. Safety risks associated with mining traffic making use of public road infrastructure include pedestrian accidents and vehicle accidents.

The impact of road disturbance and traffic safety was assessed as part of the original EMPr (Metago, 2009) as having a **medium** overall significance, reducing to **LOW** with management actions. Mitigation measures include addressing the safety issue at the railway crossing on D3457 to the Tshipi Borwa Mine. The approved EMPr amendment (SLR, 2017) noted no significant additional road disturbance and traffic safety impacts.

The proposed WRD extensions, powerline and conveyor infrastructure is not expected to generate additional traffic. The mine implements measures to manage traffic and road safety in accordance with the approved EMPr amendment (SLR, 2017). Consequently the potential for increased traffic and road safety risks due to project activities is expected to be **negligible**. The management actions in the approved EMPr will continue to be implemented by Tshipi.

The cumulative impact rating therefore remains unchanged for the overall mine as per the original EMPr (Metago, 2009) as follows:

Unmitigated – summary of the rated road disturbance and traffic safety impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	M	M	M	H	**M**

Mitigated – summary of the rated road disturbance and traffic safety impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	L	M	M	L	M	**L**

D11. HERITAGE/CULTURAL AND PALEONTOLOGICAL RESOURCES

ISSUE: LOSS OF HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

Information in this section was sourced from the heritage study undertaken by PGS (PGS, 2018) for the proposed project (Appendix I), as well as the previous heritage studies (PGS, 2009 and PGS, 2017).

Introduction

The establishment of the proposed WRD extensions, powerline and conveyor infrastructure has the potential to damage or destroy heritage/cultural resources, either directly or indirectly. This could result in the loss of the resource for future generations, if such resources are present, particularly within the proposed West WRD extension footprint.

Mine phase and link to project specific activities/infrastructure

Construction	**Operational**	**Decommissioning**	**Closure**
			N/A
Earthworks Construction works	Mineralised waste Support services	Mineralised waste Support services	N/A

Discussion

The 2009, 2017 and 2018 heritage studies have found no heritage resources within the Tshipi Borwa Mine area and the proposed additional infrastructure areas. In addition, there is a low possibility of palaeontological resources occurring in the area. This impact has therefore been rated as being **INSIGNIFICANT**; however, the management actions outlined below cover the steps to be taken should there be a chance find.

Management objective

To minimize the disturbance of heritage resources.

Management actions

- Consult a professionally registered heritage and/or palaeontological specialist to make associated recommendations that will be complied with prior to the removal or destruction of any heritage/cultural and palaeontological resources that may be discovered by chance at the mine.
- Implement the emergency response procedure (Section 30.2.2) if there are any chance finds of heritage/ cultural or paleontological sites.

D12. SOCIO-ECONOMIC

ISSUE: INWARD MIGRATION

Introduction

Mining operations tend to bring with them an expectation of employment in all phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. This section focuses on the potential for the inward migration and associated social issues.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Construction works	Mineralised waste Support services Continued use of approved facilities and services	Mineralised waste Support services Continued use of approved facilities and services	Closure activities in line with closure plan

Discussion

The original EMPr (Metago, 2009) assessed inward migration as having a **high** overall significance, reducing to **LOW** with mitigation. The approved EMPr amendment (SLR, 2017d) found no material change in the predicted impacts.

Given that the project forms part of an existing approved mine the establishment of additional facilities and activities will not generate any additional employment opportunities as Tshipi will make use of existing contractors and workers on site. Mitigating factors such as the monitoring of workers' living conditions, recruitment disciplines and HIV/Aids awareness and management already exist. As a result the potential for increased social risks due to the proposed project activities is negligible. Therefore, the predicted impact assessment remains in accordance with the original EMPr (Metago, 2009). In this regard, the unmitigated significance is **high** and **LOW** with management actions. The management actions in the approved EMPr (SLR, 2017d) will continue to be implemented by Tshipi.

Unmitigated – summary of the rated inward migration impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	M	M	H	M	**H**

Mitigated – summary of the rated inward migration impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning and closure						
Mitigated	L	M	M	L	L	**L**

ISSUE: ECONOMIC IMPACT

Introduction

In the broadest sense, all activities associated with the mine contribute towards a positive economic impact in all phases. Mining has a positive net economic impact on the national, local and regional economy. Direct benefits are derived from wages, taxes and profits. Indirect benefits are derived through the procurement of goods and services, and the increased spending power of employees.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Construction works	Mineralised waste Support services Continued use of approved facilities and services	Mineralised waste Support services Continued use of approved facilities and services	Closure activities in line with closure plan

Discussion

The original EMPr (Metago, 2009) assessed the positive economic impact as having a medium to high overall significance, and remaining at medium in the mitigated scenario. The approved EMPr amendment (SLR, 2017d) found no material change in this predicted positive impact.

The proposed project forms part of an existing approved mine and the proposed project will not generate any significant additional employment opportunities as Tshipi will make use of existing contractors and workers on site. Mitigating factors such as recruitment and procurement processes already exist. As a result the potential for increased economic benefits due to project activities is expected to be negligible. The cumulative impact rating therefore remains unchanged for the overall mine as per the original EMPr (Metago, 2009), i.e.

MEDIUM-HIGH positive with and without mitigation. The management actions in the approved EMPr amendment (SLR, 2017d) will continue to be implemented by Tshipi.

Unmitigated – summary of the positive economic impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M+	M	M	M	H	**M-H+**

Mitigated – summary of the rated positive economic impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning and closure						
Mitigated	M+	M	M	M	H	**M-H+**

D13. LAND USE

ISSUE: CHANGE IN LAND USE

Information in this section was sourced from on-site observations and the project team.

Introduction

Mining activities have the potential to affect land uses both within the mine area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. Tshipi operations have already changed the land use in the mining area. The proposed West WRD extension and powerline will further change land use in the area. The East WRD extension and conveyor will be established within the existing mining area and will not change the current land use.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks	Mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

Severity

Land use within the project area includes existing mining activities and infrastructure associated with the mine within the Tshipi Borwa Mining Rights area. Portion 8 of Farm Mamatwan 331 where the proposed West WRD extension will be located is fenced, therefore no ad-hoc livestock grazing takes place here.

Surrounding land use includes existing mining operations, agriculture, infrastructure (road, rail network, powerlines, water pipeline, sewage works), solar plant and isolated farmsteads. Activities and infrastructure related to the proposed WRD extensions and powerline may have an impact on land uses within and surrounding the project area in all phases. The key related potential environmental impacts include loss of soil, loss of biodiversity, pollution of water, dewatering, air pollution, noise pollution, damage from blasting, visual impacts and the influx of job seekers with related social ills.

The cumulative impact of a change in land use was assessed in the approved EMPr amendment (SLR, 2017d) as having a **medium** overall significance, and **LOW** significance with mitigation.

The West WRD extension is approximately 128 ha in extent. The powerline will follow property boundaries and will be limited in extent (2.5 km with 22 m servitude). The change in land use is considered to have a low severity given that mining is the dominant land use in the project area. As such, the cumulative impact rating in the approved EMPr (Metago, May 2009) remains unchanged.

<u>Duration</u>

In the unmitigated scenario the duration is high because the impacts will continue post closure. In the mitigated scenario the impact duration will be reduced because all any remaining WRDs will have been rehabilitated.

<u>Spatial scale / extent</u>

In all phases land use impacts are likely to extend beyond the mine in both the unmitigated and mitigated scenarios.

<u>Consequence</u>

The unmitigated consequence is high. With management actions, prior to closure, this reduces to medium. After closure the consequence reduces to low.

<u>Probability</u>

In the unmitigated and mitigated scenarios the probability of a change in land use is definite. At closure when the mine site has been rehabilitated, the probability will be reduced to low.

<u>Cumulative impact significance</u>

The unmitigated significance is **high**. The mitigated significance is **MEDIUM**. The mitigated significance would reduce to **LOW** at closure.

<u>Unmitigated – summary of the rated cumulative land use impact per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated	M	H	M	H	H	**H**

Mitigated – summary of the cumulative land use impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	M	M	M	M	**M**
Closure						
Mitigated	L	L	M	L	L	L

Management objective

The objective of is to prevent unacceptable negative impacts on surrounding land uses.

Management actions

The following management actions will be implemented in all phases:

- *Liaise with Eskom regarding the tie in of the 11 kV powerline into the 132/11kV Eskom sub-station;*
- Communicate with neighbouring communities including land users and owners and other key stakeholders as required to facilitate information sharing and environmental impact management relevant to the mine and its associated infrastructure and activities;
- Repair any damage to Openserve infrastructure as a result of Tshipi's operations;
- Contact Openserve in the event that any Openserve infrastructure needs to be altered or relocated two weeks prior to the commencement of any work. Submit as built plans within 30 days of completion of construction; and
- *Rehabilitate the overall site to provide for the post closure land use in accordance with the mine Closure Plan.*

APPENDIX E: BIODIVERSITY STUDY

APPENDIX F: STORMWATER MANAGEMENT PLAN AND WATER BALANCE UPDATE FOR EMPR2

APPENDIX G: GROUNDWATER STUDY

APPENDIX H: SOILS AND LAND USE STUDY

APPENDIX I: HERITAGE STUDY

APPENDIX J: AIR QUALITY STUDY

APPENDIX K: PRELIMINARY CLOSURE PLAN

APPENDIX L: DRAFT LETTER OF AGREEMENT AND REHABILITATION STRATEGY FOR THE MERGING OF THE TSHIPI AND MAMATWAN WASTE ROCK DUMPS

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