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**ENVIRONMENTAL IMPACT ASSESSMENT  
AND ENVIRONMENTAL MANAGEMENT  
PROGRAMME REPORT FOR THE  
PROPOSED LEHATING MINE**

**SUBMITTED IN SUPPORT OF A MINING RIGHT APPLICATION  
IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES  
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**AND**

**AS REQUIRED IN TERMS OF THE NATIONAL  
ENVIRONMENTAL MANAGEMENT ACT (107 OF 1998) AND  
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# ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED LEHATING MANGANESE MINE

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## ACRONYMS AND ABBREVIATIONS

Below a list of acronyms and abbreviations used in this report.

<b>Acronyms / Abbreviations</b>	<b>Definition</b>
ABA	Acid Base Accounting
ARD	Acid Rock Drainage
BFS	Bankable Feasibility Study
BID	Background information document
°C	Degrees Celsius
CO	Carbon monoxide
CSS	cone crusher control setting
CEC	Cation exchange capacity
DAFF	Northern Cape Department of Agriculture, Forestry and Fisheries
dBA	A-weighted decibel
DDF	Depth-duration-frequency
DEA	Department of Environmental Affairs
DENC	Northern Cape Department of Environment and Nature Conservation
DLRRD	Northern Cape Department of Land Reform and Rural Development
DPM	Diesel particulate matter
DMR	Department of Mineral Resources
DTRPW	Northern Cape Department of Transport, Roads and Public Works
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EAPSA	Environmental assessment practitioner of Southern Africa
ECO	Environmental control officer
EIA	Environmental impact assessment
EMD	Delta Electrolytic Manganese Dioxide
EMP	Environmental management programme
ESD	Emergency Storage Dam
GDP	Gross Domestic Product
GGP	Gross Geographic Product
HCs	Hydrocarbons
HDPE	High Density Polyethylene liner
IAPs	Interested and/or affected parties
ICMM	International Council for Mining and Metals
IUCN	International Union for Conservation of Nature
JMLM	Joe Morolong Local Municipality
JTGDM	John Taolo Gaetsewe District Municipality
km <sup>2</sup>	Square kilometres
KMF	Kalahari Manganese Field

<b>Acronyms / Abbreviations</b>	<b>Definition</b>
LHD	Load-Haul-Dump truck
LMO	Lower Manganese Ore
LOM	Life of mine
LSA	Late Stone Age
m	Meters
mamsl	Meters above mean sea level
m <sup>2</sup>	Square meter
m <sup>3</sup>	Cubic meter
MAP	mean annual precipitation
MAR	Mean annual runoff
mbgl	Metres below ground level
Mn	Manganese
MPRDA	Mineral and Petroleum Resources Development Act
NAG	Net Acid Generation
NCNCA	Northern Cape Nature Conservation Act, Act 9 of 2009
NEMA	National Environmental Management Act, Act 107 of 1998
NEM:WA	National Environmental Management: Waste Management Act, Act 59 of 2008
NO <sub>x</sub>	oxides of nitrogen
NP	Neutralising Potential
NPAES	National Protected Area Expansion Strategy
NNP	Net Neutralising Potential
NWA	National Water Act
PCD	Pollution Control Dam
PM <sub>10</sub>	Particulate matter less than ten microns in size
RO	Reverse osmosis
ROM	Run-of-mine
RP	Return periods
SAHRA	South African Heritage Resources Agency
SANS	South African National Standards
SARCA	The Southern African Reptile Conservation Assessment
SAWS	South African Weather Service
SLR	SLR Consulting (Africa) (Pty) Ltd
SO <sub>2</sub>	sulphur dioxide
SPLP	Synthetic Precipitation Leaching Procedure
SRTM	Shuttle Radar Topography Mission
TME	Trackless Mining Equipment
TSF	Tailings Storage Facility
TSP	Total suspended particulates

<b>Acronyms / Abbreviations</b>	<b>Definition</b>
UMK	United Manganese of the Kalahari
WHO	World Health Organisation
WML	Waste Management Licence
WRD	Waste Rock Dump
WUL	Water Use Licence

## EXECUTIVE SUMMARY

### Introduction

Lehating Mining (Pty) Ltd (Lehating) proposes to develop a new underground manganese mining operation near Black Rock in the Joe Morolong Local Municipality, located in the John Taolo Gaetsewe District Municipality, Northern Cape Province. The proposed mine will be located on Portion 1 of the farm Lehating 741, with site access to be attained through the northern section of Portion 2 of the farm Wessels 227. The regional and local settings are presented in Figure 1 and Figure 2 respectively.

The proposed project will include the following:

- site access;
- establishment of a main access shaft and mine ventilation shaft;
- on-surface crushing and screening of manganese ore;
- stockpiling of product;
- waste rock and tailings disposal;
- water abstraction; and
- associated support infrastructure and services.

SLR Consulting (Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants has been appointed to manage the environmental assessment process.

### Project motivation (need and desirability)

The proposed Lehating Mine project is located in the Joe Morolong Local Municipality where unemployment is a challenge. It is expected that the mine will create several hundred direct employment opportunities and will have a positive impact on both indirect businesses and employment. A large percentage of these employment opportunities will benefit the surrounding communities. A portion of the unskilled and semi-skilled labour is likely to be sourced locally. In addition to employment, Lehating will contribute to local communities through implementation of socio-economic development projects as well as skills development, as stipulated in its social and labour plan.

The proposed Lehating Mine could also benefit the South African economy as the manganese ore produced at the mine will be exported thus bringing foreign revenue, which will contribute to South Africa's gross domestic product (GDP). The anticipated market prices in the medium and long-term are considered to be favourable for project development. The mine also creates an additional tax base, therefore further contributing to the South African economy.

**Figure 1 – Regional setting**

**Figure 2 – Local setting**

**Stakeholder engagement**

The stakeholder engagement process commenced prior to scoping and has continued throughout the environmental assessment process. As part of this process, authorities and interested and affected parties (IAPs) were given the opportunity to attend a scoping meeting (for either the public or regulatory authorities), submit questions and comments to the project team, and review the background information document, scoping report and now the EIA/EMP reports. All comments that have been submitted to date by the authorities and IAPs have been included and addressed in the EIA/EMP report. Further comments arising from the EIA/EMP report review process will be handled in a similar manner.

**Impact assessment findings and mitigation**

A discussion of the potential impacts (as per Section 7 of the EIA/EMP report) is provided below. Thereafter a tabulated summary of the cumulative impacts is presented in Table 1.

**Geology – loss and sterilization of mineral resource:**

Mineral resources can be sterilized and/or lost through the placement of infrastructure and activities in close proximity thereto, by preventing access to potential mining areas, and through the disposal of mineral resources onto mineralised waste facilities. This potential impact can be mitigated to an acceptable level through the following measures:

- Lehating will incorporate cross discipline planning structures for mining and infrastructure developments to avoid mineral sterilization;
- mine workings and the access road will be designed and developed so as not to limit access to mineral resources; and
- final rehabilitation planning will take account of the possible future options for reprocessing the tailings and waste rock facilities.

**Topography – hazardous excavations and infrastructure:** All excavations/infrastructure that can fail, subside and/or into which or off which people and animals can fall are considered hazardous. The potential negative impact is high because the hazardous excavations and infrastructure may cause injury to people and animals even though the project will be situated in a remote area and the related impact probability is not high. This potential impact can be mitigated to an acceptable level through the following measures:

- design, construction and implementation of infrastructure stability and safety design measures;
- Lehating will survey the project areas, and update the surface use area map on a routine basis;
- implementation of adequate underground support infrastructure to prevent subsidence;
- access control through fencing, berms, barriers and/or security personnel to prevent unauthorised access;
- use of warning signs in the appropriate language(s), or warning pictures as an alternative; and
- education and training of workers and the public.

**Soil – potential loss of soil resources from pollution and/or physical disturbance:** The physical loss of soils and/or the loss of soil functionality are important issues because as an ecological driver, soil is the medium in which most vegetation grows and in which a significant range of vertebrates and invertebrates exist. In the context of mining, it is even more of an issue if one considers that mining is a temporary land use where-after rehabilitation is the key to re-establishing post closure land capability that will support conservation and ecotourism type land uses. Soil is a key part of this rehabilitation.

In the unmitigated scenario, there are a number of activities that will disturb and potentially damage the soils through physical disturbance and/or pollution. Key mitigation measures include the following:

- pollution prevention through basic infrastructure design, maintenance of equipment, education and training of permanent and temporary workers and appropriate management of hazardous materials and wastes;
- limit the disturbance of soils to what is absolutely necessary for earthworks, on-going activities, infrastructure footprints and use of vehicles;
- implementation of procedures to enable fast reaction to contain and remediate spills;
- post rehabilitation auditing to determine the success of the rehabilitation; and
- stripping, storing and maintaining soils in accordance with the soil management plan;

**Biodiversity – potential loss of biodiversity from general disturbance and physical destruction**

**factors:** In the broadest sense, biodiversity (which includes vegetation, vertebrates and invertebrates) provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known ecosystem related value includes: 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.

There are a number of activities/infrastructure that have the potential to directly disturb/destroy fauna and flora, linkages between biodiversity areas and related species, and/or the role that they play in the ecosystem. The proposed mine will apply the following mitigation measures:

- the mine will implement its biodiversity management plan and an alien/invasive/weed management programme;
- to generally limit mine infrastructure, activities and related disturbance and to establish buffers between the infrastructure areas and more sensitive habitats;
- where possible, to specifically avoid the destruction of irreplaceable biodiversity areas and important linkages between biodiversity areas;
- there will be planned removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities;



- every attempt will be made to preserve existing larger trees, and pods of *Acacia erioloba* and *Acacia haematoxylon* will be collected from the area in order to aid in the re-establishment of these species;
- permits will be obtained for the destruction and/or removal of protected vegetation;
- restoration of the biodiversity functionality, as far as is possible, in areas that have been physically rehabilitated; and follow up audits and monitoring in the short and long term;
- monitoring of both the groundwater levels near older more established trees and monitoring of the tree health;
- if irreplaceable biodiversity will be permanently lost, and/or restoration is not possible, and/or the residual impacts have a higher than medium significance rating, a biodiversity offset will be investigated and implemented where feasible;
- the use of light will be kept to a minimum, and where it is required, yellow lighting is used where possible;
- vehicles will not be allowed to travel off designated roads or outside of designated disturbance areas;
- a speed limit of 40km/h should be adhered to along all internal gravel roads;
- all hunting and/or trapping or snaring of animals by mine staff and contractors shall be prohibited;
- no plant or firewood collection or cutting down trees in the area shall be allowed by contractors or mine staff;
- internal power lines will be equipped with bird deterrent measures;
- noisy and/or vibrating equipment will be well maintained;
- all water dams will be fenced off to prevent access by larger animals; and
- dust control and litter and pollution measures will be implemented at the mine.

#### **Surface water – potential alteration of natural drainage patterns and contamination of surface**

**water:** Pre-mining natural drainage across the site is via sheet flow and/or non-perennial preferential flow paths (drainage lines). There are a number of activities/infrastructures which will alter drainage patterns either by reducing the volume of run-off into the downstream catchments or through their location within watercourses. This in turn has the potential to cause water supply impacts on downstream human and biodiversity users. There are also a number of pollution sources that have the potential to contaminate surface water, particularly in the unmitigated scenario.

In all phases mine infrastructure will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) of any future amendments thereto. These include:

- clean water systems are separated from dirty water systems;
- the size of dirty water areas are minimized and clean run-off and rainfall water is diverted around dirty areas and back into the normal flow in the environment;
- aside from the access road, the location of all activities and infrastructure should be outside of the specified zones (100m from any water courses) and/or the 1:100 flood lines, whichever is the greatest. If this is unavoidable the necessary exemptions/approvals will be obtained;

- the access road river crossing that will be constructed will be designed so that there is no material alteration of the river flow;
- discharges of dirty water may only occur in accordance with authorisations that are issued in terms of the relevant legislation specifications and they must not result in negative health impacts for downstream surface water users;
- the site wide water balance is refined on an on-going basis with the input of actual flow volumes and used as a decision making tool for water management and impact mitigation;
- the mine will ensure that all mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute surface water;
- the designs of any permanent and potentially polluting structures will take account of the requirements for long term surface water pollution prevention;
- Lehating will monitor the water quality in all potentially affected surface water resources and use the monitoring results to implement appropriate mitigation measures to achieve the surface water quality objectives; and
- where monitoring results indicates that third party water supply has been polluted by Lehating, Lehating will ensure that an alternative equivalent water supply will be provided.

#### **Groundwater – reduction of groundwater levels and availability**

Mine dewatering to ensure safe working conditions and/or the abstraction of water from the proposed water supply boreholes (well field) has the potential to cause a reduction in the level and availability of groundwater, which may cause a loss in water supply to surrounding borehole users and impact the baseflow of nearby drainage lines. This potential impact can be mitigated to an acceptable level through the following measures:

- all potentially affected third party boreholes will be included in the Lehating ground water monitoring program to ensure that changes in water depths can be identified;
- where Lehating's dewatering causes a loss of water supply to third parties an alternative equivalent water supply will be provided by Lehating until such time as the dewatering impacts cease; and
- a monitoring borehole in the vicinity of the Kuruman River alluvial aquifer will be monitored to observe the dewatering impacts of the well field on the Kuruman River. If monitoring indicates that greater impacts (than those predicted above) are occurring, well field use will be adjusted according to the advice of an appropriate specialist.

**Groundwater - contamination of groundwater:** The proposed mine presents a number of groundwater pollutant sources. These include accidental spills and leaks from vehicles, non-mineralised waste, equipment, workshops and washbays as well as the potential impact from the tailings storage facility (TSF), waste rock stockpile and other stockpiles. In the mitigated scenario, the mine will implement the following key measures:

- pollution prevention through basic infrastructure design, education and training of workers (permanent and temporary) and appropriate management of materials and non-mineralised waste;

- the required steps to enable containment and remediation of pollution incidents;
- specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures;
- implementation of a groundwater pollution management plan as part of the operational phase;
- all potentially affected third party boreholes will be included in the Lehating ground water monitoring program to ensure that changes in water quality can be identified;
- where Lehating causes a loss of water supply to third parties an alternative equivalent water supply will be provided by Lehating until the quality concerns cease.

**Air pollution impacts:** The main emissions from the proposed mine include: inhalable particulate matter (including the manganese component) less than ten microns in size (PM<sub>10</sub>), larger total suspended particulates (TSP), and limited gas emissions. 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. Other emissions types that were considered in this assessment include sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>) diesel particulate matter (DPM) and carbon monoxide (CO). Neither TSP nor the other gaseous emissions are predicted to result in impacts of any significance so the impact discussion focussed on PM<sub>10</sub> and the manganese component thereof. In this regard there is potential for high air quality impacts without mitigation. Key air pollution mitigation measures include the following:

- Lehating will implement a dynamic air quality management plan;
- dust suppression of roads through chemical binding agents and/or water sprays;
- vehicle activities on gravel roads will be managed by reducing speed limit on mine roads to 40km/hour, and gravel roads will be regularly sprayed with a combination of water and chemicals
- dust control at crushing, screening and material transfer points through water sprays as a minimum; and
- implementation of ambient and dust fallout monitoring and management programmes including the closest residential receptors (Boerdraai and van Schalkwyk) on surrounding farms.

**Noise pollution impacts:** Certain noise generating activities associated with the proposed project can cause an increase in ambient noise levels in and around the site. This may cause a disturbance to nearby sensitive receptors. The determination of severity will depend on the actual noise propagation from the mine and the receptors individual response to any increase in noise. Key measures include the following:

- prior to construction, Lehating will commission a noise specialist to determine pre-project ambient noise levels at Boerdraai and van Schalkwyk residences;
- once the project commences, all noise complaints will be documented, investigated and reasonable efforts made to address the area of concern. Where necessary and using the pre-project ambient noise levels as a reference point, noise monitoring will be undertaken;
- all vehicles and equipment will be maintained to limit noise emissions; and

- where additional noise control measures are required, additional mitigation options should be implemented.

**Blasting impacts:** blasting is associated with the following pathways (during the initial surface blasts in particular) that can injure third parties and/or damage structures: fly rock, vibration and air blast. Given the remote setting of the proposed project the probability of any blast related impacts is low. The issue will however require mitigation because the consequences associated with this impact type are potentially significant. Key measures include the following:

- pre-mining structure and crack survey of structures within 2.5km from the Main shaft including the Boerdraai and van Schalkwyk residences;
- a fly rock zone limit of less than 500 m (surface blast only);
- a peak particle velocity limit of less than 12 mm/s at third party structures that are built according to building industry standards;
- an air blast limit of less than 125 dB at third party structures (surface blast only); and
- pre-blast warning and evacuation to clear people, traffic, moveable property and livestock from the potential fly rock impact zone during surface blasts only.

**Traffic - road disturbance and traffic safety:** The surrounding road network will be used by project activities such as road dispatch of product, delivery of materials and consumables, commuting of staff and traffic related to site services. An increase in traffic and change in traffic patterns can result in a reduction of service levels and increased nuisance to other road users, road deterioration, and road safety concerns. The key mitigation measures if the R380 remains as a gravel road include the following:

- lighting and road signs will be provided at the proposed access intersection;
- the current R380 speed limit of 90km/h will with the consent of the Northern Cape Department of Roads and Public Works will be reduced to at least 60km/h at the proposed access intersection; and
- traffic travelling from the mine towards the R380 will be stop controlled at the intersection.

The following measures apply if the R380 is tarred:

- lighting and road signs will be provided at the proposed access intersection;
- the current R380 speed limit of 90km/h will with the consent of the Northern Cape Department of Roads and Public Works will be reduced to at least 60km/h at the proposed access intersection;
- traffic travelling from the mine towards the R380 will be stop controlled at the intersection;
- the intersection will be upgraded to include additional lanes (for both passing and acceleration) and road markings; and
- prior to construction of the intersection upgrade, approval is required from the Northern Cape Department of Roads and Public Works.

**Visual impacts:** The proposed project has the potential to impact on the views from properties close to the project site. The main issues are: visual exposure, visual intrusion, and sensitivity of receptors. Key mitigation measures include:

- limit the clearing of vegetation and emission of visual air emission plumes (dust emissions);
- painting infrastructure with colours that blend in with the surrounding environment where possible;
- lighting will be used only where necessary and in a focussed way;
- on-going vegetation establishment on rehabilitated areas..

**Heritage, palaeontological and cultural resources – loss of or damage to heritage, cultural, archaeological and palaeontological resources:** The specialist study identified a very low density scatter of low importance lithic artefacts that could potentially be damaged by the project. The artefacts are not located in proposed infrastructure areas. The specialist has determined that the palaeontological sensitivity of the project site can be described as low but the possibility of encountering palaeontological resources does exist. The key mitigation measures include the following;

- the artefact site shall be demarcated from the mining operations and/or the mine perimeter fence will be shifted so that the sites lie outside the impact zones, and if necessary information/warning signs if within close proximity to mining operations.
- workers will receive training and education on preserving archaeological sites; and
- where any new resources (heritage, cultural or palaeontological) are discovered during the construction, operation and decommissioning phases, the mine will follow an emergency procedure prior to damaging or moving.

**Socio-economic – economic impact:** The proposed Lehating project is predicted to have a positive impact on the local, regional and national economies. Direct benefits are derived from wages, taxes and profits. Indirect benefits through the procurement of goods and services, and the increased spending power of employees. The project is predicted to have a negative economic impact on the immediate on – site agricultural land. In both the unmitigated and mitigated scenario, the net economic impact is considered to be significantly positive. With the effective implementation of management measures the positive economic benefits can be enhanced and the mining and agricultural sectors can co-exist where possible. Key related mitigation measures include the following:

- hiring of local people where possible;
- procuring of local goods and services where possible;
- implementation of formal training and skills development programmes;
- optimisation of post mining utilisation of land for farming through implementation of rehabilitation and closure objectives;
- incorporating economic considerations into closure planning; and
- support of local entrepreneurial development and local SMMEs.

**Socio-economic – potential inward migration impacts:** Mining projects tend to bring with them an expectation of employment in all project 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. Implementation of mitigation measures requires a collective effort from government, local municipalities, neighbouring mines and other entities in the commercial sector. The key related measures include the following:

- implementation of a corporate sustainability programme and use of a skills database;
- implementation of a formal recruitment, procurement and training programmes with no employment being done at the mine site itself;
- ensuring that workers have access to formal serviced housing;
- collaborating with neighbours, local authorities and law enforcement to prevent increase in crime and informal settlement development;
- implementation of HIV/AIDS and tuberculosis education and awareness policy; and
- implementation of stakeholder communication, information sharing and grievance mechanism.

**Land use impacts:** Mining activities have the potential to affect land uses both within the proposed project site and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. These land uses include farming (mainly livestock grazing, with limited game farming to the north) and some residential land use for farmers and farm workers.

The key mitigation measures are as follows:

- when mitigating the impacts discussed above attention will focus on surrounding land users and land owners;
- all disturbed areas shall be rehabilitated as soon as possible and maintained in accordance with the rehabilitation objectives;
- land on the farm Lehating 741 that is not used for the development of infrastructure will be made available for grazing of cattle in line with existing grazing rights provided that mining operations, safety and security measures that are in place at the mine will not be jeopardised; and
- surrounding land users will be invited to participate in routine stakeholder engagement meetings for collective issues identification and problem solving.

**TABLE A: SUMMARY OF POTENTIAL CUMULATIVE IMPACTS ASSOCIATED WITH LEHATING MINE**

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
<b>Geology</b>	Loss and sterilization of mineral resources	<b>M</b>	<b>L</b>
<b>Topography</b>	Hazardous excavations and infrastructure	<b>H</b>	<b>M</b>
<b>Soils and land capability</b>	Loss of soil resources and land capability through pollution	<b>H</b>	<b>M-L</b>
	Loss of soil resources and land capability through physical disturbance	<b>H</b>	<b>L (M for tailings and waste rock)</b>
<b>Biodiversity</b>	General disturbance of biodiversity	<b>H</b>	<b>M</b>

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
	Physical destruction of biodiversity	H	M-H
Surface water	Alteration of natural drainage patterns	H	M (L for closure phase)
	Contamination of surface water	H	L
Groundwater	Reduction of groundwater levels and availability	M-L (borehole users)  L for Kuruman River	L (borehole users)  L for Kuruman River
	Contamination of groundwater	H-M	L
Air quality	Air pollution	M (construction and decommissioning phase) H (operational phase) M-L (closure phase)	M-L (construction and decommissioning phase) M (operational phase) L (closure phase)
Noise	Noise pollution	M	M- L
Blasting	Blasting impacts	H	L
Traffic	Road disturbance and traffic safety	H	M
Visual	Visual impacts	H	M (L for closure phase)
Heritage, palaeontological and cultural resources	Loss of or damage to heritage, cultural, archaeological and palaeontological resources	M	L
Socio-economic	Economic impact	H+	H+
	Inward migration	H	L
Land use	Land use impacts	H	M (L for closure phase)

### Project timing

The project will only proceed if it is approved. Table B sets out the related time frames.

**TABLE B: ESTIMATED PROJECT TIMELINES**

Aspect	Project activities
Proposed commencement of construction	Should the various required environmental authorisations be issued, the target date for commencing construction is mid-2015.
Duration of construction phase	18 months
Start operation	1 <sup>st</sup> quarter 2017
Life of operation	Approximately 15 years

### Conclusion

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments

both on the mine site and in the surrounding area. With mitigation these potential impacts can be prevented or reduced to acceptable levels.

The economic impact assessment concluded that the development of the project will have significant positive economic impacts.

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



## **ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED LEHATING MANGANESE MINE**

### **INTRODUCTION AND LEGAL FRAMEWORK**

#### **Introduction**

Lehating Mining (Pty) Ltd (Lehating) proposes to develop a new underground manganese mining operation near Black Rock in the Joe Morolong Local Municipality, located in the John Taolo Gaetsewe District Municipality, Northern Cape Province. The proposed mine will be located on Portion 1 of the farm Lehating 741, with site access to be attained through the northern section of Portion 2 of the farm Wessels 227. The regional and local settings are presented in Figure 1 and Figure 2 respectively.

The proposed project will include the following:

- site access;
- establishment of a vertical shaft and mine ventilation shaft;
- on-surface crushing and screening of manganese ore;
- stockpiling of product;
- waste rock and tailings disposal;
- water abstraction; and
- associated support infrastructure and services.

SLR Consulting (Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants has been appointed to manage the environmental assessment process.

#### **Project motivation (need and desirability)**

The proposed Lehating Mine project is located in the Joe Morolong Local Municipality where unemployment levels are high. It is expected that the mine will create several hundred direct employment opportunities and will have a positive impact on both indirect businesses and employment. A large percentage of these employment opportunities will benefit the surrounding communities. A portion of the unskilled and semi-skilled labour is likely to be sourced locally. In addition to employment, Lehating will contribute to local communities through implementation of socio-economic development projects as well as skills development, as stipulated in its social and labour plan.

The proposed Lehating Mine could also benefit the South African economy as the manganese ore produced at the mine will be exported thus bringing foreign revenue, which will contribute to South Africa's gross domestic product (GDP). The anticipated market prices in the medium and long-term are considered to be favourable for project development. The mine also creates an additional tax base, therefore further contributing to the South African economy.

## Legal framework

Prior to the commencement of the proposed project, environmental authorisations (on the basis of the environmental impact assessment) are initially required as follows:

- An environmental decision from the Department of Mineral Resources (DMR) in terms of the Mineral and Petroleum Resources Development Act (MPRDA), (Act 28 of 2002); and
- Environmental authorisation from the Northern Cape Department of Environment and Nature Conservation (DENC) in terms of the National Environmental Management Act (NEMA), (Act 107 of 1998). The proposed project incorporates several listed environmental activities (refer to Section 2.5) which require environmental authorisation prior to their commencement. A copy of the application and department acknowledgment of receipt is included in Appendix A.
- Waste management license for waste-related activities from the National Department of Environmental Affairs (DEA) in terms of National Environmental Management: Waste Management Act (NEM:WA), Act 59 of 2008. An application was submitted by SLR to DEA and was acknowledged by the department (Appendix A). The applicable list of waste management activities is provided in Section 2.5.

This report is the environmental impact assessment (EIA) (Section 1) and environmental management programme (EMP) (Section 2) for the project. Given the legal framework above, this report has been compiled to meet the requirements of the 2010 NEMA EIA Regulations and MPRDA Regulations. In this regard, the new DMR report structure template has been used. To assist with cross-referencing in the report, the chapter numbering in the EMP section follows on from the chapter numbering in the EIA section.

In terms of Regulation R543 of the 2010 EIA Regulations, Table 1 provides a guide to the relevant sections where the information is contained.

**TABLE 1: REQUIREMENTS FOR EIA AND EMP REPORTS**

Mining Regulation 527	Environmental Regulation 385	Section in report
<b>Environmental impact assessment (EIA)</b>		
-	Details of the person who compiled the EIA, and his/her expertise	Introduction
-	Comment on the need and desirability of the proposed activity(ies) in the context of alternatives	Introduction
	A description of the need and desirability of the proposed activity	Introduction
-	Description of the property and location of the activity on the property	Section 1.3.4 and 1.4
Assessment of the environment likely to be impacted by the mining operations including cumulative impacts	A description of the environment that may be affected by the activity	Section 1
An assessment of the environmental likely to be affected by the identified alternative land use or developments, including cumulative environment impacts	Description of proposed activity(ies)	Section 2
	Description and comparative assessment of alternatives identified during the EIA	Section 4 and 5
An assessment of the nature, extent, duration, probability and significance of the	Description of environmental issues, assessment of significance, and extent to	Section 7

<b>Mining Regulation 527</b>	<b>Environmental Regulation 385</b>	<b>Section in report</b>
identified potential environmental, social and cultural impacts of the proposed mining operations, including cumulative environmental impacts	which these can be mitigated. Assessment to include: cumulative impacts, nature, extent, duration, probability, reversibility of resource loss, mitigation	
Determine the appropriate migratory measures for each significant impact of the proposed mining operation	Summary of findings and recommendations of specialist reports	Section 7
-	Methodology used to determine impact significance	Section 7.3
An comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts	-	Section 8
Details of the public engagement process and identification of how all issues raised have been addressed	Details on the public involvement process	Section 10
Knowledge gaps, adequacy of predictive measures, assumptions and uncertainties	Assumptions, uncertainties and knowledge gaps	Section 11
Description of the arrangement for monitoring and management of environmental impacts	-	Section 12
-	Provide an authorisation opinion – with possible conditions	Section 27
-	Environmental impact statement – summary of key findings and comparative assessment of the positive and negative implications of the activity and alternatives	
Include appendices for supporting and technical information	Specialist reports as appendices	Section 13
<b>Environmental management programme/plan (EMP)</b>		
-	Details of the person who compiled the EMP, and his/her expertise	Introduction
-	Detailed description of the activity aspects covered in the EMP	Section 2
Description of management/technical options chosen	Details on the management/mitigation measures from planning and design stages through to closure (where relevant)	Section 19
Description of objectives and specific goals for mine closure, and management of environmental impacts, socio-economic conditions (SLP), historical and cultural aspects	Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified including the person who is responsible for the implementation of the measures	Section 14, 15, 16 and 17
Description of the appropriate technical and management options chosen for each environmental impacts, socio-economic condition and historical and cultural aspect for each phase of the mining operation	Measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures.	Section 18
Action plans to achieve the objectives and specific goals that must include a time schedule to implement migratory measures for the prevention, management and remediation of each environmental impact, socio-economic condition and historical and cultural aspects for each phase of the mining operation	A description of the manner in which it intends to modify, remedy, control or stop an activity or process which causes pollution or environmental degradation and migration of pollution. To comply with prescribed environmental management standards or practices, any applicable provisions of the Act regarding closure and financial rehabilitation	Section 19
-	Timeframes within which the measures must be implemented	
Procedures for environmental related	Process to manage any environmental	Section 20

<b>Mining Regulation 527</b>	<b>Environmental Regulation 385</b>	<b>Section in report</b>
emergencies and remediation	damage, pollution, pumping and treatment of extraneous water or ecological degradation	
Planned monitoring and environmental management performance assessment	Proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon	Section 21
Financial provision including the determination of the quantum of the financial provision and details of the method providing for financial provision		Section 22
Environmental awareness plan	Environmental awareness plan	Section 23
Supporting information	-	Section 24
Capacity to rehabilitate the environment	-	Section 25
Undertaking of the applicant	-	Section 26

### Other approvals / permits

There are other approvals that are required prior to construction and/or commissioning of the mining and related activities. This list does not cover occupational health and safety legislation requirements.

- Prior to conducting any water uses a water use license from the Department of Water Affairs (DWA) in terms of the National Water Act (NWA) 36 of 1998 is required. The applicable water uses in terms of Section 21 of the NWA may include:
  - (a) taking water from a water resource
  - (b) storing water
  - (c ) impeding or diverting the flow of a watercourse
  - (g) disposing of waste in a manner that may detrimentally impact on a water resource
  - (i) altering the beds, banks, course or characteristic of a watercourse, and
  - (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.
- prior to damaging or removing heritage resources permissions are required in terms of the National Heritage Act, 25 of 1999, the Ordinance on Exhumations, 12 of 1980, and/or the Human Tissues Act, 65 of 1983 depending on the nature of the resource in question.
- Prior to removing or damaging any protected plant species, the necessary permits will be obtained from DWA in terms of the National Forests Act of 1998 (Act 84 of 1998) and the Northern Cape Nature Conservation Act, Act 9 of 2009 (NCNCA).
- All dams with both a wall greater than 5 m and a capacity of 50 000 m<sup>3</sup> will be registered as safety risk dams with DWA in terms of the National Water Act, 36 of 1998.
- The construction of the sewage treatment plant will be registered with the DWA in terms of the National Water Act, 36 of 1998.

**FIGURE 1: REGIONAL SETTING**

**FIGURE 2: LOCAL SETTING**

## EIA approach and process

A summary of the approach and key steps in the combined EIA process and corresponding activities are outlined in Table 2.

**TABLE 2: EIA PROCESS**

Objectives	Corresponding activities
<b>Project initiation and application phase (March 2012 – October 2012)</b>	
<ul style="list-style-type: none"> <li>Notify the decision making authorities of the proposed project.</li> <li>Initiate the environmental impact assessment process.</li> </ul>	<ul style="list-style-type: none"> <li>Mining Right application submitted to DMR on 25 October 2013. Application was acknowledged on 4 March 2013.</li> <li>NEMA application for the listed activity was submitted to DENC on 21 August 2012. Application acknowledged on 3 October 2012.</li> <li>Waste management licence application submitted to DEA on 26 July 2013. Application was acknowledged on 21 August 2013.</li> </ul>
<b>Scoping phase (October 2012 - April 2013)</b>	
<ul style="list-style-type: none"> <li>Identify interested and/or affected parties (IAPs) and involve them in the scoping process through information sharing.</li> <li>Identify potential environmental issues associated with the proposed project.</li> <li>Identify any fatal flaws.</li> <li>Determine the terms of reference for the EIA.</li> </ul>	<ul style="list-style-type: none"> <li>Notify IAPs of the project and environmental assessment process (social scans, distribution of background information documents (BIDs), newspaper advertisements, telephone calls and site notices) in October and November 2012.</li> <li>Public scoping meetings (November 2012).</li> <li>Record keeping of all comments received (September 2012 to March 2013).</li> <li>Compile scoping report including a description of environmental issues and terms of reference for further investigations.</li> <li>Distribute scoping report to DMR, IAPs and other regulatory authorities for review (April 2013).</li> <li>Record comments (April - May 2013).</li> <li>Forward final scoping report including IAP comments to DENC and DEA (August 2013).</li> </ul>
<b>EIA and EMP phase (February 2012 – September 2013)</b>	
<b>Detailed specialist investigations (February 2012 to July 2013)</b>	
<ul style="list-style-type: none"> <li>Describe the affected environment</li> <li>Define potential impacts</li> <li>Give management and monitoring recommendations</li> </ul>	<ul style="list-style-type: none"> <li>Investigations by technical project team and SLR of issues identified during the scoping stage including investigations into alternatives.</li> </ul>
<b>EIA and EMP phase (April 2013 – April 2014)</b>	
<ul style="list-style-type: none"> <li>Assessment of potential environmental impacts</li> <li>Design requirements and management and mitigation measures</li> <li>Receive feedback on application</li> </ul>	<ul style="list-style-type: none"> <li>Compilation of EIA and EMP report (June – August 2013).</li> <li>Distribute EIA and EMP report to IAPs and other regulatory authorities for review (September 2013).</li> <li>Feedback meetings with authorities and IAPs as required (October 2013).</li> <li>Record comments (October 2013).</li> <li>Forward IAP comments to DMR (end November 2013).</li> <li>Circulate record of decision to all registered IAPs (2014).</li> </ul>

## EIA team

SLR is an independent firm of consultants that has been appointed by Lehating to undertake the environmental assessment. Brandon Stobart, Victoria Tucker and Suan Mulder comprise the SLR team whom are the responsible SLR environmental assessment practitioners (EAPs) for managing the project and compiling the final report.

The designations of the environmental scoping team are as follows:

- Brandon Stobart – project reviewer
- Victoria Tucker – project manager
- Suan Mulder – stakeholder facilitation

Technical input was provided by:

- Nico Hager – Lehating Mining director and project manager
- Charles Sambo – Lehating Mining CEO
- Paul Jackson and Donovan Munro – TWP Projects (Pty) Ltd, project feasibility team
- Paul Carlisle – Carlisle & Associates, consulting civil/structural engineers
- Gustav du Toit - TWP Projects (Pty) Ltd, water balance calculations

Neither SLR nor its team of specialists have any interest in the project other than fair payment for consulting services rendered as part of the environmental assessment process.

**TABLE 3: PROJECT TEAM**

Team	Name	Designation	Tasks and roles	Company
Project management	Brandon Stobart	Project reviewer	Report and process review	SLR
	Victoria Tucker	Project manager	Process and project management, stakeholder engagement, and report compilation.	SLR
	Suan Mulder	Stakeholder facilitator	Assistance with public participation process	SLR
Specialist team	Hanlie Liebenberg-Enslin	Air quality and noise specialist	Air quality and noise assessment	Airshed Planning Professionals (Pty) Ltd
	Garry Paterson	Soil and land capability specialist	Soil and land capability assessment	ARC-Institute for Soil, Climate & Water
	Rian Titus, Theo Rossouw and Jenny Ellerton	Groundwater and Geochemical specialist	Groundwater assessment	SLR
	Mark Bollaert	Surface water specialist	Surface water and floodline assessment	SLR
	Natalie Birch	Biodiversity specialist	Biodiversity assessment	Ecological Management Services
	Wouter Fourie	Heritage specialist	Heritage and culture assessment	Professional Grave Solutions (Pty) Ltd
	Paul van der Westhuizen	Traffic specialist	Traffic impact assessment	Siyazi Gauteng
	Gerrie Muller	Economic specialist	Economic impact assessment	Strategy4Good
	Steve van Niekerk and Jonathan Mograbi	Closure specialists	Closure cost assessment	SLR

### Contact details for applicant



Details of the applicant are provided in the table below.

<b>Project applicant:</b>	Lehating Mining (Pty) Ltd
<b>Contact person:</b>	Mr Nico Hager
<b>Postal address:</b>	12 Kareekraal Avenue, Eldoraigne Ext 3 0157
<b>Telephone No:</b>	+ 27 10 591 3233 and 083 453 6621
<b>E-mail Address:</b>	nhager@lehating.com

## Regional Setting

The regional and local setting of the mine and project is outlined below and illustrated in Figure 1 and Figure 2 respectively.

Aspect	Detail
Province	Northern Cape
Magisterial district	Kuruman
Local authority	Joe Morolong Local Municipality and John Taolo Gaetsewe District Municipality.
Municipal wards	Ward 4 of the Joe Morolong Local Municipality
Farms on which project will take place	The proposed Lehating Mine infrastructure will take place on Portion 1 of the farm Lehating 741, with the proposed access road corridor situated on Portion 2 of Wessels 227. Refer to Section 1.3.4 for land ownership details.
Nearest towns	The closest towns are Black Rock and Hotazel, located approximately 10km south and 19km southeast of the main shaft site, respectively. Descriptions of the closest local communities are provided in Section 1.3.4.
Presence of servitudes	Powerlines and roads are located within and surrounding the proposed Lehating Mine (Section 1.3.4).
Use of immediately adjacent land	The land on and surrounding the project area is mainly used for grazing.
Water catchment and management area	The site is located in the Orange River Basin, in quaternary catchment D41M. No perennial rivers or permanent surface water features such as dams or lakes are located in the area. The ephemeral Kuruman River runs to the south of the site from east to west.
Topographic landmarks	The project site is situated within a flat area located close to the Kuruman River.
Co-ordinates of project area	22°52'13.18"E 27° 2'27.93"S

# **SECTION 1 – ENVIRONMENTAL IMPACT ASSESSMENT**

## 1 DESCRIPTION OF THE BASELINE ENVIRONMENT

Information in this section was sourced from the specialist studies undertaken for the proposed project.

### 1.1 ON-SITE ENVIRONMENT RELATIVE TO SURROUNDING AREA

#### 1.1.1 GEOLOGY BASELINE

Information in this section was sourced from the groundwater study undertaken by SLR Consulting (SLR, July 2013) and included in Appendix G.

##### Introduction and link to impacts

As a baseline, the geology and associated structural features provides 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 stockpiles; and
- the geophysics and related 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 1.1.4) and the potential for palaeontological resources (see Section 1.3.1).

To understand the basis of these potential impacts, a baseline situational analysis is described below.

##### Data collection

Regional geological data collection was sourced from the draft hydrology report compiled for the Bankable Feasibility Study (SLR, April 2012), the groundwater impact report (SLR, July 2013) and from other EIAs conducted by SLR in the area.

##### Results

###### Regional geology

Surface geology at Lehating 741 comprises predominantly of Cenozoic deposits which are part of the Kalahari Formation. The Kalahari Formation (refer to Figure 3 and Figure 4) is approximately 80m thick and overlies the Dwyka Formation. The Dwyka Formation is approximately 200m thick and overlies the Hotazel Formation. The Hotazel Formation contains important minerals and Lehating will target this formation for manganese. The Hotazel Formation is approximately 20m metres thick in the area of investigation and overlies the Ongeluk Formation. There are also two distinct topographic

highs formed by the rocks of the Olifantshoek Supergroup outcrop approximately 30km southwest of the mine and the rocks of the Asbestos Hill Subgroup outcropping approximately 20km towards to the east of Lehating 741 (SLR, July 2013).

### Local geology

The Kalahari Formation consists of various units and constitutes the most extensive body of terrestrial sediments from the Cenozoic age in Southern Africa. Throughout the area the thickest parts of the Kalahari Formation appear to coincide with the occurrence of rocks of the Dwyka Group. The presence of faulting and graben formation in pre-Kalahari rocks also has a strong influence on the distribution of the Kalahari sediments (Partridge et al, 2006).

The overall lithology and main stratigraphic units of the Kalahari Formation are represented in Figure 4:

- Upper zone consisting of Dwyka tillite and laminate;
- Main zone consisting of hematite, red shale and tillite;
- Critical zone consisting of hausmannite making up Mamatwan-type ore and Wessels-type ore. It is within this layer that the manganese ore body is found;
- Lower Zone consisting of hematite; and
- Marginal zone consisting of Ongeluk lava.

### Lineaments

No significant faults, fractures or other lineaments were identified on site.

### Operations geology

Interbedded within the banded iron formation of the Hotazel Formation there are three laterally continuous stratiform manganese layers. These are termed the upper, middle and lower manganese bodies. The lower body varies in thickness from 5 to 45m and represents the main ore bed – virtually all the manganese reserves and production come from the lower bed. The lower body attains a maximum known thickness of 45m at Mamatwan, varies in thickness from 12 to 17m at Hotazel and ranges between 4 and 8m thick at the Wessels and N'Chwaning mines. The middle body is only 1 to 2 m thick at Mamatwan and contains uneconomic Mn grades. The upper body averages between 5m and 20m thick and is mined on a local scale, as was the case at the Hotazel Mine. Recent exploration has shown the upper manganese bed to thicken north of Mamatwan and in the southern portions of the basin, the upper body may reach 30m in thickness and the middle body is often absent. Each manganese layer forms the core or centre of three symmetrical iron formation sedimentary cycles. The interbedded banded iron formation units exhibit thickness relations antithetic to those of the manganese ores and this applies particularly to the banded iron formation section directly overlying the lowermost manganese bed.

The resources to be mined fall within the main Kalahari basin of the Kalahari Manganese Field, and sub-outcrop below approximately 40m to 50m of calcretes and gravels of the Kalahari Formation. The Hotazel Formation is displaced by a system of north-south-striking normal and thrust faults. The Lower Manganese Ore (LMO) seam is approximately 270m to 300m below surface and as a result the Lehaping Manganese Mine ore body mining depth will range from 230m to 320m.

### Geochemical analysis

Laboratory tests to determine the potential of samples to produce Acid Rock Drainage (ARD) are generally grouped into two categories; static and kinetic tests. Static tests are relatively simple and undertaken as a preliminary assessment whereas kinetic tests are typically carried out if the results of the static tests are not conclusive or the samples are flagged as potentially acid generating

Static tests include Acid Base Accounting, sulphur speciation, inorganic carbon content, Net Acid Generation Tests and Synthetic Precipitation Leaching Procedure leach tests.

Acid Base Accounting (ABA) is an internationally accepted analytical procedure that screens the acid-producing and acid-neutralizing potential of a sample. The ABA tests assumes conservatively that all sulphur in the sample will react to form sulphuric acid, while some of the sulphur may also be present in non-acid producing sulphates, organic or elemental sulphur. An assessment of sulphur speciation is therefore undertaken to allow a better characterisation of the acid generating potential, which is related to the type of sulphur minerals present. Acid generation of samples with sulphide sulphur content below 0.3 % is considered short term.

The acid neutralising potential of a rock / tailings sample, predominantly from carbonates and exchangeable alkali and alkali earth cations is further characterised by the inorganic carbon content (as an estimate of carbonate contents in the tailing material) of the sample.

Net Acid Generation (NAG) tests directly determine the acid generating potential of sulphur minerals in a rock sample by oxidation with hydrogen peroxide ( $H_2O_2$ ). The final NAG pH after complete oxidation of the sample is used as a screening criterion for the acid generation potential.

Synthetic Precipitation Leaching Procedure (SPLP) leach tests are a laboratory extraction method designed to provide an indication of the metals and salt that could be leached from the waste products. The procedure makes an assessment where rainfall is the only external factor influencing leachate generation. The pH value of the extraction value can be altered to allow the evaluation of the leachate quality under potential acid rock (pH3) or neutral (pH7) conditions. A first order risk assessment is undertaken though comparison of leach tests results with relevant water quality / mining effluent standards, however they provide only a high level screening mechanism of potential risk as actual site specific liquid to solid ratio cannot be determined.

Four samples of various materials likely to be mined at Lehating Mine were collected by a project geologist during exploratory drilling in December 2011 and sent to an accredited laboratory in Pretoria for static geochemical analysis. The sample consisted of the Kalahari Sands, Dwyka Formation and Ongeluk Lava which are considered to be representative of waste rock material likely to be deposited on the waste rock dump and Manganese Ore which, in the absence of tailings samples is considered representative of material likely to be deposited on the tailings storage facility.

The results of the ABA analysis are provided in Table 4 (SLR, Feb 2012). Leach test results for the pH7 leach test is provided in Table 5.

**TABLE 4: SUMMARY OF ABA AND SULPHUR SPECIATION RESULTS FOR THE LEHATING MINE SAMPLES**

Parameter	Kalahari Formation	Dwyka	Ongeluk Lava	Manganese Ore
NAG pH	6.72	6.8	4.18	6.45
<b>NAG (kg H<sub>2</sub>SO<sub>4</sub>/t)</b>	<b>&lt;0.01</b>	<b>&lt;0.01</b>	<b>1.176</b>	<b>&lt;0.01</b>
Paste pH	7.2	7.7	8	6.9
Total sulphur (%)	<b>&lt;0.01</b>	Repeat Analysis	<b>&lt;0.01</b>	0.05
Sulphate (SO <sub>4</sub> <sup>2-</sup> ) Sulphur (%)	<b>&lt;0.01</b>	Repeat Analysis	<b>&lt;0.01</b>	0.04
Sulphate (S <sup>2-</sup> ) Sulphur (%)	<b>0.01</b>	Repeat Analysis	<b>&lt;0.01</b>	<b>&lt;0.01</b>
Acid potential (AP) (kg CaCO <sub>3</sub> /t)	0.31	8.46	0.31	1.44
Total Carbon (%)	1.94	1.55	0.03	0.12
Organic Carbon (%)	0.05	0.46	0.01	<b>&lt;0.01</b>
Inorganic Carbon (%)	1.89	1.09	0.02	0.11
Neutralising Potential (NP) (kg CaCO <sub>3</sub> /t)	85.82	39.2	5.59	23.5
Net Neutralising Potential (NNP = NP + NA) - open	85.51	30.73	5.28	22.06
Net Neutralising Potential Ratio (NPR = NP/AP)	274.62	4.63	17.88	16.32
Assessment	Non-Acid Forming	Non-Acid Forming	Non-Acid Forming	Non-Acid Forming

**TABLE 5: LEACHATE ANALYSIS RESULTS (IN MG/L) UNDER PH7 CONDITIONS FOR LEHATING MINE SAMPLES**

Sample ID	Unit	WHO Standard for Drinking Water	IFC Mining Effluent	SANS for Drinking Water – Class I	SANS for Drinking Water – Class II	Kalahari Formation	Dwyka	Ongeluk Lava	Mn Ore
Ag	mg/l	N/A	N/A	N/A	N/A	<0.025	0.081	0.093	<0.025
Al	mg/l	0.2	N/A	0.3	0.5	<0.100	17	7.85	<0.100
As	mg/l	0.01	0.1	0.01	0.05	<0.010	0.222	<0.010	<0.010
B	mg/l	0.5	N/A	N/A	N/A	0.031	1.55	0.274	0.787
Ba	mg/l	0.7	N/A	N/A	N/A	0.152	0.032	0.099	0.753
Be	mg/l	N/A	N/A	N/A	N/A	<0.025	<0.025	<0.025	<0.025
Bi	mg/l	-	-	-	-	<0.025	<0.025	<0.025	<0.025
Ca	mg/l	300	N/A	150	300	17	11	2	14
Cd	mg/l	-	-	0.005	0.01	<0.005	<0.005	<0.005	<0.005
Co	mg/l	N/A	N/A	0.1	0.5	<0.025	<0.025	<0.025	<0.025
Cr	mg/l	0.05	N/A	0.1	0.5	<0.025	0.073	<0.025	<0.025
Cu	mg/l	2	0.3	1	2	<0.025	0.029	<0.025	<0.025
Fe	mg/l	N/A	2	0.02	2	0.030	32	6.92	0.062
K	mg/l	N/A	N/A	50	100	3.2	5.7	7.6	<1.0
Li	mg/l	N/A	N/A	N/A	N/A	<0.025	0.027	<0.025	<0.025
Mg	mg/l	N/A	N/A	70	100	8	16	3	<2
Mn	mg/l	0.4	N/A	0.1	1	0.034	1.37	0.384	1.57
Mo	mg/l	0.07	N/A	N/A	N/A	<0.025	0.095	<0.025	<0.025
Na	mg/l	200	N/A	200	400	9	57	21	3
Ni	mg/l	0.07	0.5	0.15	0.35	<0.025	0.084	0.052	<0.025

P	mg/l	N/A	N/A	N/A	N/A	<0.025	0.179	<0.025	<0.025
Pb	mg/l	0.01	0.2	0.02	0.05	<0.020	<0.020	<0.020	<0.020
Sb	mg/l	0.02	N/A	0.01	0.05	<0.010	<0.010	<0.010	<0.010
Se	mg/l	0.01	N/A	0.02	0.05	<0.020	<0.020	<0.020	<0.020
Si	mg/l	N/A	N/A	N/A	N/A	14.6	16.1	11.3	<0.2
Sn	mg/l	N/A	N/A	N/A	N/A	<0.025	<0.025	<0.025	<0.025
Sr	mg/l	N/A	N/A	N/A	N/A	0.068	0.256	0.049	0.921
Ti	mg/l	N/A	N/A	N/A	N/A	<0.025	0.079	0.090	<0.025
V	mg/l	N/A	N/A	0.2	0.5	<0.025	0.146	0.100	<0.025
W	mg/l	N/A	N/A	N/A	N/A	<0.025	0.034	0.035	<0.025
Zn	mg/l	N/A	0.5	5	10	<0.025	0.060	<0.025	<0.025
Zr	mg/l	-	-	-	-	<0.025	<0.025	<0.025	<0.025
Alkalinity as CaCO <sub>3</sub>	mg/l	-	-	-	-	92	132	76	28
Chloride as Cl	mg/l	250	N/A	200	600	<5	27	<5	12
Sulphate as SO <sub>4</sub>	mg/l	400	N/A	400	600	11	52	7	<5
Nitrate as N	mg/l	10	N/A	10	20	<0.2	<0.2	<0.2	<0.2
Fluoride as F	mg/l	1.5	N/A	1	1.5	0.5	0.7	0.3	<0.2
pH	pH unit	N/A	N/A	5 – 59	4 – 10	8.3	8.9	9.6	8.1
EC	mS/m	-	-	-	-	18.8	33	11.8	10.2



The results suggest that all four samples are non-acid forming due to the limited sulphide sulphur content which is the primary source of acid. The total sulphur content of the manganese ore sample predominantly occurs as sulphate sulphur. This along with the paste pH of near neutral (6.9) suggests that the majority of sulphide minerals have been oxidised and the possibility of generating acid is low. The Kalahari sample demonstrates significant neutralising potential.

The leach tests demonstrate that numerous metalliferous elements recorded in the SPLP leachate exceeded acceptable drinking water and /or mining effluent limits. These included aluminium (Al), arsenic (As), boron (B), barium (Ba), chromium (Cr), iron (Fe), manganese (Mn), molybdenum (Mo) and nickel (Ni) for material considered to be representative of waste rock material and tailings material.

## **Conclusion**

In regard to geological structure, no significant geological lineaments were identified at the proposed project site. In regard to geochemistry, it is concluded that all four samples were non-acid forming however the quality of leachate produced would not be acceptable for discharge into the environment without mitigation.

### **1.1.2 CLIMATE BASELINE**

Information in this section was sourced from the hydrology report (SLR, June 2013) (Appendix F), the air quality report (Airshed, July 2013) (Appendix I) and from other EIAs conducted by SLR in the area.

## **Introduction and link to impact**

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

- 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.

To understand the basis of these potential impacts, a baseline situational analysis is described below.

## **Data collection**

Rainfall data for the areas near the proposed Lehating Mine was sourced from a number of weather stations. The South African Weather Service (SAWS) weather stations are within 50km of the site, while the closest Department of Water Affairs (DWA) station is approximately 55km away. The SAWS gauges nearest to the site are Winton and Milner located at 40.5km and 17.5km away respectively, with the DWA station located 55km away near Kuruman.

Temperature data was sourced from the South African Weather Services and SLR's Surface Water Management Plan (SLR, June 2013).

Wind direction data was sourced from hourly MM5 meteorological data were obtained for the period January 2009 to December 2011 (Airshed, July 2013). Monthly average A-Pan and lake evaporation was sourced from the DWA station (Kuruman) which is located closest to the site.

## Results

### Regional climate

The proposed project site falls within the Northern Steppe climatic zone as defined by the South African Weather Bureau. This is a semi-arid region characterised by erratic rainfall, high evaporation levels, hot temperatures in summer and cold temperatures in winter. The regional average daily maximum temperature varies between 30°C and 33°C in January and in July it is approximately 17°C. The regional average daily minimum temperature is about 15°C in January and in July it is roughly 0°C.

### Rainfall

The mean annual precipitation (MAP) for the site is more than 300 mm/year. The mean annual rainfall measured at the nearby Winton and Milner weather stations ranges between 330mm and 362mm respectively. Rainfall is typically in the form of thunderstorms during the summer months of October to March. The peak rainy period occurs between the months of January to March. Rainfall is erratic and may vary significantly from year to year. Monthly average rainfall for each month is presented in Table 6 below.

**TABLE 6: MONTHLY RAINFALL FOR WEATHER STATIONS NEAR THE SITE**

	STATIONS		
Station name	Winton	Milner	Kuruman
Station No.	392148 W	393083 W	D4E004
Latitude	27°29' S	27°22' S	27°28' S
Longitude	22°37' E	23°02' E	23°26' E
Distance to site (km)	55	40	75
Altitude (m)	1180	1118	1320
Years of Record	72	67	54
	RAINFALL (mm)		
January	62.1	66.1	85.6
February	61.2	61.4	82.9
March	58.0	66.4	86.5
April	31.8	35.5	45.1
May	13.9	16.1	21.5
June	4.2	6.0	7.4
July	2.5	1.9	2.8
August	4.9	4.2	9.8
September	6.2	6.2	7.8
October	16.2	19.0	26.3

<b>November</b>	25.7	32.0	45
<b>December</b>	43.3	46.8	44.9
<b>Annual</b>	330.1	361.6	465.7

The rainfall depth estimates for the site are provided in Table 7 below.

**TABLE 7: RAINFALL DEPTH FOR VARIOUS METHODOLOGIES AND RETURN PERIODS FOR THE 1-HOUR AND 24-HOUR STORM**

<b>Methodology</b>	<b>Rainfall Depth (mm) for associated Return Periods in relation to a 1-hour rainfall duration</b>						
	<b>2</b>	<b>5</b>	<b>10</b>	<b>20</b>	<b>50</b>	<b>100</b>	<b>200</b>
RLMA&SI (standard)	26.2	37.3	45.1	52.9	63.6	72.1	80.9
HRU 1978	18.86	24.8	30.6	37.6	49.5	61.0	75.1
	<b>Rainfall Depth (mm) for associated Return Periods in relation to a 24-hour rainfall duration</b>						
	<b>2</b>	<b>5</b>	<b>10</b>	<b>20</b>	<b>50</b>	<b>100</b>	<b>200</b>
RLMA&SI (standard)	58.3	82.8	100.3	117.6	141.4	160.3	179.8
HRU 1978	32.2	42.2	52.08	64.1	84.2	103.9	127.9

### Wind

The period average windrose for January 2009 to December 2011 is illustrated in Figure 5, seasonal wind roses in Figure 6 and day and night wind roses in Figure 7 (Airshed, July 2013). A wind rose is comprised of 16 spokes, which represent the direction from which the wind blew during the period in question. The colours reflected the different categories of wind speeds with the dotted circles indicating the frequency of occurrence.

In general, the prevailing wind direction at the proposed Lehating Mine site is from the north east direction with significant winds also blowing from the south east. The strongest winds are in excess of 7m/s.

### Evaporation

The annual evaporation for the site is greater than 2100mm (A-Pan estimate). A correction factor of approximately 0.65 (based upon the annual average for monthly correction factors) allows for the translation of the A-Pan estimate to the evaporation estimate for a very shallow body of water (Lake), equivalent to 1375.7mm. Monthly average A-Pan and lake evaporation sourced from the DWA station (Kuruman) closest to the site are presented in Table 8. It should be noted that evaporation greatly exceeds rainfall.

**TABLE 8: MONTHLY EVAPORATION FOR KURUMAN WEATHER STATION**

Month	Mean Monthly A-Pan Evaporation (mm)	Mean Monthly Lake Evaporation (mm)
Jan	259.0	169.7
Feb	208.4	144.9
Mar	161.3	112.1
Apr	122.3	83.9
May	113.2	76.8
Jun	82.5	56.1
Jul	99.1	63.3
Aug	131.2	81.8
Sep	188.5	109.9
Oct	236.3	135.9
Nov	243.6	157.8
Dec	272.7	183.3
<b>Total</b>	<b>2118.1</b>	<b>1375.7</b>

## Conclusion

This is a semi-arid region characterised by erratic rainfall, high evaporation levels, hot temperatures in summer and cold temperatures in winter. High evaporation rates reduce infiltration rates, while the high rainfall events can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does however allow for surface infiltration thereby reducing 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 into the atmosphere. Wind significantly affects the amount of material that is suspended from exposed surface to the atmosphere. The wind speed determines the distance of downward transport as well as the rate of dilution of pollutants in the atmosphere. Where wind speeds increase above 5m/s the possibility of dust dispersion increases and this will require consideration from a planning and management perspective. These climatic aspects need to be taken into consideration during rehabilitation and surface water management planning.

### 1.1.3 TOPOGRAPHY BASELINE

Information for the topography section was sourced from the surface water management plan study (Appendix F) undertaken by SLR (SLR, June 2013) and the BFS study (SLR, April 2012).

### Introduction and link to impacts

The topography of a particular area will determine the following factors:

- the flow of surface water (Section 1.1.7), and in many cases, also groundwater (1.1.8);
- the depth of soils and the potential for soil erosion (1.1.4), for example, in the case of steep slopes soils are shallow;
- the type of land use (1.3.4), including safety of both people and animals;
- the aesthetic appearance of the area (Section 1.1.11); and

- topography can also influence climatic factors such as wind speeds and direction, for example, wind will be channelled in between mountains and along valleys.

To understand the basis of these potential impacts, a baseline situational analysis is described below.

### **Data Collection**

For the current proposed project, data was sourced through site visits conducted by the EIA project team, review of 1:50000 topographical maps and a review of the project layout in relation thereto.

### **Results**

The proposed project site is relatively flat and slopes gently towards the Kuruman River. The average elevation is between 1 009 and 1 013 meters above mean sea level (mamsl). The proposed access road junction with the R380 lies at 1 015 mamsl. The lowest point in the project area which is in the Kuruman River channel at the proposed river crossing is at 997 mamsl.

The topography of the study area is undisturbed due to the lack of infrastructure and activities.

### **Conclusion**

Mining activities and infrastructure have the potential to alter the topography and the natural state of areas. An alteration of the natural topography has the potential to present dangers to both animals and people. The design of proposed surface infrastructure, specifically permanent infrastructure such as the proposed mineralised facilities should be such that any changes to topography result in stable topographic features, which do not pose significant risk to third parties and limit impacts on the visual character, water resources and the surrounding land users.

#### **1.1.4 SOIL BASELINE**

Information in this section was sourced from the soil study undertaken by ARC-Institute for Soil, Climate and Water (ARC-ISCW, May 2013).

#### **Introduction and link to impacts**

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 the soil resource 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. To understand the basis of these potential impacts, a baseline situational analysis is described below.

## Data Collection

A field survey was not undertaken, as it was determined that a previous survey (Dreyer & Paterson, 2006) was carried out at a nearby site in very similar soil conditions. That survey involved around 95 auger observations on a 250 x 250 m grid and confirmed that virtually the whole area was covered by deep, sandy Hutton and Clovelly soils. In addition, 16 soil samples were collected and analysed in that study in order to investigate/log and classify the different soil profiles. The identification and classification of soil profiles were carried out using the Taxonomic Soil Classification System. For more detail refer to Appendix J.

## Results

### Soil forms

The land type survey of the region indicates that the project area falls within land type Ah5, which comprises structureless, deep (>1 200 mm), sandy, red and yellow soils of the Hutton and Clovelly forms. A more detailed description of these identified soil forms is provided below. Refer to Figure 8 for an illustration of the land type that was mapped as per the Soil and Land Capability Study.

#### *Hutton (Hu)*

The Hutton soil forms comprise the following characteristics:

- consist of an orthic A horizon on a red apedal B horizon overlying unspecified material;
- structureless or have very weakly developed structure;
- red apedal soils have generally developed on meta-sandstone/quartzite parent material, which has a low content of weatherable minerals and thus low clay forming potential;
- soil texture is coarse to medium sand to sandy-loam in the topsoil; and
- Hutton profiles are not shallower than 800mm and some are deeper than 1200mm.

#### *Clovelly (Cl)*

The Clovelly soil forms comprise the following characteristics:

- The Clovelly form has an orthic A horizon overlying a yellow-brown apedal B1-horizon with unspecified material under the apedal horizon;
- the horizons have apedal structure and friable consistence;
- soil texture is fine sandy to sandy-loam to loam for all horizons; and
- profiles were not shallower than 600mm and some were deeper than 1500mm.

### Soil Physical Characteristics

The physical characteristics of the soil forms that were identified within the study area are provided below.

#### *Soil distribution*

The distribution of the soils (Figure 8) is closely linked to the topography and parent materials from which they are derived. The better drained soils are generally associated with a less basic parent material; while the more structured and more clay rich (less easily drained) soils are associated with the intrusive, basic parent material which underlay the majority of the study area.

#### *Dry land production potential*

The dryland production potential of the deep Hutton and Clovelly form soils is low. The soils of the area are sandy and deep and therefore will drain rapidly. Due to this tendency, along with the lack of fertility as shown by the low cation exchange capacity (CEC) values, they have a low agricultural potential. Coupled with the hot, dry nature of the climatic regime, it can be seen that this area is not suited to dryland arable agriculture, and most of the farming enterprises in the vicinity are either game farms or cattle ranches.

#### *Irrigation potential*

The irrigation potential for the soil forms identified within the study area is moderate due to the very low clay content. The sandy nature of the soils would necessitate very careful scheduling because of the very low water holding capacity of the soils. The soils would require a substantial and reliable supply of water to ensure optimum soil moisture at all times.

#### *Nutrient Storage and Cation Exchange Capacity (CEC)*

The potential for a soil to retain and supply nutrients can be assessed by measuring the CEC of the soils. Low CEC values are an indication of soils lacking organic matter and clay minerals. Typically a soil rich in humus will have a CEC of 300 me/100g (>30 me/%), while a soil low in organic matter and clay may have a CEC of 1-5 me/100g (<5 me/%). The soils on site display low CEC values and low clay content. These factors coupled with the low annual rainfall and hot temperatures in the area, means that this area has a low potential for arable agriculture and that the area is best suited for extensive grazing.

### **Conclusion**

Soil forms found within the study area are predominately friable, deep soils that have a low clay content and are well drained. In general the soil forms located within the study area are difficult to work and have a limited utilization potential. No evidence of any arable cultivation is present and most of the farming enterprises in the vicinity are either game farms or cattle ranches.

Taking the above into consideration soils located within the study area will require appropriate management measures during construction and operation to prevent the loss of soil resources through pollution and erosion as soil resources form a crucial role during rehabilitation.

### **1.1.5 LAND CAPABILITY BASELINE**

Information in this section was sourced from the soil study undertaken by ARC-Institute for Soil, Climate and Water (ARC-ISCW, May 2013).

#### **Introduction and link to impacts**

The land capability classification is based on the soil properties and related potential to support various land use activities. Mining operations in general have the potential to significantly transform land capability. To understand the basis of this potential impact, a baseline situational analysis is described below.

#### **Data collection**

Land capability within the proposed project areas were classified into different classes namely, wetland, arable land, grazing and wilderness by applying the classification system in terms of the ARC Institute for Soil, Climate and Water Land Capability Classification System for South Africa (Schoeman et al, 2000).

Data for the soil and land capability study (ARC, May 2013) undertaken for Portion 1 of the farm Lehating 741 was sourced from the review of maps and on site observations.

#### **Results**

The land capability classification as described above was used to classify the land unit identified as part of the soil study. The land capability is a combination of grazing and wetland. Each aspect is discussed below.

##### Grazing

Portion 1 of Lehating 741 (the site of the proposed mine and related infrastructure) and part of Portion 2 of Wessels 227 classifies as moderate grazing land. In this part of the Northern Cape the grazing capacity of the region is very low, at around 18-20 ha/LSU (ARC-ISCW, 2004). Currently cattle grazing activities take place on the farm Lehating 741.

##### Wetland

No wetlands were identified on Portion 1 of Lehating 741. Despite the prevailing dry climate, the adjacent Kuruman River (which has to be crossed by the access road on Portion 2 of Wessels 227) is a natural drainage channel, which will flow periodically.



## Conclusion

The land capability within the project site is classified as having a moderate grazing potential, and the majority of the area is utilised for cattle grazing purposes. The land capability will be changed as a result of the placement of infrastructure associated with the proposed project. Therefore, impact management and rehabilitation planning is required to achieve acceptable post rehabilitation land capabilities.

In the context of the Kuruman River, care needs to be taken to prevent excessive sedimentation or other contamination due to mining-related actions. There should be a buffer distance between any activities and the river itself and any access or other roads which cross the river should be constructed by qualified engineers to minimize soil erosion and not to affect water flow.

### 1.1.6 BIODIVERSITY BASELINE

Information in this section was sourced from the specialist biodiversity study conducted by Ecological Management Services (July, 2013) included in Appendix E.

#### Introduction and link to impacts

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

- 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 destruction and/or a range of disturbances.

As a baseline, this section provides an outline of the type of vegetation occurring on site, related habitats and associated fauna.

#### Data Collection – Vegetation

The biodiversity study undertaken for the proposed project (EMS, July 2013) included the review of existing literature as well as field work to identify the various types of plant species within the proposed project area. Aerial photographs & satellite images were used to identify homogenous vegetation/habitat

units within the proposed development area. These were then sampled on the ground with the aid of a GPS to navigate in order to characterise the species composition. The information gathered during the assessment was used to produce a vegetation type (Figure 9) and sensitivity map (Figure 10). For further information refer to the biodiversity study included in Appendix E.

## Data collection – Fauna

Methods used for the faunal study for the proposed project (EMS, July 2013) included a desktop review of available literature to determine the potential biodiversity lists, vegetation types and habitat suitability for the study area. In addition to this, field work was undertaken to identify animal species through physical observations such as visual identification, animal spoor identification, animal and bird calls, presence of burrows and/or nests, and dung identification. For further detail refer to the faunal study included in Appendix E.

## Results – Vegetation

### Vegetation types

Biomes are broad ecological units that represent major life zones extending over large natural areas. The proposed Lehating Mine is located within the Karoo Biome. Within this biome there are various vegetation types. The project site is located in the Kathu Bushveld and Southern Kalahari Mkgacha Vegetation Type (Mucina & Rutherford 2006). These vegetation types are discussed below, but not shown on any of the figures. On a more localized scale there are two vegetation types and four habitat units on the proposed project site. The vegetation types and habitat units are discussed below. The four habitat units are indicated on Figure 9.

### *Kathu Bushveld vegetation type*

The Kathu Bushveld vegetation type occurs in the Northern Cape Province. This vegetation type occurs along the Kathu and Dibeng plains, through Hotazel, in the vicinity of Frylinkspan and to the Botswana border. The proposed activities and infrastructure at the Lehating Mine will encroach on this vegetation type.

The Kathu Bushveld vegetation type is considered Least Threatened. The conservation target for the area is 16%. None of this vegetation type is conserved in statutory reserves. About 1% of this vegetation type is transformed mainly by mining activities, including the iron ore mining locality at Sishen. Threats on this vegetation include mining and to a lesser extent heavy grazing pressure.

The Kathu Bushveld vegetation type is characterised by medium-tall tree layers with *Acacia erioloba* in places. Mostly open woodland, with *Boscia albitunca* as the prominent trees, and a prominent shrub layer.

Key indicator species of this vegetation type include (dominant species (d)):

- Tall trees: *Acacia erioloba* (d);

- Small trees: *Acacia mellifera* subsp. *detinens* (d), *Boscia albitunca* (d), *Terminalia sericea*;
- Tall shrubs: *Diospyros lycioides* subsp. *lycioides* (d), *Dichrostachys cinerea*, *Grewia flava*, *Gymnosporia buxifolia*, *Rhigozum brevispinosum*;
- Low shrubs: *Aptosimum decumbens*, *Grewia retinervis*, *Nolletia arenosa*, *Tragia dioica*;
- Graminoids: *Aristida meridionalis* (d), *Brachiaria nigropedata* (d), *Centropodia glauca* (d), *Eragrostis lehmannia* (d), *Schmidtia pappophoroides* (d), *Stipagrostis ciliate* (d), *Aristida congesta*, *Eragrostis biflora*, *E. chloromelas*, *E. heteromera*, *E. pallens*, *Melinis repens*, *Schmidtia kalahariensis*, *Stipagrostis uniplumis*, *Tragus berteronianus*;
- Herbs: *Acrotome inflata*, *Erlangea misera*, *Giseka Africana*, *Heliotropium ciliatum*, *Hermbsstaedtia fleckii*, *H. odorata*, *Limeum fenestratum*, *L. viscosum*, *Lotononis platycarpa*, *Senna italica* subsp. *arachoides*, *Tribulus terrestris*.

### Southern Kalahari Mekgacha Vegetation Type

The Southern Kalahari Mekgacha vegetation type occurs in the Northern Cape and North-West Provinces. The proposed infrastructure associated with the Lehating Mine is located mainly within this vegetation type.

The Southern Kalahari Mekgacha vegetation type is considered least threatened. The conservation target for the area is 24% and around 18% is statutorily conserved in the Kgaladadi Transfrontier Park and the Molopo Nature Reserve. Parts of this vegetation type have been transformed (2%) by road building. Alien invasive plants such as woody *Prosopis* species occur in this vegetation type.

The Southern Kalahari Mekgacha vegetation type is characterised by sparse, patchy grasslands, sedgeland and low herblands dominated by C4 grasses on the bottom of dry riverbeds. Along the banks of some riverbeds such as the Kuruman River, *Acacia erioloba* trees can form a dominant belt.

Key indicator species of this vegetation type include (dominant species (d)):

- Tall tree: *Lebeckia linearifolia* (d), *Sisyndite sparteae* (d), *Deverra denudate* subsp. *aphylla*, *Acacia erioloba* (d);
- Low Shrubs: *Aptosimum lineare*, *Pechuel-Loeschea leubnitziae*;
- Herbs: *Amaranthus dinteri* subsp. *dinteri*, *A. praetermissus*, *A. schinzianus*, *Boerhavia repens*, *Chamaesyce inaequilatera*, *Cucumis africanus*, *Geigeria ornativa*, *G. pectidea*, *Heliotropium lineare*, *Indigofera alternans*, *I. argyroides*, *Kohautia cynanchica*, *Lotononis platycarpa*, *Osteospermum mericatum*, *Platycarpha carlinoides*, *Radyera urens*, *Stachys spathulata*, *Tribulus terrestris*, *Dicoma capensis*;
- Succulent Herbs: *Zygophyllum simplex* (d);
- Graminoids: *Cenchrus ciliaris* (d), *Chloris virgate* (d), *Enneapogon desvauxii* (d), *Eragrostis annulata* (d), *Eragrostis bicolor* (d), *Odyssea paucinervis* (d), *Panicum coloratum* (d), *Eragrostis porosa*, *Panicum impeditum*, *Sporobolus nervosus*, *Setaria verticillata* (d), *Enneapogon scaber*, *Oropetium capense*, *Stipagrostis uniplumis*, *Tragus racemosus*;

### Vegetation units and dominant species identified during the 2011 survey

Within the two vegetation types four different vegetation units were identified by the specialist, that form an integral part of the ecosystem (EMS, July 2013). These vegetation units include the *Cynodon dactylon*– *Prosopis glandulosa* shrubland Habitat Unit, the *Acacia erioloba* Woodland Habitat Unit, the *Acacia haematoxylon* Savannah Habitat Unit and the *Acacia mellifera* Shrub Habitat Unit. Further detail on the different vegetation units and dominant species within these units is provided below. Refer to Figure 9 for an illustration of the various habitat units within the study area.

#### *Cynodon dactylon*– *Prosopis glandulosa* shrubland Habitat Unit

*Cynodon dactylon*– *Prosopis glandulosa* shrubland habitat unit is located in the Southern Kalahari Mekgacha vegetation type and is found along the bottom of the dry river bed that runs through the area. Characteristics that were identified for this habitat unit are listed below:

- characterised by open grassy shrubland;
- this habitat unit has experienced disturbance and in some parts has been invaded by *Prosopis grandulosa*; and
- habitat unit is deemed to be of high sensitivity, due to the presence of habitats and/or terrain features that represent important ecological processes and habitats.

For a list of dominant plant species that were identified within this habitat unit during the site visits undertaken for the proposed project refer to Table 9 below. For a full list of species that are likely to occur within this habitat unit refer to Appendix E.

**TABLE 9: SPECIES OCCURRING IN THE CYNODON DACTYLON– PROSOPIS GLANDULOSA SHRUBLAND HABITAT UNIT (EMS, JULY 2013)**

Scientific name	Common name
<b>Grass/sedge/reed species</b>	
<i>Cynodon dactylon</i>	Bermuda grass
<i>Enneapogon cenchroides</i>	Soft feather Pappusgrass, Nine-awned grass
<i>Aristida stipitata</i>	Long-awned Three-awn
<i>Cyperus margaritaceus</i>	Witbiesie
<i>Eustachys paspaloides</i>	Red Rhodes grass
<b>Herb species</b>	
<i>Geigeria ornativa</i>	Common geigeria
<b>Tree/Shrub Species</b>	
<i>Acacia karoo</i>	Sweet Thorn
<i>Searsia erosa</i>	Broom karee
<i>Ziziphus mucronata</i>	Buffalo Thorn

#### *Acacia erioloba* Woodland Habitat Unit

The *Acacia erioloba* Woodland habitat unit is located in the Southern Kalahari Mekgacha vegetation type and it covers the prominent dune which runs the length of the river within the study area. Characteristics that were identified for this habitat unit are listed below:

- vegetation is distinctive owing to the height of the tree layer which forms a distinct canopy coverage and three vegetation strata are evident within this vegetation unit. The three strata are as follows: a prominent tree layer between 2.5m – 8m, a shrub layer, between 1.5m – 2.5m and a grass layer with an average height of 70cm;
- some disturbance as a result of past and present disturbances, such as grazing activities and informal road construction have taken place in these areas and resulting bush encroachment and low levels of alien plant invasion are evident within this habitat unit; and
- habitat unit is deemed to be of high sensitivity, due to the presence of habitats and terrain features that represent important ecological processes and habitats.

For a list of dominant plant species that were identified within this habitat unit during the site visits undertaken for the proposed project refer to Table 10 below. For a full list of species that are likely to occur within this habitat unit refer to Appendix E.

**TABLE 10: SPECIES OCCURRING IN THE ACACIA ERIOLOBA WOODLAND HABITAT UNIT (EMS, JULY 2013)**

Scientific names	Common names
<b>Grass/sedge/reed species</b>	
<i>Aristida congesta</i>	Buffalo Grass
<i>Centropodia glauca</i>	Gha grass
<i>Eragrostis lehmannia</i>	Lehmann lovegrass
<i>Schmidtia kalahariensis</i>	Kalahari sour grass, Bushman grass
<i>Stipagrostis uniplumis</i>	Silky Bushman grass
<b>Forb species</b>	
<i>Acanthosicyos naudinianus</i>	Gemsbok cucumber
<i>Tribulus zeyheri</i>	Yellow devil's thorn, Devil thorn weed
<b>Tree/Shrub Species</b>	
<i>Acacia erioloba</i>	Camel thorn, Giraffe thorn
<i>Acacia hebeclada</i>	Candle-pod Thorn
<i>Grewia flava</i>	Velvet raisin
<i>Ziziphus mucronata</i>	Buffalo Thorn

#### *Acacia haematoxylon Savannah Habitat Unit*

The *Acacia haematoxylon* Savannah habitat unit is located in the Kathu Bushveld vegetation type. Characteristics that were identified for this habitat unit are listed below:

- this community has a moderate grass cover (50-60%);
- the shrub layer is moderately developed;
- *Acacia haematoxylon* is the dominant shrub species;
- this habitat unit shows signs of disturbance due to trampling and overgrazing; and
- the habitat unit is deemed to be of moderate sensitivity, due to the presence of species of conservation concern or habitat for species of conservation concern.

For a list of dominant plant species that were identified within this habitat unit during the site visits undertaken for the proposed project refer to Table 11 below. For a full list of species that are likely to occur within this habitat unit refer to Appendix E.

**TABLE 11: SPECIES OCCURRING IN THE ACACIA HAEMATOTOXYLON SAVANNAH HABITAT UNIT (EMS, JULY 2013)**

Scientific names	Common names
<b>Grass/sedge/reed species</b>	
<i>Aristida adscensionis</i>	Six weeks three awn
<i>Eragrostis micrantha</i>	Lovegrass
<i>Eragrostis lehmannia</i>	Lehmann lovegrass
<i>Schmidtia pappophoroides</i>	Perennial Bushman grass
<i>Stipagrostis uniplumis</i>	Silky Bushman grass
<i>Cleome angustifolia</i>	Yellow mouse-whiskers
<i>Chrysopogon serrulatus</i>	Golden Beard Grass
<i>Aristida vestita</i>	Soft-haired Bushman grass
<b>Tree/Shrub Species</b>	
<i>Acacia erioloba</i>	Camel thorn, Giraffe thorn
<i>Acacia haematoxylon</i>	Grey Camel Thorn

#### *Acacia mellifera* Scrub Habitat Unit

The *Acacia mellifera* Scrub habitat unit is located in the Kathu Bushveld vegetation type. Characteristics that were identified for this habitat unit located within the areas planned for surface infrastructure are listed below:

- *Acacia mellifera* constitutes the dominant shrub species within this community;
- it is characterised by a high shrub density with a poor to moderate grass coverage (40 –60%);
- in some areas the *Acacia mellifera* forms impenetrable thickets;
- patches of this vegetation type have been over utilised and consequently karroid shrub vegetation also has invaded; and
- stands of *Rhigosum trichotomum* dispersed between the moderate grass cover can be observed within this vegetation community.

For a list of dominant plant species that were identified within this habitat unit during the site visits undertaken for the proposed project refer to Table 12 below. For a full list of species that are likely to occur within this habitat unit refer to Appendix E.

**TABLE 12: SPECIES OCCURRING IN THE ACACIA MELLIFERA SCRUB HABITAT UNIT (EMS, JULY 2013)**

Scientific names	Common names
<b>Grass/sedge/reed species</b>	
<i>Eragrostis lehmannia</i>	Lehmann's-lovegrass
<i>Aristida congesta</i>	Perennial bristle grass
<i>Pogonarthria squarrosa</i>	Fishbone grass
<i>Eragrostis chloromelas</i>	Boer love grass

Scientific names	Common names
<i>Eragrostis echinocloidea</i>	Tick grass
<i>Aristida meridonalis</i>	Giant stick grass
<i>Schmidtia pappophoroides</i>	Perennial Bushman grass
<i>Tragus racemosus</i>	Large Carrot seed grass
<b>Forb species</b>	
<i>Rhigozum trichotomum</i>	Three-Thorn
<i>Polygala leptophylla</i>	Skaapertjie
<i>Chrysocoma ciliata</i>	Bitter bush
<i>Melolobium candicans</i>	Honey Bush
<b>Tree/Shrub Species</b>	
<i>Acacia erioloba</i>	Camel thorn, Giraffe thorn
<i>Acacia hebeclada</i>	Candle-pod Thorn
<i>Acacia mellifera</i>	Hook Thorn
<i>Grewia flava</i>	Velvet raisin
<i>Ziziphus mucronata</i>	Buffalo Thorn

### Protected species

As part of the survey for the specialist study, two protected species was identified within the area planned for the proposed infrastructure, namely *Acacia erioloba* and *Acacia haematoxylon* (EMS, July 2013). The removal of *Acacia erioloba* trees in particular not only results in a loss of the species richness in the area but has impacts on the ecosystem function of the area. In terms of the National Forests Act of 1998 (Act 84 of 1998) and the Northern Cape Nature Conservation Act, Act 9 of 2009 (NCNCA) protected tree species may not be cut, disturbed, damaged or destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the Department of Water Affairs or a delegated authority. The NCNCA contains schedules of specially protected fauna and flora that may not be damaged or disturbed without a permit from the Department of Environment and Nature Conservation (DENC). Applications for such activities should be made to the responsible official within the Northern Cape Province.

### Alien and invasive species

Very few alien species occur within the study area. Furthermore, where encountered, alien plant species were sparse and no significant populations or colonies were present. Table 13 below provides a list of alien plant species identified by the biodiversity specialist study (EMS, July 2013).

**TABLE 13: ALIEN PLANT SPECIES IDENTIFIED ON SITE**

Species	Common name	Category
<i>Prosopis cf. glandulosa</i>	Mesquite	Category 2
<i>Prosopis velutina</i>	Mesquite	Category 2
<i>Cymbopogon pospischilii</i>	Mana grass	Not applicable
<i>Salsola kali</i>	Prickly saltwort	Not applicable

Alien and weed species encountered are to be removed in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section

28 of the National Environmental Management Act, 1998). With reference to Table 13 two species (*Prosopis cf. glandulosa* and *Prosopis velutina*) were classified as a Category 2 species. Category 2 invasive plant species may only be grown under controlled conditions in South Africa. These plants have certain useful qualities and are allowed in demarcated areas. In other areas they must be eradicated and controlled.

#### Areas of disturbance

Some areas within the property have already been disturbed by the prospecting activities. These areas are localised and restricted to roads that have been made in the veld and the immediate area around the drill sites. Other types of disturbances are associated with farming practises, such as disturbances caused by grazing, and trampling effects.

#### Medicinal plants

No medicinal species were encountered within the study area.

### **Results – Animal life**

Very little evidence of wild faunal populations was evident on the property. A species checklist has been compiled for the study area as it was not possible to compile a complete list of species present on the project site during the field survey. It is important to note that many species that potentially occur on-site could not be identified due to the time of year when the survey was undertaken. However some observations were made during the site visit but emphasis was placed rather on the habitat in order to determine potential occurrence of species.

#### Mammals

For a list of mammal species likely to occur in the study area refer to Table 14 below.

**TABLE 14: LIST OF MAMMAL SPECIES LIKELY TO OCCUR IN THE WIDER AREA AROUND THE PROPOSED LEHATING MANGANESE MINE**

Common name	Scientific Name	IUCN Red List Status
Warthog	<i>Phacochoerus africanus</i>	Least concern
Steenbok	<i>Raphicerus campestris</i>	Least concern
Yellow Mongoose	<i>Cynictis penicillata</i>	Least concern
Aardvark	<i>Orycteropus after</i>	Least concern
Black tailed tree rat	<i>Thallomys nigricauda</i>	-

A list of mammal species that are likely to occur within the project site are listed in Table 15 below.

**TABLE 15: POTENTIAL MAMMAL SPECIES AT THE PROPOSED LEHATING MANGANESE MINE**

Common Name	Scientific Name	IUCN Red List Status
Dent's Horseshoe	<i>Bat Rhinolophus denti</i>	Near threatened
Honey badger	<i>Mellivora capensis</i>	Near threatened
Schreiber's long-fingered bat	<i>Miniopterus schreibersii</i>	Near threatened
South African Hedgehog	<i>Atelerix frontalis</i>	Near threatened



Results of the site survey indicated that there is relatively low likelihood of Dent's Horseshoe Bat and Schreiber's long-fingered bat occurring on the Lehating Manganese Mine project site as there is a lack of suitable habitat for roosting due to the absence of caves or mine adits on the project site. There is a high likelihood that the Honey Badger and South African Hedgehog will be found in the project site due to the fact that there is suitable natural habitat in the form of groundcover and dry nesting places which are abundant over the project site.

### Avifauna

For a list of bird species likely to occur in the study area refer to Table 16 below.

**TABLE 16: BIRD SPECIES LIKELY TO OCCUR IN THE WIDER AREA AROUND THE PROPOSED LEHATING MANGANESE MINE**

Family Name	Species Name	Common Name
Alaudidae	<i>Calendulauda africanoides</i>	Fawn-coloured Lark
Alaudidae	<i>Calendulauda sabota</i>	Sabota Lark
Alaudidae	<i>Chersomanes albofasciata</i>	Spike-heeled Lark
Alaudidae	<i>Eremopterix verticalis</i>	Grey-backed Sparrow lark
Alaudidae	<i>Mirafrapiata</i>	Cape Clapper Lark
Anatidae	<i>Anas erythrorhyncha</i>	Red-billed Teal
Anatidae	<i>Anas undulata</i>	Yellow-billed Duck
Anatidae	<i>Dendrocygna viduata</i>	White-faced Duck
Apodidae	<i>Apus affinis</i>	Little Swift
Bucerotidae	<i>Tockus leucomelas</i>	Southern Yellow-billed Hornbill
Bucerotidae	<i>Tockus nasutus</i>	African Grey Hornbill
Burhinidae	<i>Burhinus capensis</i>	Spotted Thick-knee
Capitonidae	<i>Tricholaema leucomelas</i>	Acacia Pied Barbet
Charadriidae	<i>Charadrius tricollaris</i>	Three-banded Plover
Charadriidae	<i>Vanellus armatus</i>	Blacksmith Lapwing
Charadriidae	<i>Vanellus coronatus</i>	Crowned Lapwing
Ciconiidae	<i>Ciconia nigra</i>	Black Stork
Coliidae	<i>Colius colius</i>	White-backed Mouse bird
Coliidae	<i>Urocolius indicus</i>	Red-faced Mouse bird
Coraciidae	<i>Coracias caudatus</i>	Lilac-breasted Roller
Coraciidae	<i>Coracias naevius</i>	Purple Roller
Cuculidae	<i>Chrysococcyx caprius</i>	Diderick Cuckoo
Dicruridae	<i>Dicrurus adsimilis</i>	Fork-tailed Drongo
Estrildidae	<i>Amadina erythrocephala</i>	Red-headed Finch
Estrildidae	<i>Estrilda astrild</i>	Common Waxbill
Estrildidae	<i>Estrilda erythronotos</i>	Black-faced Waxbill
Estrildidae	<i>Granatina granatina</i>	Violet-eared Waxbill
Estrildidae	<i>Pytilia melba</i>	Green-winged Pytilia
Falconidae	<i>Falco naumanni</i>	Lesser Kestrel
Falconidae	<i>Falco rupicoloides</i>	Greater Kestrel
Fringillidae	<i>Crithagra atrogularis</i>	Black-throated Canary
Fringillidae	<i>Crithagra flaviventris</i>	Yellow Canary
Fringillidae	<i>Emberiza flaviventris</i>	Golden-breasted Bunting
Fringillidae	<i>Emberiza impetuanii</i>	Lark-like Bunting
Glareolidae	<i>Cursorius rufus</i>	Burchell's Courser
Halcyonidae	<i>Alcedo cristata</i>	Malachite Kingfisher

Family Name	Species Name	Common Name
Hirundinidae	<i>Hirundo albigularis</i>	White-throated Swallow
Hirundinidae	<i>Hirundo cucullata</i>	Greater Striped Swallow
Hirundinidae	<i>Hirundo fuligula</i>	Rock Martin
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow
Hirundinidae	<i>Hirundo semirufa</i>	Red-breasted Swallow
Hirundinidae	<i>Hirundo spilodera</i>	South African Cliff-Swallow
Hirundinidae	<i>Riparia paludicola</i>	Brown-throated Martin
Laniidae	<i>Lanius collaris</i>	Common Fiscal
Laniidae	<i>Lanius collurio</i>	Red-backed Shrike
Laniidae	<i>Lanius minor</i>	Lesser Grey Shrike
Malaconotidae	<i>Laniarius atrococcineus</i>	Crimson-breasted Shrike
Malaconotidae	<i>Tchagra australis</i>	Brown-crowned Tchagra
Malaconotidae	<i>Telophorus zeylonus</i>	Bokmakierie
Meropidae	<i>Merops apiaster</i>	European Bee-eater
Meropidae	<i>Merops hirundineus</i>	Swallow-tailed Bee-eater
Motacillidae	<i>Anthus cinnamomeus</i>	African Pipit
Motacillidae	<i>Motacilla capensis</i>	Cape Wagtail
Muscicapidae	<i>Batis pririt</i>	Pirit Batis
Muscicapidae	<i>Bradornis infuscatus</i>	Chat Flycatcher
Muscicapidae	<i>Bradornis mariquensis</i>	Marico Flycatcher
Muscicapidae	<i>Sigelus silens</i>	Fiscal Flycatcher
Nectariniidae	<i>Cinnyris mariquensis</i>	Marico Sunbird
Numididae	<i>Numida meleagris</i>	Helmeted Guineafowl
Otididae	<i>Eupodotis afra</i>	Southern Black Korhaan
Otididae	<i>Lophotis ruficrista</i>	Red-crested Korhaan
Paridae	<i>Parus cinerascens</i>	Ashy Tit
Phalacrocoracidae	<i>Phalacrocorax africanus</i>	Reed Cormorant
Phasianidae	<i>Pternistis adspersus</i>	Red-billed Spurfowl
Phoeniculidae	<i>Rhinopomastus cyanomelas</i>	Common Scimitarbill
Plataleidae	<i>Platalea alba</i>	African Spoonbill
Plataleidae	<i>Plegadis falcinellus</i>	Glossy Ibis
Plataleidae	<i>Threskiornis aethiopicus</i>	African Sacred Ibis
Podicipedidae	<i>Tachybaptus ruficollis</i>	Little Grebe
Pteroclididae	<i>Pterocles bicinctus</i>	Double-banded Sandgrouse
Pteroclididae	<i>Pterocles burchelli</i>	Burchell's Sandgrouse
Pteroclididae	<i>Pterocles namaqua</i>	Namaqua Sandgrouse
Pycnonotidae	<i>Pycnonotus nigricans</i>	African Red-eyed Bulbul
Rallidae	<i>Fulica cristata</i>	Red-knobbed Coot
Rallidae	<i>Gallinula chloropus</i>	Common Moorhen
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper
Scolopacidae	<i>Calidris ferruginea</i>	Curlew Sandpiper
Scolopacidae	<i>Gallinago nigripennis</i>	African Snipe
Scopidae	<i>Scopus umbretta</i>	Hamerkop
Strigidae	<i>Bubo lacteus</i>	Verreaux's Eagle-Owl
Strigidae	<i>Glaucidium perlatus</i>	Pearl-spotted Owlet
Struthionidae	<i>Struthio camelus</i>	Common Ostrich
Sturnidae	<i>Creatophora cinerea</i>	Wattled Starling
Sturnidae	<i>Lamprolornis nitens</i>	Cape Glossy Starling
Sturnidae	<i>Onychognathus naboroup</i>	Pale-winged Starling
Timaliidae	<i>Turdoides bicolor</i>	Southern Pied Babbler

Family Name	Species Name	Common Name
Viduidae	<i>Vidua regia</i>	Shaft-tailed Whydah
Sylviidae	<i>Acrocephalus baeticatus</i>	African Reed-Warbler
Ardeidae	<i>Ardea cinerea</i>	Grey Heron
Ardeidae	<i>Ardea melanocephala</i>	Black-headed Heron
Turdidae	<i>Cercomela familiaris</i>	Familiar Chat
Turdidae	<i>Cercotrichas paena</i>	Kalahari Scrub-Robin
Sylviidae	<i>Cisticola aridulus</i>	Desert Cisticola
Sylviidae	<i>Cisticola tinniens</i>	Levaillant's Cisticola
Columbidae	<i>Columba guinea</i>	Speckled Pigeon
Ardeidae	<i>Egretta garzetta</i>	Little Egret
Accipitridae	<i>Elanus caeruleus</i>	Black-shouldered Kite
Sylviidae	<i>Eremomela icteropygialis</i>	Yellow-bellied Eremomela
Falconidae	<i>Falco rupicolus</i>	Rock Kestrel
Accipitridae	<i>Melierax canorus</i>	Southern Pale Chanting Goshawk
Accipitridae	<i>Melierax gabar</i>	Gabar Goshawk
Turdidae	<i>Myrmecocichla formicivora</i>	Ant-eating Chat
Ardeidae	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron
Columbidae	<i>Oena capensis</i>	Namaqua Dove
Turdidae	<i>Oenanthe pileata</i>	Capped Wheatear
Sylviidae	<i>Parisoma subcaeruleum</i>	Chestnut-vented Tit-Babbler
Ploceidae	<i>Passer diffusus</i>	Southern Grey-headed Sparrow
Ploceidae	<i>Passer domesticus</i>	House Sparrow
Ploceidae	<i>Passer melanurus</i>	Cape Sparrow
Ploceidae	<i>Philetairus socius</i>	Sociable Weaver
Ploceidae	<i>Plocepasser mahali</i>	White-browed Sparrow-Weaver
Ploceidae	<i>Ploceus velatus</i>	Southern Masked-Weaver
Accipitridae	<i>Polemaetus bellicosus</i>	Martial Eagle
Sylviidae	<i>Prinia flavicans</i>	Black-chested Prinia
Ploceidae	<i>Quelea quelea</i>	Red-billed Quelea
Ploceidae	<i>Sporopipes squamifrons</i>	Scaly-feathered Finch
Columbidae	<i>Streptopelia capicola</i>	Cape Turtle-Dove
Columbidae	<i>Streptopelia senegalensis</i>	Laughing Dove
Sylviidae	<i>Sylvia borin</i>	Garden Warbler
Sylviidae	<i>Sylvietta rufescens</i>	Long-billed Crombec

A list of bird species that are likely to occur within the project site are listed in Table 17 below.

**TABLE 17: POTENTIAL BIRD SPECIES AT THE PROPOSED LEHATING MANGANESE MINE**

Common Name	Scientific Name	IUCN Red List Status
Martial Eagle	<i>Polemaetus bellicosus</i>	Vulnerable
Ludwig's Bustard	<i>Neotis ludwigii</i>	Vulnerable
Secretarybird	<i>Sagittarius serpentarius</i>	Near threatened
African Whitebacked Vulture	<i>Gyps africanus</i>	Vulnerable
Kori Bustard	<i>Ardeotis kori</i>	Vulnerable
Black Stork	<i>Ciconia nigra</i>	Near threatened
Lesser Kestrel	<i>Falco naumanni</i>	Vulnerable

There is a high likelihood that Martial Eagles, Secretary birds and African Whitebacked Vultures may be found at the Lehating Manganese Mine project site due to the habitat suitability of *Acacia haematoxylon* savannah habitat. These bird species are listed as vulnerable, and they may roost within the large *Acacia erioloba* and *Acacia haematoxylon* trees, forage on the project site or use the site as a migratory corridor; therefore the proposed project may pose a conservation threat to these species.

There is a low to moderate potential of occurrence of Ludwig's Bustards, Kori Bustards, Black storks and Lesser Kestrels on the project site, as there is a lack of suitable habitat due to the high density of woodland found on site.

In terms of conservation, the likelihood that any threatened mammal and bird species that are listed by the Red Data Book for Mammals (Barnes, 2000) and the Red Data Book for Birds (EWT, 2004) will be encountered within the study area is deemed moderate. This is due to narrow distribution range, the moderate levels of human activity, moderate faunal habitat availability and partially transformed habitat within the project site.

### Reptiles

No red data terrapin, tortoises, snakes or lizards were identified as occurring in the quarter degree square 2722BB, based on the distribution maps available in the South African Red Data Book for reptiles (Branch, 1988) and The Southern African Reptile Conservation Assessment (SARCA). The conservation status was cross checked on the IUCN website to determine most recent status listing for these species.

For a list of reptile species likely to occur in the study area refer to Table 18 below.

**TABLE 18: REPTILES SPECIES LIKELY IN THE WIDER AREA AROUND THE PROPOSED LEHATING MANGANESE MINE**

Family Name	Species Name	Common Name
Agamidae	<i>Agama aculeata subsp. aculeata</i>	Ground agama
Lacertidae	<i>Heliobolus lugubris</i>	Bushveld Lizard
Lacertidae	<i>Pedioplanis lineoocellata</i>	Spotted Sand lizard
Gekkonidae	<i>Chondrodactylus bibronii</i>	Bibron's Gecko
Lacertidae	<i>Heliobolus lugubris</i>	Bushveld Lizard
Lacertidae	<i>Pedioplanis lineoocellata</i>	Spotted Sand Lizard
Lacertidae	<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard
Agamidae	<i>Agama aculeata subsp. aculeata</i>	Ground agama

The conservation importance of reptile species within the project and study area can be deemed low since there is limited suitable habitat for reptile species.

### Amphibians

No red data amphibians were identified as occurring in the quarter degree square 2722BB, based on the distribution maps available in the South African Red Data Book for amphibians (Minter et al., 2004) and the South African Frog Atlas project.

For a list of amphibian species likely to occur in the study area refer to Table 19 below.

**TABLE 19: AMPHIBIAN SPECIES LIKELY IN THE WIDER AREA AROUND THE PROPOSED LEHATING MANGANESE MINE**

Family Name	Species Name	Common Name
Bufonidae	<i>Amietophrynus poweri</i>	Power's Toad
Hyperoliidae	<i>Kassina senegalensis</i>	Senegal kassina
Pyxicephalidae	<i>Cacosternum boettgeri</i>	Common Dainty Frog
Pyxicephalidae	<i>Tomopterna cryptotis</i>	Common Sand Frog
Bufonidae	<i>Amietophrynus poweri</i>	Power's Toad

The study area does not provide suitable or favourable habitat to accommodate these species. The likelihood of these species occurring in the study area is low.

#### Ecological sensitivity

With reference to Figure 10, the *Cynodon dactylon*–*Prosopis glandulosa* shrubland and the *Acacia erioloba* Woodland Habitat Units are of high ecological importance/sensitivity, while the *Acacia haematoxylon* Savannah Habitat Unit shows signs of some modification and is therefore of moderate ecological sensitivity. The *Acacia mellifera* Scrub Habitat Unit is of a low ecological sensitivity.

#### **Conclusion**

The placement of infrastructure as well as mining activities in general have the potential to disturb and/or destroy vegetation, habitat units and related ecosystem functionality including the disturbance of sensitive/ endangered species. Two protected plant species (*Acacia erioloba*, *Acacia haematoxylon*) were identified within the project site. Several red data species have been identified within the study area. The necessary permits for protected plant species will be obtained from the DAFF and DENC prior to the removal of these plant species. Areas of higher sensitivity and ecological importance include the *Cynodon dactylon*– *Prosopis glandulosa* shrubland habitat unit as well as the *Acacia erioloba* Woodland habitat unit. These areas should be avoided where possible and development of infrastructure should be focused in less sensitive habitat units. In addition to this, mitigation measures need to be formulated to conserve and reduce the impacts that the proposed project may have towards these areas.

#### **1.1.7 SURFACE WATER BASELINE**

Information for this section was sourced from site visits conducted by the EIA project team, the surface water management plan study (SLR, May 2013) and the Lehating Flood Assessment (SLR, October 2011).

#### **Introduction and link to impacts**

Surface water resources include drainage lines, paths of preferential flow of stormwater runoff as well as the channelling and/or collection of water on the surface such as irrigation canals and dams. Mine related activities have the potential to alter the drainage of surface water through the placement of both temporary (such as processing infrastructure and support facilities) and permanent infrastructure (such

as mineralised waste facilities) and/or result in the contamination of the surface water resources through seepage and/or spillage of process materials, non-mineralised and mineralised wastes. To understand the basis of these potential impacts, a baseline situational analysis is described below.

## **Data Collection**

Data used in determining the surface water characteristics includes climatic data (section 1.1.2) and topographical data (section 1.1.3).

The mean annual runoff (MAR) was sourced from the existing WR 2005 database (SLR, May 2013).

Available floodlines were sourced from the Lehating Flooding Assessment (SLR, October 2011).

## **Results**

### Catchments within the context of South Africa

The proposed Lehating Mine is located within the catchment D41M which is marked by the ephemeral Kuruman River which runs to the south of the site from east to west (Figure 11). The quaternary catchment D41M has a catchment area of 13 780km<sup>2</sup>. The Kuruman River is considered ephemeral as the river only exhibits surface flow during periods of heavy precipitation (SLR, May 2013).

### Surface water resources and Catchment boundaries

During various site visits undertaken as part of the proposed project, it was noticed that no flow occurs across the Lehating Mine site during the dry season. The streams are therefore considered to be ephemeral in nature as confirmed by the 1:50 000 topographical maps and were also found to be dry or contain very little water during rainy seasons.

A minor tributary joins the Kuruman River to the south of the site. This river is only defined as having a length of 400m according to the 1:50,000 topographical map for the site. The ASTER data indicates that a catchment area of approximately 58km<sup>2</sup> drains to this tributary during heavy rainfall events. A secondary elevation SRTM dataset (Shuttle Radar Topography Mission) indicates that this catchment is only 20km<sup>2</sup>. This disparity is due to the coarse topographic data from which the drainage pathways are being derived as well as the flat slopes of the area (which add error into the calculation of drainage pathways). The presence of a second minor tributary 500m upstream of site tributary is the alternate drainage pathway to which a part the 58km<sup>2</sup> of catchment may flow. To maintain a conservative approach, a 58km<sup>2</sup> catchment area is assumed.

The catchment is large but sparsely vegetated and features freely draining soils which indicates that minor rainfall events would infiltrate to groundwater as opposed to generating significant volumes of runoff. This understanding is supported by the fact that numerous road crossings and houses are situated within or immediately adjacent to the watercourse channels which suggests that the

watercourses do not flow on a regular basis. Anecdotal evidence suggests that no flow has been observed in this locality for some years.

The Kuruman River in this locality is meandering and features a low longitudinal gradient (approximately 1V:1050H) indicating that any flows are likely to be relatively deep but slow moving. As described above the Kuruman River and the site tributary are ephemeral in nature only flowing during periods of heavy rainfall.

#### Flood peaks, volumes and floodlines

Floodlines (1:50 and 1:100) were determined for the study area. In this regard refer to Figure 12 for the floodlines that were determined.

#### Wetland features within the project area

No wetlands were identified within the project area.

#### Surface water use

In periods of flow, water could be abstracted from surface water resources both up and downstream of the proposed mine for domestic purposes. The precise quantities of abstraction are unknown. It was noted that project site is used for cattle grazing and the streams, when in flow, were used for drinking by the cattle.

#### Surface water quality

No water sampling within the proposed project site has been conducted because there are no permanent water features. Given this, no water quality data is available.

### **Conclusion**

The nature of the proposed project components are such that they present potential for pollution of water resources that in some cases (when water is available in the non-perennial drainage lines) may be used by third parties for agricultural purposes. Therefore the proposed project's surface infrastructure must be managed/implemented in a way that pollution of water resources is prevented.

#### **1.1.8 GROUNDWATER BASELINE**

The information in this section was sourced from the groundwater specialist study undertaken by SLR (SLR, August 2013) included in Appendix G.

#### **Introduction and link to impacts**

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 hazardous materials and handling and storage of mineralised and non-mineralised wastes

have the potential to result in the loss of groundwater resources, both to the environment and third party users, through pollution. In addition, where mining requires dewatering or groundwater supply, there is the potential for a dewatering cone to develop and this can result in a loss of water supply to surrounding users. To understand the basis of these potential impacts, a baseline situational analysis is described below.

## Data Collection

As part of the proposed project scope a hydrocensus of 76 boreholes was undertaken in order to determine the depth of groundwater levels and to identify groundwater users. Two groundwater boreholes were sampled to determine the pre-mining groundwater quality. In addition to this a regional groundwater flow model was developed based on the available and determined aquifer parameters to evaluate the potential impacts of mining activities on groundwater flow and quality.

## Results

### Groundwater zone (aquifers)

The Lehating mining area is underlain by deeply weathered sedimentary rocks (i.e. mainly sandstones). The sedimentary deposit can be classified as an 'intergranular aquifer' system. The primary porosity of the rocks provides the storage capacity with limited groundwater movements while secondary features such as fractures/faults and bedding planes enhance the groundwater flow.

Regionally an unconfined water table aquifer is proposed while isolated occurrences of silts and clay units may confine the groundwater flow locally.

Based on the aquifer classification map (Parsons and Conrad, 1998) the majority of study area is regarded a "poor aquifer" while the aquifer adjacent (west) to the proposed Lehating portion is regarded as "minor". A summary of the classification scheme is provided in Table 20. It must be noted that within any aquifer, isolated higher yielding zones can be present.

**TABLE 20: AQUIFER CLASSIFICATION SCHEME (PARSONS, 1995; PARSONS AND CONRAD, 1998).**

<b>Sole source aquifer</b>	An aquifer used to supply 50% or more of urban domestic water for a given area, for which there are no reasonably available alternative sources, should this aquifer be impacted upon or depleted.
<b>Major aquifer region</b>	High-yielding aquifer of acceptable quality water.
<b>Minor aquifer region</b>	Moderately yielding aquifer of acceptable quality or high yielding aquifer of poor quality water.
<b>Poor aquifer region</b>	Insignificantly yielding aquifer of good quality or moderately yielding aquifer of poor quality, or aquifer that will never be utilised for water supply and that will not contaminate other aquifers.
<b>Special aquifer region</b>	An aquifer designated as such by the Minister of Water

Therefore, Based on the 1:500 000 hydrogeological map sheet, Lehating is located on an aquifer classed as a poor aquifer with potential groundwater yields between 0.1L/s and 2L/s. Within this context borehole



pump tests of one borehole indicated a higher yielding zone to the west of the planned infrastructure layout which is assumed to be associated with the mineralised zone (SLR, August 2013).

Further details pertaining to the aquifers are provided below.

#### *Unconfined Kalahari Aquifer*

The unconfined, intergranular Kalahari aquifer represents the upper-most aquifer in the regional model area, covering all other aquifer units, except for localized areas where rocks of the Olifantshoek Supergroup and Asbestos Hill Subgroup outcrop on the western and eastern boundaries of quaternary catchment (D41M) representing the model boundaries. The Kalahari aquifer consists of heterogeneous sedimentary deposits, changing in porosity over short distances, influencing both the groundwater flow and borehole yields. The Kalahari aquifer thickness decreases southwards away from the Kalahari basin that covers geographically most of Botswana and some parts of Namibia and South Africa. Exploration boreholes drilled within the Lehating area indicate an average thickness of 80 metres for the Kalahari sediments. Typical borehole yields expected in the Kalahari aquifer are between 0.1 and 0.5 L/s. Localized palaeo-channels typically occurring on (or close to) the contact between sediments of the Kalahari Formation and Dwyka Formation generally produce higher yielding boreholes.

#### *Confined Dwyka Aquifer*

The confined, fractured Dwyka aquifer unconformably overlies older lithologies, i.e. rocks of the Hotazel / Ongeluk and Asbestos Hill units. The Dwyka aquifer consists of diamictites with clay lenses influencing the overall hydraulic properties of the aquifer. The Dwyka aquifer outcrops close to the eastern quaternary catchment (model) boundary at the contact between the overlying Kalahari sediments and Asbestos Hill Subgroup. The exploration boreholes drilled in Lehating indicate an average thickness of 200 metres for the Dwyka aquifer. According to the GRA II data, expected borehole yield in this aquifer ranges between 0.5 and 2 L/s.

#### *Olifantshoek Aquifer (Western geological boundary)*

The semi-confined, fractured Olifantshoek aquifer unconformably overlies rocks of the Transvaal Supergroup units (i.e. Hotazel and Ongeluk formations). This aquifer unit outcrops on the western side of the catchment (model) boundary forming a topographical high and regional recharge zone. The expected borehole yields in this fractured aquifer unit range between 0.1 and 2.0 L/s. The Olifantshoek aquifer is covered extensively by a thin layer of Kalahari sediments.

#### *Deeper Fractured Hotazel / Ongeluk Aquifer*

The confined, fractured Hotazel and Ongeluk aquifers are the deepest aquifer units characterised by the conceptual model. Both formations form part of the Pretoria Group (Transvaal Supergroup). The Hotazel Formation overlying the Ongeluk Formation is economically the most important unit due to the presence of manganese deposits. The unit is structurally confined within the Dimoten Syncline, plunging 8° in a north-western direction comprising mostly of banded iron with manganese bearing units. The exploration

boreholes drilled on Lehating indicate an average thickness of no more than 20 metres for the Hotazel Formation. The Ongeluk Formation underlies the Hotazel Formation and consists predominantly of lavas. Towards the eastern and western catchment (model) boundaries rocks of the Ongeluk Formation is directly overlain by Kalahari sediments. The expected borehole yields for the Ongeluk aquifer unit range between 0.1 and 0.5 L/s.

#### *Asbestos Hill Aquifer (eastern geological boundary)*

The semi-confined, fractured Asbestos Hill aquifer unit is overlain by the Hotazel / Ongeluk aquifer units except towards the eastern catchment (model) boundary where the unit outcrops. Rocks of the Asbestos Hill Subgroup dip 30° in a western direction and form a geological boundary on the west of the catchment (model) area. A thin layer of Kalahari sediments covers the Asbestos Hill Subgroup. The expected borehole yields for this aquifer unit range between 0.5 and 2.0 L/s.

#### Groundwater regimes

Two existing boreholes were pump tested during early-2011. Borehole LEX 3A, drilled to a depth of approximately 50m, targeted a known higher yielding area of the Kalahari sediments. Borehole LEX 4, drilled to a depth of over 300m and cased off to a depth of 180m, targeted the deeper Dwyka Group and Hotazel / Ongeluk Formations. These boreholes were selected to characterize two distinct groundwater regimes.

Borehole LEX 3A was pumped with a constant abstraction rate of 10L/s for 18 hours. This abstraction rate resulted in a total drawdown of 20 metres. A transmissivity value of ~117m<sup>2</sup>/day was determined for an unconfined aquifer and appears plausible for a shallow primary aquifer in the Kalahari Formation. Results from the pumping test indicate that the borehole can be pumped at a recommended rate of 8.0L/s for 12 hours with a maximum groundwater level drawdown of 8 metre. This will allow a 12 hour recovery time for the aquifer to recover to its original water level.

Borehole LEX 4 was pumped with a constant abstraction rate of 0.13L/s for 24 hours. The data for the hydraulic test of borehole LEX 4 shows only a good fit during late times. During early time the effects of wellbore storage and/or skin effects renders an over-all fit difficult. A transmissivity value of ~0.95m<sup>2</sup>/day was determined based on the leaky aquifer solution. A similar good fit was achieved with the Hantush model for a leaky aquifer (transmissivity of 0.7m<sup>2</sup>/day). This borehole was cased off to a depth of 180mbgl and the transmissivity value(s) may be representative of the deeper Dwyka, Hotazel and upper Ongeluk formations. Due to the low yielding capability of the deeper Dwyka, Hotazel and upper Ongeluk formations borehole LEX4 is not recommended for water supply use.

#### Groundwater flow directions

The dominant groundwater flow is in a north-western direction, driven by the mountain range located towards the west and east flowing towards the Kuruman River. Localised groundwater flow within and

around the Lehating Mine area shows a dominant groundwater flow direction in a north-western direction with slight localised groundwater flow towards the Kuruman River.

Furthermore, of major importance for regional groundwater flow in the Lehating Mine area is the continuous presence of an impermeable or semi-permeable interface between the upper, unconfined Kalahari aquifer and the deeper, confined Dwyka aquifer. This interface prevents rapid vertical drainage of the Kalahari aquifer on a regional scale, thus permitting lateral groundwater flow in the Kalahari aquifer driven by topographic gradients. Vertical infiltration across this interface is controlled by the existence of major permeable zones.

#### Groundwater levels

The first hydrocensus (site walkover) was conducted by SLR Africa (Pty) Ltd within the proposed mining as part of the conducted during mid-2011. A follow up hydrocensus was conducted during July 2013 to expand on the existing groundwater level dataset, focusing on farm around Lehating. A total of 76 boreholes were visited mainly for the purpose to identifying groundwater users and taking groundwater levels measurements. Details of the hydrocensus data collected are given in Appendix B of the groundwater specialist report (Appendix G). The locality of the borehole sites are shown in Figure 13. With reference to Table 21, the water levels measured during the hydrocensus vary from a minimum of 9.8 mbgl to more than 110 mbgl with an average of 54 mbgl. Water levels located in and around Lehating mine portion has an average depth of 37 mbgl.

**TABLE 21: WATER LEVEL DATA OBTAINED FROM HYDROCENSUS.**

Borehole locations	Nr. Of BHs	Water Level (mbgl)		
		Min	Max	Mean
Hydrocensus (Catchment D41M)	76	9.8	114.8	54.0
Lehating Mine	24	9.8	58.7	36.7

#### Groundwater use

The majority of boreholes are for either domestic use and/or cattle/game feedlots or prospecting boreholes. A number of boreholes are not in use or unequipped.

#### Groundwater quality

Two groundwater samples were collected during mid-2011 from borehole LEX3A and LEX4. Prior to sampling the boreholes were purged until the field parameters stabilised (i.e. electrical conductivity, pH, etc.) or the stagnant borehole water was replaced three times. This was achieved by sampling the boreholes during the latter stages of the constant discharge tests. The samples were submitted to an accredited lab for analysis.

The results of the sampled points are included in Table 22. The sampling points were compared to the SANS 241 Drinking Water Guidelines. Exceedances of the guidelines are indicated in orange text box in Table 22.

**TABLE 22: CHEMISTRY OF GROUNDWATER SAMPLES COLLECTED DURING THE PUMPING TESTS AND COLOUR CODED ACCORDING TO SANS WATER QUALITY GUIDELINES.**

Determinants	Units	Class I	Class II	Period of consumption (Class II)	LEX3A	LEX4
<b>Physical and organoleptic requirements</b>						
EC	mS/m	<150	150-370	7 years	98.6	204
TDS	mg/l	<1000	1000-2400	7 years	622	1236
pH	pH units	5.0-9.5	4.0-10	No limit	8.3	8.1
<b>Chemical requirements</b>						
Ca	mg/l	<150	150-300	7 years	67	106
Cl	mg/l	<200	200-600	7 years	84	416
F	mg/l	<1.0	1.0-1.5	1 year	0.2	0.5
Mg	mg/l	<70	70-100	7 years	82	72
NO <sub>3</sub> as N	mg/l	<10	10.0-20	7 years	3.3	1.1
K	mg/l	<50	50-100	7 years	3.5	6.9
Na	mg/l	<200	200-400	7 years	44	232
SO <sub>4</sub>	mg/l	<400	400-600	7 years	45	113
Zn	mg/l	<5.0	5.0-10	1 year	<0.025	<0.025
Al	µg/l	<300	300-500	1 year	<0.1	<0.1
Sb	µg/l	<10	10-50	1 year	<0.01	<0.01
As	µg/l	<10	10-50	1 year	<0.01	<0.01
Cd	µg/l	<5	5.0-10	6 months	<0.005	<0.005
Cr	µg/l	<100	100-500	3 months	<0.025	<0.025
Co	µg/l	<500	500-1000	1 year	<0.025	<0.025
Cu	µg/l	<1000	1000-2000	1 year	<0.025	<0.025
Fe	µg/l	<200	200-2000	7 years	<0.025	0.316
Pb	µg/l	<20	20-50	3 months	<0.02	<0.02
Mn	µg/l	<100	100-1000	7 years	<0.025	0.443
Ni	µg/l	<150	150-350	1 year	<0.025	<0.025
Se	µg/l	<20	20-50	1 year	<0.02	<0.02
V	µg/l	<200	200-500	1 year	<0.025	<0.025
<b>Carbon requirements</b>						
Total Organic Carbon	mg/l	-	-		6.6	3.8
Dissolved Organic Carbon	mg/l	<10	10 - 20	3 months	5.3	2.6

The groundwater sample collected at borehole LEX3A presented a Mg-HCO<sub>3</sub> water type with an elevated magnesium concentration. The enriched bicarbonate type water indicates shallow, younger groundwater conditions possibly associated with the weathering of calcareous and limestone units within the Kalahari sediments. This is expected from the sample collected at borehole LEX3A as the borehole was drilled to a depth of 40 metres targeting higher yielding zones in the Kalahari Formation.

The groundwater sample collected at borehole LEX4 presented a Na-Cl water type with elevated concentrations of chloride, sodium and magnesium. The elevated sodium and chloride concentrations may represent deeper and/or older groundwater within an evolved groundwater regime. This water type is probably characteristic of the groundwater within the deeper, confined Hotazel and Ongeluk aquifers.

The groundwater samples for LEX3A and LEX4 are thus indicative of two distinctive groundwater regimes.

## Conclusion

Surface geology at Lehating comprises predominantly of Cenozoic deposits (Kalahari Formation). The Kalahari Formation is approximately 80 metres thick and overlies the Dwyka Formation which forms the basal part of the Karoo Supergroup. The majority of study area is regarded a “poor aquifer” while the aquifer adjacent (west) to the proposed Lehating portion is regarded as “minor” aquifer class. Localised groundwater flow within and around the Lehating Mine area shows a dominant groundwater flow direction in a north-western direction with slight localised groundwater flow towards the Kuruman River. A total of 2 pumping tests were conducted. Borehole LEX3A is characterised by a transmissivity value of  $\sim 117\text{m}^2/\text{day}$ , typical for an unconfined aquifer and appears plausible for a shallow primary aquifer in the Kalahari Formation. As a result, the hydraulic conductivity of the Kalahari Formation is estimated to be 2m/d. Results from the pumping test for borehole LEX3A indicate that the borehole can be pumped at a recommended rate of 8.0L/s for 12 hours with a maximum groundwater level drawdown of 8 metres. The groundwater samples for LEX3A and LEX4 are thus indicative of two distinctive groundwater regimes. The water levels measured during the hydrocensus vary from a minimum of 9.8 mbgl to more than 110 mbgl with an average of 54 mbgl. Water levels located in and around Lehating mine portion has an average depth of 37 mbgl.

The nature of the proposed project is such that they present a potential for the pollution of groundwater resources and the lowering of groundwater levels that in some cases may be used by third parties for domestic purposes. The proposed project must be implemented/ managed in a way that pollution and reduction of groundwater resources is prevented as far as possible.

### 1.1.9 AIR QUALITY BASELINE

Information in this section was sourced from the air quality impact study compiled by Airshed (Airshed, April 2012) and included in Appendix I.

#### 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 nuisance and/or health impacts to nearby receptors. Receptor sites include the residential areas and communities and natural environments that

have been described in Section 1.3.4. To understand the basis of these potential impacts, a baseline situational analysis is described below.

### **Data collection**

For the proposed project, MM5 meteorological data and available meteorological was used as baseline information. No ambient air quality data or dust fallout rates were available in the study area for characterisation of the baseline condition. (Airshed, April 2012).

### **Results**

#### Regional and local air quality

The following sources of emissions were identified as existing contributors to air quality:

- dust emissions from mining and mineral processing operations;
- vehicle tailpipe emissions-significant primary pollutants emitted by motor vehicles include CO<sub>2</sub>, CO, hydrocarbons (HCs), NO<sub>x</sub>, SO<sub>2</sub>, particulate matter and lead;
- vehicle entrained dust from paved and unpaved roads;
- household fuel combustion by means of coal and wood;
- biomass and veld burning; and
- various miscellaneous fugitive dust sources, including: agricultural activities and wind erosion of open areas.

#### PM<sub>10</sub> and Dust fallout data

No ambient PM<sub>10</sub> data or dust fallout data were available in the study area for characterisation of the baseline condition.

#### Potential receptors

There are farm houses, farm worker houses and a residential compound on the adjacent farming areas. These could be receptors of any air pollution generated by the proposed project. More detailed discussion is provided in Section 1.3.4.

### **Conclusion**

The proposed project has the potential to add to the existing ambient air quality in the region and local area. This could present the potential for additional impacts which will require consideration and management.

#### **1.1.10 NOISE BASELINE**

Information in this section was sourced from previous EIAs compiled by Metago for Ntsimbintle (Metago, 2009) and Kudumane (Metago, 2011) manganese mines located in the region.

**Introduction and link to impact**

Certain noise generating activities associated with the proposed project can cause an increase in ambient noise levels in and around the site. This may cause a disturbance to nearby receptors. Potential receptor sites include the residential areas and communities that have been described in Section 1.3.4. To understand the basis of these potential impacts, a baseline situational analysis is described below.

**Data collection**

Data was sourced from previous EIAs compiled by Metago for manganese mines within the area as well as from observations made in the field.

**Results**Ambient noise data

According to previous noise investigation in the region, the South African National Standards (SANS 10103, 2008) day-time noise rating of 40 dBA and night-time noise rating of 35 dBA for rural areas is expected to be relevant. Site observation and surrounding land uses confirm the rural nature of the area. It should however be noted that levels of noise generated by specific distant sources, such as mines and traffic roads, vary by a considerable margin with a change in wind direction and temperature profiles in the lower atmosphere.

**Conclusion**

Noise emissions from the proposed project will add to the baseline and potentially cause noise disturbance. Careful design and planning should be taken into consideration for the proposed project in order to minimise increasing disturbing noise levels. This will be of particular importance with regards to the increase in traffic volumes along the R380 and the operational activities associated with the processing plant.

**1.1.11 VISUAL BASELINE****Introduction and link to impacts**

Mining infrastructure has the potential to alter the landscape character of the site 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 Collection**

For the current proposed project data collection was sourced from on-site observations by the EIA project team and the review of relevant maps.

**Results**

The various aspects of the visual baseline are set out below.

### Landscape character

Flat, open plains displaying semi-arid vegetation and ephemeral drainage lines define the landscape character of the project area. Livestock and game farms and associated farm settlements are typical of the region.

In contrast, the region to the south of the project area is characterised by scattered operational and closed mining operations, and supportive infrastructure such as rail and road networks, power lines and the residential and business centre of Hotazel (Figure 2). Areas located to the north, east and west of the proposed project area remain relatively undisturbed and are characterised by semi-arid vegetation cover.

### Scenic quality

The scenic quality is linked to the type of landscapes that occurs within an area. Scenic quality ranges from high to low as follows:

- **high** – linked to visually appealing features like mountains and water bodies;
- **moderate** – linked to homogeneous rural landscape that are undeveloped; and
- **low** – these include towns, communities, roads, and existing mines to the south of the mine.

Although numerous mining related structures dominate the landscape to the south of the project area, the overall scene surrounding the project area is characterised by the Kuruman River channel and associated sand dune, open views with grazing lands and associated activities. The result is a landscape with a high to moderate scenic quality.

### Sensitivity of Visual Resource

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

### Sense of place

The sense of place results from the combined influence of landscape diversity and distinctive features. In this regard, it is the extent to which a person can recognise or recall a place as being distinct from other places, and as having a vivid and unique character of its own. When deriving the sense of place of the study area, the landscape context is considered, as it is the existing land types that define a sense of place.

To the south of the proposed project area, the sense of place is influenced by a largely flat, natural landscape, dominated by mining and community land uses (Figure 16). These areas are considered to have a low sense of place, being that the landscape generally has few, if any, valued features.



The flat plains, which occur to the north, east and west of the proposed project area, create a contained, complex yet coherent spatial dimension, which invites the visitor into a scene dominated by these natural edges and which add “wildness” to the scene. These factors combine to evoke a strong emotional response in the visitor, created by a landscape that is unique and has a distinct character of its own. This landscape type has a high scene of place as this landscape exhibits a positive character with valued features.

#### Visual receptors

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

Public views (sensitive viewing areas) to the proposed project area could be experienced by people living and visiting the adjacent farm settlements. Public views are confined to the immediate and surrounding landowners and land users, as well as people located on the outskirts of the Hotazel community and a small section of the R380. Views from Hotazel and Black Rock towns and from the R380 road are minimal due to the naturally flat topography of the area. These views are only visible from the periphery of the Hotazel community and by roads that service the mine.

#### **Conclusion**

When considering landscape character, scenic quality, visual resource, sense of place and visual receptors the baseline includes two distinct areas of differing visual value. The areas located to the north, east and west of the proposed project site have a high visual value. The developed areas to the south of the proposed project site have a lower value. Public views are confined to the immediate and surrounding landowners and land users, as well as people located on the outskirts of the Hotazel community and a small section of the R380. This indicates that mining, community and agricultural activities impact on the current visual resource and that visual resource management must be considered during the design of the proposed infrastructure.

## **1.2 ENVIRONMENTAL ASPECTS WHICH MAY REQUIRE PROTECTION OR REMEDIATION**

Existing environmental aspects both on the site applied for and in the surrounding area which may require protection or remediation is discussed further in this section. Based on the concise description provided above, these include:

- Soil resources within the footprint of project infrastructure;
- The ephemeral Kuruman watercourse;
- The *Acacia erioloba* Woodland and the *Cynodon dactylon* – *Prosopis glandulosa* shrubland located along the banks of the Kuruman River that is located to the south of the surface infrastructure;

- Ambient air quality; and
- Groundwater resources.

### 1.3 LAND USES, CULTURAL AND HERITAGE ASPECTS AND INFRASTRUCTURE

A description of the specific land uses, cultural and heritage aspects and infrastructure on site and on neighbouring properties/farms is provided in this section. This section identifies whether or not there is potential for the socio-economic conditions of other parties to be affected by the proposed operations.

#### 1.3.1 CULTURAL ASPECTS

Cultural aspects of the proposed project areas are discussed below as part of the heritage discussion.

#### 1.3.2 HERITAGE BASELINE (INCLUDING CULTURAL RESOURCES)

Information in this section was sourced from the heritage/cultural study undertaken for the proposed project (PGS, July 2013) and included in Appendix H.

#### Introduction and link to impacts

The placement of infrastructure and related construction and operational activities associated with the proposed infrastructure has the potential to impact heritage, cultural and palaeontological resources. To understand the basis of potential impacts, a baseline situational analysis is provided below.

#### Data Collection

Data collection for the proposed project was obtained through the review of existing literature, databases, field surveys as well as the heritage study undertaken by Professional Grave Solutions (PGS, July 2013), which is included in Appendix H.

#### Results – Heritage and cultural resources

The proposed Lehating Mine is situated in the southern Kalahari to the north of Hotazel and Blackrock. As a whole the area has a relative low human presence due to the dryness of the region, and as such if there are human settlements they tend to be located on or near water courses.

Heritage and cultural resources identified on Portion 1 of Lehating 741 and Portion 2 of Wessels 227 are listed below and illustrated in Figure 15.

Site	Description	Significance
LM01	Very low density scatter of lithic artefacts (two waste flakes)	Low

#### Results – Palaeontological

The palaeontological study indicates that project site is situated on Kalahari Formation and Hotazel Formation geology (Section 1.1.1), and that palaeontological resources in the form of stromatolites may be associated with this underlying geology. Stromatolites are algal fossil structures, from the dolomites of the Transvaal Supergroup, and are recognised as having a high significance for palaeontology. Stromatolite structures are usually associated with dolomite deposits such as the dolomite of the Mooidraai Formation that overlies the Hotazel Formation. The palaeontological sensitivity is predicted after identifying potentially fossiliferous rock units during the field visit, as well as by determining the fossil heritage from relevant literature. The palaeontological sensitivity of the project site can be described as low but the possibility of encountering palaeontological resources does exist.

## **Conclusion**

Heritage and cultural resources are expected to occur within the Lehating Manganese Mine project site. The site is characterised by a very low density scatter of lithic artefacts. Two lithic artefacts (waste flakes from the LSA) eroding from a Hutton sand dune overlooking the Kuruman River were observed. Palaeontological resources could occur in the Lehating Manganese Mine study area. Although the palaeontological sensitivity of the study area is found to be low, the possibility of encountering Stromatolites during mining does exist.

The developer and the environmental control officer (ECO) must be made aware of the possible presence of stromatolites in the pre-Kalahari Formations and if recorded in future drilling operations, a palaeontologist must be informed and appropriate actions taken in the event of future mining of the stratigraphic units.

Historical sites of significant archaeological importance are protected by national legislation. Any mine developments should ideally avoid these resources. Any disturbance of these sites requires a permit from the South African Heritage Resources Agency (SAHRA) on the basis of further assessment work.

### **1.3.3 SOCIO-ECONOMIC**

Information in this section was sourced from the socio-economic review conducted by Strategy4Good July 2013 (Strategy4Good, July 2013) as well as Census 2011 data (Statistics South Africa, 2012) and Lehating's Social and Labour Plan.

#### **Introduction and link to impact**

The proposed project has 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 local and regional economies 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.

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 crime, introduction of diseases and disruption to the existing social structures within established communities;
- 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.

To understand the basis of these potential impacts, a baseline situational analysis is described below.

### **Data collection**

Data was collected through the review of available databases.

### **Results**

The farms Lehating 741 and Wessels 227 are all located within the John Taolo Gaetsewe District Municipality and Joe Morolong Local municipality of the Northern Cape Province. The nearest towns to the mine are the Black Rock and Hotazel (Figure 2).

#### Provincial Level – Northern Cape Province

##### *Population*

The Northern Cape Province has a population of approximately 1.146 million residents in 2011, with an average household size of 3.5.

##### *Economic activity*

Provincially it was estimated that, in 2006, the most dominant sector contributing to the Northern Cape Province's economy was the mining industry. The sectors with the smallest contributions to the province's Gross Geographic Product (GGP) were electricity and water industries.

##### *Unemployment*

It was estimated that the unemployment rate of the Northern Cape Province in 2011 was 27.4% (presenting a similar profile to South Africa as a whole – with an unemployment rate of 29.8% in the same year).

##### *Education*

Six percent of the working age population has had no formal education. Furthermore, only 13% of the total working age population in the province has a grade 12 matric education.

#### *Basic Services*

Seventy eight percent of the population's households have access to piped water inside their dwelling or yard. Approximately 66% of households in the province have access to flush or chemical toilets. Eight percent have no toilet facilities. In terms of households' dominant energy source, 85% use electricity as the primary means for lighting. Refuse removal services are provided to most households, with a small percentage of the population (an estimated 5%) not having any refuse disposal facilities.

#### *Housing*

Within the Northern Cape Province, it is estimated that 82% of the population reside in informal dwellings (with 14% of the population living in informal settlements and 4% in traditional dwellings).

### Local level – John Taolo Gaetsewe District Municipality

#### *Population*

The population residing within the John Taolo Gaetsewe District Municipality (JTGDM) constitutes approximately 20% of the total population of the Northern Cape Province. The average household size in JTGDM is estimated to be with an average household size of 3.5.

#### *Economic activity*

Mining plays an important role in the region's economy and is the district's major source of employment. It was estimated that in 2011, 8% of the district's economically active population was employed in the mining sector, with 18% being employed in the community services sector.

#### *Unemployment*

An unemployment rate of 29.7% was estimated for 2011 at the district municipal level.

#### *Education*

In 2011, approximately 61.2% of the JTGDM residents constituted the working age population. Of these individuals, 20.5% have completed matric and 14.7% have received no formal education in line with the South African schooling system.

#### *Basic Services*

Forty percent of the district municipality households' have access to piped water inside the dwelling or yard. Lower than the provincial average, 30.9% of households have access to flush or chemical toilet facilities in JTGDM. Just over the provincial level of 8%, 9.5 percent of households have no toilet facilities. Electricity is used as a primary source of energy for lighting in 87% of the homes within JTGDM. Refuse removal services are provided to the majority of all households at the district municipal level, with 7.5% not having any refuse disposal facilities.

### *Housing*

It is estimated that 23.4% of the JTGDM homes are informal dwellings.

### Municipal level: Joe Morolong Local Municipality

#### *Population*

The Joe Morolong Local Municipality (JMLM) has a population concentration of approximately 39 % of the total population of JTGDM. The average population growth rate is approximately 1.6% in the Joe Morolong Local Municipality.

#### *Economic activity*

Two percent of Joe Morolong Local Municipality's economically active population is employed by the mining industry. 34% of the economically active population is unemployed.

#### *Unemployment*

An unemployment rate of 30.1% has been estimated at the Joe Morolong local municipal level.

#### *Education*

In 2011, approximately 11% of the Joe Morolong Local Municipality is uneducated.

#### *Basic Services*

Approximately 15% of the Joe Morolong Local Municipality has access to piped water. 11% have no access to piped water sources. Approximately 9% of the Joe Morolong Local Municipality has access to flush and chemical toilets. Electricity is utilised by 81% of the population within the Joe Morolong Local Municipality.

#### *Housing*

In 2011, it was estimated that approximately 72% Joe Morolong Local Municipality comprised of formal settlements, with 4% of the households living in traditional dwellings.

### **Conclusion**

When considering socio-economic impacts the existing situation indicates that there is a measure of inward migration of people with the resultant pressure on basic infrastructure and services, informal settlement development, increased crime, introduction of diseases and disruption to the existing social structures within established communities, and pressure of delivery of basic services (health, education, sanitation, water etc).

### **1.3.4 LAND USES**

Information provided in this section was sourced by SLR as part of the proposed project.

## Introduction and link to impacts

Mining activities have the potential to affect land uses both within the proposed project 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, loss of heritage resources, 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 Collection

Mining right and land ownership details were sourced from Lehating and deed a search undertaken by SLR as part of the proposed project. On-site and surrounding land use data was sourced from site observations, social scan undertaken by SLR and the review of topographical maps and satellite imagery as part of the proposed project.

## Results – Mineral and prospecting rights

Lehating currently hold the manganese prospecting rights for Portion 1 of the farm Lehating 741 (NC 1160/PR). The application for a mining right was submitted to the DMR on 25 October 2012 and accepted by DMR on 4 March 2013 under DMR reference number NC 30/5/1/2/2/10028 MR. Ntsimbintle Mining (Pty) Ltd hold prospecting rights on Portion 2 of Wessels 227.

## Results – land ownership within and surrounding the proposed project area

The surface right owners and corresponding title deeds numbers of the land in and adjacent to the mine and project area is listed in Table 23 and Table 24 respectively.

**TABLE 23: LAND OWNERSHIP WITHIN THE PROPOSED PROJECT AREA**

Farm name	Portion number	Title Deed Number	Registered Landowner
Lehating 741	Portion 1	T628/1995	Terra Nominees (Pty) Ltd - contact person: Dineo Peta
Wessels 227	Portion 2	T904/2011	Ntsimbintle Mining (Pty) Ltd – contact person: Jeff Leader and Justin Pitt

**TABLE 24: LANDOWNERS ADJACENT TO THE PROPOSED PROJECT AREA AND MINE**

Farm name	Portion	Title deed number	Registered Landowner
Wessels 227	Portion 0	G6/1947	Hotazel Manganese Mines Pty Ltd
Wessels 227	Portion 1	T1627/1981	Eskom Holdings
Dibiaghomo 226	Portion 0	G10/1943	Joseph van der Walt
Dibiaghomo 226	Portion 1	T1133/1948	Hotazel Manganese Mines Pty Ltd
Dibiaghomo 226	Portion 2	T261/1957	Hotazel Manganese Mines Pty Ltd

Dikgathlong 268	Portion 0	G4/1924	Gawie Stols
Dikgathlong 268	Portion 1	T416/1956	Hotazel Manganese Mines Pty Ltd
Dikgathlong 268	Portion 2	T414/1956	Anna Williamson
N'Chwaning 267	Portion 0	G12/1940	Engela Elizabeth Reynecke
N'Chwaning 267	Portion 1	T541/1940	Assmang Mining
N'Chwaning 267	Portion 2	T467/1969	Eskom Holdings
N'Chwaning 267	Portion 4	T1214/1984	Assmang Mining
N'Chwaning 267	Portion 5	T1608/1983	Telkom S A Ltd
N'Chwaning 267	Portion 7	T343/2004	Delta EMD
Rhodes 269	Portion 0	G30/1947	Nicky Pretorius
East 270	Portion 0	G25/1954	Nicky Pretorius
East 270	Portion 1	T479/1958	Nicky Pretorius
East 270	Portion 2	T993/1972	George Smit
Cornish 225	Portion 0	G6/1931	V-C Lamprecht Trust
Bowden 223	Portion 0	G2/1928	Moshaweng Plaaslike Municipaliteit
Bowden 223	Portion 1	T960/1953	Kobus Grobler
Bowden 223	Portion 2	T562/1971	Moshaweng Plaaslike Municipaliteit
Mathlapani 222	Portion 0	G12/1929	Rian van der Westhuizen
Mathlapani 222	Portion 1	T94/1930	Johanna Alida van der Westhuizen
Titanic 221	Portion 0	T4115/2004	Itekeng Dipudi Project Trust
Vostershoop 706	Portion 0	G6/1925	V-C Lamprecht Trust
Annex Gamodisa 707	Portion 0	KF2/7	Jan van Straten
Gamodisa 712	Portion 0	FT2431-KF2/3	Department of Land Affairs
Gamodisa 712	Portion 2	T526/1957	Department of Land Affairs
Karlsruhe 711	Portion 0	FT2432-KF2/4	Karlsruhe Trust
Karlsruhe 711	Portion 1	T86/1950	Karlsruhe Trust
Karlsruhe 711	Portion 2	T252/1960	Karlsruhe Trust
Karlsruhe 711	Portion 3	T252/1960	Karlsruhe Trust
Karlsruhe 711	Portion 4	T692/1962	Martinus Venter
Sirocco 703	Portion 42	T304/1944	Martinus Venter
Rosebank 703	Portion 43	T1048/1950	Karlsruhe Trust
Morgenzon 703	Portion 42	T932/1947	Karlsruhe Trust
Eersbeijnt 703	Portion 43	T49/1931	Saltrim Ranches
Grafton 709	Portion 0	KF3/26	Saltrim Ranches
Grafton 709	Portion 1	T11/1954	Carel Reynecke



Mollersville 703	Portion 49	G21/1932	Mollersville Boerdery
Boerdraai 228	Portion 0	G10/1930	Hester Magdalena Gertruida Stols
Mecca 233	Portion 0	T45/1951	Mecca Trust
Bergheim 229	Portion 0	T3/1951	Manganese Mines of South Africa
Harefield 232	Portion 0	T2/1953	Joseph van der Walt and Willem van der Walt
Santoy 230	Portion 0	G13/1940	Johan Lamprecht
Belgravia 264	Portion 0	G11/1940	Assmang Mining
Belgravia 264	Portion 1	T540/1940	Assmang Mining
Elizabethville 231	Portion 0	G23/1953	Elizabethville CC

### Results – land claims

According to the Department of Rural Development and Land Reform (Regional Land Claim Commissioner), a land claim has been submitted by the Madibeng community for Portion 1 of the farm Lehating 741 (Appendix A). The merits of the land claim have not been adjudicated.

### Results - Land use within the project site (Lehating 741 and Wessels 227)

Land use within the project site is a predominantly agriculture and prospecting activities. More detail is provided below:

#### *Agriculture*

Within the project site, agricultural activities currently undertaken include grazing for livestock. It is a condition of the relevant grazing lease agreement that grazing must give way to mining if a mining project is approved. Farmers in the area rely on groundwater and borehole access to provide water for their livestock because the area receives low annual rainfall.

#### *Community/suburban areas*

There are no communities located on the project site.

#### *Infrastructure and servitudes*

There are no powerline or telecommunication servitudes on the project site.

### Result - Land use surrounding the project site in the greater study area

Land use surrounding the study area is a mixture of agriculture, community, infrastructure/servitudes, recreational activities and mining activities. More detail is provided below:

### *Agriculture*

Within the study area, agricultural activities currently undertaken include grazing for livestock. Farmers in the area rely on groundwater and borehole access to provide water for their livestock because the area receives low annual rainfall.

### *Communities/suburban*

The Black Rock (10km south) and Hotazel communities (19km south east) are both located to the south of the study area (Figure 2). The Black Rock and Hotazel communities have residential components as well as varying types of amenities and facilities such as schools and shops.

With reference to Figure 14 the following residences (potential environmental impact receptor sites) are located near the project area:

- farm homesteads (for farm owners and farm workers), the closest of which are on Portion 0 of Lehating 741 and Portion 0 of Boerdraai 228 - approximately 2.5km from the proposed infrastructure site;
- temporary prefab accommodation compound rented by mines in the region for workers on Portion 0 of Dibiaghomo 226 - approximately 4.5km from the infrastructure site.

### *Infrastructure and servitudes*

The study area incorporates various roads and powerlines (refer to Figure 2 and Figure 16) Further detail is provided below.

The un-surfaced R380 road runs along the southern side of the Kuruman River to the south of the project site, linking Hotazel in the south east with McCarthy's Rest border post in the north. Various un-surfaced farm roads are present throughout the study area and surrounding properties.

A 132KV power line is located to the south of the study area, which follows the R380 road route (on the northern and eastern side of the road).

### *Recreational activities*

There are a number of recreational facilities within the vicinity of the study area. These include:

- Hotazel Recreation Club, approximately 19 km to the south-east of the study area, and includes facilities such as tennis and squash courts as well as a golf course;
- Tswalu Kalahari Reserve, which lies on the at the foot of the Korannaberg mountains, approximately 55km south west of the study area;
- The Eye of Kuruman, a natural spring, approximately 75km south east of the study area; and
- Kgalagadi Transfrontier Park lies further afield, approximately 260km to the north west of the study area and includes various tourist activities and facilities.

Various other mining project/operations located in the immediate vicinity of the study area include:

- Assmang's N'Chwaning and Gloria mines (exclusively underground);
- Samancor's Wessels (exclusively underground) and Mamatwan (opencast) mines;
- United Manganese of the Kalahari (UMK) mine (opencast);
- Kudumane Manganese Mine (opencast and underground);
- Kgalagadi Manganese mine (underground); and
- Ntsimbintle mine (opencast and underground).

Other decommissioned and closed mining operations include:

- N'Chwaning shaft 1;
- Black Rock;
- Hotazel;
- Devon;
- York;
- Perth;
- Smartt;
- Adams; and
- Middelplaats.

## Conclusion

There are a number of land uses in the surrounding project site and study area which may be influenced by the proposed project and associated potential environmental impacts. It follows that all potential impacts require careful consideration so as not to reduce the quality of life of nearby land users.

## 1.4 MAPS SHOWING THE SPATIAL LOCALITY AND AERIAL EXTENT OF ENVIRONMENTAL FEATURES

This section includes a series of maps that show the spatial locality and aerial extent of all environmental, cultural/heritage, infrastructure and land use features identified on site and on the neighbouring properties and farms. These maps include:

- Regional geology (Figure 3);
- Stratigraphy of the of the Kalahari Complex (Figure 4)
- Period average wind roses (Figure 5);
- Seasonal wind roses (Figure 6);
- Day and night wind roses (Figure 7);
- Soil forms within the proposed project area (Figure 8)
- Vegetation types (Figure 9);
- Areas of sensitivity (Figure 10);

- Hydrological catchment areas (Figure 11);
- Floodlines (Figure 12);
- Hydrocensus Sample Points (Figure 13);
- Receptors and surrounding disturbances (Figure 14);
- Heritage sites (Figure 15); and
- Land use (Figure 16).

**FIGURE 3: REGIONAL GEOLOGY**

**FIGURE 4: STRATIGRAPHY OF THE KALAHARI COMPLEX**

**FIGURE 5: PERIOD AVERAGE WIND ROSES (AIRSHED, JULY 2013)**

**FIGURE 6: SEASONAL WIND ROSES (AIRSHED, JULY 2013)**



**FIGURE 7: DAY AND NIGHT WIND ROSES (AIRSHED, JULY 2013)**

**FIGURE 8: SOIL FORMS WITHIN THE PROPOSED PROJECT AREA (ARC-ISCW, MAY 2013)**

**FIGURE 9: VEGETATION TYPES (EMS, JULY 2013)**

**FIGURE 10: AREAS OF SENSITIVITY (EMS, JULY 2013)**

**FIGURE 11: HYDROLOGICAL CATCHMENT AREAS (SLR, MAY 2013)**

**FIGURE 12: FLOODLINES (SLR, MAY 2013)**

**FIGURE 13: HYDROCENSUS SAMPLE POINTS (SLR, JULY 2013)**

**FIGURE 14: RECEPTORS AND SURROUNDING DISTURBANCES (AIRSHED, JULY 2013)**



**FIGURE 15: HERITAGE SITES (PGS, JULY 2013)**

**FIGURE 16: LAND USE (SLR, JULY 2013)**

## **2 PROPOSED MINING PROJECT**

The information in this section was provided to SLR by the Lehating project team and sourced from the Lehating Bankable Feasibility Study conducted by TWP Projects (Pty) Ltd (TWP, 2012).

### **2.1 MINERAL TO BE MINED**

Lehating currently holds the manganese and iron ore prospecting rights for a defined 98 hectare portion of Portion 1 of the farm Lehating 741 (NC 30/5/1/1/2/1160 PR). The application for a mining right was submitted to the DMR on 25 October 2012 and accepted by DMR on 4 March 2013 under DMR reference number NC 30/5/1/2/2/10028 MR. Lehating Mine's mining right application is for the mining of manganese and iron ore.

### **2.2 MINING AND MINERAL PROCESSING METHOD TO BE EMPLOYED**

This section should be read with reference to the conceptual process flow diagram and overall site layout drawings (Figure 17 and Figure 18).

#### **2.2.1 UNDERGROUND MINING METHOD**

The mining method selected was that of trackless mechanised bord and pillar mining (TWP, 2012). The method selected for the project is typical in the Kalahari Manganese Field (KMF) and is used in all wide body mines from the perspectives of safety and productivity.

The manganese reef will be accessed through two vertical shafts to reach the ore body which is between 3.49m and 6.78m thick. The shaft system consists of a main shaft with a lined diameter of 6.5 metres which will be used for men and material, and a ventilation shaft with a lined diameter of 5.1m metres. The shaft's design depths are 273 and 241 metres respectively.

Topsoil from the shaft areas will be excavated and stockpiled, for use in rehabilitation at a later phase. In the process of shaft development, pre-stripping material and waste rock will be removed and stockpiled. During mining, the blasted Run of Mine (ROM) ore will be transported by Load-Haul-Dump (LHDs) and mine trucks to the underground silos to undergo the first sizing. The ROM will be passed through a screen which will separate out undersized and oversized ROM material. Undersized material (<350mm) will pass into the silo, and oversized material (>350mm) to be further broken down by a mobile impact breaker and then fed into the silo. All of the ore passing through the silo is now <350mm in size, and will be extracted from the underside of the silo into skips for transport to surface.

Waste rock generated during the course of underground mining will either be loaded into a rear tipper truck and then transported to the waste rock stockpile, or stored underground. Minimum waste rock is expected as mining will be carried on reef.

**2.2.2 MINERAL PROCESSING METHOD**

Manganese ore is classified by Lehating as follows:

Classification	Class	Description
Grade	Low	Less than 44% Manganese by weight
	High	Equal to or greater than 44% Manganese by weight
Size	Lumpy or coarse ore	More than 9mm but less than 75mm
	Fines ore	More than 1mm but less than -6mm
	Slimes or tailings	Less than 1mm

The ROM will be processed on site by a crushing and screening plant with equipment for low and high grade ore. The process plant will produce a coarse (-75+6mm) and fines (-6+1mm) product for sale. All -1mm product will be pumped for storage at the Tailings Storage Facility (TSF).

Ore Receiving, primary crushing and screening

Ore will be delivered from the main shaft underground silos to the processing plant via a skip. Primary crushing will take place underground with the crushed ore transported by skip to the surface ore bin. From the bin the ore is fed onto a conveyor system for onward processing in the plant. Thereafter ore will be diverted into two crushed ore stockpiles of >100mm and <100mm. Water sprays will be used for dust suppression during crushing.

The crushed ore will be conveyed from the underside of the stockpile, then passed through a series of vibrating feeders and to a scalping screen for the reclamation of <100mm or >100mm material for processing. The conveyor will be fitted with a belt magnet to remove any tramp iron that could potentially damage the screens and crushers.

Scalping screen and secondary crushing

The scalping screen will separate ore into undersize (<75mm) and oversize (>75mm). The undersize ore from the scalping screen will be collected and conveyed to the primary screen. The oversize will be conveyed to a secondary crusher process at a cone crusher, where it will pass through a cone crusher control setting (CSS) of 40mm and then to the primary screen conveyor. Dust suppression will be provided at the secondary crusher.

Primary screening

The primary screen consists of a top and bottom deck, and is fitted with spray nozzles to effectively wash off all fines. The ore that is passed through the primary screen and is sized between 6mm and 75mm (oversize) will be conveyed to the coarse product stockpile. The undersized ore (less than 6mm) will be conveyed to the secondary screen. There is the allowance for water to be added to the undersize at this stage to ensure that there is a steady flow to the secondary screening. Dust suppression will be provided at the primary screening section.

Secondary screening

The secondary classification screen consists of a top and bottom deck, and is fitted with spray nozzles to effectively wash off all fines. The ore that is passed through the secondary screen and is sized between 1mm and 6mm (oversize) will be conveyed to the fine product stockpile. The undersized ore (less than 1mm) will be pumped through a desliming cyclone situated at the thickener, in order to remove fine particles. Dust suppression will be provided at the secondary screening section.

#### Dewatering

Undersize from the secondary screening section will flow to the desliming cyclone. The overflow will be introduced into the thickener, and the cyclone underflow will be collected in the tailings tank for disposal at the tailings storage facility. Flocculants will be added to the ultrafine overflow material (<50 microns) to assist in the settling of solids, and this clarified water will be collected in the process water tank for redistribution within the processing circuit. The underflow from the thickener will be pumped into a tailings tank where it will be combined with the underflow received from the dewatering cyclone and delivered to the TSF for disposal. A barge located within a sump on the tailings dam will recover any clarified water from the TSF and direct the water via a pipeline to a silt trap. The clear water recovered from the silt trap will be pumped to the process water tank. Solids collected in the silt trap will be removed periodically for disposal to the TSF.

#### Product transport, loading and dispatch

The course product (between 6 and 75mm) which is received from the primary screen will be conveyed to the coarse product stockpile. The fine product (less than 6mm) will be conveyed from the secondary screen, and will be stored in the fines stockpile. The two ore stockpiles are separated by a concrete partition to prevent cross contamination between the two products.

The course product will be passed through a vibrating feeder onto a conveyor which will forward the product to either 20 tonne or 34 tonne payload trucks.

The fines product will be loaded by a front loader and transferred to one of three destinations depending on the market cycle and demand for the product. The fines product may be trucked to the waste rock dump where there will be a dedicated fine ore product stockpile for the storage of fines. Fines product may also be loaded into a load-in hopper or a feeder hopper for bagging into bulk bags.

**FIGURE 17: CONCEPTUAL PROCESS FLOW DIAGRAM**

## **2.3 LIST OF MAIN ACTIONS/ACTIVITIES/PROCESSES ON SITE**

Key proposed activities including activities that currently take place at the Lehating Manganese Mine during each phase (construction, operational, decommissioning, closure) are listed in Table 25 below. For the purposes of this report, in broad terms, construction is the phase in which infrastructure is established, operation covers the production phase, decommissioning covers infrastructure removal and site rehabilitation, and the closure phase refers to the period of time when maintenance and aftercare of rehabilitated areas and facilities is required to ensure closure objectives are met.

This table reflects the chosen preferred alternative. Alternatives considered in the development of the proposed project plan are discussed in Section 2.8.

**TABLE 25: LIST OF ACTIONS / ACTIVITIES / PROCESSES**

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
<b>Site preparation</b>	Bush clearing in line with Lehigh biodiversity management plan	On-going	As required	As required	
	Removal of existing structures (if present).	On-going	As required	As required	
	Establishing the construction contractor's camp	At start of phase	As required	As required	
<b>Earthworks</b>	Vehicle maintenance, wash bays, storage of fuel and lubricants	On-going	As required	As required	
	Stripping and stockpiling of soil resources in line with soil conservation procedure	On-going	As required	As required	
	Cleaning, grubbing and bulldozing activities	On-going	As required	As required	
	Establishing internal roads	On-going	As required	As required	
	Digging trenches and foundations. Possible blasting	On-going	As required	As required	
	Establishing storm water controls (channels, berms) as per storm water management plan	At start of phase	As required	As required	
<b>Civil works</b> Civil works on site relate mainly to any steel and concrete work.	General building activities and erection of structures	On-going	As required	As required	
	Foundation excavations and compaction	On-going	As required	As required	
	Use of scaffolding and cranes	On-going	As required	As required	
	Erection and destruction of scaffolding	On-going	As required	As required	
	Mixing of concrete and concrete work, such as concrete plinths	On-going	As required	As required	
	Steel work (including grinding and welding)	On-going	As required	As required	
	Vehicle maintenance and wash bays	On-going	As required	As required	
	Storage and handling of: fuel, lubricants, sand, rock, cement, chemical additives in cements	On-going	As required	As required	
	Installing re-enforcement steel	On-going	As required	As required	
<b>Main and Ventilation Shafts</b>	Sinking of Main and Ventilation shafts and underground mining infrastructure using drilling and blasting methods	On-going	On-going		
	Construction and operation of shaft supporting infrastructure typically includes: - a winder house (rock, service, man and materials) - ventilation shaft with fans - compressor infrastructure - bulk air cooler shaft - headgear	On-going	On-going		



Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	- conveyor belts				
	Water management facilities include: - Diversion of clean water - Separation of dirty water and clean water - Collection of dirty water using pollution control dam for recycling and re-use	On-going	On-going	On-going	
	Stockpiling of waste rock	On-going	On-going	On-going	Permanent
	Construction and utilisation site support services include: - Workshop equipped with washbays - Office complex including IT facilities - Change house and ablution facilities - Sewage treatment plant - Silos - Diesel storage tanks (re-fuelling of equipment) - Parking area - Explosives magazine - Stores - Waste management area for hazardous and non-hazardous input materials and waste - Crushed ore and product stockpiles - Medical clinic - Change room and lamp room	On-going	On-going		
<b>Process Plant</b>	Ore processing (primary screening and crushing and secondary screening and crushing)		On-going		
	Water management facilities include: - collection of dirty run-off, process water and spills using sumps, pipes, canals, pumps and dams - storage facilities for receiving recycled process water, clean make-up potable water and stormwater - diversion of clean water around infrastructure	On-going	On-going	On-going	
	Construction and utilisation of site supporting services include: - stores for the storage of hazardous and non-hazardous material which include the following: oil, grease, steel balls, conveyor lining, general	On-going	On-going		

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	<ul style="list-style-type: none"> <li>equipment and spares</li> <li>workshops and wash bays</li> <li>laydown areas for contractors</li> <li>compressor house</li> <li>power lines and substations</li> <li>offices, ablution facilities, change house, parking, medical clinic</li> <li>laboratory</li> <li>storage of hazardous and non-hazardous waste</li> <li>crushed ore and product stockpiles</li> </ul>				
<b>Tailings Storage Facility</b>	Delivery of tailings from process plant via pipeline		On-going		
	Water management facilities for TSF to control/contain dirty seepage and runoff	On-going	On-going	On-going	
	Final disposal				Permanent
<b>Power and compressed air supply and use</b>	Construction, operation and maintenance of electricity lines, compressors and compressed air pipe lines	On-going	On-going	On-going	
	Construction, operation and maintenance of substations and transformers	On-going	On-going	On-going	
<b>Water supply and use</b>	Construction, operation and maintenance of pipelines and well fields for water supply	On-going	On-going		
	Recycling and re-use via pipelines from the following sources: <ul style="list-style-type: none"> <li>Raw water tank;</li> <li>Process water tank;</li> <li>Sewage treatment plant;</li> <li>Reverse osmosis treatment plant;</li> <li>Tailings return water;</li> <li>Pollution control dam;</li> <li>Emergency storage dam;</li> <li>Shaft ingress water from fissures</li> </ul>	On-going	On-going	On-going	
<b>Transport systems</b>	Construction, operation and maintenance of internal and access roads	On-going	On-going	On-going	
	Vehicle, hopper and equipment servicing and maintenance workshops, spray painting and wash bays.	On-going	On-going	On-going	
	Installation and use of parking, loading and off-	On-going	On-going	On-going	

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	loading areas for trucks, busses and other vehicles				
	Transportation of staff to and from site (using private cars and busses via gravel roads)	On-going	On-going	On-going	
	Transport of input materials, supplies, services, sewage and waste removal (using trucks and vans via gravel roads)	On-going	On-going	On-going	Limited
	Transportation of ROM, soil and waste rock via conveyors, shaft and trucks		On-going	On-going	Limited
	Transport of manganese ore product via trucks		On-going		
	Transportation of materials and explosives to underground mine working using main shaft		On-going		
<b>Non-mineralised waste management</b> (general and industrial hazardous)	Handling and storage of general waste on site: - domestic waste; - cleared vegetation; - building rubble.	On-going	On-going	On-going	
	Handling and storage of hazardous waste on site: - fuel; - lubricants; - explosive packaging.	On-going	On-going	On-going	
	Separation of oil and water at wash bays	On-going	On-going	On-going	Limited
	Disposal and/or treatment of contaminated soils in bio-remediation facility	On-going	On-going	On-going	
	Storage of hazardous waste within dedicated demarcated containers/areas	On-going	On-going	On-going	
	Removal of waste by contractor for recycling, re-use and/or final disposal at appropriately licensed waste management facilities	On-going	On-going	On-going	
	Treatment of sewage sludge at the on-site sewage treatment facility. The treated sludge is used for topsoil enhancement for rehabilitation purposes or transported off site. The treated effluent is disinfected and used for dust suppression	On-going	On-going	On-going	
<b>General site management</b>	Appointment of contractors and establishment of contractor working camps and areas	On-going	On-going	On-going	On-going
	Site management (monitoring, inspections, maintenance, security, access control)	On-going	On-going	On-going	On-going
	Environmental awareness training and emergency	On-going	On-going	On-going	On-going

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
	response				
	On-going rehabilitation of facilities/disturbed areas (where possible)	On-going	On-going	On-going	On-going
	Implementing and maintaining management plans	On-going	On-going	On-going	On-going
<b>Other support services and amenities</b>	On-site first aid facilities and medical clinic for Lehaping employees and contractors	On-going	On-going	On-going	
	Training facilities	On-going	On-going	On-going	
	Various office and administration areas	On-going	On-going	On-going	
<b>Demolition</b>	Removing construction contractor's camp	At end of phase		At end of phase	
	Dismantling and demolition of infrastructure and equipment. Possible blasting		For maintenance	On-going	
	Utilisation of site supporting services: - access control and security - contractors camp - workshops and wash bays - general stores - storage area for hazardous and non-hazardous waste - formal ablution - diesel tanks and or diesel bowsers (re-fuelling equipment)		For maintenance	On-going	
	Sealing shafts and providing underground support infrastructure		For maintenance	On-going	
<b>Rehabilitation</b>	Replacing soil resources	On-going	On-going	On-going	
	Slope stabilisation and erosion control	On-going	On-going	On-going	
	Landscaping	On-going	On-going	On-going	
	Re-vegetation of disturbed areas and where infrastructure was removed	On-going	On-going	On-going	
	Removal of alien invasive species from rehabilitated sites	On-going	On-going	On-going	
	Restoration of natural drainage patterns as far as practically possible	On-going	On-going	On-going	
	Rehabilitation of all mineralised waste facilities and other stockpiles(tailings storage facility and waste rock)	On-going	On-going	On-going	
	Rehabilitation of internal and access roads		On-going	On-going	
	Remediation of groundwater (if required)		As required	As required	As required

Main activity/process	Typical sub-activities	Construction	Operation	Decommissioning	Closure
Maintenance and aftercare	Initiation of aftercare and maintenance program			At end of phase	
	Maintenance and repair of post closure landforms, facilities, and rehabilitated areas				On-going

## **2.4 PLAN SHOWING LOCATION AND EXTENT OF OPERATIONS**

### **2.4.1 SURFACE INFRASTRUCTURE**

The topographical setting of the infrastructure is provided in Figure 2. A site layout of the proposed Lehating operation is provided in Figure 18.

This figure provides an indication of the location of the key infrastructure components including the following:

- access road;
- dirty water containment facility;
- emergency dirty water containment facility;
- topsoil stockpile;
- tailings storage facility;
- process water tank;
- internal roads;
- process plant, containing primary and secondary screens and crushers;
- settling pond;
- ventilation shaft;
- main shaft;
- stores and workshops;
- offices, change house and medical clinic;
- service road to wellfield boreholes;
- contractor laydown area;
- fine and course product stockpiles;
- waste management facilities including sewage treatment plant and bioremediation facility;
- waste rock stockpile;
- stormwater management drainage channels;
- changehouse;
- crushed ore stockpiles;
- substation and generators;
- fire water tank; and
- dust suppression tank.

**FIGURE 18: PROPOSED CONCEPTUAL INFRASTRUCTURE LAYOUT**

**FIGURE 19: CONCEPTUAL ROAD INTERSECTION LAYOUT FOR TARRED R380 SCENARIO ONLY**



**FIGURE 20: CONCEPTUAL ACCESS ROAD RIVER CROSSING LAYOUT AND CROSS SECTION**

## 2.5 LISTED ACTIVITIES IN TERMS OF NEMA AND NEM:WA EIA REGULATIONS

The listed activities for the proposed project that were applied for in terms of NEMA are included in Table 26. The waste listed activities for the proposed project that were applied for in terms of NEMWA are included in Table 27. These activities have been incorporated into the list of project activities as presented in Table 25. Refer to Appendix A for the NEMA and NEMWA applications.

**TABLE 26: NEMA LISTED ACTIVITIES APPLIED FOR AS PER THE JUNE 2010 REGULATIONS**

Activity No.	Listed Activity	Activity description
<b>Regulation 544, 18 June 2010, Listing Notice 1</b>		
1	The construction of facilities or infrastructure for the generation of electricity where: (i) the electricity output is more than 10 megawatts but less than 20 megawatts; or (ii) the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare	Diesel powered electricity generators used at construction phase will be in the region of 7.5MW – 10MW. The final output will be confirmed once specific details are known.
10	The construction of facilities or infrastructure for the transmission and distribution of electricity – (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or (ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.	The Lehating power transformer (substation) will have the capacity to step power from the external powerline (expected to be 132kV) to 11kV required on site.
11	The construction of: (i) canals (ii) channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk storm water outlet structures; (vii) marinas; (viii) jetties exceeding 50 square metres in size; (ix) slipways exceeding 50 square metres in size; or (x) buildings exceeding 50 square metres in size; or (i) infrastructure or structures covering 50 square metres or more; where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	A river crossing is proposed over the Kuruman River so as to provide access to Portion 1 of Lehating 741 from Portion 2 of Wessels 227.
12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010.	The proposed project will require the construction of return water and stormwater control dams.
13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.	The proposed project will require the storage and handling of fuel with a combined capacity exceeding 80 cubic metres.

Activity No.	Listed Activity	Activity description
18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from <ul style="list-style-type: none"> <li>(i) a watercourse</li> <li>(ii) the sea;</li> <li>(iii) the seashore;</li> <li>(iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater –</li> </ul> but excluding where such infilling, depositing, dredging, excavation, removal or moving <ul style="list-style-type: none"> <li>(i) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or</li> <li>(ii) occurs behind the development setback line.</li> </ul>	The construction of the proposed river crossings may require the excavation, removing and/or removal of soil in excess of 5m <sup>3</sup> from a watercourse.
22	The construction of a road, outside urban areas, <ul style="list-style-type: none"> <li>(i) with a reserve wider than 13,5 metres or,</li> <li>(ii) where no reserve exists where the road is wider than 8 metres, or</li> <li>(iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.</li> </ul>	Preliminary design information indicates that the access road on Lehating and Wessels will be wider than 8m.
26	Any process or activity identified in terms of Section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004):	Prior to removing or damaging any protected plant species, the necessary permits will be required from the Department of Agriculture, Forestry and Fisheries (DAFF) as well as from DENC in terms of the National Forests Act, 84 of 1998 and authorisation from the Department of Nature Conservation (DENC) in compliance with the Northern Cape Nature Conservation Ordinance (Schedule 4).
<b>Regulation 545, 18 June 2010, Listing Notice 2</b>		
5	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of Section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the Act will apply.	The proposed Lehating project will require the submission of a Water Use Licence application for the control of pollution from the tailings dam and waste rock facilities.
15	Physical alternation of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: <ul style="list-style-type: none"> <li>(i) linear development activities; or</li> <li>(ii) agriculture or afforestation where activity 16 in this schedule will apply.</li> </ul>	The total site area that will be transformed will exceed 20 hectares.
19	The construction of a dam, where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high-water mark of the dam covers an area of 10 hectares or more.	The proposed project will require the construction of return water and stormwater control dams.

Activity No.	Listed Activity	Activity description
<b>Regulation 546, 18 June 2010, Listing Notice 3</b>		
2	The construction of reservoirs for bulk water supply with a capacity of more than 250 cubic meters; (a) in the Northern cape Province; (iii) Outside urban areas, in: (bb) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;	The proposed project will require the construction of return water and stormwater control dams that are calculated as having a combined capacity of more the 250 cubic meters.
3	The construction of masts or towers of any material or type used for telecommunication broadcasting or radio transmission purpose; (a) in the Northern cape Province; (ii) Outside urban areas, in: (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;	The proposed project will require the construction of a telecommunication mast or tower.
4	The construction of a road wider than 4 meters with a reserve less than 13,5 meters; (a) in the Northern cape Province; (ii) Outside urban areas, in: (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;	The project area is located near to a Sensitive Area and will require the construction of a road wider than 4 metres.
9	The construction of above ground cableways and funiculars; (a) in the Northern cape Province; (ii) Outside urban areas.	The proposed project will require the construction of conveyors.
10	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in container with a combined capacity of 30 but not exceeding 80 cubic metres. (a) in the Northern Cape province: (ii) Outside urban areas. (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;	The proposed project will require the storage and handling of fuel with a combined capacity exceeding 30 cubic metres.
14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation; (a) in the Northern Cape Province; (i) All areas outside urban areas	The proposed project will require the removal of indigenous vegetation for the establishment of the proposed main and ventilation shafts and surface infrastructure.
16	The construction of: (iv) infrastructure covering 10 square metres in size or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. (a) in the Northern Cape Province; (ii) Outside urban areas. (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority.	In order to facilitate access to the proposed project site, a river-crossing road will be constructed over the Kuruman river.

**TABLE 27: NEM:WA LISTED WASTE MANAGEMENT ACTIVITIES APPLIED FOR AS PER GN32368, OF 3 JULY 2009**

Activity No.	Listed Activity	Activity description
Category A3 (1)	The storage, including the temporary storage, of general waste at a facility that has the capacity to store in excess of 100m <sup>3</sup> of general waste at any one time, excluding the storage of waste in lagoons.	The temporary storage of general waste.
Category A3 (2)	The storage including the temporary storage of hazardous waste at a facility that has the capacity to store in excess of 35m <sup>3</sup> of hazardous waste at any one time, excluding the storage of hazardous waste in lagoons.	The temporary storage of hazardous waste.
Category A3 (5)	The sorting, shredding, grinding or bailing of general waste at a facility that has the capacity to process in excess of one ton of general waste per day.	The biological treatment of soils contaminated with hydrocarbons
Category A3 (18)	The construction of facilities for activities listed in Category A of this Schedule (not in isolation to associated activity).	The construction of facilities for activities listed in Category A of this Schedule (not in isolation to associated activity).
Category B4 (7)	The treatment of effluent, wastewater or sewage with an annual throughput capacity of ≥15 000m <sup>3</sup> .	The treatment of effluent, waste water or sewage.
Category B4 (11)	The construction of facilities for activities listed in Category B of this Schedule (not in isolation to associated activity).	The construction of facilities for activities listed in Category B.

## 2.6 INDICATION OF PHASES AND TIMEFRAMES ASSOCIATED WITH THE MAIN ACTIONS/ ACTIVITIES/ PROCESSES

The timeline for the proposed project is provided in Table 28 below. The commencement of the proposed project is subject to authorisation.

**TABLE 28: ANTICIPATED PHASES AND TIMEFRAMES FOR THE PROPOSED PROJECT**

Aspect	Timeframe
<b>Vegetation clearing and earthworks</b>	
Start construction	First quarter of 2015
Duration of construction	Approximately 6 months
<b>Establishment of new access road</b>	
Start construction	First quarter of 2015
Duration of construction	Approximately 6 months
Life of operation	For the life of mine
<b>Construction of Waste Rock Dump</b>	
Start construction	Third quarter of 2015

Duration of construction	Approximately 3 months
Life of operation	For the life of mine
<b>Shaft Sinking</b>	
Start construction	Third quarter of 2015
Duration of construction	Approximately 21 months
Life of operation	For the life of mine
<b>Tailings Facility Construction</b>	
Start construction	Fourth quarter of 2015
Duration of construction	Approximately 6 months
Life of operation	For the life of mine
<b>Process Plant Construction</b>	
Start construction	First quarter of 2017
Duration of construction	Approximately 9 months
Life of operation	For the life of mine
<b>Construction of Water and Power Supply</b>	
Start construction	First quarter of 2016
Duration of construction	Approximately 6 months
Life of operation	For the life of mine
<b>Construction of Sewage Plant</b>	
Start construction	First quarter of 2016
Duration of construction	Approximately 3 months
Life of operation	For the life of mine
<b>Underground Drilling and Blasting</b>	
Start construction	First quarter of 2018
Duration of construction	Approximately 15 months
Life of operation	For the life of mine

## 2.7 ADDITIONAL INFORMATION

This section provides additional technical information relative to the construction, operation, decommissioning and closure phases for the proposed project.

### 2.7.1 CONSTRUCTION PHASE

An overview of the key mining and processing activities is provided in Section 2.3. Further detail where required is provided in the sections below.

#### Site preparation

The site will be prepared through the selective clearing of vegetation in areas designated for surface infrastructure in line with a biodiversity management plan and soil conservation procedure. Topsoil will be stripped and stockpiled. During this phase there will be the establishment of the access road and internal roads, digging of foundations and trenches, drilling and blasting associated with the development of the main shaft and the ventilation shaft and if required, there will be dewatering. Other mine infrastructure will be constructed including shafts, waste rock stockpile, plant infrastructure including processing plant,

stockpile pads, tailings storage. Related support facilities such as storm water management dams, solid waste management facilities, sewage treatment plant, water supply infrastructure and power supply infrastructure will be developed.

### Support services and facilities

The proposed support facilities that will be required include:

- portable air compressors for sinking operations;
- temporary handling and storage area for construction materials (paints, solvents, oils, grease);
- temporary storage area for non-mineralised waste prior to removal by appropriate contractor;
- temporary water supply will be supplied by borehole and/or trucks;
- power supply will be by temporary diesel-powered electricity generator;
- stores, workshops and wash bays;
- fuel handling and storage area;
- explosives magazine;
- temporary offices and temporary chemical toilets; and
- settling ponds for sinking operations.

These facilities would either be removed at the end of the construction phase or incorporated into the layout of the proposed operational infrastructure.

### Contractor facilities

The proposed project will require the establishment of contractor facilities and as such a construction camp, wash bays, contractor's laydown areas, workshops, administrative buildings, change houses, designated waste disposal areas, stores and parking areas will be established.

### Employment and housing for construction phase

The total construction worker compliment over the construction phase is approximately 320 people. There will be a construction camp on site for the duration of the construction phase. During peak construction periods there will be approximately 180 workers on site that will be accommodated as per the specifications in Table 29.

**TABLE 29: CONSTRUCTION ACCOMMODATION CAMP**

Item	Description
Duration	The camp will be a temporary facility that is required for approximately 3 years
Capacity	The camp will be designed to house up to 180 occupants during peak construction periods.
Occupants	Only construction workers and camp facility service personnel will be permitted to stay in the camp.
Ablution facilities	Prefab toilets and showers will be provided until the permanent sewerage plant is constructed.
Transport	The construction work cycle will be six days on duty and one day off duty.
Potable water	Water will be abstracted from a well-field comprising four boreholes each

Item	Description
	delivering raw water to a raw water tank located in its permanent position on the construction camp terrace. A reverse osmosis plant will be installed to treat the water to potable water standard as required.
Power supply	Power will be sourced from a temporary 500kVA diesel generator.
Sewage	Sewage will be treated in the sewage treatment plant.
General waste	General waste will be sorted and stored before being trucked off site and disposed of at the appropriately licenced waste facility. The construction camp company would be responsible for disposing of waste generated as a result of the construction camp operations.
Health, safety and environment	All camp occupants will receive induction on arrival and at appropriate intervals when returning from extended leave periods. There will be ongoing awareness campaigns.
Security	The camp will be fenced and will have one access gate with 24 hour security.

### Transportation for construction

#### Routes and mechanisms

As part of the proposed project, a 10m wide gravel access road will be constructed to provide access from the R380 road to the Lehating Mine site surface infrastructure. If the R380 remains as a gravel road there will be no road intersection upgrade in terms of additional lanes and road markings etc. There will however be lighting at the intersection, stop control of traffic travelling from the mine to the R380 and speed control measures on the R380 in the vicinity of the intersection. If the R380 is tarred, the intersection will be upgraded in accordance with the specifications in Figure 19 as an addition to the aforementioned lighting, speed and stop controls.

The access road will have to cross the Kuruman River (Figure 20). The proposed crossing will be achieved by means of a drift constructed from precast concrete culverts. The drift height and culvert sizes have been specified to accommodate the 1 in 50 year storm event. The drift was sized and designed in a similar manner to the existing R380 river crossing. The access road will be constructed using in-situ sands and waste rock sourced from Wessels Manganese Mine.

#### Workers, materials and supplies

During the construction of the Lehating Manganese Mine there will be workers travelling to and from site, vehicles supplying input materials and machinery, and vehicles removing ore. Table 30 below provides a conceptual indication of the traffic associated with the construction phase of the Lehating Manganese Mine.

**TABLE 30: CONSTRUCTION PHASE TRAFFIC: WORKERS, MATERIALS AND SUPPLIES**

Item	Number of vehicles to and from site per day	Transportation routes
<b>Construction workers</b>		
Construction workers transported via own vehicles	Approximately forty two light vehicles per day	Workers, contractors and trucks are likely to come from Kuruman, Hotazel and Kathu. Traffic will come along the
Construction workers transported via vehicles(using 50 seater	Approximately thirty eight busses per day	



Item	Number of vehicles to and from site per day	Transportation routes
busses)		R380 and use the proposed main access to the Lehating Manganese Mine.
<b>Service and heavy trucks</b>		
Transportation of construction materials, machinery and supplies, diesel, spares and other consumables to and from site	Approximately four heavy vehicles	

### Water supply and use for construction

#### Potable and construction water

Water will be abstracted from a well-field comprising four number boreholes each delivering raw water to a raw water tank located in its permanent position on the construction camp terrace. A reverse osmosis plant, which will be located adjacent to the raw water tank, will be installed to treat raw water to potable water standard as required. As an alternative, water may be transported in.

### Stormwater management system during the construction phase

Water management facilities for the control of stormwater and for pollution prevention will be designed to meet the requirements of Regulation 704, 4 June 1999 for water management on mines. In general, the footprint of all dirty areas will be minimised by isolating these areas from clean water runoff and dirty water will be contained in designated systems. This water should be recycled and used as process water.

#### Water flow process for the construction phase

During the construction phase, the process plant and tailings storage facility will not be operational, therefore no water will be required at these facilities. During the construction phase run off dirty water will be collected in the pollution control dam and any excess water from this dam will flow to the emergency storage dam. Both the pollution control dam and the emergency storage dam/s are located to the south of the project site.

Clean stormwater that flows towards the project site will be diverted around the site by elevated roads, various stockpiles and dedicated diversion berms where required.

### Power supply for construction

A 550V diesel engine driven generator will be located on the Construction Camp terrace and will be mainly used as temporary construction power and emergency supply. The diesel engine will supply power to the well-field (by way of an 11kV overhead power line), the tank farm and to the Construction Camp.

### Non-mineralised waste management for construction

Waste will be separated at source, stored in a manner that there can be no discharge of contamination to the environment and either recycled or reused where possible. The remainder will be transported off site

to appropriately licensed recycling or disposal facilities. Kuruman is the closest destination for general waste and Holfontein for hazardous waste.

Table 31 presents the waste management specification that has been developed for the proposed Lehating project and outlines the waste management for all waste types.

The types of non-mineralised non-hazardous general wastes that could be generated during the construction phase of the proposed Lehating Mine include:

- treated sewage effluent;
- packaging;
- plastics;
- glass;
- wood;
- building rubble and waste concrete;
- cleaning agents; and
- scrap metal.

The types of non-mineralised hazardous wastes that could be generated during the construction phase of the proposed Lehating Manganese Mine include:

- sewage;
- hydrocarbons and waste oil;
- workshop wastes;
- batteries;
- empty laboratory chemical containers; and
- fluorescent tubes.

In summary, these wastes will be handled and stored on site in the temporary waste storage area before being removed for recycling by suppliers, reuse by scrap dealers or final disposal at permitted waste disposal facility.

**TABLE 31: WASTE MANAGEMENT FOR CONSTRUCTION PHASE**

Waste type	Waste specifics (example of waste types)	Storage facility	End use
Non-hazardous solid waste (non-mineralised)	Treated effluent, plastics, glass, wood, cleaning agents, building rubble and waste concrete, scrap metal, general domestic waste such as	Skips in relevant work areas will be provided for different waste types.	Waste will be sorted. Recyclable waste will be sent to a reputable recycling company. The remainder of the waste will be transported to a licensed general landfill facility in Kuruman or Kathu for disposal.

Waste type	Waste specifics (example of waste types)	Storage facility	End use
	food and packaging		
Hazardous solid waste (non-mineralised).	workshop wastes, batteries, empty laboratory chemical containers, and fluorescent tubes	Hazardous waste will be separated at source and stored in designated containers in bunded work areas.	Hazardous waste will be recycled, reused or disposed of at the licensed hazardous disposal site in Holfontein.
	Hydrocarbons (oils, grease)	Used oil and grease will be stored in drums in bunded areas at key points in work areas. The bunds will be able to accommodate 110 % of the container contents and include a sump and oil trap.	The waste management facility will have a dedicated used oil storage area that will include an impermeable concrete slab, bunding, an oil trap and sump. Used oil will be sent to a reputable recycling company for recycling.
	Sewage	Portable toilet septic tanks	Removed from site and delivered to treatment works at Kuruman or Kathu
Medical waste	Syringes, material with blood stains, bandages, etc.	Medical waste will be stored in sealed containers at the medical clinic.	Medical waste will be transported by the waste management contractor to a permitted incineration facility

### Sewage

During construction phase activities, contractors make use of chemical toilet facilities. The sewage will be collected in trucks and transported off-site to the Kuruman or Kathu sewage treatment works.

### **Topsoil stockpile**

Topsoil in the terrace, waste rock dump, fines and tailings storage facility footprint areas will be stripped and stockpiled in accordance with the soil conservation procedure and will be stockpiled at the topsoil stockpile near the stockyard area, to the south west of the process plant.

## **2.7.2 OPERATIONAL PHASE**

An overview of the key mining and processing activities is provided in Section 2.3. Further detail where required is provided in the sections below.

### **Employment and housing**

It is estimated that there will be approximately 350 people that will be on the site at any stage during the operational period. No housing is provided on the project site, so operational workers will be accommodated in the nearby villages as well as surrounding towns of Black Rock, Hotazel, Kathu and Kuruman.

### Transportation routes and mechanisms for operational phase

Access to the proposed Lehating project site from the R380 will be via the new 10m wide gravel access road as described in the transport part of section 2.7.1. Table 32 below provides a conceptual indication of the traffic associated with the operational phase of the Lehating Manganese Mine.

**TABLE 32: OPERATIONAL PHASE TRAFFIC: MATERIALS AND STAFF**

Item	Number of vehicles to and from site per day	Transportation routes
Mining Staff		Workers, contractors and trucks are likely to come from Kuruman, Hotazel and Kathu. Traffic will come along the R380 and use the main access to the Lehating Manganese Mine.
Employees transported via own vehicles	Approximately thirty one light vehicles per day	
Employees transported via vehicles(using 15 seater busses)	Approximately ten busses per day	
Process Plant staff		
Transportation of management staff and visitors to and from site	Approximately seven light vehicles per day	
Employees transported via vehicles(using 15 seater busses)	Approximately two busses per day	
Other staff		
Transportation of management staff and visitors to and from site	Approximately thirty five light vehicles per day	
Employees transported via vehicles(using 15 seater busses)	Approximately three busses per day	
Service and heavy trucks		
Transportation of materials, machinery and supplies, diesel, spares and other consumables to and from site	Approximately forty six heavy vehicles	
Transportation of ore product via trucks	Approximately nine heavy vehicles	

### Water Supply and Management

Water is a scarce commodity in the area and piped water is not currently available beyond Wessels Manganese Mine at a point approximately 8km due South of the Lehating Manganese Mine site. Bulk water in the region is controlled by the Sedibeng Water Board. Although the preferred design case would be for piped potable water supply, this case could not be guaranteed hence raw water supply from the well field and from dewatering will supply water to the mining operation. Piped water remains an alternative option.

The borehole well field comprises four number boreholes positioned north, east, south and west of a central field tank. Water displaced from the boreholes reports to the field tank from where it is pumped to the raw water tank associated with the mine.

Dewatering is required to make the underground workings safe. All water generated underground is pumped to horizontal settlers from where it is pumped into the water bowser for dust allaying purposes. Only once the water inflow exceeds the water demand for dust allaying purposes is water pumped from

underground to surface. In that instance, dirty water pumped from underground reports to the process plant settler.

On average, the make-up water requirement (from boreholes, dewatering and the storm water dam when it holds water) is estimated to be 12.7 m<sup>3</sup>/h.

#### Potable water

Raw water will be abstracted from boreholes and will be pumped to the raw water tank. The raw water tank in turn will be fitted with centrifugal pumps distributing raw water to the process water tank, potable water tank, dust suppression systems, flocculant supply tank and underground services respectively. Raw water will be pumped to a reverse osmosis (RO) water treatment plant that will ensure the production of suitable quality potable water fit for human consumption. The potable water will be used in offices, the change house and for domestic use. Once treated, the water will be pumped to an elevated process water tank that will distribute the potable water under gravity flow conditions to the various surface sections. All reverse osmosis plant brine will be returned to the thickener during the operations phase and mixed with return water from the sewage treatment plant.

#### Process Plant, TSF and Pollution Control Dam water

Return water recovered via the barge pump penstock on the TSF will be pumped to a silt trap prior to being pumped directly into the process water tank.

Any runoff water from the process plant will be collected in the Pollution Control Dam (PCD). Under normal conditions the water collected in this dam will be returned back to the process water tank via the silt trap pumping system. In conditions of excessive rain or storm events where the likelihood of this tank overflowing is high, the water level will be controlled with the use of a diesel generated mobile centrifugal pump.

#### Fire water

A fire water network will be installed above ground, which will feed water to hydrants and hose reels. A pressurised fire water main will be installed on the loading level and at the workshop. Underground fire water will be raw water sourced directly from the process water tank and will be fitted with both an electrical and diesel engine centrifugal pump. All fire water piping will be dedicated supply pipes not utilized for any purpose other than supplying fire water. All conveyors are equipped with associated fire mains and hoses, a foam system will be specified for the diesel storage tanks and all mobile equipment will be fitted with hand held fire extinguishers.

#### Water flow in the operational phase

Figure 21 presents the water flow diagram for the operational phase.

**FIGURE 21: WATER FLOW DIAGRAM FOR THE OPERATIONAL PHASE**

### Stormwater management

Water management facilities for the control of stormwater and for pollution prevention will be designed to meet the requirements of Regulation 704, 4 June 1999 for water management on mines. In this regard the management of stormwater generated at the project site will include the diversion of clean water by means of berms and/or channels and the containment of dirty water.

#### *Pollution control and emergency dirty water dams*

As part of the proposed project the establishment of a pollution control dam is required. The pollution control dam will be used to receive dirty runoff water from the designated dirty water area which includes the shaft, plant and associated infrastructure. Dirty water will be collected by a perimeter diversion, and water will be conveyed to the pollution control dam which will be located downstream of the designated dirty area. The emergency dirty water containment facility will be located downstream of the pollution control dam and will be used to receive overflow from the pollution control dam. The emergency dirty water containment facility is required to store excess water from the pollution control dam.

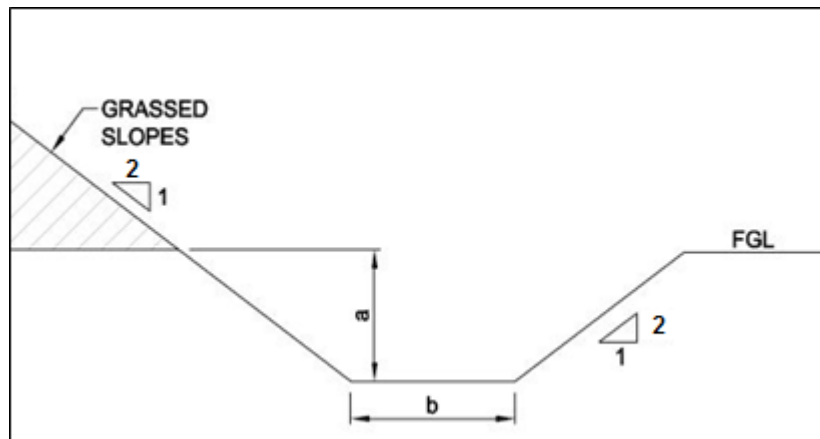
The combined capacity of these dams is approximately 33,364 m<sup>3</sup>. The dams will operate empty or close to empty and as such, a diesel engine driven pump will transfer water from the pollution control dam to the process water tank for recovery to the process plant (Figure 18).

### Stormwater management channels

As part of the proposed project, as stormwater management plan was compiled. This stormwater management plan provides a conceptual stormwater management design for both dirty water and clean water diversion channels (Appendix F) for infrastructure. Figure 22 illustrates the conceptual design of stormwater diversion channels.

In Figure 23:

- a = Channel Depth
- b = Channel base breadth



**FIGURE 22: CONCEPTUAL STORMWATER DIVERSION CHANNEL SIZING (SLR, JUNE 2013)**

#### GN 704 Compliance

In order to demonstrate compliance with condition 6 of GN 704, which requires the capacity of dirty water systems to be designed “so that it is not likely to spill into any clean water system more than once in 50 years” a minimum freeboard of 0.8 m above full supply level must be maintained. Water accumulated in the pollution control dam during the wet season should be used as a priority in the process water circuit where possible, to ensure the capacity requirements are not compromised during periods of heavy/extended rainfall.

The dirty water containment facilities were calculated based on the summation of the 1 in 50 year design rainfall (24 hour) event for the catchment area and the highest monthly rainfall (March) falling over the catchment, less the corresponding monthly evaporation (March) taking place over the surface area of the proposed containment facility. Runoff coefficients used were determined according to the return period of interest, such that maximum monthly rainfall event was associated with a smaller runoff coefficient than the 1 in 50 year design rainfall event.

#### **Water balance**

An operational annual average water balance has been prepared for the Lehating Manganese mine. The annual average water balance is illustrated in Figure 23. This water balance shows the scenario where the stormwater dam is dry. In the wet season water from this dam will be used in preference to borehole water.



**FIGURE 23: ANNUAL AVERAGE WATER BALANCE SUPPLIED BY TWP**

**Power supply**

It is estimated that the power requirements for the mine will be 10MVA at full production. Diesel generators will be used until Eskom is in a position to supply the required power via a dedicated powerline. Thereafter the diesel generators will be retained as a back-up to Eskom power. The diesel generators will be placed on impermeable floors with bunds and collection traps for any spilled diesel and lubricants.

A substation will be constructed in order to receive power from a regional Eskom power line. The substation will be equipped with transformers and switchgear to enable the voltage from the regional line to be stepped down and internally distributed. The substation will also be equipped with impermeable floors, bunds and collection traps where required to contain any spills of lubricants.

Internal power reticulation (from the diesel generators and the substation) will be by means of an 11 kV distribution network comprising powerlines and mini substations. These mini substations will be equipped impermeable floors, bunds and collection traps where required to contain any spills of lubricants.

The EIA related to the powerline will be handled separately and does not form part of the scope of this EIA.

**Sewage**

Sewage water emanating from toilets and showers at the change house and offices will be pumped to the sewage plant. The water produced from the sewage treatment plant will be disinfected and pumped to an elevated tank from where the surface water bowsers will draw water. This disinfected grey water will be mixed with brine produced from the reverse osmosis plant and will be used for surface road dust suppression. Drying beds have been provided for the sewage sludge and the dry product will likely be used to enhance the potential of topsoil if authorised. If not the other alternative is to transport the sludge off site to a sewage plant in one of the towns in the region. The sewage treatment plant will have the capacity to treat approximately 16 000 l/day. The conceptual process flow diagram of the sewage treatment plant is included in Figure 24, and Figure 25 indicates the conceptual layout of the sewage treatment plant.

**FIGURE 24: SEWAGE TREATMENT PLANT - CONCEPTUAL FLOW DIAGRAM**

**FIGURE 25: CONCEPTUAL SEWAGE TREATMENT PLANT LAYOUT**

**Non-mineralised wastes**

As described for the construction phase above, waste will be separated at source, stored at the waste management facility in a manner that there can be no discharge of contamination to the environment, and either recycled or reused where possible. On site facilities will be provided at the waste management facility for sorting and temporary storage prior to removal and disposal to an appropriately licensed off site recycling or disposal facilities (Kuruman for general waste and Holfontein for hazardous waste).

In summary, wastes will be temporarily handled and stored on site in the waste management facility before being removed for recycling by suppliers, reuse by scrap dealers or final disposal at appropriately licensed waste disposal facilities. A summary of this is provided in Table 33.

**TABLE 33: NON MINERALISED WASTE MANAGEMENT FOR OPERATIONS**

Waste type	Waste specifics (example of waste types)	Storage facility	End use
Non-hazardous solid waste (non-mineralised)	Plastics, glass, wood, cleaning agents, building rubble and waste concrete, scrap metal, general domestic waste such as food and packaging	Skips in relevant work areas will be provided for different waste types.	Recyclable waste will be sent to a reputable recycling company. The remainder of the waste will be transported by the waste management contractor to a appropriately licensed general landfill facility in Kuruman or Kathu for disposal.
Hazardous solid waste (non-mineralised).	Workshop wastes, batteries, empty laboratory chemical containers, and fluorescent tubes	Hazardous waste will be separated at source and stored in designated containers in bunded work areas.	Hazardous waste will be recycled, reused or disposed of at the licensed hazardous disposal site in Holfontein.
	Hydrocarbons (oils, grease)	Used oil and grease will be stored in drums in bunded areas at key points in work areas. The bunds will be able to accommodate 110 % of the container contents and include a sump and oil trap. The waste management contractor will remove these drums regularly to the WMF. The yard will have a dedicated used oil storage area which will include a concrete slab, proper bunding and an oil sump. The appointed bulk fuel supplier will collect used oil for recycling.	Used oil will be sent to a reputable recycling company for recycling.
	Sewage	Sewage will be treated at the on-site sewage treatment plant (STP).	Sewage effluent will be used for dust suppression. Sewage sludge will be dried and buried in the drying beds and used for rehabilitation or removed off-site and delivered to the Kathu or Kuruman treatment works.
Medical waste	Syringes, material with blood stains, bandages, etc.	Medical waste will be stored in sealed containers at the medical clinic. A waste management contractor will remove these drums regularly to the WMF.	Medical waste will be transported by to a permitted incineration facility for incineration.

**Mineralised waste management for the operational phase**

The relevant mineralised wastes are discussed below.

Waste rock dump

In accordance with Section 73 of Regulation 527, the design features associated with the waste rock dump is outlined in Table 34. The waste rock stockpile has been designed on the assumption that only waste rock from the primary development will be dumped on the waste rock stockpile, and rock from the lateral development of the mine will be stored underground.

**TABLE 34: DESIGN FEATURES FOR WASTE ROCK STOCKPILE (WRS)**

Feature	Detail
Physical Dimensions	The total area to be covered by WRS over the life of the mine is approximately 1 Ha, with a total volume of 61888 m <sup>3</sup> storage capacity and a height of 6m. The total capacity will be 11 398 tonnes.
Physical characteristics	The material comprises waste rock of large rock. The water content is expected to be about 5%.
Chemical characteristics	Unlikely to generate acid owing to the limited sulphide sulphur content. Leachate/runoff quality produced may not be acceptable for discharge.
Management, transport	Waste rock will be loaded onto trucks and transported to the WRS.
Diversion	The WRS will be in the dirty stormwater contained area. Outside of this area storm water trenches will be provided to direct clean storm water away from the dirty water area.
Topsoil Stripping	Topsoil in the WRS footprint areas will be stripped and stockpiled during construction in accordance with the soil conservation procedure and will be stockpiled at the topsoil stockpile near the TSF area. Stripping and stockpiling of topsoil will be done immediately in advance of dumping.
Lining	No lining will be provided for the WRS.
Side slopes	The effective slopes of the WRS will be 1V:3H.
Under Drains and runoff	No under drainage will be provided. Surface run-off will be directed around the WRS towards the pollution control dam.
Access and Access Control	Mining haul roads will be constructed using waste rock. No perimeter fence will be provided around the individual WRS. Rather a perimeter fence around the whole of the mine site will be installed.
Waste Minimisation	Waste rock will be used to construct foundations and haul roads.
Monitoring	A monitoring strategy will be developed to manage excessive surface cracking, bulging, foundation creep, and seepage at the WRS. Moreover the mine's water and air monitoring programmes will incorporate the WRSF.
Dust Control	No specific dust control measures are required at the WRS due to the large particle size distribution.
Closure	Where WRS remain after mining because of the bulking factor, these will be flattened to a maximum side slope of 1V: 8H. Land use options for rehabilitation will be considered during the life of mine.  In the event that water quality monitoring around any WRS indicates that the WRS is causing pollution measures will be implemented to remedy pollution and prevent further pollution
Rehabilitation Success Criteria	Rehabilitation success criteria will be linked to the final land use objective for this facility. This will be determined as part of detailed closure planning.

*Safety classification of waste rock stockpiles*

The safety classification for the waste rock stockpile was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of Mineral Regulation 527 of 23 April 2004. The summarised classifications are included in Table 35.

**TABLE 35: SAFETY CLASSIFICATION CRITERIA FOR WASTE ROCK STOCKPILE**

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in Zone of Influence	0 (Low hazard)	No formal or informal settlements were noted 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)	Minimal workers will be located in the zone of influence as the main activities will take place in the shaft area	Low 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 characteristic of the waste rock dump is 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)	The Lehating Main Shaft is moderately deep with the LMO seam approximately 270 – 300m below ground level. Therefore no influence on surface storage dumps is expected.	Low Hazard
		50 m – 200 m (Medium hazard)		
		<50 m (High hazard)		

With reference to Table 35 above, the waste rock stockpile is classified as a low safety risk.

*Environmental classification for the waste rock stockpile*

The waste rock stockpile may be associated with leachate contamination that could impact ground and surface water resources. It follows that the waste rock stockpile can be classified as being medium to low risk.

Tailings

Jones and Wagener completed the conceptual engineering design of the Lehating tailings storage facility (Appendix M). TWP further refined the Jones and Wagener design of the tailings storage facility, and as such the conceptual revised details are provided in Table 36 (TWP, May 2012). The design features for the proposed Lehating Manganese Mine tailings storage facility are in accordance with Section 73 of Regulation 527. There is currently provision for one TSF at the mine, which will contain 8 paddocks.

**TABLE 36: DESIGN FEATURES FOR THE PROPOSED LEHATING MANGANESE MINE TAILINGS STORAGE FACILITY**

Feature	Detail
Physical Dimensions	The TSF has been sized for a tailings volumetric deposition rate of 10 850 m <sup>3</sup> /annum for a 15 year design life. Paddock wall length = 50m, Paddock wall width = 50m, Paddock life = 1.92years, No. of paddocks required = 8, TSF Footprint = 20 000 m <sup>2</sup> , Assumed height of paddock wall = 2.5m. The maximum height of the TSF will be 20m, including a 2m freeboard, and the overall footprint is 2 hectares.
Physical properties	Particle size = less than 1mm, Dry solids ratio = 30%, Tailings approximate density = 2.50t/m <sup>3</sup> , Volume of tailings produced/annum = 27 126m <sup>3</sup> , Volume of dry solids produced/annum = 3 255m <sup>3</sup> , Volume of paddock = 6 250m <sup>3</sup>
Chemical properties	<p>Based on the geochemical testing undertaken on the manganese ore sample, considered to be representative of tailings material, it is unlikely that the oxide tailings material will generate acid owing to the limited sulphide sulphur content. In addition the sample shows a high neutralising potential, therefore reducing the risk of the potential for acid rock drainage.</p> <p>Metals and dissolved salts within runoff and/or seepage waters could result in water contamination and the leachate produced may not be acceptable for discharge into the environment.</p>
Lining	The TSF will have an impermeable lining to preventing seepage from entering the environment, and to conserve water through maximising return water volumes. The outcome of the study has determined that the use of a Welded 2mm thick High Density Polyethylene (HDPE) liner will be suitable.
Delivery and Deposition	<p>The tailings will be delivered to the site in a slurry consisting of particles finer than 1.0mm and having a slurry density of approximately 1.4 t/m<sup>3</sup>.</p> <p>The proposed method of depositing the tailings will be the spraybar method. The delivery system consists of a 250mm HDPE main delivery line from the plant to the deposit, with 250mm pipes branching off from the mainline on the wall crest to the individual spraybars.</p> <p>Deposition can be performed by multiple spraybars simultaneously. The spraybars themselves consist of 30m lengths of 180mm HDPE pipe, drilled with 50mm diameter holes spaced at 1m centres. The hole diameter and spacing, as well as the spraybar diameter have been selected to adequately reduce the velocity of the slurry stream upon deposition.</p> <p>There are 12 spraybars in total to provide sufficient control over deposition, the formation of an even beach with minimal fine material against the wall, and the location of the pool.</p>
Rate of rise	The allowable rate of rise is the time it takes a layer to reach a moisture content at which shrinkage ceases. The rate of rise during the life of the TSF should not exceed 3m/annum.
Storm water diversion	A storm water trench adjacent to the northern and eastern slopes, i.e. immediately downstream of the dam and a waste rock lined spill way will collect water and direct it to the pollution control dam.
Topsoil Stripping	Topsoil will be stripped to a depth of approximately 0.2 m and stockpiled in accordance with the soil conservation procedure. Stripping and stockpiling of topsoil will be done as part of the initial TSF construction.
Embankments /slopes and walls	<p>The overall side slopes of the TSF will be limited to a maximum of 1:3 which will ensure sustainable and stable side slopes.</p> <p>The two metre high starter wall will have a 1:2.5 internal side slope, and a 1:3 external side slope.</p>
Under Drains	A filter drain is to be constructed at the inner toe of the wall, and in a herringbone formation under the TSF basin. The filter drain consists of progressively finer



Feature	Detail
	150mm layers of selected materials having particle sizes that will retain the particles of the finer layer above while allowing free drainage of seepage water. The outlet of these drainage pipes connects into a collection sump outside the TSF's toe line, from where the collected water will be pumped to either a pollution control dam or the plant.
Decant System	A single silt trap/sump will be constructed adjacent to the TSF paddocks into which water from the TSF will be pumped by means of a floating barge pump. Water will then be pumped from the silt trap back to the Process Water Tank.
Access and Access Control	A calcrete/waste rock gravel access road will be constructed around the perimeter of the TSF to enable access for inspection. A perimeter fence will be constructed around the property boundary to keep livestock and people out. Access to the dam shall only be provided via gates that are locked closed. A permit system with records of access to the area shall be implemented.
Waste Minimisation	No re-processing of the tailings is envisaged at this stage. Lehating will investigate options once operations commence.
Rehabilitation	Waste rock, vegetation and topsoil will be used for rehabilitation of the outer walls at closure.
Monitoring	The monitoring of the TSF 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.  Moreover the mine's water and air monitoring programmes will incorporate the TSF.
Dust Control	The TSF access roads and ramps will be watered as necessary to ensure that dust pollution is kept to a minimum.
Closure and rehabilitation success criteria	Rehabilitation success criteria will be linked to the final land use objective for this facility. This will be determined as part of detailed closure planning.
Design drawings	The relevant conceptual design drawings are included in Appendix M.

#### *Safety classification of the Lehating Manganese Mine tailings storage facility*

The safety classification for the tailings storage facility was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of Mineral Regulation 527 of 23 April 2004. The summarised classifications are included in Table 37.

**TABLE 37: SAFETY CLASSIFICATION CRITERIA FOR THE LEHATING MANGANESE MINE TAILINGS STORAGE FACILITY**

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in Zone of Influence	0 (Low hazard)	No residents live in the zone of influence.	Low hazard
		1 -10 (Medium hazard)		
		>10 (High hazard)		
2	No. of Workers in Zone of Influence	<10 (Low hazard)	It is assumed that there will be Between 11-100 workers within the zone of influence.	Medium hazard
		11 – 100 (Medium hazard)		
		>100 (High hazard)		
3	Value of third party property	0 – R2 Million (Low hazard)	No formal assessment of the value of the third party property	Low hazard

Criteria No.	Criteria		Comment	Safety Classification
	in zone of influence	R2 – R20 million (Medium hazard)	within the zone of influence has been done, however it is likely to be less than R2 million (in 1996 replacement value terms).	
		>R20 million (High hazard)		
4	Depth to underground mine workings	>200 m (Low hazard)	No underground mining will occur below the proposed TSF.	Low hazard
		50 m – 200 m (Medium hazard)		
		<50 m (High hazard)		

With reference to Table 38 the Lehating Manganese Mine tailings storage facility therefore classifies as a medium hazard dam.

The implications of this hazard rating are captured in the following Table 38:

**TABLE 38: MINIMUM REQUIREMENTS ASSOCIATED WITH A MEDIUM HAZARD TAILINGS STORAGE FACILITY**

Planning stage	Design Stage	Operation/ Commissioning Stage	Decommissioning Stage
Conceptualisation by owner Preliminary site selection by appropriate specialist. Geotechnical investigation by suitably qualified person	Geotechnical investigation required Residue characterisation verified by laboratory analyses Design by Pr Eng. Risk analysis optional Construction supervision by suitably qualified person	Risk analysis optional Suitably qualified person responsible for operation Pr Eng appointed to monitor Pr Eng to audit every two years	Pr Eng appointed to monitor Pr Eng to audit every two years

#### *Environmental classification for the Lehating Manganese Mine tailings storage facility*

Tailings storage facility leachate poses a potential threat to the ground and surface water resources. More detail is provided with respect to potential groundwater impacts and mitigation measures in section 7.2.9.

#### **Blasting**

Both surface and underground blasting will take place on site. It should however be noted that surface blasting will only take place when required during site preparation for the establishment of infrastructure and the sinking of the main and ventilation shafts. Underground blasting takes place on a daily basis, anytime within a 24 hour period. Surface blasting during the construction phase would be limited to day-time hours.

#### **Operating times**

The total number of operating days per annum is 334 with 31 days per annum lost to public holidays, mine closure and annual maintenance shutdowns. The Lehating Manganese Mine will operate 24 hours a day. The process plant will be operated for 2 shifts per day each having duration of 12 hours.

**Additional support services and facilities**

In addition to the abovementioned core infrastructure and activities, the support services and facilities include the following:

- parking areas for trucks, cars and busses;
- workshops and wash bays – used for servicing equipment and general maintenance, fitted with oil sumps and separators and capacity for storage for hazardous material and fuel and lubricants.
- laydown and storage areas;
- stores, tanks and handling areas for storage of general raw materials, consumables, and
- hazardous chemical substances including new oil/lubricants, hydraulic fluid and diesel:
  - the general storage method of these substances is to contain them in sealed containers within impermeable, bunded areas with sufficient capacity to contain spilled materials;
  - any spilled materials will drain to sumps with oil traps that will also be equipped to allow collection and removal of spilled substances as per SANS 10089-1:2003;
  - 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 the site:
    - diesel – a number of storage tanks with a total storage capacity of approximately 500 000 litres
    - oil/lubricants and hydraulic fluid – approximately 10 000 litres.
- laboratory at the plant – used for basic sample preparation and analysis;
- salvage, scrap yard and other waste areas for the temporary storage of waste before re-use or collection and removal. The hazardous waste storage areas will be bunded and be equipped to drain spilled material to sumps with traps that will also be equipped to allow collection and removal of spilled substances as per SANS 10089-1:2003;
- 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. In this regard, it will be reinforced and locked with strict access control measures and will only be used to store the type and quantity of explosives required in accordance with the final blast design and procedures;
- change house with ablution facilities for 350 people per underground shift
  - adequate shower and ablution facilities;
  - overalls will be washed and replaced into the locker for each employee; and
  - washing of gumboots is proposed to be undertaken on each underground station and no surface facilities will be provided for this.
- a medical clinic facility for the primary treatment of injuries and illness;
- bus/taxi off-loading and loading areas,
- mining contractors camp (workshop/yard area);
- security checkpoints at all entrances;
- fencing and lighting (with masts) within the project area for security and safety reasons; and
- main office/admin block.

### **2.7.3 DECOMMISSIONING PHASE ACTIVITIES**

#### **Decommissioning phase activities**

In broad terms, decommissioning activities associated with the proposed site includes the demolition and the removal of infrastructure, preparation of final land forms for closure and promoting vegetation growth where possible in order to reduce the effects of soil erosion and to re-establish landscape functionality.

Decommissioning activities will include:

- removal of most surface infrastructure;
- providing underground support and sealing the shaft;
- replacing of stockpiled topsoil over disturbed areas;
- flattening of waste rock dump and rehabilitating the TSF;
- establishing dust and water pollution control measures for final land forms; and
- vegetation growth will be promoted on all cleared and prepared areas to reduce the effects of soil erosion and to re-establish landscape functionality.

### **2.7.4 CLOSURE PHASE ACTIVITIES**

#### **Closure phase activities**

After decommissioning, closure activities will include maintenance and aftercare that is required to ensure that rehabilitation is successful.

The closure activities include:

- there will be a period of active after-care followed by a passive after-care phase;
- maintenance of vegetation;
- maintenance of facilities such as fencing and fire breaks;
- removal of any invasive species from the rehabilitated sites;
- inspecting on an annual basis to repair any erosion gullies;
- monitoring of relevant surface water, groundwater and air quality points.

## **2.8 PROJECT ALTERNATIVES**

The proposed surface infrastructure will be located within the boundary of Portion 1 of Lehating 741 and Portion 2 of Wessels 227 and as a result no alternative sites have been considered.

#### **Tailings Storage Facility options**

During the initial prefeasibility studies for Lehating, four potential sites for the tailings storage facility were identified by Jones and Wagener. The criteria which were used in the identification of the 4 options include (but are not limited to):

- suitable topography for a TSF;
- suitable site away from major services (such as roads and powerlines);

- avoidance of sensitive biodiversity;
- avoidance of heritage resources
- proximity to watercourses and drainage lines;
- avoidance of major aquifer zones and areas with high yielding boreholes
- reduction of carbon footprint; and
- suitable sites off the underground ore body.

The four options are indicated in Drawings D087-00-050 and D087-00-060 of the TSF conceptual design document (Appendix M).

SLR provided the pre-feasibility environmental inputs (SLR, October 2011) to the site selection process and recommended that the TSF be located at least 100 m to the east of the mineralised zone (and associated higher yielding groundwater zone), away from the Kuruman flood zone and associated sensitive habitats, as well as outside of preferential surface water flow paths. After taking into account the various selection criteria, Option 1 was selected as the preferred option for the proposed TSF.

### **Transport options**

Access to the project site will be by means of the proposed access road from the R380. One possible alignment within a corridor is indicated on Figure 2.

The detailed design of the proposed access road was undertaken by TWP as part of the Bankable Feasibility Study. Technical considerations for the proposed route of the road include:

- nature of the road users (anticipated traffic volumes and size of vehicles which will use the road);
- nature of the topography; and
- position of, and distance from, starting point and end point.

Provided that the sight distance is suitable, the intersection could be located at variable locations on the R380, and as such the road can be shifted within the assessed access corridor.

It is important that the final access road route through the access corridor does not interfere with underground mineral resources as part of Ntsimbintle's operations.

### **Sewage sludge management options**

The alternatives of off-site disposal or on-site use of the sludge have been considered. The criteria considered for these alternatives were waste minimisation, long term closure objectives, environmental rehabilitation and environmental protection. Use of the treated sludge for on-site rehabilitation of disturbed areas is considered to be the best alternative if the sludge is declassified and its use is licensed. Alternatively, if the on-site use of treated sludge is not authorised then off-site disposal of sewage sludge will take place.

**2.8.1 THE “NO PROJECT” OPTION**

The assessment of this option requires a comparison between the options of proceeding with the project with that of not proceeding with the project. Proceeding with the project attracts potential economic benefits and potential negative environmental and social impacts. Not proceeding with the project leaves the status quo. Further detail on the potential impacts is provided in Section 7.

### 3 POTENTIAL IMPACTS

#### 3.1 LIST OF POTENTIAL IMPACTS ON ENVIRONMENTAL ASPECTS

This section provides a list of potential impacts on environmental aspects (excluding social and cultural aspects – see Section 6) in respect of each of the main project actions / activities and processes. The potential impacts are presented for each of the project phases in tabular format (Table 39).

**TABLE 39: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO PROJECT ACTIONS / ACTIVITIES / PROCESSES (EXCLUDING SOCIAL AND CULTURAL)**

<b>Main activity/process</b>	<b>Phase</b>	<b>Impacts (unmitigated)</b>
<b>Site preparation</b>	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Air pollution Noise pollution Blasting impacts Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Earthworks</b>	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Blasting impacts Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Civil works</b>	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Blasting impacts Visual impacts

Main activity/process	Phase	Impacts (unmitigated)
		Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Main and Ventilation Shafts</b>	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Blasting impacts Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Process Plant</b>	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Blasting impacts Road disturbance and traffic safety Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Tailings storage facility</b>	Construction Operation Decommissioning Closure	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Blasting impacts Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Power supply</b>	Construction	Loss and sterilization of mineral resource



Main activity/process and use	Phase	Impacts (unmitigated)
	Operation Decommissioning	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Water supply and use</b>	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Transport systems</b>	Construction Operation Decommissioning Closure	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Road disturbance and traffic safety Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Non-mineralised waste management</b> (general and industrial hazardous)	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution

Main activity/process	Phase	Impacts (unmitigated)
		Noise pollution Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>General site management</b>	Construction Operation Decommissioning Closure	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Other support services and amenities</b>	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts
<b>Demolition</b>	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Blasting impacts Visual impacts Loss of or damage to heritage, cultural, archaeological and palaeontological resources Economic impact Inward migration Land use impacts

Main activity/process	Phase	Impacts (unmitigated)
<b>Rehabilitation</b>	Construction Operation Decommissioning	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Blasting impacts Road disturbance and traffic safety Visual impacts Economic impact Inward migration Land use impacts
<b>Maintenance and aftercare</b>	Construction Operation Decommissioning Closure	Loss and sterilization of mineral resource Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance General disturbance of biodiversity Physical destruction of biodiversity Alteration of natural drainage patterns Contamination of surface water Reduction of groundwater levels and availability Contamination of groundwater Air pollution Noise pollution Blasting impacts Road disturbance and traffic safety Visual impacts Economic impact Inward migration Land use impacts

### 3.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

This section provides a list of potential cumulative environmental impacts (excluding social and cultural aspects – see Section 6):

- Loss and sterilization of mineral resources
- Hazardous excavations and infrastructure
- Loss of soil resources and land capability through pollution
- Loss of soil resources and land capability through physical disturbance
- General disturbance of biodiversity
- Destruction of biodiversity
- Alteration of natural drainage patterns
- Contamination of surface water
- Reduction of groundwater levels and availability
- Contamination of groundwater
- Air pollution
- Noise pollution

- Blasting impacts
- Road disturbance and traffic safety
- Visual impacts
- Land use impacts

### **3.3 POTENTIAL FOR ACID MINE DRAINAGE OR GROUNDWATER CONTAMINATION**

Detailed information on these issues is provided in Section 1.1.1. In summary, geochemical tests and analysis indicate that the four Lehating samples are non-acid generating.

## **4 ALTERNATIVE LAND USE OR DEVELOPMENT**

### **4.1 DESCRIPTION OF ALTERNATIVE LAND USE OF THE AREA**

The proposed project site is currently used for cattle grazing. A list and description of the current land uses that exist on the proposed project site or on adjacent or non-adjacent properties that may be affected by the proposed mining operation is provided in Section 1.3.4.

As an alternative to the development of the proposed projects, these current land uses would continue. Given current land uses, the most obvious alternative to mining is livestock grazing.

### **4.2 MAIN FEATURES AND INFRASTRUCTURE RELATED TO ALTERNATIVE LAND USE / DEVELOPMENT**

Potential features and infrastructure that could be associated with the alternative land use/development are listed below.

<b>Feature / infrastructure</b>	<b>Description</b>
Livestock farming	livestock watering holes
Roads	Gravel roads providing access to grazing lands and food supplement points

### **4.3 PLAN SHOWING LOCATION AND EXTENT OF ALTERNATIVE LAND USE / DEVELOPMENT**

A plan showing the location and extent of the alternative land use / development is not possible to present at this stage as this would depend on the individual landowners preferences and financial situation.

## 5 POTENTIAL IMPACTS OF ALTERNATIVE LAND USE OR DEVELOPMENT

### 5.1 LIST OF POTENTIAL IMPACTS

Potential impacts, expected to occur as a result of the alternative land use / development described in Section 4 above, are listed below:

Feature / infrastructure	Potential impacts
Livestock farming	Increased pressure on veld resources Loss of soils through incorrect management Increased income and associated socio-economic benefits Increased pressure on water resources
Roads	Dust generation
Water supply and use	Increased pressure on water resources

### 5.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

Potential cumulative impacts associated with the alternative land use, when compared to the existing land use on site and in the surrounding area, are expected to include:

- Increased pressure on water resources; and
- Increased pressure on veld resources for grazing purposes.

## **6 POTENTIAL SOCIAL AND CULTURAL IMPACTS**

### **6.1 LIST OF POTENTIAL IMPACTS ON SOCIO-ECONOMIC CONDITIONS OF THIRD PARTY LAND USE ACTIVITIES**

Potential impacts on the socio-economic conditions of other parties land use activities surrounding the proposed Lehating Mine are discussed in detail in Section 7 and listed below.

- Loss of current land uses through impacts on the bio-physical environment
- Dust generation
- Noise disturbance
- Pollution of groundwater and surface water resources
- Loss of heritage resources
- Project-related road use and traffic
- Blasting hazards
- Economic impacts (positive and negative)
- Inward migration: Informal settlements, safety, security and services and associated social ills

### **6.2 CULTURAL ASPECTS AND POTENTIAL IMPACTS THEREON**

Cultural aspects are discussed as part of heritage discussion below.

### **6.3 HERITAGE FEATURES AND POTENTIAL IMPACTS THEREON**

#### **6.3.1 HERITAGE (AND CULTURAL) FEATURES**

A detailed description of heritage (including cultural resources) in and around the project area is provided in section 1.3.2. There has been only one identified heritage resource, and it is located in close proximity to the proposed mine:

- LM01 - very low density scatter of lithic artefacts

Potential impacts on heritage (including cultural) features include the loss of these resources for future generations through physical destruction and/or disturbance. These resources are of low significance.

#### **6.3.2 PALAEOLOGICAL FEATURES**

The palaeontological study indicates that project site is situated on Kalahari Formation and Hotazel Formation geology and that palaeontological resources in the form of stromatolites may be associated with this underlying geology. The palaeontological sensitivity of the project site can be described as low but the possibility of encountering Stromatolites during mining does exist.

#### **6.4 QUANTIFICATION OF IMPACT ON SOCIO-ECONOMIC CONDITIONS**

Refer to Section 7.2.17 for the impact assessment associated with the loss of land per hectare as well as Lehating's contribution to the provincial and national economy. Refer to Appendix L for the relevant specialist study undertaken.



## **7 ASSESSMENT AND EVALUATION OF POTENTIAL IMPACTS**

### **7.1 LIST OF EACH POTENTIAL IMPACT**

Potential environmental and socio-economic impacts were identified by SLR and other stakeholders. The impacts are discussed under issue headings in this section. All identified impacts are considered in a cumulative manner such that the current baseline conditions on site and in the surrounding area are discussed and assessed together.

Environmental impacts that will be assessed in this section include the following:

- Loss and sterilization of mineral resources (Section 7.2.1)
- Hazardous excavations and infrastructure (Section 7.2.2)
- Loss of soil resources and land capability through pollution (Section 7.2.3)
- Loss of soil resources and land capability through physical disturbance (Section 7.2.4)
- General disturbance of biodiversity (Section 7.2.5)
- Alteration of surface drainage patterns (Section 7.2.7)
- Contamination of surface water (Section 7.2.8)
- Reduction of groundwater levels and availability (Section 7.2.9)
- Contamination of groundwater (Section 7.2.10)
- Air pollution (Section 7.2.11)
- Noise pollution (Section 7.2.12)
- Blasting impacts (Section 7.2.13)
- Road disturbance and traffic safety (Section 7.2.14)
- Visual impacts (Section 7.2.15)
- Loss of or damage to heritage, cultural, archaeological and palaeontological resources (Section 7.2.16)
- Economic impacts (Section 7.2.17)
- Inward migration impact (Section 7.2.18)
- Land use impacts (Section 7.2.19)

### **7.2 IMPACT RATING FOR EACH POTENTIAL IMPACT**

The impact rating for each potential impact is provided in the section below. The criteria used to rate each impact as part of this report is outlined in Section 7.3. The potential impacts are rated with the assumption that no mitigation measures are applied and then again with mitigation. An indication of the phases in which the impact will occur is provided below and summarised in Section 7.4 together with the estimated timeframes for each rated impact.

The assessment below takes into consideration both the incremental and cumulative impacts associated with the proposed mine. The summary impact rating provided in each impact section only includes the cumulative impact ratings.

## GEOLOGY

### 7.2.1 ISSUE: LOSS AND STERILIZATION OF MINERAL RESOURCE

#### Introduction

Mineral resources can be sterilized and/or lost through the placement of infrastructure and activities in close proximity thereto, by preventing access to potential mining areas, and through the disposal of mineral resources onto mineralised waste facilities.

#### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Placement of surface infrastructure	Placement of surface infrastructure Mineralised waste management (tailings and waste rock)	Placement of surface infrastructure Mineralised waste management (tailings and waste rock)	Placement of surface infrastructure Mineralised waste management (tailings and waste rock)

#### Rating of impact

##### Severity

In the normal course of mining a certain degree of sterilisation is required to ensure safe underground workings. Typically mines sterilise resources by leaving support pillars underground and by leaving safe barriers between the base of open pits and the roof of underlying mining areas. This routine sterilisation is not assessed below because it is necessarily linked to safe mining conditions.

Aside from the abovementioned issues, the severity of sterilising mineral resources is considered to be high because of the associated potential economic value that is lost when sterilisation occurs. In the unmitigated scenario, this may occur in the event that Lehating develops or decommissions infrastructure in a manner that it prohibits the mining of feasible resources, or where it disposes of feasible mineral resources onto waste facilities in a manner that makes it difficult or impossible to access the resources.

With mitigation surface infrastructure can be placed in a manner that prevents sterilisation and/or optimised mining access points. Moreover, provision can be made to allow access to both waste rock and tailings if there is a viable means of extracting residual mineral resources. This reduces the severity to low.

##### Duration

If sterilisation of resources occurs it is likely that the related impact will extend beyond the life of the project. This is a long term duration and as such a high impact rating.

Spatial scale/ extent

In the first place, the spatial extent of the physical impact is linked to the spatial extent of the proposed project site. This is a localised spatial extent. If one considers the economic nature of the impact, it will extend beyond the site into the broader economy.

Consequence

The unmitigated consequence is high. The mitigated consequence is medium.

Probability

Information provided by Lehating indicates that the ore body is located 200m or more below the surface on both Lehating 741 and Wessels 227. It therefore follows that placement of surface infrastructure is unlikely to prevent the mining of the mineralised ore body regardless of mitigation. Moreover the waste rock and tailings facilities will be easily accessible for future reprocessing if required. The associated probability is low in both the unmitigated and mitigated scenario. By implementation of the mitigation measures sterilisation will probably be avoided completely.

Significance

The unmitigated significance is medium. In the mitigated scenario the significance is low.

Unmitigated – summary of the cumulative rated hazardous excavations and infrastructure impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	L	M

Mitigated – summary of the cumulative rated hazardous excavations and infrastructure impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	H	M	M	L	L

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

To prevent unacceptable mineral sterilisation.

Actions

Lehating will incorporate cross discipline planning structures for mining and infrastructure developments to avoid mineral sterilization.

Mine workings and the access road will be designed and developed so as not to limit access to mineral resources.

Final rehabilitation planning will take account of the possible future options for reprocessing the tailings and waste rock facilities.

### Emergency situations

None identified.

## TOPOGRAPHY

### 7.2.2 ISSUE: HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE

#### Introduction

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Hazardous excavations and infrastructure occur in all mine phases from construction through operation to decommissioning and closure.

The assessment below takes into account the impacts associated with hazardous excavations and infrastructure established for the proposed project.

#### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works Water Management Facilities Power supply and use Water supply and use Transport systems General site management Other support services and amenities	Earthworks Civil works Water Management Facilities Main and Ventilation Shafts Process Plant Tailings Storage Facility Waste rock stockpile Power supply and use Water supply and use Transport systems General site management Other support services and amenities	Water Management Facilities Main and Ventilation Shafts Process Plant Tailings Storage Facility Waste rock stockpile Transport systems General site management Other support services and amenities Demolition	Water Management Facilities Tailings Storage Facility Waste rock stockpile

#### Rating of impact

##### Severity

In the unmitigated scenario, most of the identified hazardous excavations and infrastructure relating to the proposed project components present a potential risk of injury and/or death to both people and animals. This includes safety issues associated with tailings failure and subsidence associated with underground mine workings. This is therefore rated as a high severity.

In the mitigated scenario, measures will be taken to reduce the possibility and frequency of potential incidents which reduces the severity to medium.

#### Duration

In the context of this assessment, death or permanent injury is considered a long term, permanent impact.

#### Spatial scale/ extent

For the most part, the direct impacts will be located within the Impala surface use area, but the indirect impacts will extend to the communities to which the people/animals belong.

#### Consequence

The consequence is high in the unmitigated and mitigated scenarios.

#### Probability

Even though the proposed mine is in a fairly remote area, it is not impossible that curious third parties and animals can access the site. In the unmitigated scenario, it is possible that the hazardous excavations and infrastructure present a risk to unaccompanied third parties and/or animals during all phases. Similarly if the tailings facility is not properly constructed and managed, there is a greater probability of failure and it is not impossible that people and animals could be situated in the failure zone. In the case of subsidence the unmitigated probability is reduced because the mine is being designed with support infrastructure but with mitigation this will receive specific attention as required.

In the mitigated scenario security measures such as fences and access control will be in place to prevent harm to people and animals, the tailings facility will be designed and managed to prevent failure, and underground mine workings will be equipped with support infrastructure to maintain stability and prevent surface subsidence. In which case the probability in the mitigated scenario reduces to low.

#### Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance of this potential impact is medium because there will be a reduction in probability that the impact occurs.

#### Unmitigated – summary of the cumulative rated hazardous excavations and infrastructure impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the cumulative rated hazardous excavations and infrastructure impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	H	M	H	L	M

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objectives

The objective is to prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure.

Actions

All proposed mineralised waste facilities will be designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. These issues will be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer.

Lehating will survey the proposed project area and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations and hazardous infrastructure is known. It will furthermore ensure that appropriate management measures are taken to address the related safety risks to third parties and animals. Included in this will be the implementation of adequate underground support infrastructure to prevent subsidence.

During construction and operation the safety risks associated with identified hazardous excavations, and infrastructure will be addressed through one or more of the following:

- fencing, berms, barriers and/or security personnel to prevent unauthorised access;
- warning signs in the appropriate language(s). Warning pictures can be used as an alternative.

Where Lehating has caused injury or death to third parties and/or animals, as a result of their mining operations, appropriate compensation will be provided.

During decommissioning planning of any part of the mine, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases.

At closure, the hazardous infrastructure will either have been removed or decommissioned and rehabilitated in a manner that it does not present a long term safety and/or stability risk.

At closure the hazardous excavations will be dealt with as follows:

- all shaft openings will have been sealed and rehabilitated;
- the potential for surface subsidence will have been addressed by providing underground support in mined out areas; and
- monitoring and maintenance will take place to observe whether the relevant long term safety objective have been achieved and to identify the need for additional intervention where the objectives have not been met.

### Emergency situations

If people or animals fall off or into hazardous excavations or infrastructure causing injury, or if any mineralised waste or water facilities fail causing injury to people or animals, the Lehigh emergency response procedure in Section 20 will be initiated.

## SOILS AND LAND CAPABILITY

### 7.2.3 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH POLLUTION

Information in this section was sourced from the soil study undertaken by ARC-Institute for Soil, Climate & Water (ARC-ISCW, May 2013) for the Lehigh project site.

#### Introduction

The proposed project has the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources (see Sections 7.2.7, 7.2.8, 7.2.9 and 7.2.10, for water related impacts). The loss of soil resources has a direct impact on the potential loss of the natural capability of the land. This section therefore focuses directly on the contamination of the soil resources and the effect this has on land capability.

There are a number of sources in all phases that have the potential to pollute soil resources. In the construction and decommissioning phases these activities are temporary in nature, usually existing from a few weeks to a few months. The operational phase will present more long term activities and the closure phase will present final land forms that may be susceptible to erosion and dispersion of pollution to surrounding soils.

#### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works General site management Transport systems Non-mineralised waste management Rehabilitation	General site management Main and Ventilation Shafts Process Plant Transport systems Surface water management infrastructure Non-mineralised waste	Demolition Main and Ventilation Shafts Process Plant General site management Transport systems Surface water management infrastructure	Tailings dam Waste rock stockpile Rehabilitation Maintenance and aftercare

Construction	Operational	Decommissioning	Closure
	management Tailings dams Water supply infrastructure Power supply infrastructure Rehabilitation	Non-mineralised waste management Tailings dams Water supply infrastructure Power supply infrastructure	

## Rating of impacts

### Severity

In the unmitigated scenario, pollution of soils from numerous incidents can result in a loss of land capability as an ecological driver because it can create a toxic environment for vegetation and ecosystems that rely on the soil. It could also negatively impact on the chemistry of the soils such that current growth conditions are impaired. This is a high severity in the unmitigated scenario.

In the mitigated scenario the number of pollution events should be significantly less which reduces the potential severity to medium.

### Duration

In the unmitigated scenario, most pollution impacts and associated loss in land capability will remain long after closure for all the proposed projects. In the mitigated scenario most of these potential impacts should either be avoided or be remedied within the life of the project, which reduces the duration to medium. This will be achieved by the effective reaction time of the clean-up team and the chosen remediation methods.

### Spatial scale/extent

In both the unmitigated and mitigated scenarios for all phases, the potential loss of soil resources and associated land capabilities will be restricted to within the site boundary.

### Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is reduced to medium as the severity and duration of the impact is reduced.

### Probability

Without any mitigation the probability of impacting on soils and land capability through pollution events is high. With mitigation, the probability will be reduced to medium - low because emphasis will be placed on preventing pollution events and on quick and effective remediation if pollution events do occur.

### Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance reduces to medium-low because with mitigation the severity, duration and probability associated with the potential the impact all reduce.



Unmitigated – summary of the rated loss of soil resources and land capability through pollution impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	L	H	H	H

Mitigated – summary of the rated loss of soil resources and land capability through soil pollution impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	L	L	M	M-L	M-L

### Conceptual description of proposed mitigation measures

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

#### Objectives

The objective is to prevent soil pollution.

#### Actions

In the construction, operation and decommissioning phases Lehating will ensure that all dirty water, mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute soils. This will be implemented through a procedure covering the following:

- pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment;
- pollution prevention through education and training of permanent and temporary workers;
- pollution prevention through appropriate management of hazardous materials and wastes;
- the required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in situ treatment or disposal of contaminated soils as hazardous waste. In-situ treatment 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 bioremediation 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; and
- specifications for post rehabilitation audit criteria 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.

The designs of any permanent and potentially polluting structures (such as the waste rock stockpile and tailings storage facility) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring.

## Emergency situations

Major spillage incidents will be handled in accordance with the Lehating emergency response procedure in Section 20.

### 7.2.4 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

Information in this section was sourced from the soil study undertaken by ARC-Institute for Soil, Climate & Water (ARC-ISCW, May 2013) for the Lehating project site.

## Introduction

There are a number of activities/infrastructure in all phases that have the potential to disturb soils and related land capability through removal, compaction and/or erosion. In the construction and decommissioning phases these activities could be temporary in nature, usually existing for a few weeks to a few months. The operational and closure phase will present more long term activities and the closure phase will present final land forms that may be susceptible to erosion.

### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works General site management Water supply and use Power supply and use Transport systems	Earthworks Civil works General site management Process Plant Main and Ventilation Shafts Stormwater management facilities Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation	General site management Process Plant Main and Ventilation Shafts Stormwater management facilities Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation Demolition	Rehabilitation Maintenance and aftercare Final waste rock stockpile and tailings facility

## Rating of impact

### Severity

In the unmitigated scenario, physical soil disturbance can result in a loss of soil functionality as an ecological driver. In the case of erosion, the soils will be lost to the area of disturbance, and in the case of compaction the soils functionality will firstly be compromised through a lack of rooting ability and aeration, and secondly the compacted soils are likely to erode because with less inherent functionality there will be little chance for the establishment of vegetation and other matter that naturally protects the soils from erosion. Any soils that remain beneath the permanent landforms (tailings facility and waste rock stockpile) will be a lost resource and the associated land capability will be permanently altered. This amounts to a high severity.

In the mitigated scenario, the soils can be conserved and reused to establish land capabilities. This does not apply to the soils that will remain under the tailings dam and waste rock stockpile, and associated land capability of these footprints. In total this reduces the high unmitigated severity to medium.

#### Duration

In the unmitigated scenario the loss of soil and related land capability is long term and will continue after the life of the proposed project. In the mitigated scenario, the soil is conserved and replaced in all areas which reduces the duration of the impact to the life of the proposed operations. However for both the unmitigated and mitigated scenarios the tailings facility and waste rock stockpile land capability will be altered forever.

#### Spatial scale/extent

In both the unmitigated and mitigated scenarios for all phases of the project, the potential loss of soil and land capability through physical disturbance will be restricted to within the site boundary.

#### Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is medium as the severity and duration of the impact is reduced.

#### Probability

Without any mitigation the probability of losing soil and related land capability is definite. With mitigation, the probability will be reduced because emphasis will be placed on soil conservation and re-establishment. In the case of the tailings dam and waste rock stockpile, while some topsoil can be conserved and used for rehabilitation, the probability of a land capability change will remain high as the these components will remain in perpetuity.

#### Significance

In the unmitigated scenario the significance is high for all the proposed projects. In the mitigated scenario the significance of this impact is reduced to low as the severity, duration and probability are reduced. In the case of tailings and waste rock the significance only reduces to medium.

#### Unmitigated – summary of the rated loss of soil resources and land capability through physical disturbance impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	L	H	H	H

Mitigated – summary of the rated loss of soil resources and land capability through physical disturbance impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	L	M	L (H for tailings and waste rock)	L (M for tailings and waste rock)

**Conceptual description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

The objective is to minimise the loss of soil resources and related land capability through physical disturbance.

Actions

In the construction, operation and decommissioning phases a soil management plan, with the following key components, will be implemented:

- limit the disturbance of soils to what is absolutely necessary for earthworks, on-going activities, infrastructure footprints and use of vehicles; and
- where soils have to be disturbed the soil will be stripped, stored, maintained and replaced in accordance with the specifications of the soil management principles in Table 40 and the detailed Lehigh soils management procedure.

**TABLE 40: SOIL MANAGEMENT PRINCIPLES**

Steps	Factors to consider	Detail
Delineation of areas to be stripped		Stripping will only occur where soils are to be disturbed by activities and infrastructure that are described in the EIA/EMP report, and where a clearly defined end rehabilitation use for the stripped soil has been identified.
Reference to biodiversity mitigation		All requirements for moving and preserving fauna and flora according to the biodiversity mitigation measures will be adhered to.
Topsoil Stripping		As a general requirement, a minimum of 500mm topsoil will be stripped from the shaft, waste rock, tailings, other stockpiles, process plant and stormwater dam areas. Stripping of soil from the other areas and the linear infrastructure footprints (pipelines, powerlines, and roads) can be reduced or eliminated on the advice of a suitable specialist.
Delineation of stockpiling areas	Location	The topsoil stockpile area 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.

Steps	Factors to consider	Detail
Stockpile management	Vegetation establishment and erosion control	Rapid growth of vegetation on the topsoil stockpile will be promoted (e.g. by means of watering or fertilisation). The purpose of this exercise will be to encourage vegetation growth on soil stockpile and to combat erosion by water and wind.
	Storm water controls	The topsoil stockpile will be established with storm water diversion berms to prevent run off erosion.
	Height and slope	The topsoil stockpile height will be controlled to avoid compaction and damage to the underlying soils. The stockpile side slopes should be flat enough to promote vegetation growth and reduce run-off related erosion.
	Waste	No waste material will be placed on the topsoil stockpile.
	Vehicles	Equipment movement on top of the topsoil stockpile will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank.
Rehabilitation of disturbed land: restoration of land capability	Placement of soil	Soils will be replaced as per the stripping depth unless a soils expert advises otherwise.
	Fertilisation	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.
	Erosion control	Erosion control measures will be implemented to ensure that the topsoil is not washed away and that erosion gulleys do not develop prior to vegetation establishment.
	Restore land function and capability	Where the land function and capability has not been effectively restored, apply landscape function analysis and restoration interventions.

As part of closure planning, the designs of any permanent landforms (eg. mineralised waste facilities) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring.

### Emergency situations

Soil eroding incidents such as burst water pipes will be handled in accordance with the Lehaving emergency response procedure in Section 20.

## BIODIVERSITY

By way of introduction to this section of the impact assessment, the International Council for Mining and Metals (ICMM) has been instrumental in research and development of good environmental practices in mining. The ICMM's Good Practice Guidance for Mining and Biodiversity provides some useful insights into issues around biodiversity. In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known ecosystem related value is listed as follows:

- 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 (key for medicines, crop and livestock breeding).

The assessment covers the following broad issues: physical destruction of biodiversity and related functions, and general disturbances to biodiversity. Each of these issues is individually assessed below.

### 7.2.5 ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY

Information in this section was sourced from the biodiversity study (EMS, July 2013) included in Appendix E.

#### Introduction

There are a number of activities/infrastructure that have the potential to directly disturb fauna and flora in all project phases, 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 that may have pollution potential through long term seepage and/or run-off.

#### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works General site management Water supply and use Power supply and use Transport systems	Earthworks Civil works General site management Process Plant Main and Ventilation Shafts Stormwater management facilities Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation	General site management Process Plant Main and Ventilation Shafts Stormwater management facilities Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation Demolition	Rehabilitation Maintenance and aftercare Final waste rock stockpile and tailings facility

#### Rating of impact

##### Severity

In the unmitigated scenario, biodiversity will 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;
- power lines can lead to bird kills;
- 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 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 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;
- the presence of vehicles in the area can cause road kills especially if drivers speed;
- the presence of mine water dams and pipelines may lead to drowning of fauna; and
- pollution emissions and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

Taken together, the disturbances will have a high severity in the unmitigated scenario when considered both incrementally for the proposed project and cumulatively. In the mitigated scenario, many of these disturbances can be prevented or mitigated to acceptable levels, which reduces the severity to low.

#### Duration

In both the unmitigated scenarios, the impacts are long term because where biodiversity is compromised, killed or removed from the area this impact is likely to exist beyond the life of the project. With mitigation, it may be possible to prevent impacts or reverse them within the life of the project which is a medium duration.

#### Spatial scale / extent

Given that biodiversity processes are not confined to the study area, the spatial scale will extend beyond the project site in the unmitigated and mitigated scenario. Key related issues are the migration of species and linkages between biodiversity areas. This is a medium spatial scale.

#### Consequence

In the unmitigated scenario, the consequence of this potential impact is high. In the mitigated scenario, this reduces to low because the severity of the impact is reduced.

Probability

Without any mitigation the probability of negatively impacting on biodiversity through multiple disturbance events is definite. With mitigation, the probability will be reduced to medium because some of the disturbances can be controlled through implementation and enforcement of practices, policies and procedures but for some of the disturbances like noise and vibration the mitigation options are limited.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance is reduced to medium because the associated severity, probability and spatial scale are reduced.

Unmitigated – summary of the rated cumulative general disturbance of biodiversity impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated cumulative general disturbance of biodiversity impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	M	M	L	M	M

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent unacceptable disturbance of biodiversity and related ecosystem functionality.

Actions

In the construction, operation, decommissioning and closure phases the mine will ensure that:

- The use of light is kept to a minimum, and where it is required, yellow lighting is used where possible: vertebrates should be kept away from the lighted areas with appropriate fencing where feasible.
- Vehicle will not be allowed to travel off designated roads or outside of designated disturbance areas.
- A speed limit of 40km/h should be adhered to along all gravel roads.
- All hunting and/or trapping or snaring of animals by mine staff and contractors shall be prohibited.
- No plant collection shall be allowed by contractors or mine staff.
- Employees shall be prohibited from collecting firewood and or cutting down trees in the area.



- Internal power lines will be equipped with bird deterrent measures to prevent bird kills where deemed necessary by an appropriately qualified specialist.
- Noisy and/or vibrating equipment will be well maintained to limit noise and vibration emission levels.
- All water dams will be fenced off to prevent access by larger animals.
- Dust control measures will be implemented at the mine in accordance with Section 7.2.11.
- Litter and pollution prevention measures will be implemented in accordance with Section 7.2.3.

### Emergency situations

Major spillage incidents will be handled in accordance with the Lehaving emergency response procedure in Section 20.

## 7.2.6 ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY

### Introduction

There are a number of activities/infrastructure in all phases that have the potential to destroy biodiversity in the broadest sense. In this regard, the discussion relates to the physical destruction of specific biodiversity areas, of linkages between biodiversity areas and of related species which are considered to be significant because of their status, and/or the role that they play in the ecosystem.

### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works General site management Water supply and use Power supply and use Transport systems	Earthworks Civil works General site management Process Plant Main and Ventilation Shafts Stormwater management facilities Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation	General site management Process Plant Main and Ventilation Shafts Stormwater management facilities Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation Demolition	Rehabilitation Maintenance and aftercare Final waste rock stockpile and tailings facility

### Rating of impact

#### Severity

The proposed activities and infrastructure have mostly been positioned in the moderately sensitive biodiversity areas (Figure 10). The exception is the access road corridor which traverses the Kuruman River and the dune on the south western boundary of the project, on Portion 2 of Wessels 227.

Despite the attempt to avoid more sensitive areas, the project will require the clearing of vegetation and associated habitat in the infrastructure footprint area. This will cause vegetation fragmentation and habitat

disturbance which although limited to a relatively small footprint on site, is part of a growing cumulative impact in the region. The habitat disturbance and fragmentation will cause the following negative impacts:

- opportunity for secondary pioneer vegetation and invasive vegetation to colonise disturbed areas thereby changing the nature of the vegetation and reducing ecosystem functionality and land use capability;
- habitat that is relied on by a range of mammals, insects, reptiles and amphibians will be lost which will cause the permanent displacement of these faunal species; and
- the transformed site will also break up the broader habitat which (when considered cumulatively with the similar impact of the surrounding mines) will cut off previous corridors of movement and further restrict foraging availability. This in turn will reduce the number of faunal species that the area can support.

Dewatering activities will reduce groundwater levels which can impact on trees that rely on groundwater for survival. This impact is typically more significant in the older more established trees because they can less easily adapt to dropping water levels and they support a significant range of flora and fauna species from an ecosystem functionality perspective.

Given the above discussion, the unmitigated severity is high which may reduce to medium depending on the successful implementation of the mitigation measures.

#### Duration

In the unmitigated scenario the loss of biodiversity and related functionality is long term and will continue after the life of the mine. In the mitigated scenario the biodiversity and related functionality may be partially restored during the operational and decommissioning phases, but given the long term nature of ecological processes in the semi-arid environment, it is unlikely that full restoration will occur before mine closure. The duration is therefore high in the unmitigated and medium to high in the mitigated scenarios.

#### Spatial scale

Given that biodiversity processes are not confined to the proposed project site, the spatial scale of impacts will extend beyond the site boundary in both the mitigated and unmitigated scenario. Key related issues are the migration of species, the flow of nutrients and linkages between biodiversity areas. The spatial scale is therefore medium in both the unmitigated and mitigated scenarios.

#### Consequence

In the unmitigated scenario, the consequence of this potential impact is high. This reduces to Medium – high with mitigation.

Probability

Without any mitigation the probability associated with the impact is definite. With mitigation, the probability will be reduced because emphasis will be placed on conserving and possibly restoring or offsetting critical areas and related biodiversity.

**Significance**

The significance of this potential impact is high in the unmitigated and medium-high in the mitigated scenario.

Unmitigated – summary of the rated cumulative physical destruction of biodiversity impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated cumulative physical destruction of biodiversity impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M-H	M	M-H	M	M-H

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent, as far as is possible, the unacceptable loss of biodiversity and related functionality through physical destruction.

Actions

In the construction, operation and decommissioning phases the mine will implement its biodiversity management plan. The key components are:

- to generally limit mine infrastructure, activities and related disturbance to those specifically identified and described in this EIA report and to establish buffers between the infrastructure areas and more sensitive habitats;
- where possible, to specifically avoid the destruction of irreplaceable biodiversity areas and important linkages between biodiversity areas;
- there will be planned removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities. This will include planning on the preservation, cultivation and re-use of these species in ongoing rehabilitation. Links will also be made to the soil conservation procedure

and actions. Harvesting of seed in a controlled manner from similar areas within the project area will be undertaken to aid in rehabilitation of the mining areas;

- as a first priority, every attempt will be made to preserve existing larger trees. In addition, pods of *Acacia erioloba* and *Acacia haematoxylon* will be collected from the area in order to aid in the re-establishment of these species. Necessary steps (such as artificial scarring/acid washing) will be taken in order to aid in germination of these species.
- permits will be obtained for the destruction and/or removal of protected vegetation;
- restoration of the biodiversity functionality, as far as is possible, in areas that have been physically rehabilitated; and follow up audits and monitoring in the short and long term to determine the success of the rehabilitation and restoration activities in terms of a range of performance indicators;
- implementation of an alien/invasive/weed management programme to control the spread of these plants onto and from disturbed areas;
- monitoring of both the groundwater levels near older more established trees and monitoring of the tree health to determine if mine related dewatering impacts this set of trees. If an impact is observed a specialist will be commissioned to determine the appropriate mitigation measures; and
- if irreplaceable biodiversity will be permanently lost, and/or restoration is not possible, and/or the residual impacts have a higher than medium significance rating (to be determined by an appropriate specialist) a biodiversity offset will be investigated and implemented where feasible. Issues that will be considered in the investigation are as follows:
  - the size of the potentially affected area;
  - the conservation/sensitivity 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: no net biodiversity loss, compensation for the mine's negative impact on biodiversity, long term functionality, long term viability, contribution to biodiversity conservation in the Namib including linkages to areas of conservation importance, acceptability to key stakeholders, distances from other mines in relation to dust fallout and other impacts, and biodiversity condition scores as compared to that at the mine 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 the mine to implement and manage the offset;
  - 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.

As part of closure planning, the designs of any permanent structures (mineralised waste facilities) will take into consideration the requirements for the establishment of long term biodiversity functionality, aftercare and confirmatory monitoring.

## Emergency situations

None identified.

## SURFACE WATER

The proposed project could result in an alteration of drainage patterns, as well as potentially contaminate surface water resources. These issues are assessed separately below.

### 7.2.7 ISSUE: ALTERATION OF NATURAL DRAINAGE PATTERNS

Information for this section was sourced from site visits conducted by the EIA project team and the biodiversity study (EMS, July 2013) included in Appendix E and the stormwater management study included in Appendix F (SLR, June 2013).

#### Introduction

Pre-mining natural drainage across the site is via sheet flow and/or non-perennial preferential flow paths (drainage lines). With reference to the table below, there are a number of activities/infrastructures which will alter drainage patterns either by reducing the volume of run-off into the downstream catchments or through their location within watercourses. This in turn has the potential to cause water supply impacts on downstream human and biodiversity users. During the decommissioning phase, these activities will continue until such time as mine and project infrastructure can be removed and/or the areas rehabilitated. During the closure phase rehabilitation will allow for the restoration of drainage patterns as far as possible except where final landforms remain.

#### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works General site management Water supply and use Power supply and use Transport systems	Earthworks Civil works General site management Process Plant Main and Ventilation Shafts Stormwater management facilities Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation	General site management Process Plant Main and Ventilation Shafts Stormwater management facilities Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation Demolition	Rehabilitation Maintenance and aftercare Final waste rock stockpile and tailings facility

#### Rating of impacts

##### Severity

During the construction, operation, decommissioning, and to a lesser extent, the closure phases, rainfall and surface water run-off will be 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. In the context of the affected quaternary catchment this is considered to be a low severity because the reduction is measurable but will not result in a substantial deterioration in the water reserve and downstream water uses. The overall low severity rating applies in both the unmitigated (all phases) and mitigated scenarios (prior to closure).

In terms of drainage lines, the proposed project will affect the non-perennial Kuruman River located to the south west of the project site, through the creation of a river crossing associated with the construction of an access road. In the unmitigated scenario if this is not correctly designed, constructed and maintained this could impede flow, cause ponding upstream and possibly also flooding. Given that the river does not flow with any regularity, this is a medium severity. With mitigation these issues will be avoided which reduces the severity to low.

After closure, in the mitigated scenario, the project site will be rehabilitated to re-establish landscape functionality and surface water runoff will no longer be contained. The associated severity reduces to low.

#### Duration

In the unmitigated scenario, the alteration of drainage patterns will extend beyond closure. In the mitigated scenario, the duration of the alterations will mostly be restricted to the phases before closure.

#### 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 medium for the site and high for the crossing. In the mitigated scenario the consequence is low because of reductions in duration and severity.

#### 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 therefore probability is medium until closure when it is expected to reduce to low.

The probability of the impacts associated with the river crossing is medium without mitigation because of the fact that the river seldom flows. With mitigation the probability reduces to low.

#### Significance

The significance is high in all phases without mitigation. With mitigation this reduces to medium prior to closure and to low thereafter.

Unmitigated – summary of the rated cumulative alteration of natural drainage patterns impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>All phases</b>						
Unmitigated	L (M for the river crossing)	H	M	M (H for crossing)	H	H

Mitigated – summary of the rated cumulative alteration of natural drainage patterns impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>Construction, operation and decommissioning</b>						
Mitigated	L	M	M	L	M	M
<b>Closure</b>						
Mitigated	L	M	M	L	L	L

### **Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and tabulated in the EMP (Section 19).

#### Objective

The objective of the mitigation measures is to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.

#### Actions

In all phases mine infrastructure will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) of any future amendments thereto. These include:

- clean water systems are separated from dirty water systems;
- the size of dirty water areas are minimized and clean run-off and rainfall water is diverted around dirty areas and back into the normal flow in the environment. Dirty or contaminated water will be contained; and
- aside from the access road, the location of all activities and infrastructure should be outside of the specified zones (100m from any water courses) and/or the 1:100 flood lines, whichever is the greatest. If this is unavoidable the necessary exemptions/approvals will be obtained.

The access road river crossing that will be constructed will be designed so that there is no material alteration of the river flow. The crossing will be designed with culverts of sufficient capacity to handle a 1 in 50 flood event. The crossing will be inspected regularly for erosion and any culvert blockages. Where blockages have formed these will be cleared and damaged areas will be repaired immediately.

### **Emergency situations**

None identified.

## 7.2.8 ISSUE: CONTAMINATION OF SURFACE WATER

Information for this section was sourced from the surface water management plan (SLR, June 2013).

### Introduction

There are a number of pollution sources that have the potential to contaminate 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 will present more long term potential sources and the closure phase will present final land forms that may have the potential to contaminate surface water through long term seepage and/or run-off.

### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works General site management Transport systems Non-mineralised waste management Rehabilitation	General site management Main and Ventilation Shafts Process Plant Transport systems Surface water management infrastructure Non-mineralised waste management Tailings dams Water supply infrastructure Power supply infrastructure Rehabilitation	Demolition Main and Ventilation Shafts Process Plant General site management Transport systems Surface water management infrastructure Non-mineralised waste management Tailings dams Water supply infrastructure Power supply infrastructure	Tailings dam Waste rock stockpile Rehabilitation Maintenance and aftercare

### Rating of impacts

#### Severity

In the unmitigated scenario, surface water may collect contaminants (hydrocarbons, salts, chemicals, metals and bacteria) from numerous sources. At elevated pollution concentrations these contaminants can exceed the relevant limits imposed by DWA (these limits may be subject to periodic revision in consultation with DWA) and can be harmful to humans and livestock if ingested directly and possibly even indirectly through contaminated vegetation, vertebrates and invertebrates (impacts on biodiversity have been assessed in Section 7.2.5 and will not be reassessed in this section). The related unmitigated severity is high.

In the mitigated scenario, clean water will be diverted away from the project site and contaminated run-off and process water will be contained and re-used in the normal course. The severity can therefore be reduced to low.

#### Duration



In the unmitigated scenario, the contamination of surface water resources will occur for periods longer than the life of mine. With mitigation, contamination can be prevented and/or managed and as such the impacts can be reversed or mitigated within the life of mine.

#### Spatial scale / extent

The spatial scale of the potential unmitigated impacts will be restricted to potential surface and near surface water use for as far as the contaminated surface water travels either on surface or in the underlying zones. In the mitigated scenario contaminated water will be contained on site, which is a localised spatial scale.

#### Consequence

In the unmitigated scenario the consequence is high and can be reduced to low with mitigation.

#### Probability

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 animals utilise this contaminated water?
- Is the contamination level harmful?

The first element is that contamination reaches the surface water resources adjacent to project site. Due to the proximity of the proposed project, contaminants could reach surface water resources.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There is a possibility for this to occur, albeit limited in terms of third parties because most of the inhabitants surrounding the Lehating Manganese Mine use groundwater boreholes and no surface water users were identified in the footprint area of the mine. Areas surrounding the proposed project site are utilised for grazing activities and as such it is possible that cattle will utilise the tributaries of the Kuruman River for drinking purposes during the rainy seasons when water is available.

The third element is that it is likely that 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 in the rainy season.

As a combination, the unmitigated probability is medium and the mitigated probability is low.

#### Significance

In the unmitigated scenario, the significance of this potential impact is high. 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 pollution of water resources impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the rated cumulative pollution of water resources impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	M	L	L	L	L

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent contamination of surface water resources and related harm to surface water users.

Actions

Lehating will comply with the terms and conditions of water authorisations/licenses.

In all phases, infrastructure associated with the proposed projects will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto. Key related issues are to ensure that:

- clean water systems are separated from dirty water systems;
- the location of all activities and infrastructure (aside from the access road) should be outside of the specified zones and/or floodlines of watercourses. If this is unavoidable the necessary exemptions/approvals will be obtained;
- the size of dirty areas are minimised and dirty water is contained in systems that allow the reuse and/or recycling of this dirty water;
- discharges of dirty water may only occur in accordance with authorisations that are issued in terms of the relevant legislation specifications and they must not result in negative health impacts for downstream surface water users. The relevant legislation specifications comprises any applicable authorisation/exemption, the National Water Act (36 of 1998) and Regulation 704, or any future amendment thereto; and
- the site wide water balance is refined on an on-going basis with the input of actual flow volumes and used as a decision making tool for water management and impact mitigation.

In the construction, operation and decommissioning phases the mine will ensure that all mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute surface water. This will be implemented through a procedure(s) covering the following:

- pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment;
- pollution prevention through education and training of workers (permanent and temporary);
- pollution prevention through appropriate management of hazardous materials and waste;
- the required steps to enable containment and remediation of pollution incidents; and
- specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.

The designs of any permanent and potentially polluting structures will take account of the requirements for long term surface water pollution prevention.

Lehating will monitor the water quality (Section 21) in all potentially affected surface water resources and use the monitoring results to implement appropriate mitigation measures to achieve the surface water quality objectives.

Where monitoring results indicates that third party water supply has been polluted by Lehating, Lehating will ensure that an alternative equivalent water supply will be provided.

### **Emergency situations**

Discharge incidents that may result in contamination of surface water resources will be handled in accordance with the Lehating's emergency response procedure in Section 20.

## **GROUNDWATER**

### **7.2.9 ISSUE: REDUCTION OF GROUNDWATER LEVELS AND AVAILABILITY**

The information in this section was sourced from the groundwater specialist study (SLR, July 2013) included in Appendix G.

#### **Introduction**

Mine dewatering to ensure safe working conditions and/or the abstraction of water from the proposed water supply boreholes (well field) has the potential to cause a reduction in the level and availability of groundwater, which may cause a loss in water supply to surrounding borehole users and impact the baseflow of nearby drainage lines. Dewatering related impacts on biodiversity have been assessed in Section 7.2.6 and will not be repeated here.

**Project phase and link to activities/infrastructure**

Construction	Operation	Decommissioning	Closure
			-
Water supply and use	Mining Water supply and use	Water supply and use	N/A

**Rating of impact**Severity

Specialist modelling and assessment indicates that dewatering cones may develop around the mine and the well field.

The potential drop in water levels will vary depending on the distance from the mine and the nature of the developing dewatering cones. It is predicted that dewatering associated with the mine will result in an on-site drop in water levels of approximately five metres. In the case of the well field it is predicted that dewatering will result in an offsite drop in water levels of less than two metres extending approximately one kilometre off site.

It follows that limited dewatering impacts are expected on either third party boreholes or the Kuruman River. This is a low severity in both the mitigated and unmitigated scenario.

Duration

In the unmitigated scenario, the duration of the impacts (on the Kuruman River and third party boreholes) is linked to the duration of the dewatering and the recharge time thereafter. This impact could extend post decommissioning until water levels have re-established to pre-mining levels during the closure phase. With mitigation, the duration of impacts on any third party boreholes are reduced (through alternative water supply) therefore the duration reduces to short term.

Spatial scale / extent

The spatial scale is medium for all scenarios because the cumulative dewatering cone extends off site.

Consequence

In the unmitigated scenario the consequence for the impact on surrounding borehole users is medium. With mitigation it reduces to low. In both the unmitigated and mitigated scenario, the consequence for the Kuruman River is medium.

Probability

Unmitigated probability of impacting surrounding borehole users is medium to low because of the prediction that the off site drop in water levels (associated mainly with the well field) is less than 2metres. With mitigation the probability reduces to low.

The probability that the Kuruman River base flow will be materially impacted by the dewatering cone is low because measured groundwater levels are far below the base of the non-perennial Kuruman River. As a result an impact on the non-perennial Kuruman River due to dewatering of the well field is not expected.

### Significance

In the unmitigated scenario, the significance of the impacts on surrounding borehole users is medium - low. With mitigation this reduces to low.

In the unmitigated and mitigated scenario, the significance for the Kuruman River base flow is low.

### Unmitigated significance for impacts on borehole users – summary of the rated impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction to decommissioning						
Unmitigated	L	H	M	M	M-L	M-L

### Mitigated significance for impacts on borehole users – summary of the rated impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction to decommissioning						
Mitigated	L	L	M	L	L	L

### Unmitigated and mitigated significance for impacts on Kuruman River base flow – summary of the rated impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction to decommissioning						
Unmitigated	L	H	M	M	L	L

### **Conceptual description of proposed mitigation measures**

Conceptual mitigation measures are provided below and tabulated in the EMP (Section 19)

### Objective

The objective of the mitigation measures is to prevent water losses to third party water users.

### Actions

All potentially affected third party boreholes will be included in the Lehating ground water monitoring program to ensure that changes in water depths can be identified.

Where Lehating's dewatering causes a loss of water supply to third parties an alternative equivalent water supply will be provided by Lehating until such time as the dewatering impacts cease.

One monitoring borehole in the vicinity of the Kuruman River alluvial aquifer will be monitored to observe the dewatering impacts of the well field on the Kuruman River. If monitoring indicates that greater impacts (than those predicted above) are occurring, well field use will be adjusted according to the advice of an appropriate specialist.

### Emergency situations

None identified.

### 7.2.10 ISSUE: CONTAMINATION OF GROUNDWATER

The information in this section was sourced from the groundwater specialist study (SLR, July 2013) included in Appendix G.

### Introduction

There are a number of sources in all mine phases that have the potential to pollute groundwater. In the construction and decommissioning phases some of these potential pollution sources are temporary and diffuse in nature. Even though the sources are temporary in nature, related potential pollution can be long term. The operational phase will present more long term potential sources and the closure phase will present final land forms that may have the potential to pollute water resources through long term seepage and/or run-off.

### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works Site management Transport systems Non-mineralised waste management Support services and amenities Rehabilitation	Earthworks Civil works Site management Transport systems Non-mineralised waste management Support services and amenities Shafts Process plant Mineralised waste (TSF and waste rock) Other stockpiles Water supply infrastructure Power supply infrastructure Rehabilitation	Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Support services and amenities Mineralised waste (TSF and waste rock) Other stockpiles Water supply infrastructure Power supply infrastructure Rehabilitation	Maintenance and aftercare of final land forms and rehabilitated areas including TSF and waste rock stockpile

### Rating of impacts

#### Severity

The proposed mine presents a number of groundwater pollutant sources. These include:

- accidental spills and leaks from vehicles, non-mineralised waste, equipment, workshops and washbays have the potential to reach shallow groundwater during the construction, operational and decommissioning phases; and
- the TSF, waste rock stockpile and other stockpiles have the potential to impact upon groundwater during all project phases, as well as after closure through seepage.

Contaminant transport modelling of groundwater pollution assumed that responsible housekeeping and management of diffuse pollution sources would limit the sources of groundwater contamination to the TSF, waste rock and other stockpiles.

The model results indicate that there is potential for localised contamination dispersion. That has the potential to impact groundwater resources.

In the unmitigated scenario the related severity is high because of the importance of groundwater in the region. With mitigation this reduces to medium.

#### Duration

In the unmitigated scenario, groundwater contamination and the potential related health impacts are long term in nature, occurring for periods longer than the life of project. With mitigation the pollution and related impacts can be prevented or mitigated during the life of all the projects which reduces the duration to medium.

#### Spatial scale / extent

Modelling results indicate that contaminates will not extend beyond the mine site, will remain localised and are unlikely to reach third party boreholes or the Kuruman River in both the unmitigated and mitigated scenario.

#### Consequence

The unmitigated consequence is high. With mitigation this reduces to medium.

#### Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach groundwater or surface water resources?
- Will people and animals utilise this contaminated water?
- Is the contamination level harmful?

The first element is that contamination reaches the ground water resources. Groundwater modelling indicates that groundwater is impacted by contamination but that this does not migrate off site.

The second element is that third parties and/or livestock use this contaminated borehole water for drinking purposes. The model predicts that it is unlikely that contamination plumes will reach third party boreholes but this does not mean that future, post mining land use will exclude uses relating to farming and related groundwater abstraction.

The third element is that 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 the receiving water bodies particularly in the rainy season. As per the geochemistry results, the potential exists for contamination to exceed acceptable drinking water standards.

As a combination, the unmitigated impact probability is medium-low and the mitigated probability is low.

### Significance

The unmitigated significance is high-medium and the mitigated significance is low.

### Unmitigated – summary of the rated cumulative contamination of groundwater impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	L	H	M-L	H-M

### Mitigated – summary of the rated cumulative contamination of groundwater impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	L	M	L	L

### **Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below. Mitigation measures for both the approved and proposed project are tabulated in the EMP (Section 19).

### Objective

The objective of the mitigation measures is to prevent pollution of ground water resources and related harm to water users.

### Actions

Lehating will comply with both the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto, and the terms and conditions of water authorisations/license.



In the construction, operation and decommissioning phases the mine will ensure that all hazardous substances, mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute groundwater. This will be implemented through a procedure(s) covering the following:

- pollution prevention through basic infrastructure design, such as lining the TSF;
- pollution prevention through education and training of workers (permanent and temporary);
- pollution prevention through appropriate management of materials and non-mineralised waste;
- the required steps to enable containment and remediation of pollution incidents; and
- specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.

Infrastructure that has the potential to cause groundwater contamination will be identified and included in a groundwater pollution management plan which will be implemented as part of the operational phase.

This plan has the following principles:

- determine potential pollution sources;
- determine the extent of the existing or potential contamination plume; and
- design and implement intervention measures to prevent, eliminate and/or control the pollution plume. monitor all existing and potential impact zones to track pollution and mitigation impacts.

Groundwater monitoring will be done in accordance with the monitoring plan included in Section 21. In this regard Lehating will:

- monitor all potential impact zones including the closest third party boreholes and the aquifer beneath the Kuruman River; and
- where monitoring results indicates that third party water supply has been polluted by mine related activities/infrastructure, Lehating will ensure that an alternative equivalent water supply will be provided.

The designs of any permanent and potentially polluting structures will take account of the requirements for long term water pollution prevention. Moreover, where these facilities are associated with groundwater plumes that have or will impact the quality of water resources, Lehating will implement mitigation measures for as long as is needed to eliminate the risk and achieve the stated mitigation objectives.

### **Emergency situations**

Discharge incidents that may result in pollution of groundwater resources will be handled in accordance with the Lehating emergency response procedure (Section 20).

**AIR QUALITY****7.2.11 ISSUE: AIR POLLUTION**

Information in this section was sourced from the air quality impact study undertaken by Airshed (Airshed, July 2013).

**Introduction**

There are a number of activities/infrastructure in all phases that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

Air pollution related impacts on biodiversity have been discussed in Section 7.2.5 and therefore this section focuses on the potential for human health impacts.

**Project phase and link to activities/infrastructure**

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works Transport systems General site management Other support services and amenities	Main and Ventilation Shafts Process Plant Power supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	Tailings and Waste Rock facilities Demolition	Tailings and Waste Rock facilities Rehabilitation Maintenance and aftercare

**Rating of impact**Severity

The main emissions from the proposed mine include: inhalable particulate matter (including the manganese component) less than ten microns in size (PM<sub>10</sub>), larger total suspended particulates (TSP), and limited gas emissions. 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. Other emissions types that were considered in this assessment include sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>) diesel particulate matter (DPM) and carbon monoxide (CO). Neither TSP nor the other gaseous emissions are predicted to result in impacts of any significance so the discussion below focusses on PM<sub>10</sub> and the manganese component thereof.

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. In addition, the inhalable dust fraction (PM<sub>10</sub>) can be associated with respiratory disease such as asthma. Both qualitative and quantitative limits have been set internationally to regulate health impacts from these types of emissions.

The assessment of impacts refers to the modelled pollution dispersion and draws comparisons to the limits.

The air specialist made use of a model to predict air quality impacts. In this regard, the most significant project phase is the operational phase.

In the unmanaged scenario, PM<sub>10</sub> and manganese concentrations were predicted to exceed relevant daily and annual evaluation criteria at the Boerdraai third party residences off site and in other areas where cattle minders may be located, which is of high significance. Given this, the model was also used to predict impacts with mitigation in place. In some instances, the level of routine mitigation that was assumed in the remodelling proved insufficient to negate all impacts of concern and therefore even more stringent management measures have been included.

In the routinely mitigated scenario, exceedances of the daily **PM<sub>10</sub>** standards are predicted to occur past the project boundary. These exceedances do not extend to third party residences, but they do extend off site to areas where cattle minders may be for ad hoc time periods.

In the routinely managed scenario, off site **manganese** concentrations are predicted to exceed the World Health Organisation (WHO) guideline at the Boerdraai residence and in areas where cattle minders may be for ad hoc periods. With additional mitigation measures the impact is reduced so as not to reach the Boerdraai residence but it still extends off site to areas where cattle minders may be for ad hoc time periods.

It follows that the unmitigated scenario is associated with a high severity and the mitigated scenario is associated with a medium severity

#### Duration

Health impacts have the potential to continue after mine closure so the associated duration is long term in the unmitigated scenario reducing to high-medium with mitigation.

#### Spatial scale

The impacts are predicted to extend off site with and without mitigation so the associated spatial scale is medium.

#### Consequence

The unmitigated consequence is high. This reduces to high-medium with mitigation because severity and duration change.

Probability

The probability of health impacts occurring relates to the probability that third parties will be exposed to PM<sub>10</sub> and/or Manganese concentrations in excess of the relevant health evaluation criteria. In this regard, the unmitigated probability is high and the mitigated probability is medium to low.

Significance

It follows that the unmitigated significance is high and the mitigated significance is medium.

Unmitigated – summary of the rated cumulative air pollution impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>Construction and Decommissioning</b>						
Unmitigated	M	M	M	M	M	M
<b>Operational phase</b>						
Unmitigated	H	H	M	H	H	H
<b>Closure phase</b>						
Unmitigated	M	M	L	M	M-L	M-L

Mitigated – summary of the rated air pollution impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>Construction and Decommissioning</b>						
Mitigated	M	M	M	M	H	M-L
<b>Operational phase</b>						
Mitigated	M	H-M	M	H-M	M-L	M
<b>Closure phase</b>						
Mitigated	M	M	L	M	L	L

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent air pollution health impacts.

Actions

Lehating will implement a dynamic air quality management plan that covers:

- the identification of sources (emissions inventory);
- the implementation of source based controls;
- the use of source and receptor based performance indicators and monitoring strategies;
- the use of source and receptor based mitigation measures;
- the use of internal and external auditing; and
- review and plan adjustment as required.

During the construction phase the following actions will be implemented:

- during land clearing activities:

- the area will be sprayed with water prior to clearance, so as to reduce the potential for dust generation when stockpiling topsoil; and
  - travel distances between clearing area and topsoil stockpiles will be kept to a minimum.
- during road construction and/or grading:
  - the area will be sprayed with water prior to grading;
  - freshly graded areas will be kept to a minimum; and
- wind erosion from exposed areas will be managed by keeping the exposed areas moist through regular water spraying, and by the monitoring of dust buckets.

During the operational phase the following actions will be implemented:

- PM<sub>10</sub> concentrations from ventilation shafts will be measured routinely and during blasting conditions in order to monitor the levels of dust generated;
- vehicle activities on gravel roads will be managed by reducing speed limit on mine roads to 40km/hour, and gravel roads will be regularly sprayed with a combination of water and chemicals to ensure at least 75% control efficiency;
- the generation of PM<sub>10</sub> and dust fallout at material transfer points at conveyors will be controlled by:
  - enclosing the transfer points to ensure 70% control efficiency;
  - performing visual monthly inspections to ensure no visual dust is generated from these points;
- crushing and screening operations will be managed by:
  - reducing PM<sub>10</sub> concentrations and dust fallout through regular spraying with water sprays;
  - increasing the moisture content of the ore to a minimum of 4% prior to crushing as a primary measure. If ambient off site monitoring indicates that Manganese concentrations at Boerdraai are above the relevant evaluation criteria an additional measure will be to enclose the crushers and equip them with dust extraction systems.

The ambient and dust fallout monitoring and management programmes (Section 21.1.2) will be implemented at Lehating and the results thereof will be used to determine appropriate emission controls and other relevant mitigation interventions. In this regard monitoring will be a combination of dust buckets, PM<sub>10</sub> ambient samplers and manganese analysis. Dust fallout in the mine site will be monitored with dust buckets to ensure that monthly dust fallout rates do not exceed 1 200mg/m<sup>2</sup>/day. Dust buckets at sensitive receptor sites will monitor that monthly dust fallout rates do not exceed 600mg/m<sup>2</sup>/day. A PM<sub>10</sub> sampler will be installed at sensitive receptor site so as to monitor that the daily averages do not exceed 75µg/m<sup>3</sup> for more than four days in a calendar year and the annual average will not to exceed 40 µg/m<sup>3</sup>. Manganese monitoring will be conducted at the sensitive receptor site (Boerdraai) to monitor that manganese concentrations are less than 0.15µg/m<sup>3</sup>.

During decommissioning wind erosion from exposed areas will be managed by the use of water sprays where high levels of vehicle activity are encountered.

As part of closure planning the designs of any permanent and potentially polluting structures (particularly the mineralized waste facilities) will, on the basis of impact modelling, incorporate measures to address long term pollution prevention and confirmatory monitoring. In concept, closure related erosion and dust dispersion will be mitigated by ensuring that vegetation is re-established on cleared areas and other areas that could potentially be dust emission sources are vegetation and or capped.

### Emergency situations

Upset conditions and related unmitigated emission incidents that are likely to result in an exceedance of one or more of the evaluation criteria are considered an emergency situation. These will be addressed in accordance with the Lehating's emergency response procedure in Section 20.

## NOISE

### 7.2.12 ISSUE: NOISE POLLUTION

Information in this section was sourced from the Lehating project team, as well as previous EIAs compiled by SLR for other mines in the region.

#### Introduction

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 (eg. distant humming noises).

Potential noise impacts on biodiversity have been addressed in Section 7.2.5 and so this section will focus on the potential human related noise impacts.

#### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Site preparation Earthworks Civil works Transport systems	Earthworks Civil works Main and Ventilation Shafts Process Plant Power supply and use Water supply and use Transport systems Other support services and amenities	Earthworks Transport systems Demolition	

## Rating of impact

### Severity

The SANS guidelines (SANS:10103, 2008) stipulate that noise levels from a development that cause ambient background noise levels to increase in excess of 3 to 5dBA will create a noise disturbance. These are the evaluation criteria for this assessment.

In the unmitigated scenario, the proposed project could result in off site ambient noise increases of 3 to 5dBA from the main mining related noise sources particularly at night. In this regard, there are third party receptors that may be affected (Boerdraai farmhouse and the van Schalkwyk farmhouse and worker dwellings). The determination of severity will depend on the actual noise propagation from the mine and the receptors individual response to any increase in noise. For the purpose of this assessment, a negative response has been assumed, which translates to medium severity.

With successful mitigation, the severity reduces to medium - low.

### Duration

In both the unmitigated and mitigated scenarios the noise pollution impacts will occur until the closure phase of the mine when the noise generating activities are stopped. This is a medium duration.

### Spatial scale / extent

In the unmitigated and mitigated scenarios the noise impacts will extend off site. This is a medium spatial scale.

### Consequence

The unmitigated scenario the consequence is medium and low in the mitigated scenario.

### Probability

The probability of a noise impact occurring will be determined by the individual response of the receptors. It follows that noise pollution will have different impacts on different receptors because some are very sensitive to noise and others are not. For the purpose of this assessment, the assumed unmitigated probability is medium. With successful mitigation the probability reduces to medium-low.

### Significance

The significance in the unmitigated scenario is medium and low in the mitigated scenario.

### Unmitigated – summary of the rated cumulative noise pollution impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>Construction, operation and decommissioning</b>						
Unmitigated	M	M	M	M	M	M

**Mitigated – summary of the rated cumulative noise pollution impact per phase of the project**

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M-L	M	M	L	M-L	M-L

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

**Objective**

The objective of the mitigation measures is to prevent unacceptable noise impacts.

**Actions**

Prior to construction, Lehating will commission a noise specialist to determine pre-project ambient noise levels at Boerdraai and van Schalkwyk residences.

Once the project commences, all noise complaints will be documented, investigated and reasonable efforts made to address the area of concern. Where necessary and using the pre-project ambient noise levels as a reference point, noise monitoring will be undertaken as part of the investigation to quantify mine related impacts.

In the normal course, all vehicles and equipment will be maintained to limit noise emissions.

Where additional noise control measures are required, the following will be considered as additional options that could be implemented:

- Equipping noise sources with silencers;
- Construction of noise attenuation measures where required; and
- Adjusting the operational times of the noise generating activities.

**Emergency situations**

None identified.

**BLASTING IMPACTS****7.2.13 ISSUE: BLASTING IMPACTS**

Information in this section was sourced from the Lehating project team and previous EIAs compiled by SLR in the area.



## Discussion

Blasting is required for the sinking of the shaft, underground mining of the ore body, and possibly establishment of surface infrastructure and demolition of infrastructure during decommissioning.

This section assesses the potential for blasting related impacts on third parties and their structures, and does not assess potential blasting impacts on Lehating's staff or infrastructure.

Related air quality impacts are discussed in Section 7.2.11 and related biodiversity impacts are discussed in Section 7.2.5. These will not be re-assessed in this section.

### Activities and infrastructure - link to mine phases

Construction	Operational	Decommissioning	Closure
			N/A
Site preparation Earthworks Civil works	Mining	Demolition	

## Rating of impact

### Severity

In the unmitigated scenario, surface blasting activities could cause injury to third parties and livestock through fly rock. Damage to third party infrastructure may also be caused by fly rock, ground vibration, and/or air blast. The severity is therefore high in the unmitigated scenario. In the mitigated scenario, this severity reduces to low because measures can be taken to control blasts and associated impacts.

### Duration

Given that blasting (near surface blasting in particular) can cause injury and/or death the duration of the impacts is considered to be long term. Therefore the unmitigated and mitigated impact duration is high.

### Spatial scale / extent

Blasting impacts will extend off site therefore the spatial scale is medium. Table 41 provides a list of infrastructure, animal and human receptors at different distances from the main shaft.

**TABLE 41: PROXIMITY OF STRUCTURES TO LEHATING MANGANESE MINE**

500 m	1 km	1.5 km	2 km	2.5km
Lehating offices, access road, underground workings, stormwater management facilities and parking areas	Lehating offices, access road, underground workings, stormwater management facilities and parking areas	Lehating offices, access road, underground workings, stormwater management facilities and parking areas	Lehating offices, access road, underground workings, stormwater management facilities and parking areas	Lehating offices, access road, underground workings, stormwater management facilities and parking areas
Internal and access roads	Internal and access roads	Internal and access roads	Internal and access roads	Internal and access roads

Wellfield pipeline	Wellfield pipeline	Wellfield pipeline	Wellfield pipeline	Wellfield pipeline
Ad-hoc grazing cattle	Ad-hoc grazing cattle	Ad-hoc grazing cattle	Ad-hoc grazing cattle	Ad-hoc grazing cattle
		R380	R380	R380
				Boerdraai farmhouse
				R van Schalkwyk farmhouse

### Consequence

The consequence is high in the unmitigated scenario and medium in the mitigated scenario.

### Probability

Fly rock, airblast and vibration will only occur as a combined risk with surface blasting. The proposed project will only use surface blasting for a limited time during the construction phase and possibly during decommissioning. Once the mine is operational, and the blasts are located underground, airblasts and fly rock risks are eliminated. Moreover the charge and intensity of blasts typically associated with underground mining is reduced which limits the potential for vibration related impacts. It follows that the unmitigated probability is medium, reducing to low with mitigation.

### Significance

The significance has been rated as high in the mitigated and low in the unmitigated scenario.

#### Unmitigated – summary of the rated cumulative blasting impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operational						
Unmitigated	H	H	M	H	L	H

#### Mitigated – summary of the rated cumulative blasting impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operational						
Mitigated	L	H	M	M	L	L

### **Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

### Objectives

The objective of the management measures is to prevent harm to people, animals and structures.

### Actions

Lehating will implement a blast management plan which has the following key principles:

- pre-mining structure and crack survey of structures within 2.5km from the Main shaft including the Boerdraai and van Schalkwyk residences;
- blasts will be designed to achieve:
  - a fly rock zone limit of less than 500 m (surface blast only);
  - a peak particle velocity limit of less than 12 mm/s at third party structures that are built according to building industry standards; and
  - an air blast limit of less than 125 dB at third party structures (surface blast only).
- pre-blast warning and evacuation to clear people, traffic, moveable property and livestock from the potential fly rock impact zone during surface blasts only;
- stakeholders will be notified of the blast programme through the stakeholder engagement department;
- blast monitoring to verify the effectiveness of the blast design and compliance with legislation;
- audit and review to adjust the blast design where necessary to achieve the stated objectives; and
- damage to third party structures as a direct result of Lehating's mining activities will be investigated and rectified where appropriate.

### **Emergency situations**

If a person or animal is injured by blasting activities this must be handled in accordance with the Lehating emergency response procedure in Section 20.

## **TRAFFIC**

### **7.2.14 ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY**

Information in this section was sourced from the traffic impact study undertaken by Siyazi (Siyazi, July 2013).

### **Introduction**

Traffic impacts are expected from construction through to the end of the decommissioning phase when trucks, buses, and private vehicles make use of the private and public transport network in and adjacent to the mine. The key potential traffic related impacts relate to road capacity and public safety.

### **Activities and infrastructure - link to mine phases**

Construction	Operation	Decommissioning	Closure
			N/A
Transport systems	Transport systems	Transport systems	

## Rating of impact

### Severity

Existing traffic volumes on the R380 are associated with an acceptable level of service in the context of the existing public and private road infrastructure. Notwithstanding this, the following safety risks apply when additional traffic from new projects (Lehating and Gravenhage) is added to the transport network:

- excessive road wear and tear;
- pedestrian accidents; and
- vehicle accidents.

Excessive wear and tear of roads can cause increased wear and tear on vehicles, and can contribute to increased accidents. Traffic accidents have the potential to injure people and animals. The severity is high in the unmitigated scenario. In the mitigated scenario the severity reduces to medium because the potential and frequency of accidents is expected to reduce.

### Duration

Any serious injury or death is a long term impact in both the unmitigated and mitigated scenarios.

### Spatial scale / extent

Possible accident sites could be located within or outside the Lehating Manganese Mine area and the indirect impacts associated with any injuries or fatalities will extend to the local residents to which the injured people/animals belong. This is a medium spatial scale.

### Consequence

The consequence is high in both unmitigated and mitigated scenarios.

### Probability

In the unmitigated scenario the probability of traffic accidents is medium because although there is a possibility that traffic accidents would occur these are not expected to occur on a continuous basis. With mitigation this reduces to low. Similarly wear and tear impacts are expected to have a medium probability without mitigation, reducing to low with mitigation.

### Significance

The unmitigated significance is high. With mitigation this reduces to medium.

### Unmitigated – summary of the rated cumulative road disturbance and traffic safety impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the rated cumulative road disturbance and traffic safety impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	H	M	H	L	M

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to prevent transport related accidents and/or injury to people and livestock.

Actions

In the construction, operation and decommissioning phases Lehating will implement a transport safety programme to achieve the mitigation objectives. Key components of the programme include education, training, awareness, and transport system maintenance.

The gravel access road used by project traffic will be cordoned off by fencing to prevent access by third party traffic, people and animals.

A dedicated loading and offloading area will be provided as close as possible to the project site for workers, visitors and materials. This area will not be located on the R380.

The following measures apply if the R380 remains as a gravel road:

- lighting and road signs will be provided at the proposed access intersection to ensure visibility during night time and sufficient information to road users;
- the current R380 speed limit of 90km/h will with the consent of the Northern Cape Department of Roads and Public Works will be reduced to at least 60km/h at the proposed access intersection; and
- traffic travelling from the mine towards the R380 will be stop controlled at the intersection.

The following measures apply if the R380 is tarred:

- lighting and road signs will be provided at the proposed access intersection to ensure visibility during night time and sufficient information to road users;
- the current R380 speed limit of 90km/h will with the consent of the Northern Cape Department of Roads and Public Works will be reduced to at least 60km/h at the proposed access intersection;
- traffic travelling from the mine towards the R380 will be stop controlled at the intersection;

- the intersection will be upgraded to include additional lanes and road markings to achieve a dedicated left turning lane for traffic approaching from the north, acceleration lanes in both directions and a dedicated right turning lane for traffic approaching from the south;
- prior to construction of the intersection upgrade, approval is required from the Northern Cape Department of Roads and Public Works.

In order to address wear and tear impacts Lehating is committed to working with the Northern Cape Department of Roads and Public Works and other significant road users to contribute to:

- investigations into the life span and integrity of the R380 in its gravel form; and
- a road maintenance and/or upgrade plan where required.

### Emergency situations

If a person or animal is injured by mine-related transport activities this must be handled in accordance with the Lehating emergency response procedure.

## VISUAL

### 7.2.15 ISSUE: VISUAL IMPACTS

#### Introduction

Visual impacts may be caused by activities and infrastructure in all mine phases. The more significant visual impacts relate to the larger infrastructure components (such as mineralised waste facilities and the shaft infrastructure) and the long term infrastructure that will remain post closure.

#### Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works General site management Other support services and amenities	Earthworks Civil works Main and Ventilation Shafts Process Plant Tailings Storage Facility Transport systems Non-mineralised waste management General site management Other support services and amenities	Earthworks Civil works Tailings Storage Facility Non-mineralised waste management Other support services and amenities Demolition	Final Tailings and Waste Rock Facilities Rehabilitation Maintenance and aftercare

#### Rating of impacts

##### Severity

The severity of visual impacts is determined by assessing the change to the visual landscape as a result of mine related infrastructure and activities.

As discussed in Section 1.1.11, the visual landscape is determined by considering: landscape character,

sense of place, scenic quality, sensitivity of the visual resource and sensitive views. In this regard, the study area is characterised by the Kuruman River channel and associated sand dune, open views with grazing lands and associated activities. The result is a landscape with a high to moderate scenic quality.

When considering the potential change to the visual landscape the key issues are: visual exposure, visual intrusion, and sensitivity of receptors. Each of these issues is discussed in more detail below.

Visual exposure is the extent to which mine infrastructure and activities will appear in the various views. It follows that the closer the infrastructure and activities, the greater the visual exposure. It is possible that some of the proposed project infrastructure will be visible from the R380 which is approximately 1.5km from the mine as well as some of the local residences which are approximately 2.5km from the mine.

Visual intrusion is the extent to which the infrastructure and activities contrast with the visual landscape and can/cannot be absorbed by the landscape. The proposed project and related infrastructure will be different to the rural visual landscape immediately surrounding the study area, but similar to the existing mining activities to the south of the project site.

Sensitivity of receptors relates to the way in which people will view the visual intrusion. In this regard, it is anticipated that the public and the community receptors will not be overly sensitive to the development given the presence of the existing mine infrastructure as well as other mining operations to the south of the study area. Moreover visual impacts have not been raised as a concern by any stakeholders to date.

The severity is medium in the mitigated and unmitigated scenario for the project phases prior to closure. During the closure phase this can be reduced to low in the mitigated scenario when final landforms are completely rehabilitated.

#### Duration

In the unmitigated scenario the duration is high because the impacts will continue post closure. In the mitigated scenario the impacts are unlikely to extend post closure because all final landforms will have been rehabilitated.

#### Spatial scale / extent

Visual impacts are likely to extend beyond the project site boundary and as such this is a medium spatial scale in both the mitigated and unmitigated scenario.

#### Consequence

The unmitigated consequence is high for all project phases. With mitigation, prior to closure, this reduces to medium. After closure the consequence reduces too low.

Probability

The unmitigated probability is high for all the project phases. With mitigation, prior to closure, this reduces to medium. After closure the probability reduces to low due to the rehabilitation of final landforms.

Significance

The unmitigated significance is high. The mitigated significance reduces to medium before closure. After closure the significance reduces to low.

Unmitigated – summary of the cumulative rated visual impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>All phases</b>						
Unmitigated	M	H	M	H	H	H

Mitigated – summary of the cumulative rated visual impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
<b>Construction, operation and decommissioning</b>						
Mitigated	M	M	M	M	M	M
<b>Closure</b>						
Mitigated	L	L	M	L	L	L

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to limit negative visual impacts.

Actions

In the construction and operation phases the following visual mitigation techniques will be implemented:

- limit the clearing of vegetation;
- limit the emission of visual air emission plumes (dust emissions);
- painting infrastructure with colours that blend in with the surrounding environment where possible;
- lighting will be used only where necessary and in a focussed way to prevent dispersion of night pollution;
- on-going vegetation establishment on rehabilitated areas; and
- care will be taken to ensure that the rehabilitated areas merge with the immediate environment.

In the decommissioning phase Lehating will implement its closure objectives which involve the removal of infrastructure, and the rehabilitation and re-vegetation of cleared areas and any final landforms that will remain post closure. These final landforms should be rehabilitated in a manner that achieves landscape functionality and limits and/or enhances the long term visual impact.



At closure, final landforms will be managed through an aftercare and maintenance programme to limit and/or enhance the long term post closure visual impacts.

### Emergency situations

None identified.

## HERITAGE, PALAEOLOGICAL AND CULTURAL RESOURCES

### 7.2.16 ISSUE: LOSS OF OR DAMAGE TO HERITAGE, CULTURAL, ARCHAEOLOGICAL AND PALAEOLOGICAL RESOURCES

Information in this section was sourced from the heritage and palaeontological impact study undertaken by PGS (PGS, July 2013).

#### Introduction

There are a number of activities/infrastructure in all phases prior to closure that have the potential to damage heritage and cultural resources, either directly or indirectly, and result in the loss of the resource for future generations. Heritage and cultural resources include sites of archaeological, cultural or historical importance. The specialist has determined that the palaeontological sensitivity of the project site can be described as low but the possibility of encountering palaeontological resources does exist. It follows that an assessment of related impacts has not been included below, but a chance find procedure has been included.

#### Activities and infrastructure - link to mine phases

Construction	Operation	Decommissioning	Closure
Site preparation Earthworks Civil works Water supply and use Transport systems Other support services and amenities	Earthworks Civil works Main and Ventilation Shafts Process Plant Tailings Storage Facility Power supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	Earthworks Transport systems Other support services and amenities Demolition	N/A

#### Rating of impact

##### Severity

An archaeological resource has been identified and mapped on Portion 1 of Lehating 741 (Figure 15). This resource is a very low density scatter of low importance lithic artefacts eroding from a Hutton sand dune overlooking the Kuruman River. The artefacts are not located in proposed infrastructure areas.

Any damage to this resource is considered to be a low severity.

#### Duration

If heritage and cultural resources are removed, damaged or destroyed the impact duration is long term. In the mitigated scenario the duration reduces to less than the project life.

#### Spatial scale / extent

Regardless of mitigation, the impact is limited to the site of the artefacts which is a low spatial scale.

#### Consequence

The unmitigated scenario the consequence is medium. In the mitigated scenario the consequence reduces to low as the spatial scale, duration and severity is reduced.

#### Probability

While the location of the identified cultural site will not be directly impacted by the placement of infrastructure, the possibility remains that this site can be disturbed by general mining related activities and as such the impact probability is medium without mitigation and low with mitigation.

#### Significance

The unmitigated significance is medium and the mitigated significance is low.

#### Unmitigated – summary of the rated cumulative heritage, paleontological and cultural resources impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases prior to closure						
Unmitigated	L	H	M	M	M	M

#### Mitigated – summary of the rated cumulative heritage, paleontological and cultural resources impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases prior to closure						
Mitigated	L	L	L	L	L	L

#### **Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

### Objective

The objective of the mitigation measures is to prevent the loss of heritage and cultural resources that may be caused by mining activities.

### Actions

The artefact site on the farm Lehating 741 shall be demarcated from the mining operations and/or the mine perimeter fence will be shifted so that the sites lie outside the impact zones. Additional measures to prevent damage may include information/warning signs if within close proximity to mining operations.

All workers (temporary and permanent) will be educated about the heritage and cultural sites that may be encountered in their area of work and about the need to conserve these.

In the event that new resources (heritage, cultural or palaeontological) are discovered during the construction, operation and decommissioning phases, the mine will follow an emergency procedure prior to damaging or moving these, which includes the following:

- work at the find will be stopped to prevent damage;
- an appropriate heritage specialist will be appointed to assess the find and related impacts; and
- permitting applications will be made to SAHRA, if required.

In the event that any graves are discovered during the construction, operational or decommissioning phases, prior to damaging or destroying any identified graves, permission for the exhumation and relocation of graves must be obtained from the relevant descendants (if known) and the relevant local and provincial authorities.

### Emergency situations

If there are any chance finds of heritage and/or cultural sites, Lehating will follow its emergency response procedure as in Section 20.

## **SOCIO-ECONOMIC**

In the broadest sense, all activities associated with the proposed project will have socio-economic impacts in all phases. Some of these are considered to be positive impacts and others are considered to be negative impacts. Each impact is assessed separately below.

### **7.2.17 ISSUE: ECONOMIC IMPACT**

Information in this section was sourced from the economic study (Strategy4Good, July 2013) included in Appendix L.

## Introduction

The mine has a positive economic impact on the local, regional and national economies. Direct benefits are derived from wages, taxes and profits. Indirect benefits through the procurement of goods and services, and the increased spending power of employees. The proposed project components will support the continuation and potential increase of these positive impacts. These are discussed further below.

## Rating of impact

### Severity

The proposed project will have a net positive impact on the provincial and national economy. The following positive and negative aspects apply (Strategy4Good, July 2013):

- In instances where agricultural land (approximately 30ha) will be lost due to the construction of infrastructure associated with the proposed project, the unmitigated loss to the provincial economy per hectare (assuming productive grazing practices) is in the order of R21 000 Gross Geographic Product (GGP).
- The value of the agricultural land that will be lost is potentially R2 million. In macro-economic terms this is considered to be an inconsequential loss when considering the R42 million investment by the mine.
- The net economic value added from the proposed project is predicted to exceed the net economic value that may be lost to agriculture by at least tenfold. The mining related land use is therefore the predicted use in economic terms.
- generally not more than one person will be employed on 30 hectares of mixed farming land. This is orders of magnitude less than the proposed mine which will be in excess of 500 employment opportunities from construction through to closure.

It follows that when considered incrementally without mitigation the economic contribution from the proposed project is high and the potential loss to agriculture is relatively low so the net impact severity is high positive. With mitigation at closure all the areas other than the tailings and waste rock facilities can be rehabilitated to grazing potential.

### Duration

The net positive economic impacts will continue post closure because of the fact that after the operation has closed people will have skills, wealth and associated economic momentum. This is a long-term duration.

### Spatial scale / extent

In both the mitigated and unmitigated scenarios, the spatial scale of the impact is high because it will extend far beyond the Lehating Manganese Mine on a regional and national scale.

Consequence

In both the unmitigated and mitigated scenarios the consequence is high and positive.

Probability

In the normal course of economic activity the net positive impacts will definitely occur. With mitigation, the potential negative impacts on farming are reduced and the positive impacts particularly relating to local economic developments and continuation of economic developments post closure are enhanced. However this cannot be reduced for final landforms (tailings storage facility and the waste rock stockpile) as this agricultural land will be permanently lost.

Significance

In the unmitigated scenario, the significance of this potential impact is high positive. In the mitigated scenario, the significance is further increased.

Unmitigated – summary of the rated economic impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H+	H	H	H+	H	H+

Mitigated – summary of the rated economic impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	H+	H	H	H+	H	H+

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to enhance the positive economic impacts and limit the negative economic impacts. Part of this objective is to enhance the contribution to the local economy in particular.

Actions

The mine will ensure that:

- during recruitment, the mine will make use of a stakeholder database to ensure that as far as possible people from the local towns of Black Rock and Hotazel are employed;
- Lehating will support entrepreneurial development in order to ensure that increased income is reinvested in local communities and to reduce reliance on income from the mine;

- the workforce will be trained and their skills developed during the operational phase, particularly in the area of basic literacy, basic numeracy and basic business skills, which will enhance future employment opportunities outside the mine;
- the development and growth of SMMEs will be supported in local towns and on-going skills development programmes will be available to the labour force;
- Lehating will ensure its formal bursary and skills development programmes to the closest communities to increase the number of local skilled people and thereby increase the potential local employee base; and
- Lehating will ensure that it incorporates economic considerations into its closure planning from the outset. Closure planning considerations cover the skilling of employees for the downscaling, early closure and long term closure scenarios. It identifies and develops sustainable business opportunities and skills, independent from mining for members of the local communities to ensure continued economic prosperity beyond the life of mine.

Post mining utilisation of land for farming will be optimised through implementation of rehabilitation and closure objectives as set out in Section 7.2.4, Section 7.2.19 and Section 22.

#### Emergency situations

None identified.

### **7.2.18 ISSUE: INWARD MIGRATION**

Information in this section was sourced from the socio-economic review conducted by Strategy4Good in July 2013 that was compiled based on the 2013/2014 Joe Morolong Integrated Development Plan.

#### **Introduction**

Mining projects tend to bring with them an expectation of employment in all project 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.

#### **Rating of impact**

##### Severity

The effects of inward migration can be significant. These effects could include, but not be limited to:

- potential establishment or expansion of informal settlements;
- increased pressure on housing, water supply infrastructure, sanitation and waste management services/infrastructure, health care and community services/infrastructure;
- potential for increased pressure on natural resources such as water, fauna, flora and soils;
- increase in crime; and

- spread of disease, most notably HIV/Aids and tuberculosis.

It is not possible to predict how significant the inward migration may be, however this impact severity has been rated as high in line with the precautionary approach and given the proposed increase in workforce needed for the proposed project. It may be possible to mitigate this impact by managing expectations with regard to employment through communication structures at Lehating.

#### Duration

In the normal course, social impacts associated with each phase of the project will occur for the life of the project, but negative social issues associated with inward migration can continue beyond the closure of the mine, particularly in the unmitigated scenario.

#### Spatial scale / extent

In both the unmitigated and mitigated scenarios, the impacts of inward migration could extend beyond the Lehating Manganese Mine area and into surrounding communities.

#### Consequence

In the unmitigated scenario the consequence associated with inward migration is high. In the mitigated scenario, the consequence is reduced to medium.

#### Probability

In the unmitigated scenario the impact is considered to be probable because this type of pressure has been experienced in the communities around other mining operations. With mitigation, impacts associated with inward migration are considered to be less likely, but they are unlikely to be eliminated.

#### Significance

In the unmitigated scenario, the significance of this potential impact is high. With mitigation this may reduce to low.

#### Unmitigated – summary of the rated inward migration impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated	H	H	M	H	H	H

#### Mitigated – summary of the rated inward migration impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	M	M	M	L	L

**Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

Objective

The objective of the mitigation measures is to limit inward migration and related social impacts.

Actions

Expectations will be managed in such a way as to discourage the influx of people into the area through the use of a skills database managed by the Local Department of Labour.

An effective corporate sustainability programme will be implemented to mitigate these impacts, particularly at the local level.

In terms of recruitment, procurement and training:

- good communication with all job and procurement opportunity seekers will be maintained throughout the recruitment process. The process must be seen and understood to be fair and impartial by all involved. The personnel in charge of resolving recruitment and procurement concerns must be clearly identified and accessible to potential applicants;
- the number of new job opportunities (permanent and temporary) and procurement opportunities will be made public together with the required skills and qualifications. The duration of temporary work will be clearly indicated and the relevant employees/contractors provided with regular reminders and revisions throughout the temporary period;
- recruitment and procurement, by Lehating and its contractors, will be where possible preferentially provided to people in the local towns that are near to Lehating. In order to be in a position to achieve this a skills register of people within the closest communities will be maintained. Lehating will also preferentially provide bursaries and training to people that reside in these closest towns; and
- there will be no recruitment or procurement at the gates of the mine. All recruitment will take place off site, at designated locations in the closest towns. All procurement will be through established procurement and tendering processes that will include mechanisms for empowering service providers from the closest communities where possible.

Lehating acknowledges that it is responsible for ensuring that its employees and contractors are housed in formal serviced housing. This will be achieved by:

- providing on site accommodation for construction workers;
- allocating an accommodation allowance to all operational employees that can demonstrate that they live in formal housing in surrounding towns and residential areas; and
- by maintaining an employee profile (for Lehating and contractor employees) that can be used as a tool to identify socio-economic concerns and plan long term mitigation interventions.



Lehating will work with its neighbours, local authorities and law enforcement officials to monitor and prevent the development of informal settlements near the mine and to assist where possible with crime prevention within the Lehating Manganese Mine area.

Lehating will implement a policy on HIV/AIDS and tuberculosis. This policy will be developed for the workforce to address the concerns regarding the pandemic. A training programme on HIV/AIDS will be implemented on the mine to ensure employees are educated and made aware of the risks involved

Lehating will implement a stakeholder communication, information sharing and grievance mechanism to enable all stakeholders to engage with Lehating on both socio-economic and environmental issues.

### Emergency situations

The establishment of any informal settlements is considered to be an emergency situation that will be handled in accordance with the Lehating emergency response procedure (Section 20).

## **LAND USE**

### **7.2.19 ISSUE: LAND USE IMPACTS**

Information in this section was sourced from on-site observations and the Lehating project team.

### **Introduction**

There are mine and project related activities and infrastructure that may have an impact on other land uses in the area in all mine phases. These land uses include farming (mainly livestock grazing, with limited game farming to the north) and some residential land use for farmers and farm workers.

### **Activities and infrastructure - link to mine phases**

<b>Construction</b>	<b>Operation</b>	<b>Decommissioning</b>	<b>Closure</b>
Site preparation Earthworks Civil works Transport systems General site management Other support services and amenities	Main and Ventilation Shafts Process Plant Tailings Storage Facility Power supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	Main and Ventilation Shafts Process Plant Tailings Storage Facility Power supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition	Final tailings and waste rock facilities Rehabilitation Maintenance and aftercare

### **Rating of impact**

#### Severity

Regardless of mitigation the proposed project will disturb approximately 30ha of land that is currently used for livestock grazing by Mr van Schalkwyk in terms of a lease agreement with Terra Nominees (the

landowner of Portion 1 Lehating 741). In the unmitigated scenario the disturbance zone may extend further than this 30 ha because of impacts associated with:

- blasting;
- traffic;
- noise;
- dust fallout;
- visual;
- contamination of soil and water; and
- inward migration.

In this scenario additional grazing land would be affected and the possibility also exists that the quality of life at the two closest residences (Boerdraai and van Schalkwyk) would be reduced. This is a high severity.

In the mitigated scenario, where all the individual impacts are eliminated or mitigated, the severity can reduce from high to medium.

#### Duration

In the unmitigated scenario the impact on land use will extend beyond mine closure. With mitigation the land use impacts are expected to be limited to the phases prior to mine closure.

#### Spatial scale / extent

The spatial scale extends beyond the proposed project area.

#### Consequence

The unmitigated consequence is high in all project phases. The mitigated consequence is medium as the severity and duration decrease.

#### Probability

In the unmitigated scenario, where environmental and social impacts are uncontrolled, the probability that land uses will be impacted by mining is definite. With mitigation, the probability reduces to medium for construction, operation and decommissioning and low at closure.

#### Significance

The unmitigated scenario, the significance is high in all project phases. With mitigation this reduces to medium prior to closure and to low post closure.

#### Unmitigated – summary of the rated cumulative land use impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Unmitigated	H	H	M	H	H	H

#### Mitigated – summary of the rated land use impact per phase of the project

Management	Severity	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, Operation and Decommissioning						
Mitigated	M	M	M	M	M	M
Closure						
Mitigated	M	M	M	M	L	L

### **Description of proposed mitigation measures**

Mitigation measures specific to the proposed project are provided below and are tabulated in the EMP (Section 19).

#### Objective

The objective of the mitigation measures is to prevent unacceptable negative impacts on surrounding land uses.

#### Actions

Lehating will implement the EMP commitments with a view not only to prevent and/or mitigate the various environmental and social impacts, but also to prevent negative impacts on surrounding land uses.

All disturbed areas shall be rehabilitated as soon as possible and maintained in accordance with the rehabilitation objectives in Section 7.2.4, Section 7.2.19 and Section 22.

Land on the farm Lehating 741 that is not used for the development of infrastructure will be made available for grazing of cattle in line with existing grazing rights provided that mining operations, safety and security measures that are in place at the mine will not be jeopardised.

Surrounding land users will be invited to participate in routine stakeholder engagement meetings for the purpose of information sharing and environmental problem solving.

#### Emergency situations

None identified.

## **7.3 DEFINITION OF CRITERIA USED**

Both the criteria used to assess the impacts and the method of determining the significance of the impacts is outlined in Table 42. This method complies with the method provided in the EIA guideline document. Part A provides the approach for determining impact consequence (combining severity / nature, 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. Unmitigated scenario is considered for each impact

#### **7.4 PHASES AND TIMEFRAMES OF POTENTIAL IMPACTS**

An indication of the phases in which impacts could occur is included in Section 7.2. This section also provides an indication of the duration of potential impacts. Potential impacts associated with the project have the potential to occur in almost all project phases and on a continuous basis if unmitigated. With the implementation of the mitigation as presented in Section 19, the monitoring programmes as presented in Section 21 and the emergency response procedures as presented in Section 20 the timeframe of potential impacts will be reduced significantly.

TABLE 42: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Definition of SIGNIFICANCE	Significance = consequence x probability	
Definition of CONSEQUENCE	Consequence is a function of severity / nature, spatial extent and duration	
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action. Irreplaceable loss of resources.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints. Noticeable loss of resources.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints. Limited loss of resources.
	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/ EXTENT 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 / NATURE = L					
DURATION	Long term	H	Medium	Medium	Medium
	Medium term	M	Low	Low	Medium
	Short term	L	Low	Low	Medium
SEVERITY / NATURE = M					
DURATION	Long term	H	Medium	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Low	Medium	Medium
SEVERITY / NATURE = H					
DURATION	Long term	H	High	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Medium	Medium	High
			L	M	H
SPATIAL SCALE / EXTENT					

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.

## **8 COMPARATIVE LAND USE ASSESSMENT**

### **8.1 ALTERNATIVE LAND USES WHICH COULD BE IMPACTED ON**

A description of the current land uses that exist on the property or on adjacent or non-adjacent properties that may be affected by the proposed project is provided in Section 1.3.4.

The proposed project site is currently used for cattle grazing and recreational game farming. As an alternative to the development of the proposed projects, these current land uses would continue. It is possible that IAPs on site could consider increasing the current scale of grazing by increasing their cattle numbers. Given current land uses, the most obvious alternative to mining is livestock grazing.

### **8.2 RESULTS OF SPECIALIST COMPARATIVE LAND USE ASSESSMENT**

The specialist report (Strategy4Good, July 2013) included in Appendix L concludes that the mining related development is the best land use alternative. The socio-economic value added by the proposed project significantly surpasses the opportunity costs of the current land-use that would be lost. Secondly, the socio-economic benefits outweigh the potential environmental risks (in the mitigated scenario) and for this reason the project is also acceptable on an integrated sustainable development basis.

## 9 LIST OF SIGNIFICANT IMPACTS

A list of significant cumulative impacts, when considered without mitigation, as identified in the assessment conducted in Section 7 is provided below.

- Loss and sterilization of mineral resources (Section 7.2.1)
- Hazardous excavations and infrastructure (Section 7.2.2)
- Loss of soil resources and land capability through pollution (Section 7.2.3)
- Loss of soil resources and land capability through physical disturbance (Section 7.2.4)
- General disturbance of biodiversity (Section 7.2.5)
- Physical destruction of biodiversity (Section 7.2.6)
- Alteration of surface drainage patterns (Section 7.2.7)
- Contamination of surface water (Section 7.2.8)
- Reduction of groundwater levels and availability (Section 7.2.9)
- Contamination of groundwater (Section 7.2.10)
- Air pollution (Section 7.2.11)
- Noise pollution (Section 7.2.12)
- Blasting impacts (Section 7.2.13)
- Road disturbance and traffic safety (Section 7.2.14)
- Visual impacts (Section 7.2.15)
- Loss of or damage to heritage, cultural, archaeological and palaeontological resources (Section 7.2.16)
- Economic impacts (Section 7.2.17)
- Inward migration impact (Section 7.2.18)
- Land use impacts (Section 7.2.19)

## 10 STAKEHOLDER ENGAGEMENT PROCESS

This section provides a description of the engagement process with interested and affected persons (IAPs) followed during the course of the environmental assessment process. It outlines how IAPs were identified, confirms the details of the engagement process (with supporting documentation included as appendices), and indicates how issues raised have been addressed.

### 10.1 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES

The stakeholder engagement process commenced with a social scan to identify IAPs that should be involved during the environmental assessment process and associated communication structures. This was done by updating the existing database, by sourcing IAPs details through a deeds search of the relevant properties within the project site and immediately adjacent portions of land, site visits in the surrounding areas, sourcing information from existing prospecting databases, networking and direct discussions with IAPs. Key stakeholders identified for the project include:

#### IAPs

- landowners as listed in Table 23 and Table 24;
- land occupiers and communities in the region;
- mines and industries; and
- non-government organisations and associations.

#### Regulatory authorities

- Department of Mineral Resources (DMR);
- Northern Cape Department of Environment and Nature Conservation (DENC);
- Department of Water Affairs (DWA);
- South Africa Heritage Resource Agency (SAHRA);
- Department of Agriculture, Forestry and Fisheries (DAFF);
- Department of Rural Development and Land Reform (DRDLR);
- Department of Environmental Affairs (DEA); and
- Northern Cape Department of Transport, Roads and Public Works (DTRPW).

#### Local authorities

- John Taolo Gaetsewe District Municipality (JTGDM); and
- Joe Morolong Local Municipality (JMLM).

#### Ward councillors and other parties:

- Ward councillor for Ward 4 (Magdalene Schuping); and
- Parastatals such as Eskom and Telkom.



A full list of IAPs and regulatory authorities is included in the database (Appendix B). The database is updated on an ongoing basis throughout the environmental process.

## 10.2 DETAILS OF ENGAGEMENT PROCESS

Stakeholder engagement is an integral component of any development process. The goal of stakeholder engagement is to facilitate and improve communication between stakeholders (including the applicant) in the interest of facilitating better decision-making and more sustainable development (DEAT, 2002). In accordance with the requirement of Chapter 6 of the EIA Regulations, 2006, a stakeholder engagement programme has been developed to set out a coordinated process through which IAPs are informed of the proposed development and environmental assessment process and provided with an opportunity to provide input into the project plan, the assessment and proposed mitigation measures. By consulting with authorities and IAPs, the range of environmental issues to be considered in the EIA has been given specific context and focus. Included below is an outline of the process followed, and the people engaged. Refer to Section 10.3 for a list of issues that were identified during the engagement process.

### 10.2.1 STEPS IN THE PUBLIC PARTICIPATION PROCESS

Steps in the process that have been conducted to date are set out in Table 43 below.

**TABLE 43: CONSULTATION PROCESS WITH IAPS AND AUTHORITIES**

Task	Description	Date
<b>Notification - regulatory authorities and IAPs</b>		
Notification of DMR and applications submitted to DENC and DEA	The DMR application for mining right submitted on 25 October 2012. The Application was acknowledged on 4 March 2013. Refer to Appendix A for a copy of the DMR acknowledgement letter. A formal application was submitted by SLR to DENC on 21 August 2012. A copy of the application is attached in Appendix A. A waste licence application was submitted to DEA on 26 July 2013. The application was acknowledged on 21 August 2013. A copy of the application and acknowledgment is attached in Appendix A.	August 2012 – March 2013
Notification of the land claims commissioner	The land claims commissioner at the Northern Cape Department of Land Reform and Rural Development (DLRRD) was consulted on 12 November 2012 by SLR in order to verify if any land claims had been lodged Portion 1 of the farm Lehating 741. Refer to Appendix A for a copy of the fax that was sent to the land claims commissioner and the response received.	November 2012
Social scan	A social scan of the Lehating project site was conducted by SLR. The purpose of the social scan was: <ul style="list-style-type: none"> <li>to identify relevant landowners, land occupiers, and other interested and affected parties;</li> <li>to obtain contact details for IAPs;</li> <li>to identify appropriate communication structures; and</li> <li>to inform IAPs of the project, upcoming public consultation process and associated scoping and EIA/EMP process.</li> </ul> As part of the social scan, direct consultation with landowners took place through informal discussions, and/or telephonic discussions. Issues raised during the social scan have been included in the issues	October 2012

Task	Description	Date
	and concerns report. One output of the social scan is an IAP database (Appendix B). The IAP database is updated as required.	
Distribution of background information document (BID)	A BID was produced for the proposed project. The purpose of the BID was to inform IAPs and authorities about the project, the environmental assessment process, possible environmental impacts and means of inputting into the environmental assessment process. Attached to the BID was a registration and response form, which provided IAPs with an additional opportunity to submit their names, contact details and comments on the project.  The BID was distributed by SLR to IAPs by hand, email, post and fax using contact details obtained during the social scan and public scoping meetings. BIDs were sent by fax and/or e-mail to the regulatory authorities on the project's public involvement database. A copy of the BID is attached in Appendix C.	October 2012 to January 2013
Site notices	Laminated A2 site notices (in English and Afrikaans) were placed at key conspicuous positions by SLR in and around the project site. A copy of the site notice as well as photos of the placement of these notices is attached in Appendix C.	October 2012
Newspaper advertisements	Block advertisements were placed in the Kalahari Bulletin and Kathu Gazette newspapers on 1 and 3 November 2012 respectively. Refer to Appendix C for a copy of the above mentioned advertisements.	July 2012
<b>Scoping stage meetings</b>		
Information-sharing scoping meeting	The following public scoping meeting was held for the proposed project: <ul style="list-style-type: none"> <li>one public scoping meeting was held on 27 November 2012 at the Hotazel Recreation Club.</li> </ul> The purpose of the public meeting was to: <ul style="list-style-type: none"> <li>Inform IAPs about the proposed project</li> <li>Inform IAPs about the stakeholder engagement process and how IAPs can have input into the process</li> <li>Provide information about the baseline environment and obtain input thereon</li> <li>Provide information about the potential impacts of the project and obtain input thereon</li> <li>Provide an opportunity for IAPs to raise issues and concerns. These issues and concerns were used to inform the Plan of Study for the EIA Phase.</li> </ul> Meeting attendance registers, minutes, and the meeting presentation are included in Appendix C. The issues table is provided in Appendix D.	November 2012
Regulatory authority scoping meeting	One regulatory authorities meeting was held at the Hotazel Recreation Club on 27 November 2012. The following departments were invited to attend: <ul style="list-style-type: none"> <li>Department of Mineral Resources (DMR)</li> <li>Northern Cape Department of Environment and Nature Conservation (DENC)</li> <li>Department of Water Affairs (DWA)</li> <li>South Africa Heritage Resource Agency (SAHRA)</li> <li>Department of Agriculture, Forestry and Fisheries (DAFF)</li> <li>Department of Rural Development and Land Reform (DRDLR)</li> <li>Northern Cape Department of Transport, Roads and Public Works (DTRPW).</li> <li>John Taolo Gaetsewe District Municipality (JTGDM)</li> <li>Joe Morolong Local Municipality (JMLM)</li> <li>Ward councillor for Ward 4 (Magdalene Schuping)</li> </ul>	November 2012

Task	Description	Date
	<p>The regulatory authorities meeting attendance register, meeting minutes, the meeting presentation are included in Appendix C and the issues and concerns report is provided in Appendix D.</p> <p>The purpose of the meeting was to provide regulatory authorities with an outline of the project and environmental assessment process, obtain input into the legal process being followed, identify potential issues to be investigated further, provide input into the terms of reference for specialist studies and agree on the way forward. Minutes of the meeting have been included in Appendix A.</p>	
<b>Review of scoping report</b>		
Public review of scoping report	<p>The scoping report was subject to public review from 12 April 2013 to 11 May 2013. Copies of the scoping report were made available at the following venues:</p> <ul style="list-style-type: none"> <li>• Joe Morolong Local Municipality;</li> <li>• John Taolo Gaetsewe District Municipality;</li> <li>• Hotazel Public Library;</li> <li>• SLR's offices in Johannesburg.</li> </ul> <p>The proof of the scoping report distribution to the above listed IAPs is included in Appendix C.</p> <p>Summaries of the scoping report (Appendix C) were sent by SLR via post or e-mail to all IAPs and authorities that were registered on the public involvement database at the time of distribution. In addition, IAPs were notified when the scoping report was available for review via SMS. Electronic copies of the scoping report were made available on request.</p>	April 2013 to May 2013
Regulatory authority review of scoping report	<p>The scoping report was subject to review by regulatory authorities from 12 April 2013 to 30 May 2013. Copies of the scoping report were made available for review to DMR, DENC, DWA, DAFF, SAHRA, DRDLR, DTRPW, John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality (JMLM).</p> <p>Following the review of the scoping report by IAPs and regulatory authorities the updated scoping report was submitted to DENC and DEA.</p>	April 2013 to July 2013
<b>Review of EIA and EMP</b>		
Public review of the EIA and EMP report	Copies of the EIA and EMP report will be made available for public review as outlined in Section 10.2.3	September 2013
Public feedback meetings	The purpose of the public feedback meetings will be to provide IAPs with the opportunity to liaise with the EIA technical and specialist team on a one-to-one basis.	September 2013
Regulatory authority review of the EIA and EMP report	Copies of the EIA and EMP report will be made available for review as outlined in Section 10.2.4	September 2013

### 10.2.2 SPECIALIST TEAM

Several specialists (see Table 3 for a complete list of all appointed specialist, their roles and responsibilities) were appointed to assess the potential impact of the proposed development. Where required, specialists consulted with stakeholders directly during their specialist studies. Details are provided in the specialist reports included as appendices.

### 10.2.3 REVIEW OF EIA AND EMP REPORT BY IAPS

Copies of the EIA and EMP report will be made available for public review as follows:

- Joe Morolong Local Municipality;
- John Taolo Gaetsewe District Municipality;
- Madibeng land claimants (c/o Dorkus Moremi);
- Hotazel Public Library; and
- SLR's offices in Johannesburg.

Electronic copies of the EIA and EMP report will be made available to IAPs on request (electronically by e-mail or on disk). A summary of the EIA and EMP report (in English, Afrikaans and Setswana) will be compiled and distributed to all IAPs registered on the project's public involvement database by hand, post and/or e-mail. In addition to this, IAPs will be notified when the EIA and EMP report is available for review via SMS. IAPs will be given 40 days to review the EIA and EMP report and submit comments in writing to SLR.

### 10.2.4 REVIEW OF THE EIA/EMP REPORT FOR BY REGULATORY AUTHORITIES

The EIA and EMP report will be distributed to regulatory authorities for review as follows:

- A hard copy of the EIA and EMP report will be forwarded to the following regulatory and local authorities: DWA, DAFF, DRDLR, DTRPW, John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality.
- A copy of the EIA and EMP will be uploaded electronically onto the SAHRA website for review;
- Five hard copies and one CD of the EIA and EMP report will be submitted to the DMR who will distribute to other regulatory authorities as required;
- Two hard copies and three CDs of the draft EIA and EMP report will be submitted to DENC.
- Two hard copies and one CD of the draft EIA and EMP report will be submitted to the DEA.

Following the IAP and regulatory authority review, two hard copies of the updated EIA and EMP report will be forwarded to DENC and DEA for review and comment.

## 10.3 MANNER IN WHICH ISSUES RAISED WERE ADDRESSED

Stakeholder meetings and public review of the scoping reports provided IAPs with an opportunity to comment on the baseline environment and potential impacts of the project (including social and cultural impacts). All views, issues and concerns raised have been captured into the issues table (Appendix D). The issues table provides responses to issues raised and identifies where the issues have been addressed in the EIA and EMP report. A summary of the issues is as follows:

- Procedural related issues;

- Technical and project related issues;
- Access to minerals issues;
- Groundwater issues;
- Roads, transport and traffic issues;
- Heritage/cultural and palaeontological resources;
- Economic, infrastructure development, and employment issues;
- Communication process;
- Emergency procedural information; and
- Biodiversity issues.

## **11 ADEQUACY OF PREDICTIVE METHODS AND ASSUMPTIONS AND UNCERTAINTIES**

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

### **11.1 ENVIRONMENTAL ASSESSMENT LIMIT**

The EIA focused on third parties only and did not assess health and safety impacts on workers because the assumption was made that these aspects are separately regulated by health and safety legislation, policies and standards, and that Lehaving will adhere to these.

### **11.2 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.

### **11.3 GEOCHEMISTRY**

The assessment was based on one sample of each rock type and this is limited in terms of providing statistically significant results. It is recommended that further static tests be undertaken on the tailings material when available and on additional waste rock samples when available.

### **11.4 BIODIVERSITY**

The following assumptions and limitations are applicable to this report:

- Due to the nature and habits of most faunal taxa it is unlikely that all species would have been observed during a site assessment of limited duration and in the particular season. Therefore, site observations were compared with literature studies where necessary.
- A desktop survey was undertaken to determine the red data reptile, amphibian, mammalian and bird species occurring in the study area. The likelihood of red data species occurring on site was determined using the distribution maps in the red data reference books and a comparison of the habitat described from the field survey.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. A more accurate assessment would require that assessments take place in all seasons of the year however by undertaking assessments in the spring period it is deemed likely that most faunal and floral communities would have been adequately assessed and/or considered.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa on the subject property may therefore been missed during the assessment. The results of this

study are however deemed to be an accurate representation of the overall ecology and conservation value of the subject property.

Very little research in the Kalahari has focused on water consumption by the various types of vegetation and on the partitioning of transpired water between water that is extracted from different depths of the unsaturated zone and that which originates from the saturated zone. Thus it is very difficult to predict the extent to which altering the water levels in the aquifers may impact on these ecosystems.

## 11.5 HYDROLOGY (SURFACE WATER)

A number of assumptions have been made in undertaking the hydraulic modelling. These assumptions are in the context of the study and are considered appropriate in view of the level of detail required and the existing site conditions. The key assumptions include:

- That the topographic data provided was of a sufficient accuracy and coverage to enable hydraulic modelling at a suitable level of detail. The approach taken in surveying the river was to restrict survey to the limit at which a sufficiently robust hydraulic model could be derived. Consequently, the cross-sections were purposely spaced at a distance 300m to 600m. Due to the very flat nature of the watercourse, a large cross-section spacing is deemed appropriate. It is, however, the case that channel or floodplain anomalies present between cross-sections would not be represented in the hydraulic model.
- Hydraulic structures such as bridges and weirs were not modelled as part of this study. This limitation in the model is based on the assumption that only minor structures are likely to be present. The size of the peak flows occurring would easily inundate any minor hydraulic structure present, effectively 'drowning out' their effect.
- The Manning's 'n' values used is considered suitable for use in both the 50 year and 100 year return periods modelled, as well as in representing both the channel and floodplain.
- Steady state hydraulic modelling was undertaken, which assumes the flow is continuous at the peak rate. This is a conservative approach as it ignores the effect of storage within the system and therefore produces higher flood levels than would be expected to occur in reality. In addition to pure conveyance, in-channel and floodplain flood storage exhibit a large influence on flood levels and floodplain extents within the low gradient watercourses such as the study catchment. As such, the steady state modelling will result in worse case (conservative) estimates of flooding, and resultant flood levels and floodplain extents would decrease significantly if unsteady state modelling were undertaken using an inflow hydrograph as opposed to continuous peak flow.

The main assumption in the dirty water diversion layout is that all water generated in the dirty area will be able to drain under gravity, to the area allocated for the dirty water containment facility. The proposed works are expected to level out much of the site, while site drainage is expected to facilitate the drainage of all areas into the proposed dirty water diversions.

## 11.6 WATER BALANCE

The water balance presented is based on available information only. As the project proceeds flow meters will be required to measure actual flows and fine tune the balance on the basis of real data.

## 11.7 GROUNDWATER

The key deficiencies in the hydrogeological datasets include:

- Long term rainfall data in and around Lehating area;
- Long term evapotranspiration data in and around Lehating area;
- Long term groundwater level monitoring data;
- Large spatial distances between groundwater monitoring points for mine area;
- Long term river flow monitoring data;
- The quantification of groundwater-surface water interaction;
- Source concentration for mine residue deposits / wastes; and
- Chemical and biological reaction rates for contaminants in the subsurface.

Therefore, the final groundwater model confidence level is low to moderate due to the limited hydrogeological data available. Once additional data (i.e. long term monitoring data) becomes available, transient modelling of the existing conditions and future impacts can be undertaken and the confidence level of the model would be increased (not part of the scope for the current hydrogeological investigation).

Moreover, the conceptualisation of a complex groundwater flow system into a simplified groundwater management tool, i.e. numerical model, has a number of uncertainties, assumptions and limitations. These limitations include:

- Input data on the types and thickness of hydrogeological units, water levels, and hydraulic properties are only estimates of actual values;
- All the physical and chemical processes in a catchment cannot be represented completely in a numerical model;
- The numerical model developed for Lehating can't be used for any other purpose than the defined model objectives;
- The numerical model is a non-unique solution that can be calibrated with an unlimited number of acceptable parameters; and
- The numerical model is a simplification of the natural world.

## 11.8 AIR QUALITY

The project assumptions and data limitations influencing the dispersing modelling results can be summarised as follows:



- The impact assessment focused primarily on particulate emissions, identified as the primary pollutants associated with the mine. Although gases will be emitted by haul trucks, generators and mine vehicles, such vehicle activity and associated emissions would be limited and the potential for ambient air pollutant concentrations considered negligible;
- Particle size distributions for stockpiles (topsoil, overburden, ROM, tailings facility and road surfaces) were not available and particle sizes from similar operations were utilised for the purposes of the study;
- The dispersion model cannot compute real time mining processes. Thus even though the nature mining operations may change over the life of mine depending on which fines product destination is chosen. The proposed option 1 for fines product destinations was modelled to reflect the worst case condition (i.e. resulting in the highest impacts);
- Insufficient information was available for the calculation of the ventilation shaft's possible emission rates. Thus these were not included in the emission estimations and modelling;
- The range of uncertainty of the model predictions could to be -50% to 200%. There will always be some error in any geophysical model, but it is desirable to structure the model in such a way to minimise the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere;
- No baseline air pollution monitoring data exists close to the mining area. The predicted concentrations were therefore limited to incremental impacts only (only Lehating Mine contribution). However, given the general localised nature of mining impacts, cumulative impacts are expected to be less significant;
- It was assumed that all processing operations will have ceased by the closure phase of the project. The potential for impacts during this phase will depend on the extent of demolition and rehabilitation efforts during closure and on features which will remain. Information regarding the extent of demolition and/or rehabilitation procedures were limited and therefore not included in the emissions inventory or the dispersion modelling; and
- A specialist health risk assessment is required for manganese exposures. Predicted Mn concentrations were compared to international community exposure limits.

## 11.9 NOISE

No specific specialist study was conducted for the noise assessment. It was assumed that the quantitative findings of the assessments done by SLR for other similar manganese mining projects in the region would apply.

## 11.10 HERITAGE AND CULTURAL RESOURCES

It is possible that some heritage and cultural resources have not been discovered and/or recorded. If any new heritage and cultural resources are exposed Lehating's chance find procedure will be implemented.

## 11.11 ECONOMIC IMPACT

The following relating to the cost-benefit analysis was assumed:

- This study is limited in its scope as it uses "inferred economic data", which is limited to desktop research, economic data supplied by Lehating and relied on independent information from the environmental assessment team.

## 11.12 CLOSURE COST ESTIMATE

The following general assumptions and qualifications are described below:

- The closure cost estimate is aligned to the Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine, by the DMR (January, 2005);
- The closure costs for the site could comprise a number of cost components. This report only addresses the decommissioning and reclamation costs, equating to an outside (third party) contractor establishing on-site and conducting reclamation-related work. Other components such as staffing of the site after decommissioning, the infrastructure and support services (e.g. power supply, etc.) for this staff as well as workforce matters such as separation packages, re- training /re-skilling, etc. are outside the scope of this report;
- Based on the above, dedicated contractors would be commissioned to conduct the demolition and reclamation work on the site. This would inter alia require establishment costs for the contractors and hence, the allowance for preliminary and general (P&Gs) in the cost estimate;
- Allowance has also been made for third party contractors and consultants to conduct post-closure care and maintenance work as well as compliance monitoring;
- Closure costs have been determined for both the scheduled and un-scheduled closure situations. Specifically, scheduled closure takes place at a planned date and/or within a time horizon, in accordance with overall mine planning. Un-scheduled closure entails immediate closure of a site, representing decommissioning and reclamation of the site in its present state;
- In accordance with the DMR guideline, no cost off-sets due to possible salvage values were considered and gross reclamation costs are reported; and
- Fixed percentages for P&Gs and contingencies as per the DMR guideline have been applied.

Site specific aspects such as surface and groundwater remediation have not been costed at this stage – the likelihood of such remediation would only be identified during the ongoing operation of the mine through surface and groundwater monitoring and/or by carrying out risk assessment and water pollution potential studies.

## **12 ARRANGEMENT FOR MONITORING AND MANAGEMENT OF IMPACTS**

This section describes the arrangements for monitoring and management of environmental impacts. It identifies the impacts that require monitoring programmes and outlines the functional requirements, roles and responsibilities and timeframes for the monitoring programmes. Further detail on each monitoring programme is included in Section 19.

### **12.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES**

Impacts that require monitoring include:

- Hazardous excavations and infrastructures
- Physical destruction and general disturbance of biodiversity
- Pollution of surface water resources
- Contamination of groundwater
- Increase in air pollution
- Increase in noise levels
- Blasting damage
- Traffic increase and road use

In addition to the above, the commitments as included in Section 19 will require monitoring to a) ensure that they are being implemented and b) that they are effective in mitigating potential impacts on the environment, socio-economic conditions of third parties and heritage/cultural aspects. This will be done through regular internal auditing by mine personnel.

### **12.2 FUNCTIONAL REQUIREMENTS OF MONITORING PROGRAMMES**

The purpose of the monitoring programmes is to review the mine's impact on various aspects of the environment and to report on changes needed to the management programme.

As a general approach, the mine will ensure that the monitoring programmes comprise the following:

- a formal procedure;
- appropriately calibrated equipment;
- where samples require analysis they will be preserved according to laboratory specifications;
- an independent, accredited laboratory will undertake sample analyses and/or internal laboratory results will periodically be checked by independent and accredited laboratories;
- parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority;
- if necessary, following the initial monitoring results, certain parameters may be removed from the monitoring programme in consultation with a specialist and/or the relevant authority;

- If necessary monitoring points can be moved in consultation with a specialist and/or the relevant authority;
- monitoring data will be stored;
- data will be interpreted and reports on trends in the data will be compiled; and
- both the data and the reports will be kept on record for the life of mine.

### 12.3 ROLES AND RESPONSIBILITIES

The roles and responsibilities for the execution of the monitoring programmes are defined below.

- Senior Operational Manager and Environmental Department Manager:
  - ensure that the monitoring programmes are scoped and included in the annual mine budget;
  - identify and appoint appropriately qualified specialists/engineers to undertake the programmes; and
  - appoint specialists in a timeous manner to ensure work can be carried out to acceptable standards.

### 12.4 TIMEFRAMES FOR MONITORING AND REPORTING

The timeframes for monitoring and reporting thereof are detailed in the monitoring programme (see Section 21). A summary is provided below:

Programme	Monitoring: Timeframe and frequency	Reporting
Groundwater and surface water	All project phases As per requirements of water use license (default is quarterly for quality and monthly for levels)	As per water licence
Air	continuous	Monthly by specialist
Noise	From start of construction to end of decommissioning On-going	Pre project baseline then on an as need basis.
Blasting	Every surface blast	Monthly by specialist
Tailings storage facility, waste rock stockpile and stormwater dams	All project phases On-going by dam operators and quarterly by professional engineer	Quarterly by professional engineer
Traffic aspects	As required (dependant on stakeholder complaints)	As required
Internal auditing	From start of construction to end of closure On-going	As required
External auditing	From start of construction to end of closure Every two years	Every two years to DMR

## 13 TECHNICAL SUPPORTING INFORMATION

The following specialist studies are attached as appendices to this report:

- biodiversity study (Appendix E);
- surface water quality study and management plan (Appendix F);
- groundwater study (Appendix G);
- heritage, cultural and palaeontological study (Appendix H);
- air quality impact study (Appendix I);
- soils and land capability study (Appendix J);
- traffic impact study (Appendix K);
- economic study (Appendix L);
- conceptual tailings storage facility engineering design (Appendix M); and
- financial provision (Appendix N).

## **SECTION 2 – ENVIRONMENTAL MANAGEMENT PROGRAMME**

## **14 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR CLOSURE**

### **14.1 ENVIRONMENTAL ASPECTS THAT DESCRIBE THE PRE-MINING ENVIRONMENT**

Environmental aspects that describe the pre-mining environment as informed by the baseline description (Section 1.1) are listed below. This list serves to guide the setting of environmental objectives for mine closure.

- relatively flat topography;
- pre-mining soils supported grazing and wilderness land capabilities and/or uses. Closure objectives around land capability and use must be informed by consensus with relevant stakeholders;
- a functioning ecosystem;
- non-perennial drainage patterns;
- moderate to good groundwater quality; and
- quite rural environment.

### **14.2 MEASURES TO CONTROL OR REMEDY ANY CAUSES OF POLLUTION OR DEGRADATION**

Measures required to contain or remedy any causes of pollution or degradation or migration of pollutants, both for closure of the mine and post-closure are listed below.

- implement a waste management procedure for general and hazardous waste on site
- ensure immediate clean-up of any spills as per the emergency response procedures (Section 20);
- establish and maintain dirty stormwater control measures in line with regulatory requirements, until such time as potentially polluting areas are rehabilitated;
- contain pollutants at source by storing and handling potentially polluting substances on impermeable substrates, within bunded areas and with the capacity to contain spills;
- design, construct and/or operation of existing and proposed tailings storage facility with decant and drainage systems and runoff control measures;
- design, construct and/or operate existing and future waste stockpiles with runoff control measures; and
- rehabilitate the site in line with a detailed closure plan to be developed at least five years prior to decommissioning.

Further detail on the proposed action plans and mitigation measures is included in Section 19.

## **15 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR MANAGEMENT OF IDENTIFIED ENVIRONMENTAL IMPACTS**

The environmental objectives and specific goals for the management of identified environmental impacts are detailed in the discussion for mitigating impacts in Section 7.

### **15.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES**

Impacts that require monitoring include:

- hazardous excavations and structures;
- physical destruction and general disturbance of biodiversity;
- pollution of surface water resources;
- contamination and depletion of groundwater;
- increase in air pollution;
- increase in noise levels;
- blasting damage;
- damage to heritage/cultural resources; and
- traffic increase and road use.

### **15.2 ACTIVITIES AND INFRASTRUCTURE**

The source activities of potential impacts which require management are detailed in Section 2.3 and listed below.

- |                               |  |
|-------------------------------|--|
| • Site preparation            | • Transportation system                |
| • Earthworks                  | • Non-mineralised waste management     |
| • Civil works                 | • General site management              |
| • Main and Ventilation Shafts | • Other support services and amenities |
| • Tailings storage facility   | • Demolition                           |
| • Water supply infrastructure | • Rehabilitation                       |
| • Power supply infrastructure | • Maintenance and aftercare            |

### **15.3 MANAGEMENT ACTIVITIES**

Management activities which will be conducted to control the project actions, activities or processes which have the potential to pollute or result in environmental degradation are detailed in Section 19.

### **15.4 ROLES AND RESPONSIBILITIES**

The key personnel to ensure compliance to this EMP report will be the operations executive, the environmental department manager and the stakeholder engagement manager. As a minimum, these



roles as they relate to the implementation of monitoring programmes and management activities will include:

- Senior Operational Manager and Environmental Department Manager
  - ensure that the monitoring programmes and audits are scoped and included in the annual mine budget;
  - identify and appoint appropriately qualified specialists/engineers to undertake the programmes; and
  - appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards.
- Stakeholder engagement department:
  - liaise with the relevant structures in terms of the commitments in the SLP;
  - ensure that commitments in the SLP are developed and implemented timeously;
  - establish and maintain good working relations with surrounding communities and landowners; and
  - facilitate stakeholder communication, information sharing and grievance mechanism.

## 16 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR SOCIO-ECONOMIC CONDITIONS

### 16.1 ASPECTS OF THE SOCIO-ECONOMIC CONDITIONS

The socio-economic conditions surrounding the proposed project sites are described in Section 1.3.3.

### 16.2 OBJECTIVES AND GOALS

Specific environmental objectives and goals to control, remedy or stop potential impacts emanating from the proposed projects which may impact on communities and IAPs are described below. The information is presented in tabular format (Table 44).

**TABLE 44: ENVIRONMENTAL OBJECTIVES AND GOALS – SOCIO-ECONOMIC CONDITIONS**

Aspect	Environmental objective	Goals
Land uses	To prevent unacceptable impacts on surrounding land uses and their economic activity	<ul style="list-style-type: none"> <li>To co-exist with existing land uses</li> <li>To negatively impact existing land uses as little as possible</li> </ul>
Blasting	To minimise the potential for third party damage and/or loss	<ul style="list-style-type: none"> <li>To protect third party property from proposed project-related activities, where possible</li> <li>To ensure public safety</li> </ul>
Traffic	To reduce the potential for safety and vehicle related impacts on road users	<ul style="list-style-type: none"> <li>To ensure the mine's use of public roads is done in a responsible manner</li> </ul>
Socio-economic	To enhance the positive economic impacts and limit the negative economic impacts	<ul style="list-style-type: none"> <li>To work together with existing structures and organisations</li> </ul>
Informal settlements	To limit the impacts associated with inward migration	<ul style="list-style-type: none"> <li>To establish and maintain a good working relationship with surrounding communities, local authorities and land owners</li> </ul>

## 17 ENVIRONMENTAL OBJECTIVES AND SPECIFIC GOALS FOR HISTORICAL AND CULTURAL ASPECTS

Environmental objectives and goals in respect of historical and cultural aspects are listed in the table below (Table 45).

**TABLE 45: ENVIRONMENTAL OBJECTIVES AND GOALS – HISTORICAL AND CULTURAL ASPECTS**

Aspect	Environmental objective	Goals
Heritage and cultural	To prevent unacceptable loss of heritage resources and related information	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

## 18 APPROPRIATE TECHNICAL AND MANAGEMENT OPTIONS CHOSEN FOR EACH IMPACT

### 18.1 PROJECT ACTIONS, ACTIVITIES AND PROCESSES

All activities associated with the proposed infrastructure have the potential to cause pollution or environmental degradation. These are described in Section 2 of this EIA and EMP report.

### 18.2 TECHNICAL AND MANAGEMENT OPTIONS

Appropriate technical and management options chosen to modify, remedy, control or stop any action, activity or process associated with the proposed project which will cause significant impacts on the environment, socio-economic conditions and historical and cultural aspects are detailed in Section 19 and summarised briefly listed in the table below (Table 46). Further explanation is provided per impact in Section 7. In addition to these, the mine will implement an environmental management system to assist in the implementing and monitoring of commitments included in this EIA and EMP report.

**TABLE 46: TECHNICAL AND MANAGEMENT OPTIONS**

Potential impact	Summary of technical and management options
Loss and sterilization of mineral resources	Mine workings well be developed and designed taking cognisance of potential ore reserves Extraction of all possible minerals prior to final disposal
Hazardous excavations and infrastructure	Construction of berms, fencing, barriers and access control Warning signs Sealing main and ventilation shaft Implement monitoring programme Implement an emergency response procedure
Loss of soil resources and land capability through pollution	Implement hazardous waste, dirty water and mineralised and non-mineralised waste management procedures Permanent infrastructure designs to take long term soil prevention, land function and confirmatory monitoring into account Implement an emergency response procedure
Loss of soil and land capability through physical disturbance	Limiting disturbance of soil to what is necessary Implementation of a soil management plan Stripping, storing, maintenance and replacement of topsoil in accordance to soil management procedures
General disturbance of biodiversity	Prevention of the killing of animal species Reduction of use of light Elimination of vehicles travelling off road, hunting/trapping/snaring, plant collection, firewood collection Fencing off of water dams Implementation of dust control measures Pollution prevention measures

Potential impact	Summary of technical and management options
Physical destruction of biodiversity	<ul style="list-style-type: none"> <li>Implementation of the biodiversity management plan</li> <li>Restrict project footprint</li> <li>Implement alien/invasive/weed management plan</li> <li>Limit disturbance on high biodiversity areas</li> <li>Investigation of a biodiversity offset if required</li> <li>Implementation of monitoring programmes</li> <li>Rehabilitate disturbed areas</li> </ul>
Alteration of natural drainage lines	<ul style="list-style-type: none"> <li>Implement and maintain storm water controls that meet regulatory requirements</li> <li>Vegetation on site will be maintained</li> <li>Water conservation education for employees</li> <li>Avoidance of watercourses and steep gradients</li> </ul>
Contamination of surface water	<ul style="list-style-type: none"> <li>Implement and maintain storm water controls that meet regulatory requirements</li> <li>Appropriate design of polluting facilities and pollution prevention facilities (by qualified person)</li> <li>Implement site-specific soil management plan</li> <li>Implement a monitoring programme (water use, process water quality, rainfall-related discharge quality)</li> <li>Provide an alternative equivalent water supply if third party water supply has been polluted</li> <li>Implement emergency response procedure</li> <li>Implementation and maintenance of licence requirements</li> </ul>
Reduction of groundwater levels and availability	<ul style="list-style-type: none"> <li>Provide an equivalent water supply if dewatering causes loss of water supply to third parties</li> <li>Implementation of monitoring programme</li> </ul>
Contamination of groundwater	<ul style="list-style-type: none"> <li>Appropriate design and control of potential pollution sources</li> <li>Correct handling of hazardous wastes, mineralised and non-mineralised wastes</li> <li>Provide an alternative equivalent water supply if third party water supply has been polluted</li> <li>Implement and maintain terms and conditions of regulatory requirements</li> <li>Implementation of a monitoring programme</li> <li>Implement emergency response procedure</li> <li>Implementation and maintenance of licence requirements</li> </ul>
Air pollution	<ul style="list-style-type: none"> <li>Implementation of air quality management plan</li> <li>Implementation an air quality monitoring programme</li> <li>Control dust plumes</li> <li>Implementation of an air complaints procedure</li> <li>Implement an emergency response procedure</li> </ul>
Noise pollution	<ul style="list-style-type: none"> <li>Commission a noise specialist to determine pre-project noise levels</li> <li>Implementation of a noise complaints procedure</li> <li>Maintenance of vehicles and equipment</li> <li>Additional noise control measures if required</li> </ul>
Blasting damage	<ul style="list-style-type: none"> <li>Implementation of a blast management plan</li> <li>Pre-mining structure and crack survey</li> <li>Pre-blast warning</li> <li>Communication of planned blasting times with stakeholders</li> <li>Monitoring blasts</li> <li>Audit and review to adjust blast design were necessary</li> <li>Investigate blast related complaints</li> <li>Rectify damage to third party structures if the damage is caused by the mine</li> <li>Implement emergency response procedure</li> </ul>
Road disturbance and traffic safety	<ul style="list-style-type: none"> <li>Implementation of a traffic safety programme</li> <li>Dedicated loading and offloading area</li> <li>Placement of lighting and signage at intersection with R380</li> <li>Implement emergency response procedure</li> </ul>

Potential impact	Summary of technical and management options
Visual impacts	Limit the clearing of vegetation Limit the emission of visual air plumes Painting infrastructure to compliment the surrounding environment where possible Limit the use of lighting Vegetation re-establishment Implementation of a closure and rehabilitation plan Management through care and aftercare
Loss of or damage to heritage, cultural, archaeological or palaeontological resources	Demarcation of heritage sites that are within close proximity to mining activities Limit project infrastructure, activities and related disturbances to demarcated areas Education of workers Implement chance find procedure Implement emergency response procedure
Economic impact	Hire people from closest communities as far as possible Local entrepreneurial development, as well as procurement of goods and services as far as possible To extend the formal bursary and skills development to closest communities Closure planning to make consideration for skills, economic consideration and the needs of future farming
Inward migration	Good communication in terms of recruitment, procurement and training Number of temporary and permanent new job opportunities and procurement will be made public Employment and procurement opportunities provided to closest communities when possible No recruitment at the mine gate Monitor and prevent the development of informal settlements through the interaction with neighbours, local authorities and law enforcement officials Implement a health policy on HIV/AIDs and tuberculosis to promote awareness and training
Land use impact	Implementation of EMP commitments that focus on environmental and social impacts Take necessary steps to prevent negative impact on surrounding land Restrict project footprint Closure objectives to incorporate measures to achieve future land use plans Implement stakeholder engagement meetings for sharing information and solving problems.

## 19 ACTION PLANS TO ACHIEVE OBJECTIVES AND GOALS

Action plans to achieve the objectives and goals set out in Section 15 (bio-physical environment), Section 16 (socio-economic conditions) and Section 17 (historical and cultural) above, are listed in tabular format together with timeframes for each action. The action plans include the timeframes and frequency for implementing the mitigation measures as well identifies the responsible party.

Action plans as described below, include technical and management options for the proposed project. Technical and management options have been identified for the following impacts:

- Loss and sterilisation of mineral resources (Table 47)
- Hazardous excavations and infrastructure (Table 48);
- Loss of soil resources and land capability through pollution (Table 49)
- Loss of soil resources and land capability through physical disturbance (Table 50);
- General disturbance of biodiversity (Table 51);
- Physical destruction of biodiversity (Table 52);
- Alteration of natural drainage patterns (Table 53);
- Contamination of surface water (Table 54);
- Reduction of groundwater levels and availability (Table 55);
- Contamination of groundwater (Table 56);
- Air pollution (Table 57);
- Noise pollution (Table 58);
- Blasting impacts (Table 59);
- Road disturbance and traffic safety (Table 60);
- Visual impacts (Table 61);
- Loss of or damage to heritage, cultural, archaeological and palaeontological resources (Table 62);
- Economic impact (Table 63);
- Inward migration (Table 64); and
- Land use impacts (Table 65).

**TABLE 47: ACTION PLAN – LOSS AND STERILISATION OF MINERAL RESOURCES**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Placement of surface infrastructure	M	L	<ul style="list-style-type: none"> <li>Lehating will incorporate cross discipline planning structures for mining and infrastructure developments to avoid mineral sterilization.</li> <li>Mine workings and the access road will be designed and developed so as not to limit access to mineral resources.</li> <li>Final rehabilitation planning will take account of the possible future options for reprocessing the tailings and waste rock facilities.</li> </ul>	At start of phase	Once off	Mine resource manager
Operation	Placement of surface infrastructure Mineralised waste management (tailings and waste rock)	M	L		On-going	On-going	Mine Resource manager
Decommissioning	Placement of surface infrastructure Mineralised waste management (tailings and waste rock)	M	L		On-going	On-going	Senior Operational Manager
Closure	Placement of surface infrastructure Mineralised waste management (tailings and waste rock)	M	L				

**TABLE 48: ACTION PLAN – HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Water Management Facilities Power supply and use Water supply and use Transport systems General site management Other support services and amenities	H	M	<ul style="list-style-type: none"> <li>All proposed mineralised waste facilities will be designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. These issues will be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer.</li> <li>Lehating will survey its surface use area and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations, hazardous infrastructure and subsidence is known. It will further more ensure that appropriate management measures are taken to address the related safety risks to third parties and animals. Included in this will be the implementation of adequate underground support infrastructure to prevent subsidence.</li> <li>The safety risks associated with identified hazardous excavations, subsidence and infrastructure will be</li> </ul>	On-going	On-going	Professional engineer
					On-going	On-going	Senior Operational Manager
					As required	Once off	Senior Operational Manager



Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				addressed through one or more of the following: <ul style="list-style-type: none"> <li>○ fencing, berms, barriers and/or security personnel to prevent unauthorized access;</li> <li>○ warning signs in the appropriate languages (s) Warning pictures can be used as an alternative</li> </ul> • Where Lehatung has caused injury or death to third parties and/or animals, appropriate compensation will be provided           • In case of injury or death due to hazardous excavations, the emergency response procedure in Section 20 will be followed.	On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
Operation	Earthworks Civil works Water Management Facilities Main and Ventilation Shafts Process Plant Tailings Storage Facility Waste rock stockpile Power supply and use Water supply and use Transport systems General site management Other support services and amenities	H	M	• All proposed mineralised waste facilities will be designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. These issues will be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer.           • Lehatung will survey its surface use area and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations, hazardous infrastructure and subsidence is known. It will further more ensure that appropriate management measures are taken to address the related safety risks to third parties and animals. Included in this will be the implementation of adequate underground support infrastructure to prevent subsidence.           • The safety risks associated with identified hazardous excavations, subsidence and infrastructure will be addressed through one or more of the following: <ul style="list-style-type: none"> <li>○ fencing, berms, barriers and/or security personnel to prevent unauthorized access;</li> <li>○ warning signs in the appropriate languages (s) Warning pictures can be used as an alternative</li> </ul> • Where Lehatung has caused injury or death to third parties and/or animals, appropriate compensation will be provided           • In case of injury or death due to hazardous excavations, the emergency response procedure in Section 20 will be followed	On-going	On-going	Professional engineer
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					As required	As required	Senior Operational Manager
					On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Decommissioning	Water Management Facilities Main and Ventilation Shafts Process Plant Tailings Storage Facility Waste rock stockpile Transport systems General site management Other support services and amenities Demolition	H	M	<ul style="list-style-type: none"> <li>All proposed mineralised waste facilities will be designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. These issues will be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer. Provision will be made to address long term and safety risks in the decommissioning and rehabilitation planning.</li> </ul>	On-going	On-going	Professional engineer
				<ul style="list-style-type: none"> <li>Lehating will survey its surface use area and update its surface use area map on a routine basis to ensure that the position and extent of all potential hazardous excavations, hazardous infrastructure and subsidence is known. It will further more ensure that appropriate management measures are taken to address the related safety risks to third parties and animals. Included in this will be the implementation of adequate underground support infrastructure to prevent subsidence.</li> </ul>	As required	As required	Senior Operational Manager
				<ul style="list-style-type: none"> <li>During decommissioning planning of any part of the mine, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases.</li> </ul>	On-going	On-going	Senior Operational Manager
				<ul style="list-style-type: none"> <li>Where Lehating has caused injury or death to third parties and/or animals, appropriate compensation will be provided</li> </ul>	As required	As required	Senior Operational Manager
				<ul style="list-style-type: none"> <li>In case of injury or death due to hazardous excavations, the emergency response procedure in Section 20 will be followed.</li> </ul>	As required	As required	Senior Operational Manager
Closure	Water Management Facilities Tailings Storage Facility Waste rock stockpile	H	M	<ul style="list-style-type: none"> <li>All proposed mineralised waste facilities will be designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. These issues will be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer. Provision will be made to address long term and safety risks in the decommissioning and rehabilitation planning.</li> </ul>	As required	As required	Senior Operational Manager
				<ul style="list-style-type: none"> <li>At closure of any part of the mine, the hazardous infrastructure will either have been removed or decommissioned and rehabilitated in a manner that it does not present a long term safety and/or stability risk.</li> </ul>	As required	As required	Senior Operational Manager
				<ul style="list-style-type: none"> <li>At closure of any part of the mine the hazardous excavations and subsidence will have been dealt with as follows: <ul style="list-style-type: none"> <li>All shaft openings will have been sealed and rehabilitated</li> <li>the potential for surface subsidence will have been addressed by providing underground support in mined out areas;</li> <li>monitoring and maintenance will take place to observe</li> </ul> </li> </ul>	As required	As required	Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				<p>whether the relevant long term safety objective have been achieved and to identify the need for additional intervention where the objectives have not been met.</p> <ul style="list-style-type: none"> <li>In case of injury or death due to hazardous excavations, the emergency response procedure in 20 will be followed.</li> </ul>	As required	As required	Senior Operational Manager

**TABLE 49: ACTION PLAN – LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH POLLUTION**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works General site management Transport systems Non-mineralised waste management Rehabilitation	H	M-L	<ul style="list-style-type: none"> <li>Lehating will ensure that all, dirty water, mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute soils. This will be implemented through a procedure covering the following:               <ul style="list-style-type: none"> <li>pollution prevention through basic infrastructure design</li> <li>pollution prevention through maintenance of equipment;</li> <li>pollution prevention through education and training of permanent and temporary workers;</li> <li>pollution prevention through appropriate management of hazardous materials and wastes;</li> <li>the required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in situ treatment or disposal of contaminated soils as hazardous waste. In-situ treatment 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 bioremediation 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; and</li> <li>specifications for post rehabilitation audit criteria 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.</li> </ul> </li> <li>In case of major spillage incidents the emergency response procedure in Section 20 will be followed.</li> </ul>	As required	As required	Senior Operational Manager
Operation	General site management Main and Ventilation Shafts Process Plant Transport systems Surface water management infrastructure Non-mineralised waste management Tailings dams Water supply infrastructure Power supply infrastructure Rehabilitation	H	M-L				
Decommissioning	General site management Main and Ventilation Shafts Process Plant Transport systems Surface water management infrastructure Non-mineralised waste management Tailings dams	H	M-L		As required	As required	Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Water supply infrastructure Power supply infrastructure Rehabilitation						
Closure	Tailings dam Waste rock stockpile Rehabilitation Maintenance and aftercare	H	M-L	<ul style="list-style-type: none"> <li>The designs of any permanent and potentially polluting structures (such as the waste rock stockpile and tailings storage facility) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring.</li> <li>In case of major spillage incidents the emergency response procedure Section 20 will be followed.</li> </ul>	As required  As required	As required  As required	Senior Operational Manager  Senior Operational Manager

**TABLE 50: ACTION PLAN - LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works General site management Water supply and use Power supply and use Transport systems	H	L (M for tailings and waste rock)	<ul style="list-style-type: none"> <li>Limit the disturbance of soils to what is absolutely necessary for earthworks on-going activities, infrastructure footprints and use of vehicles</li> <li>Where soils have to be disturbed the soils will be stripping, storage and maintenance and replaced in accordance with the specifications of the soil management principles and the detailed Lehigh soils management procedure.</li> </ul>	On-going	On-going	Senior Operational Manager
Operation	Earthworks Civil works General site management Process Plant Main and Ventilation Shafts Stormwater management facilities Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation	H	L (M for tailings and waste rock)		On-going	On-going	Senior Operational Manager
Decommissioning	General site management Process Plant Main and Ventilation Shafts Stormwater management facilities	H	L (M for tailings and waste rock)				

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	Transport systems Non-mineralised waste management Tailings storage facility Water supply and use Power supply and use Rehabilitation Demolition						
Closure	Rehabilitation Maintenance and aftercare	H	L (M for tailings and waste rock)	<ul style="list-style-type: none"> <li>As part of closure planning, the designs of any permanent land forms (eg. Mineralized waste facilities) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring.</li> </ul>	At required	At required	Senior Operational Manager

TABLE 51: ACTION PLAN – GENERAL DISTURBANCE OF BIODIVERSITY

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan			
		UM	M		Timeframe	Frequency	Responsible parties	
Construction	Site preparation	H	M	<ul style="list-style-type: none"><li>• In the construction, operation, decommissioning and closure phases the mine will ensure that:</li><li>• The use of light is kept to a minimum, and where it is required, yellow lighting is used where possible: vertebrates should be kept away from the lighted areas with appropriate fencing where feasible.</li><li>• Vehicle will not be allowed to travel off designated roads or outside of designated disturbance areas.</li><li>• A speed limit of 40km/h should be adhered to along all gravel roads.</li><li>• All hunting and/or trapping or snaring of animals by mine staff and contractors shall be prohibited.</li><li>• No plant collection shall be allowed by contractors or mine staff.</li><li>• Employees shall be prohibited from collecting firewood and or cutting down trees in the area.</li><li>• Internal power lines will be equipped with bird deterrent measures to prevent bird kills where deemed necessary by an appropriately qualified specialist.</li><li>• Noisy and/or vibrating equipment will be well maintained to limit noise and vibration emission levels.</li><li>• All water dams will be fenced off to prevent access by larger animals.</li><li>• Dust control measures will be implemented at the mine in accordance with Section 7.2.10.</li><li>• Litter and pollution prevention measures will be</li></ul>	On-going	On-going	Senior Operational Manager	
	Earthworks				On-going	On-going	Senior Operational Manager	
	Civil works							
	Power supply and use							
	Water supply and use							
Transport systems								
Non-mineralised waste management								
General site management								
Other support services and amenities								
Operation	Civil works	H	M			On-going	On-going	Senior Operational Manager
	Main and Ventilation				On-going	On-going	Senior Operational Manager	
	Shafts				On-going	On-going	Senior Operational Manager	
	Process Plant			On-going	On-going	Senior Operational Manager		
	Tailings Storage Facility			On-going	On-going	Senior Operational Manager		
	Power supply and use			As required	As required	Senior Operational Manager		
	Water supply and use			On-going	On-going	Senior Operational Manager		
	Transport systems			On-going	On-going	Senior Operational Manager		
	Non-mineralised waste management			On-going	On-going	Senior Operational Manager		
General site management								
Other support services and amenities								
Decommissioning	Transport systems	H	M		As required	As required	Senior Operational Manager	
	Non-mineralised waste							

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	management General site management Other support services and amenities Demolition			implemented in accordance with Section 7.2.3.			
Closure	Rehabilitation Maintenance and aftercare	H	M				

TABLE 52: ACTION PLAN – PHYSICAL DESTRUCTION OF BIODIVERSITY

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Transport systems General site management Other support services and amenities	H	H	In the construction, operation and decommissioning phases the mine will implement its biodiversity management plan. The key components are: <ul style="list-style-type: none"><li>to generally limit mine infrastructure, activities and related disturbance to those specifically identified and described in this EIA report and to establish buffers between the infrastructure areas and more sensitive habitats;</li><li>where possible, to specifically avoid the destruction of irreplaceable biodiversity areas and important linkages between biodiversity areas;</li><li>there will be planned removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities. This will include planning on the preservation, cultivation and re-use of these species in ongoing rehabilitation. Links will also be made to the soil conservation procedure and actions. Harvesting of seed in a controlled manner from similar areas within the project area will be undertaken to aid in rehabilitation of the mining areas;</li><li>as a first priority, every attempt will be made to preserve existing larger trees. In addition, pods of <i>Acacia erioloba</i> and <i>Acacia haematoxylon</i> will be collected from the area in order to aid in the re-establishment of these species. Necessary steps (such as artificial scarring/acid washing) will be taken in order to aid in germination of these species.</li><li>permits will be obtained for the destruction and/or removal of protected vegetation;</li><li>restoration of the biodiversity functionality, as far as is possible, in areas that have been physically rehabilitated; and follow up audits and monitoring in the short and long term to determine the success of the rehabilitation and restoration activities in terms of a range of performance</li></ul>	On-going	On-going	Senior Operational Manager
Operation	Main and Ventilation Shafts Process Plant Tailings Storage Facility Power supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	H	H		On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
Decommissioning	Transport systems Demolition	H	H		On-going	On-going	Senior Operational Manager
					As required	As required	Senior Operational Manager
				On-going	On-going	Senior Operational Manager	

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				<p>indicators;</p> <ul style="list-style-type: none"> <li>• implementation of an alien/invasive/weed management programme to control the spread of these plants onto and from disturbed areas;</li> <li>• monitoring of both the groundwater levels near older more established trees and monitoring of the tree health to determine if mine related dewatering impacts this set of trees. If an impact is observed a specialist will be commissioned to determine the appropriate mitigation measures; and</li> <li>• if irreplaceable biodiversity will be permanently lost, and/or restoration is not possible, and/or the residual impacts have a higher than medium significance rating (to be determined by an appropriate specialist) a biodiversity offset will be investigated and implemented where feasible. Issues that will be considered in the investigation are as follows: <ul style="list-style-type: none"> <li>○ the size of the potentially affected area;</li> <li>○ the conservation/sensitivity status of the potentially affected area;</li> <li>○ the offset ratio (in terms of the required size of the offset site) to be applied;</li> <li>○ evaluation of alternative offset sites on the basis of: no net biodiversity loss, compensation for the mine's negative impact on biodiversity, long term functionality, long term viability, contribution to biodiversity conservation in the Namib including linkages to areas of conservation importance, acceptability to key stakeholders, distances from other mines in relation to dust fallout and other impacts, and biodiversity condition scores as compared to that at the mine site;</li> <li>○ land ownership now and in the future;</li> <li>○ status/security of the offset site, i.e. will it receive conservation status;</li> <li>○ measures to guarantee the security, management, monitoring and auditing of the offset;</li> <li>○ capacity of the mine to implement and manage the offset;</li> <li>○ identification of unacceptable risks associated with the offset; and</li> <li>○ the start-up and ongoing costs associated with the offset for the life of the project.</li> </ul> </li> </ul>	On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					As required	As required	Senior Operational Manager
Closure	Rehabilitation Maintenance and aftercare	H	H	<ul style="list-style-type: none"> <li>• As part of closure planning, the designs of any permanent structures (mineralised waste facilities) will take into consideration the requirements for the establishment of long term biodiversity functionality, aftercare and confirmatory monitoring.</li> </ul>	As required	As required	Senior Operational Manager

**TABLE 53: ACTION PLAN – ALTERATION OF NATURAL DRAINAGE PATTERNS**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Transport systems Non-mineralised waste management General site management Other support services and amenities	H	M	<ul style="list-style-type: none"> <li>In all phases mine infrastructure will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) of any future amendments thereto. These include: <ul style="list-style-type: none"> <li>clean water systems are separated from dirty water systems</li> <li>the size of dirty water areas are minimized and clean run-off and rainfall water is diverted around dirty areas and back into the normal flow in the environment. Dirty or contaminated water will be contained.</li> <li>aside from the access road, the location of all activities and infrastructure should be outside of the specified zones (100m from any water courses) and/or the 1:100 flood lines, whichever is the greatest. If this is unavoidable the necessary exemptions/approvals will be obtained.</li> </ul> </li> <li>The access road river crossing that will be constructed will be designed so that there is no material alteration of the river flow. The crossing will be designed with culverts of sufficient capacity to handle a 1 in 50 flood event. The crossing will be inspected regularly for erosion and any culvert blockages. Where blockages have formed these will be cleared and damaged areas will be repaired immediately.</li> </ul>	On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
Operation	Earthworks Civil works Main and Ventilation Shafts Process Plant Tailings Storage Facility Power supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	H	M		On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
Decommissioning	Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition	H	M				
Closure	Rehabilitation Maintenance and aftercare	H	L				

**TABLE 54: ACTION PLAN – CONTAMINATION OF SURFACE WATER**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties



Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works General site management Transport systems Non-mineralised waste management Rehabilitation	H	L	<ul style="list-style-type: none"> <li>Lehating will comply with the terms and conditions of water authorisations/licenses.</li> <li>In all phases, infrastructure associated with the proposed projects will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto. Key related issues are to ensure that: <ul style="list-style-type: none"> <li>clean water systems are separated from dirty water systems;</li> <li>the location of all activities and infrastructure (aside from the access road) should be outside of the specified zones and/or floodlines of watercourses. If this is unavoidable the necessary exemptions/approvals will be obtained;</li> <li>the size of dirty areas are minimised and dirty water is contained in systems that allow the reuse and/or recycling of this dirty water;</li> <li>discharges of dirty water may only occur in accordance with authorisations that are issued in terms of the relevant legislation specifications and they must not result in negative health impacts for downstream surface water users. The relevant legislation specifications comprises any applicable authorisation/exemption, the National Water Act (36 of 1998) and Regulation 704, or any future amendment thereto; and</li> <li>the site wide water balance is refined on an on-going basis with the input of actual flow volumes and used as a decision making tool for water management and impact mitigation.</li> </ul> </li> <li>In the construction, operation and decommissioning phases the mine will ensure that all mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute surface water. This will be implemented through a procedure(s) covering the following: <ul style="list-style-type: none"> <li>pollution prevention through basic infrastructure design</li> <li>pollution prevention through maintenance of equipment</li> <li>pollution prevention through education and training of workers (permanent and temporary);</li> <li>pollution prevention through appropriate management of hazardous materials and waste;</li> <li>the required steps to enable containment and remediation of pollution incidents; and</li> <li>specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further</li> </ul> </li> </ul>	On-going	On-going	Senior Operational Manager
Operation	General site management Main and Ventilation Shafts Process Plant Transport systems Surface water management infrastructure Non-mineralised waste management Tailings dams Water supply infrastructure Power supply infrastructure Rehabilitation	H	L		On-going	On-going	Senior Operational Manager
Decommission	General site management Main and Ventilation Shafts Process Plant Transport systems Surface water management infrastructure Non-mineralised waste management Tailings dams Water supply infrastructure Power supply infrastructure Rehabilitation	H	L		On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				measures. • The designs of any permanent and potentially polluting structures will take account of the requirements for long term surface water pollution prevention. • Lehating will monitor the water quality (Section 21) in all potentially affected surface water resources and use the monitoring results to implement appropriate mitigation measures to achieve the surface water quality objectives. • Where monitoring results indicates that third party water supply has been polluted by Lehating, Lehating will ensure that an alternative equivalent water supply will be provided. • Discharge incidents that may result in contamination of surface water resources will be handled in accordance with the Lehating's emergency response procedure in Section 20.	On-going	On-going	Senior Operational Manager
					Monthly/ Quarterly	Monthly/ Quarterly	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					As required	As required	Senior Operational Manager
Closure	Tailings dam Waste rock stockpile Rehabilitation Maintenance and aftercare	H	L	• At closure, Lehating will ensure that the site will be re-vegetated as soon as possible after closure.	On-going	On-going	Senior Operational Manager

TABLE 55: ACTION PLAN – REDUCTION OF GROUNDWATER LEVELS AND AVAILABILITY

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Water supply and use	M-L	L	• All potentially affected third party boreholes will be included in the Lehating ground water monitoring program to ensure that changes in water depths can be identified. • Where Lehating's dewatering causes a loss of water supply to third parties an alternative equivalent water supply will be provided by Lehating until such time as the dewatering impacts cease. • One monitoring borehole in the vicinity of the Kuruman River alluvial aquifer will be monitored to observe the dewatering impacts of the well field on the Kuruman River. If monitoring indicates that greater impacts (than those predicted above) are occurring, well field use will be adjusted according to the advice of an appropriate specialist.	On-going	On-going	Senior Operational Manager
Operation	Mining Water supply and use	M-L	L		On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
Decommissioning	Water supply and use-	M-L	L				
Closure	N/A	M-L	L				

TABLE 56: ACTION PLAN – CONTAMINATION OF GROUNDWATER

Phase of operation	Activities (see Table 25)	Sig	Technical and management options	Action plan		
				Timeframe	Frequency	Responsible parties

		UM	M				
Construction	Earthworks Civil works Site management Transport systems Non-mineralised waste management Support services and amenities Rehabilitation	H-M	L	<ul style="list-style-type: none"> <li>Lehating will comply with both the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto, and the terms and conditions of water authorisations/license.</li> <li>In the construction, operation and decommissioning phases the mine will ensure that all hazardous substances, mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute groundwater. This will be implemented through a procedure(s) covering the following: <ul style="list-style-type: none"> <li>pollution prevention through basic infrastructure design, such as lining the TSF;</li> <li>pollution prevention through education and training of workers (permanent and temporary);</li> <li>pollution prevention through appropriate management of materials and non-mineralised waste;</li> <li>the required steps to enable containment and remediation of pollution incidents; and</li> <li>specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.</li> </ul> </li> </ul>	On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
Operation	Earthworks Civil works Site management Transport systems Non-mineralised waste management Support services and amenities Shafts Process plant Mineralised waste (TSF and waste rock) Other stockpiles Water supply infrastructure Power supply infrastructure Rehabilitation	H-M	L	<ul style="list-style-type: none"> <li>Infrastructure that has the potential to cause groundwater contamination will be identified and included in a groundwater pollution management plan which will be implemented as part of the operational phase. This plan has the following principles: <ul style="list-style-type: none"> <li>determine potential pollution sources;</li> <li>determine the extent of the existing or potential contamination plume;</li> <li>design and implement intervention measures to prevent, eliminate and/or control the pollution plume. monitor all existing and potential impact zones to track pollution and mitigation impacts;</li> <li>groundwater monitoring will be done in accordance with the monitoring plan included in Section 21. In this regard Lehating will: <ul style="list-style-type: none"> <li>monitor all potential impact zones including the closest third party boreholes and the aquifer beneath the Kuruman River; and</li> <li>where monitoring results indicates that third party water supply has been polluted by mine related activities/infrastructure, Lehating will ensure that an alternative equivalent water supply will be provided.</li> </ul> </li> </ul> </li> <li>The designs of any permanent and potentially polluting structures will take account of the requirements for long term water pollution prevention. Moreover, where these facilities</li> </ul>	On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
Decommissioning	Demolition Earthworks Civil works Site management Transport systems Non-mineralised waste management Support services and amenities Mineralised waste (TSF and waste rock) Other stockpiles Water supply infrastructure Power supply infrastructure Rehabilitation	H-M	L		On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Closure	Maintenance and aftercare of final land forms and rehabilitated areas including TSF and waste rock stockpile	H-M	L	are associated with groundwater plumes that have or will impact the quality of water resources, Lehateng will implement mitigation measures for as long as is needed to eliminate the risk and achieve the stated mitigation objectives.			

**TABLE 57: ACTION PLAN –AIR POLLUTION**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Transport systems General site management Other support services and amenities	M	M-L	<ul style="list-style-type: none"> <li>Lehateng will implement a dynamic air quality management plan that covers: <ul style="list-style-type: none"> <li>the identification of sources (emissions inventory);</li> <li>the implementation of source based controls;</li> <li>the use of source and receptor based performance indicators and monitoring strategies;</li> <li>the use of source and receptor based mitigation measures;</li> <li>the use of internal and external auditing; and</li> <li>review and plan adjustment as required.</li> </ul> </li> </ul>	On-going	On-going	Senior Operational Manager
Operation	Main and Ventilation Shafts Process Plant Power supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	H	M	<ul style="list-style-type: none"> <li>During land clearing activities: <ul style="list-style-type: none"> <li>the area will be sprayed with water prior to clearance, so as to reduce the potential for dust generation when stockpiling topsoil; and</li> <li>travel distances between clearing area and topsoil stockpiles will be kept to a minimum.</li> </ul> </li> </ul>	On-going	On-going	Senior Operational Manager
				<ul style="list-style-type: none"> <li>During road construction and/or grading: <ul style="list-style-type: none"> <li>the area will be sprayed with water prior to grading;</li> <li>freshly graded areas will be kept to a minimum; and</li> <li>dust buckets (specifically DB06) will be monitored to ensure that monthly dust fallout rates do not exceed 1 200mg/m<sup>2</sup>/day;</li> </ul> </li> </ul>	On-going	On-going	Senior Operational Manager
				<ul style="list-style-type: none"> <li>Wind erosion from exposed areas will be managed by keeping the exposed areas moist through regular water spraying, and by the monitoring of dust buckets (specifically DB03) to ensure that monthly dust fallout rates do not exceed 1 200mg/m<sup>2</sup>/day.</li> </ul>	On-going	On-going	Senior Operational Manager
				<ul style="list-style-type: none"> <li>PM10 concentrations from ventilation shafts will be measured routinely and during blasting conditions in order to monitor the levels of dust generated;</li> </ul>	On-going	On-going	Senior Operational Manager
				<ul style="list-style-type: none"> <li>Vehicle activities on gravel roads will be managed by <ul style="list-style-type: none"> <li>regular spraying with a combination of water and chemicals to ensure at least 75% control efficiency;</li> <li>speed limit reduction on mine roads will not exceed</li> </ul> </li> </ul>	On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				<p>40km/hour;</p> <ul style="list-style-type: none"> <li>monitoring of dust buckets (specifically DB04 and DB05) to ensure that monthly dust fallout rates do not exceed 1 200mg/m<sup>2</sup>/day.</li> <li>the generation of PM10, PM2.5 and dust fallout at material transfer points such as stockpiles for ore, product or waste rock will sprayed with water sprays, and dust buckets (specifically DB02, DB06 and) DB07) will be monitored to ensure that monthly dust fallout rates do not exceed 1 200mg/m<sup>2</sup>/day.</li> <li>the generation of PM10 and dust fallout at material transfer points at conveyors: <ul style="list-style-type: none"> <li>will be enclosed to ensure 70% control efficiency;</li> <li>visual monthly inspections will be performed to ensure no visual dust generation from these points;</li> <li>will be monitored with dust buckets (specifically DB06) to ensure that monthly dust fallout rates do not exceed 1 200mg/m<sup>2</sup>/day.</li> </ul> </li> <li>crushing and screening operations will be managed by: <ul style="list-style-type: none"> <li>reducing PM10 concentrations and dust fallout through regular spraying with water sprays;</li> <li>ore will be wet either prior to crushing, or by water sprays at the crusher;</li> <li>crushers will be enclosed and will contain dust suppression systems to reach as close to 100% control efficiency as possible;</li> <li>monitoring of dust buckets (specifically DB02) to ensure that monthly dust fallout rates do not exceed 1 200mg/m<sup>2</sup>/day.</li> </ul> </li> <li>dust buckets will be placed at sensitive receptor sites to monitor that monthly dust fallout rates do not exceed 600mg/m<sup>2</sup>/day;</li> <li>a PM10 ambient sampler will be installed at the sensitive receptor (at the DB08 site) so as to monitor that the daily averages do not exceed 75µg/m<sup>3</sup> for more than four days in a calendar year and the annual average not to exceed 40 µg/m<sup>3</sup>;</li> <li>manganese monitoring will be conducted at the sensitive receptor site (Boerdraai).</li> <li>The ambient and dust fallout monitoring and management programmes (Airshed Air Quality Report Section 9.2) will be implemented at Lehating and the results thereof will be used to determine appropriate emission controls and other relevant mitigation interventions.</li> </ul>	On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
Decommissioning	Tailings and Waste Rock	M	M-L	<ul style="list-style-type: none"> <li>During decommissioning and closure, wind erosion from</li> </ul>	On-going	On-going	Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
	facilities Demolition			exposed areas will be managed by the use of water sprays during the demolition of infrastructure where high levels of vehicle activity are encountered. Erosion will also be mitigated by ensuring that site is restored to pre-mining conditions.			
Closure	Tailings and Waste Rock facilities Rehabilitation Maintenance and aftercare	M-L	L	<ul style="list-style-type: none"> <li>As part of closure planning the designs of any permanent and potentially polluting structures (particularly the mineralized waste facilities) will, on the basis of impact modeling, incorporate measures to address long term pollution prevention and confirmatory monitoring.</li> <li>In case of an emissions incident that may result in the exceedance of one or more of the evaluation criteria the emergency response procedure in Section 20 will be followed.</li> </ul>	On-going  As required	On-going  As required	Senior Operational Manager  Senior Operational Manager

TABLE 58: ACTION PLAN – NOISE POLLUTION

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Transport systems	M	M/L	<ul style="list-style-type: none"> <li>Prior to construction, Lehating will commission a noise specialist to determine pre-project ambient noise levels at Boerdraai and van Schalkwyk.</li> <li>Once the project commences, all noise complaints will be documented, investigated and reasonable efforts made to address the area of concern. Where necessary and using the pre-project ambient noise levels as a reference point, noise monitoring will be undertaken as part of the investigation to quantify mine related impacts.</li> </ul>	Start of phase  On-going	As required  On-going	Senior Operational Manager  Senior Operational Manager
Operation	Earthworks Civil works Main and Ventilation Shafts Process Plant Power supply and use Water supply and use Transport systems Other support services and amenities	M	M/L	<ul style="list-style-type: none"> <li>In the normal course, all vehicles and equipment will be maintained to limit noise emissions.</li> <li>Where additional noise control measures are required, the following will be considered as additional options that could be implemented: <ul style="list-style-type: none"> <li>Equipping noise sources with silencers;</li> <li>Construction of noise attenuation measures where required; and</li> <li>Adjusting the operational times of the noise generating activities.</li> </ul> </li> </ul>	On-going  As required	On-going  As required	Senior Operational Manager  Senior Operational Manager
Decommissioning	Earthworks Transport systems Demolition	M	M/L				
Closure	-	M	M/L	-	-	-	-

**TABLE 59: ACTION PLAN – BLASTING DAMAGE**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works	H	L	Lehating will implement a blast management plan which has the following key principles: <ul style="list-style-type: none"> <li>• pre-mining structure and crack survey of structures within 2.5km from the Main shaft including the Boerdraai and van Schalkwyk residences;</li> <li>• blasts will be designed to achieve:               <ul style="list-style-type: none"> <li>○ a fly rock zone limit of less than 500 m (surface blast only);</li> <li>○ a peak particle velocity limit of less than 12 mm/s at third party structures that are built according to building industry standards; and</li> <li>○ an air blast limit of less than 125 dB at third party structures (surface blast only).</li> </ul> </li> <li>• pre-blast warning and evacuation to clear people, traffic, moveable property and livestock from the potential fly rock impact zone during surface blasts only;</li> <li>• stakeholders will be notified of the blast programme through the stakeholder engagement department;</li> <li>• blast monitoring to verify the effectiveness of the blast design and compliance with legislation;</li> <li>• audit and review to adjust the blast design where necessary to achieve the stated objectives; and</li> <li>• damage to third party structures as a direct result of Lehating's mining activities will be investigated and rectified where appropriate.</li> </ul>	On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
Operation	Mining	H	L				
Decommissioning	Demolition	H	L		On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					On-going	On-going	Senior Operational Manager
					As required	As required	Senior Operational Manager
Closure	N/A	-	-	-	-	-	-

**TABLE 60: ACTION PLAN – ROAD DISTURBANCE AND TRAFFIC SAFETY**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Transport systems	H	M	<ul style="list-style-type: none"> <li>• Lehating will implement a transport safety programme to achieve the mitigation objectives. Key components of the programme include education, training, awareness, and transport system maintenance.</li> <li>• The gravel access road used by project traffic will be cordoned off by fencing to prevent access by third party traffic, people and animals.</li> <li>• A dedicated loading and offloading area will be provided as close as possible to the project site for workers, visitors and materials. This area will not be located on the R380.</li> </ul>	On-going	On-going	Senior Operational Manager
Operation	Transport systems	H	M		On going	On going	Senior Operational Manager
Decommissioning	Transport systems	H	M		As required	As required	Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				<ul style="list-style-type: none"> <li>The following measures apply if the R380 remains as a gravel road: <ul style="list-style-type: none"> <li>lighting and road signs will be provided at the proposed access intersection to ensure visibility during night time and sufficient information to road users;</li> <li>the current R380 speed limit of 90km/h will with the consent of the Northern Cape Department of Roads and Public Works will be reduced to at least 60km/h at the proposed access intersection; and</li> <li>traffic travelling from the mine towards the R380 will be stop controlled at the intersection.</li> </ul> </li> <li>The following measures apply if the R380 is tarred: <ul style="list-style-type: none"> <li>lighting and road signs will be provided at the proposed access intersection to ensure visibility during night time and sufficient information to road users;</li> <li>the current R380 speed limit of 90km/h will with the consent of the Northern Cape Department of Roads and Public Works will be reduced to at least 60km/h at the proposed access intersection;</li> <li>traffic travelling from the mine towards the R380 will be stop controlled at the intersection;</li> <li>the intersection will be upgraded to include additional lanes and road markings to achieve a dedicated left turning lane for traffic approaching from the north, acceleration lanes in both directions and a dedicated right turning lane for traffic approaching from the south;</li> <li>prior to construction of the intersection upgrade, approval is required from the Northern Cape Department of Roads and Public Works.</li> </ul> </li> <li>In order to address wear and tear impacts Lehating is committed to working with the Northern Cape Department of Roads and Public Works and other significant road users to contribute to: <ul style="list-style-type: none"> <li>investigations into the life span and integrity of the R380 in its gravel form; and</li> <li>a road maintenance and/or upgrade plan where required.</li> </ul> </li> </ul>	As required	As required	As required
					As required	As required	As required
					On going	On going	On going
Closure	N/A	-	-	-	-	-	-

TABLE 61: ACTION PLAN – VISUAL IMPACTS

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation	H	M	The following visual mitigation techniques will be implemented:			



Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Operation	Earthworks Civil works General site management Other support services and amenities			<ul style="list-style-type: none"> <li>limit the clearing of vegetation;</li> <li>limit the emission of visual air emission plumes (dust emissions);</li> <li>painting infrastructure with colours that blend in with the surrounding environment where possible;</li> </ul>	On-going On-going	On-going On-going	Senior Operational Manager Senior Operational Manager
	Earthworks Civil works Main and Ventilation Shafts Process Plant Tailings Storage Facility Transport systems Non-mineralised waste management General site management Other support services and amenities	H	M	<ul style="list-style-type: none"> <li>lighting will be used only where necessary and in a focused way to prevent dispersion of night pollution;</li> <li>on-going vegetation establishment on rehabilitated areas; and</li> <li>care will be taken to ensure that the rehabilitated areas merge with the immediate environment.</li> </ul>	On-going On-going As required	On-going On-going As required	Senior Operational Manager Senior Operational Manager Senior Operational Manager
	Decommissioning	H	M	<ul style="list-style-type: none"> <li>Implementation of the Lehating closure objectives which involves the removal of infrastructure, and the rehabilitation and re-vegetation of cleared areas and any final land forms that will remain post closure. These final landforms should be rehabilitated in a manner that both achieves landscape functionality and limits and/or enhances the long term visual impact</li> </ul>	As required	As required	Senior Operational Manager
	Closure	H	L	<ul style="list-style-type: none"> <li>Final land forms will be managed through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts</li> </ul>	As required	As required	Senior Operational Manager
	Final Tailings and Waste Rock Facilities Rehabilitation Maintenance and aftercare						

**TABLE 62: ACTION PLAN – LOSS OF OR DAMAGE TO HERITAGE, CULTURAL, ARCHAEOLOGICAL AND PALAEOLOGICAL RESOURCES**

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Water supply and use Transport systems Other support services and amenities	H	L	<ul style="list-style-type: none"> <li>The artifact site on the farm Lehating 741 shall be demarcated from the mining operations and/or the mine perimeter fence will be shifted so that the sites lie outside the impact zones. Additional measures to prevent damage may include information/warning signs if within close proximity to mining operations.</li> <li>All workers (temporary and permanent) will be educated</li> </ul>	As required On-going	As required On-going	Senior Operational Manager Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Operation	Earthworks Civil works Main and Ventilation Shafts Process Plant Tailings Storage Facility Power supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	H	L	about the heritage and cultural sites that may be encountered in their area of work and about the need to conserve these. <ul style="list-style-type: none"> <li>In the event that new resources (heritage, cultural or palaeontological) are discovered during the construction, operation and decommissioning phases, the mine will follow an emergency procedure prior to damaging or moving these, which includes the following: <ul style="list-style-type: none"> <li>work at the find will be stopped to prevent damage;</li> <li>an appropriate heritage specialist will be appointed to assess the find and related impacts; and</li> <li>permitting applications will be made to SAHRA, if required.</li> </ul> </li> <li>In the event that any graves are discovered during the construction, operational or decommissioning phases, prior to damaging or destroying any identified graves, permission for the exhumation and relocation of graves must be obtained from the relevant descendants (if known) and the relevant local and provincial authorities.</li> </ul>	On-going	On-going	Senior Operational Manager
Decommissioning	Earthworks Transport systems Other support services and amenities Demolition	H	L		As required	As required	Senior Operational Manager
Closure	N/A	-	-				

TABLE 63: ACTION PLAN – ECONOMIC IMPACT

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	All activities	H+	H+	<ul style="list-style-type: none"><li>During recruitment, the mine will make use of a stakeholder database to ensure that as far as possible people from the local towns of Black Rock and Hotazel are employed;</li><li>Lehating will support entrepreneurial development in order to ensure that increased income is reinvested in local communities and to reduce reliance on income from the mine;</li><li>the workforce will be trained and their skills developed during the operational phase, particularly in the area of basic literacy, basic numeracy and basic business skills, which will enhance future employment opportunities outside the mine;</li><li>the development and growth of SMMEs will be supported in local towns and on-going skills development programmes will be available to the labour force;</li><li>Lehating will ensure its formal bursary and skills development programmes to the closest communities to increase the number of local skilled people and thereby increase the potential local employee base; and</li></ul>	As required	As required	Stakeholder engagement department
Operation	All activities	H+	H+		On-going	On-going	Stakeholder engagement department
Decommissioning	All activities	H+	H+		On-going	On-going	Stakeholder engagement department
Closure	All activities	H+	H+		On-going	On-going	Stakeholder engagement department
					As required	As required	Stakeholder engagement department

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				<ul style="list-style-type: none"> <li>Lehating will ensure that it incorporates economic considerations into its closure planning from the outset. Closure planning considerations cover the skilling of employees for the downscaling, early closure and long term closure scenarios. It identifies and develops sustainable business opportunities and skills, independent from mining for members of the local communities to ensure continued economic prosperity beyond the life of mine.</li> <li>Post mining utilisation of land for farming will be optimised through implementation of rehabilitation and closure objectives as set out in Section 7.2.4, Section 7.2.19 and Section 22.</li> </ul>	As required	As required	Stakeholder engagement department
					As required	As required	Stakeholder engagement department

TABLE 64: ACTION PLAN – INWARD MIGRATION

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	All activities	H	L	<ul style="list-style-type: none"> <li>In terms of recruitment, procurement and training: <ul style="list-style-type: none"> <li>good communication with all job and procurement opportunity seekers will be maintained throughout the recruitment process. The process must be seen and understood to be fair and impartial by all involved. The personnel in charge of resolving recruitment and procurement concerns must be clearly identified and accessible to potential applicants;</li> <li>the number of new job opportunities (permanent and temporary) and procurement opportunities will be made public together with the required skills and qualifications. The duration of temporary work will be clearly indicated and the relevant employees/contractors provided with regular reminders and revisions throughout the temporary period;</li> <li>recruitment and procurement, by Lehating and its contractors, will be where possible preferentially provided to people in the local towns that are near to Lehating. In order to be in a position to achieve this a skills register of people within the closest communities will be maintained. Lehating will also preferentially provide bursaries and training to people that reside in these closest towns; and</li> <li>there will be no recruitment or procurement at the gates of the mine. All recruitment will take place off site, at designated locations in the closest towns. All procurement will be through established procurement</li> </ul> </li> </ul>	On-going	On-going	Stakeholder engagement department
Operation	All activities	H	L				
Decommissioning	All activities	H	L				
Closure	All activities	H	L				

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
				<p>and tendering processes that will include mechanisms for empowering service providers from the closest communities where possible.</p> <ul style="list-style-type: none"> <li>Lehating acknowledges that it is responsible for ensuring that its employees and contractors are housed in formal serviced housing. This will be achieved by: <ul style="list-style-type: none"> <li>providing on site accommodation for construction workers;</li> <li>allocating an accommodation or an allowance to all employees that can demonstrate that they live in formal housing; and</li> <li>by maintaining an employee profile (for Lehating and contractor employees) that can be used as a tool to identify socio-economic concerns and plan long term mitigation interventions</li> </ul> </li> <li>Lehating will work with its neighbours, local authorities and law enforcement officials to monitor and prevent the development of informal settlements near the mine and to assist where possible with crime prevention within the Lehating Manganese Mine area.</li> <li>Lehating will implement a policy on HIV/AIDS and tuberculosis. This policy will be developed for the workforce to address the concerns regarding the pandemic. A training programme on HIV/AIDS will be implemented on the mine to ensure employees are educated and made aware of the risks involved</li> <li>Lehating will implement a stakeholder communication, information sharing and grievance mechanism to enable all stakeholders to engage with Lehating on both socio-economic and environmental issues.</li> </ul>	On-going	On-going	Stakeholder engagement department
					On-going	On-going	Stakeholder engagement department
					On-going	On-going	Stakeholder engagement department
					On-going	On-going	Stakeholder engagement department

TABLE 65: ACTION PLAN – LAND USE IMPACTS

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan		
		UM	M		Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works Transport systems General site management Other support services	H	M	<ul style="list-style-type: none"> <li>Lehating will implement the EMP commitments with a view not only to prevent and/or mitigate the various environmental and social impacts, but also to prevent negative impacts on surrounding land uses.</li> <li>All disturbed areas shall be rehabilitated as soon as possible and maintained in accordance with the rehabilitation</li> </ul>	As required	As required	Senior Operational Manager
					As required	As required	Senior Operational Manager

Phase of operation	Activities (see Table 25)	Sig		Technical and management options	Action plan			
		UM	M		Timeframe	Frequency	Responsible parties	
	and amenities			<p>objectives in Section 7.2.4, Section 7.2.19 and Section 22.</p> <ul style="list-style-type: none"><li>Land on the farm Lehating 741 that is not used for the development of infrastructure will be made available for grazing of cattle in line with existing grazing rights provided that mining operations, safety and security measures that are in place at the mine will not be jeopardised.</li><li>Surrounding land users will be invited to participate in routine stakeholder engagement meetings for the purpose of information sharing and environmental problem solving.</li></ul>	As required	As required	Senior Operational Manager	
Operation	Main and Ventilation Shafts Process Plant Tailings Storage Facility Power supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities	H	M		As required	As required	Senior Operational Manager	
Decommissioning	Main and Ventilation Shafts Process Plant Tailings Storage Facility Power supply and use Water supply and use Transport systems Non-mineralised waste management General site management Other support services and amenities Demolition	H	M					
Closure	Final tailings and waste rock facilities Rehabilitation Maintenance and aftercare	H	L		<ul style="list-style-type: none"><li>Closure planning will incorporate measures to achieve the future land use plans for the land within the Lehating surface use area.</li></ul>	As required	As required	Senior Operational Manager

## **20 EMERGENCY RESPONSE PROCEDURES**

### **20.1 ON-GOING MONITORING AND MANAGEMENT MEASURES**

The on-going monitoring as described in Section 21 will be undertaken to provide early warning systems necessary to avoid environmental emergencies.

### **20.2 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 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 the table below (Table 66).

#### **20.2.1 GENERAL EMERGENCY PROCEDURE**

The general procedure that should be followed in the event of all emergency situations is as follows.

- Applicable incident controller defined in emergency plans must be notified of an incident upon discovery;
- Area to be cordoned off to prevent unauthorised access and tampering of evidence;
- Undertake actions defined in emergency plan to limit/contain the impact of the emergency
- If residue facilities/dams, stormwater 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;
- Take photographs and samples as necessary to assist in investigation;
- Report the incident immediately to the environmental department for emergencies involving environmental impacts or to the safety department in the case of injury;
- The Environment department must comply with Section 30 of the National Environmental Management Act (107 of 1998) such that:
  - The Environment department must immediately notify the Director-General (DWA and DEA, DMR and Inspectorate of Mines as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DENC, the head of the local municipality, the head of the regional DWA 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);
- o Within 14 days the Environment department must report to the Director-General DWA and DEA, the provincial head of DENC, the regional manager of the DMR, the head of the local and district municipality, the head of the regional DWA 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.

#### **20.2.2 IDENTIFICATION OF EMERGENCY SITUATIONS**

The site wide emergency situations that have been identified in Section 7 and together with specific emergency response procedures are outlined in Table 66.

### **20.3 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 mitigation measures as included in this EIA and EMP report.
- 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.
- Where required, the mine will seek input from appropriately qualified people.

**TABLE 66: EMERGENCY RESPONSE PROCEDURES**

Item	Emergency Situation	Response in addition to general procedures
1	Falling into hazardous excavations	Personnel discovering the fallen individual or animal must 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 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.
2	Risk of drowning from falling into water dams	Attempt rescue of individuals from land by throwing lifeline/lifesaving ring. Get assistance of 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.
3	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, Leaching will: <ul style="list-style-type: none"> <li>• Notify residents/users downstream of the pollution incident.</li> <li>• Identify and provide alternative resources should contamination impact adversely on the existing environment.</li> <li>• Cut off the source if the spill is originating from a pump, pipeline or valve (e.g. Tailings delivery pipeline, refuelling tanker) and the infrastructure 'made safe'.</li> <li>• Contain the spill (e.g. construct temporary earth bund around source such as road tanker).</li> <li>• Pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal.</li> <li>• Remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repared.</li> </ul>
4	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.
5	Pollution of surface water	Personnel discovering the incident must 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 should 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.
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 stormwater diversions during the storm event (e.g. emergency supply of sandbags). Close the roads affected by localised flooding or where a stormwater surge has destroyed crossings or bridges.
7	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/mitigation measures.



Item	Emergency Situation	Response in addition to general procedures
8	Discharge of dirty water to the environment	<p>Apply the principals listed for Item 1 above.</p> <p>To stop spillage from the dirty water system the mine will:</p> <ul style="list-style-type: none"> <li>• Redirect excess water to other dirty water facilities where possible;</li> <li>• Pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system; and</li> <li>• Carry out an emergency discharge of clean water and redirect the spillage to the emptied facility.</li> <li>• Apply for emergency discharge as a last resort.</li> </ul>
9	Overtopping or failure of the tailings storage facility	<p>Sound the alarm to evacuate danger area.</p> <p>Pump water from top of dam and follow redirection of water as indicated in Item 2 above.</p> <p>Stop pumping tailings to the tailings.</p> <p>Recover casualties resulting from dam failure using the emergency response team.</p> <p>Make the remaining structure safe.</p> <p>Apply the principles of Item 1 above.</p>
10	Veld fire	<p>Evacuate mine employees from areas at risk.</p> <p>Notify downwind residents and industries of the danger.</p> <p>Assist those in imminent danger/less able individuals to evacuate until danger has passed.</p> <p>Provide emergency fire fighting assistance with available trained mine personnel and equipment.</p>
11	Injury from fly rock	<p>The person discovering the incident will contact the mine emergency response personnel to recover the injured person or animal and provide medical assistance.</p> <p>Whilst awaiting arrival of the emergency response personnel, first aid should be administered to the injured person by a qualified first aider if it is safe to do so.</p>
12	Road traffic accidents (on site or including mine vehicles on public roads)	<p>The individual discovering the accident (be it bystander or able casualty) must 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.</p> <p>Access to the area should be restricted and access roads cleared for the emergency response team.</p> <p>Vehicles must be made safe first by trained professionals (e.g. crushed or overturned vehicles).</p> <p>Casualties will be moved to safety by trained professionals and provided with medical assistance.</p> <p>Medical centres in the vicinity with appropriate medical capabilities will be notified if multiple seriously injured casualties are expected.</p> <p>A nearby vet should be consulted in the case of animal injury</p>
13	Uncovering of graves and sites	<p>Personnel discovering the grave or site must inform the Environment department immediately.</p> <p>Prior to damaging or destroying any of the identified graves, permission for the exhumation and relocation of graves must 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.</p> <p>The exhumation process must comply with the requirements of the relevant Ordinance on Exhumations, and the Human Tissues Act, 65 of 1983.</p>
14	Uncovering of fossils	<p>Personnel discovering the fossil or potential site must inform the Environment department immediately.</p> <p>Should any fossils be uncovered during the development of the site, a palaeontologist or paleoanthropologist will be</p>

Item	Emergency Situation	Response in addition to general procedures
		consulted to identify the possibility for research.
15	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.

## 21 PLANNED MONITORING AND EMP PERFORMANCE ASSESSMENT

### 21.1 PLANNED MONITORING OF ENVIRONMENTAL ASPECTS

As a general approach, Lehating will ensure that the monitoring programmes comprise the following:

- a formal procedure;
- appropriately calibrated equipment;
- where sample require analysis they will be preserved according to laboratory specifications;
- an accredited, independent, commercial laboratory will undertake sample analyses;
- parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority;
- if necessary, following the initial monitoring results, certain parameters may be removed from the monitoring programme in consultation with a specialist and/or the relevant authority;
- if necessary monitoring points can be moved in consultation with specialists and/or the relevant authorities;
- monitoring data will be stored in a structured database;
- data will be interpreted and reports on trends in the data will be compiled by an appropriately qualified person; and
- both the data and the reports will be kept on record for the life of mine.

Environmental aspects requiring monitoring are listed below.

- Water resources (surface water and groundwater) – see Section 21.1.1 for details
- Air – see Section 21.1.2 for details
- Blasting – see Section 21.1.3 for details
- Mineralised waste facilities and water dams – see Section 21.1.4 for details
- Biodiversity – see Section 21.1.5 for details
- Noise– see Section 21.1.6 for details.

#### 21.1.1 WATER RESOURCES

##### Surface water monitoring

Given the non-perennial nature of water courses within the vicinity of the Lehating Manganese Mine, surface water quality monitoring would be undertaken on a monthly basis by Lehating when the streams are in flow. Table 67 below sets out the suggested parameters for water monitoring. The parameters may be modified based on input from an appropriate specialist and DWAF. The programme and suggested monitoring points will be confirmed as part of the integrated water license process.

**TABLE 67: PARAMETERS FOR GROUND- AND SURFACE WATER MONITORING**

Laboratory analysis	
Electrical conductivity	Potassium
Ph	Sodium

Total suspended solids	Chromium
Total dissolved solids	Sulphate
Chlorine	Iron
Fluoride	Lead
Calcium	Manganese
Magnesium	Total organic compounds
Ammonia	Aluminium
Phosphate	Nitrate
Alkalinity as CaCO <sub>3</sub>	Carbonate as CO <sub>3</sub>
Bicarbonate as HCO <sub>3</sub>	Boron as B
Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS) )	

### Groundwater monitoring

Groundwater quality and quantity should be monitored at Lehating Manganese Mine in accordance to the groundwater monitoring principles set out in the groundwater specialist report (Appendix G). The key objectives of the groundwater monitoring programme are to:

- develop improved practices and procedures for groundwater protection;
- detect short and long term trends;
- recognise changes in groundwater and enable analysis of their causes;
- measure impacts;
- check the accuracy of predicted impacts;
- develop improved monitoring systems; and
- provide information on the impact of the various facilities on groundwater.

Refer to Figure 26 for the location of the on-site boreholes. This network will be expanded to include off site boreholes of surrounding land users (in particular Boerdraai and van Schalkwyk). Refer to Table 67 for the details of the groundwater monitoring parameters. The monitoring of groundwater boreholes will be undertaken on a quarterly basis for quality and monthly basis for levels.

#### 21.1.2 AIR QUALITY

Air monitoring will be done for both dust fallout and PM<sub>10</sub> and a weather station will be erected near the shaft.

The weather station will be erected to build a database of site specific temperature, wind and rainfall data.

PM<sub>10</sub> sampling can be economically carried out by the use of a “mini-vol” apparatus. This consists of a battery-driven flow-controlled sampling pump drawing ambient air through a filter for 24 hours. The pre- and post-exposure weighting of the filters provides daily average concentration values. The changing of batteries and filters can be carried out by site personnel with a minimum of training, while deployment at regular intervals (every 3 days or so, including weekends) provides a time series free of systematic

sampling error, as well as a long-term average value. With the concern for potential off-site impacts from manganese concentrations, the PM10 filters can be analysed for manganese content.

Dust fallout measurements will be collected via a network of eight buckets that will be analysed monthly.

Refer to Figure 27 for the locations of the monitoring points. If there are changes to the surface infrastructure, it is proposed that Lehating consults directly with a relevant qualified air specialist to determine whether or not any additional monitoring points are required. If additional monitoring points are required the existing monitoring network will be updated accordingly.

### **21.1.3 BLASTING**

Monitoring of underground and surface blast (if required) will take place during the initial stages of mine development. Once underground blasting activities reach a level where it is unlikely that blasting impacts will be felt by third parties, the frequency of monitoring these underground blasts may be re-evaluated in consultation with a qualified specialist. If surface blasting is required, points for off-site vibration and airblast monitoring will be identified in consultation with a blast monitoring specialist. The monitoring results will be documented and maintained for record-keeping and auditing purposes.

### **21.1.4 MINERALISED WASTE FACILITIES AND WATER DAMS**

In addition to the abovementioned environmental monitoring programmes, all mineralised waste facilities and water dams will be monitored to ensure stability, safety and prevention of environmental impacts. The frequency of the monitoring and the qualification of the monitoring personnel will be determined on an infrastructure specific basis and in consultation with an appropriately qualified engineer.

### **21.1.5 BIODIVERSITY MONITORING PROGRAMME**

#### **Alien invasive species programme**

During operation, decommissioning and closure Lehating 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. Repeat surveys should be carried out annually for at least the first three years post-rehabilitation.

**Rehabilitation**

For each area requiring rehabilitation specific landscape functionality objectives will be set with expert input and the associated targets and monitoring program will follow accordingly.

**21.1.6 NOISE MONITORING PROGRAMME**

Lehating will commission a specialist to conduct pre-mining ambient noise monitoring at the Boerdraai and van Schalkwyk residences. Thereafter monitoring will only be done as required to investigate noise related complaints.

**21.2 AUDITING AND PERFORMANCE ASSESSMENTS**

The environmental department manager will conduct internal management audits against the commitments in the EMP. These audits will be conducted on an on-going basis until final closure. The audit findings will be documented for both record keeping purposes and for informing continual improvement. In addition, and in accordance with mining regulation R527, an independent professional will conduct an EMP performance assessment every 2 years. The site's compliance with the provisions of the EMP and the adequacy EMP report relative to the on-site activities will be assessed in the performance assessment.

**21.3 FREQUENCY FOR REPORTING**

As a minimum, the following documents will be submitted to the relevant authorities from the start of construction until mine closure:

- EMP performance assessment, submitted every two years to DMR;
- updated closure and rehabilitation cost estimate, submitted annually to the DMR in accordance to DMR requirements;
- water monitoring reports, submitted to DWA in accordance with water use license;
- TSF report by professional engineer submitted annually to DMR; and
- detailed plan for decommissioning/closure, submitted in accordance to DMR requirements 5 years before closure.

**FIGURE 26: GROUNDWATER MONITORING PROGRAMME**

**FIGURE 27: AIR QUALITY MONITORING PROGRAMME**



## 22 FINANCIAL PROVISION

The information in this section was sourced from the closure cost calculation study completed by SLR (SLR, July 2013) and is included in Appendix L.

### 22.1 PLAN SHOWING LOCATION AND AERIAL EXTENT OF PROPOSED OPERATION

The plan showing the location and aerial extent of the proposed Lehating operation showing the proposed surface infrastructure is illustrated in Figure 18.

### 22.2 ANNUAL FORECASTED FINANCIAL PROVISION

The current scheduled liability for the Lehating operation is **R 5 577 343.50** (including VAT). The annual forecasted financial provision for the first 10 years is provided in Table 68 below.

**TABLE 68: FINANCIAL PROVISION (SLR, JULY 2013)**

Year	Financial Liability incurred during the year (incl. VAT)	Progressive Financial Liability (incl. VAT)	Progressive Liability as a % of LOM Liability
<b>1</b>	R 5 577 343.50	R 5 577 343.50	54.18%
<b>2</b>	R 2 650 740.85	R 8 228 084.35	79.93%
<b>3</b>	R 712 060.18	R 8 940 144.53	86.85%
<b>4</b>	R 0.00	R 8 940 144.53	86.85%
<b>5</b>	R 813 589.69	R 9 753 734.22	94.76%
<b>6</b>	R 23 008.89	R 9 776 743.11	94.98%
<b>7</b>	R 37 677.19	R 9 814 420.30	95.35%
<b>8</b>	R 23 008.89	R 9 837 429.18	95.57%
<b>9</b>	R 23 008.89	R 9 860 438.07	95.79%
<b>10</b>	R 37 677.19	R 9 898 115.26	96.16%
<b>11 - LoM</b>	R 395 465.93	R 10 293 581.19	100.00%

### 22.3 CONFIRMATION OF AMOUNT TO BE PROVIDED

This will be confirmed in consultation with the DMR.

### 22.4 METHOD OF PROVIDING FINANCIAL PROVISION

The financial provision will be provided by means of a bank guarantee or other agreed instrument.

## 23 ENVIRONMENTAL AWARENESS PLAN

This section includes an environmental awareness plan for the mine. The plan describes how employees will be informed of environmental risks which may result from their work, the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment and 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 Lehating are bound by the content of the EMP and a contractual condition to this effect will be included in all such contracts entered into by the mine. If contractors are used, the responsibility for ensuring compliance with the EMP will remain with Lehating.

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 Lehating to achieve the objectives of the environmental policy.

### 23.1 ENVIRONMENTAL POLICY

At present Lehating are in the process of developing an environmental policy. Lehating will display the environmental policy prominently at the mine entrance and key notice boards at the mine's business units. Key principles associated with Lehating's environmental policy are described below:

1. To minimise the impact of Lehating's mining operations on the environment wherever possible by carrying out activities in an environmentally responsible manner;
2. Develop and maintain a positive environmental culture by demonstrating to employees good environmental management is everyone's responsibility, for example:
  - Holding all employees accountable for environmental performance by including it as a factor in job performance assessments;
  - Encourage communication of new ideas/suggestions by offering awards for positive contributions.
3. To comply with all applicable environmental legislation and the commitments contained in Lehating's approved EIA/EMP report and amendments as a minimum requirement;
4. To ensure that all Lehating's employees, contractors and sub-contractors:
  - Are aware of the impact of their activities on the environment;
  - Are informed about the measures required to prevent, mitigate and manage environmental impacts; and
  - Apply these principles whilst carrying out their work.

5. Investigate and report all environmental incidents and near misses to reduce the potential for recurrence.
6. To establish and maintain a good relationship with surrounding communities, industries and other interested and affected parties, with regard to Lehating's activities;
7. To develop a localised environmental strategy to preserve and promote awareness of the natural environment encountered in the area; and
8. To provide relevant and constructive consultation/public participation on the management of the potential environmental impacts posed by the mine in the future.

## 23.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

Lehating's environmental policy will be 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:
  - Lehating will establish and appoint Managers at senior mine management level, 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 EMP commitments;
    - Implementing and maintaining an environmental management system with the assistance of the appointed EMS Area Coordinator and the Area Waste Coordinator;
    - 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, and specifically Lehating will:
    - Set the discussion of environmental issues and feedback on environmental projects as an agenda item at all company board meetings;
    - Provide progress reports on the achievement of policy objectives and level of compliance with the approved EMP to the Department of Minerals Resources;
    - Ensure environmental issues are raised at monthly mine management executive committee meetings and all relevant mine wide meetings at all levels; and
    - Ensure environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties.
- Environmental awareness training:
  - Lehating 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 induction programme. All non-Lehating personnel who will be on site for more than three days must undergo the SHE induction training.
  - 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 EMP which currently includes the following purpose
    - Topography (hazardous excavations);
    - Soil and land capability management (loss of soil resource);
    - Management of biodiversity;
    - Surface water management (alteration of surface drainage and pollution of surface water);
    - 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, blast management, land use loss);
    - Heritage resources (management of sites);
    - Socio-economic impacts (management of positive and negative impacts);
  - All mine projects will be designed to minimise impact on the environment and to accomplish closure/rehabilitation objectives.
  - Lehating will maintain records of all environmental training, monitoring, incidents, corrective actions and reports.

### 23.3 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 should communicate:

- 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
- Individuals roles and responsibilities in achieving the aims and objectives of the environmental policy
- The potential consequences of not complying with environmental procedures.

### 23.3.1 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.
  - 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 and industries 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;
  - Lehating'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 and industries, 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 (soil, 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).
  - Lehating's duty of care (specifically with respect to waste management); and
  - Purpose and function of Lehating'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.

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 Lehating 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.
- Participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Labour Week, World Environment Day and National Water Week.

## **24 TECHNICAL SUPPORTING INFORMATION**

The following specialist studies are attached as appendices to this report:

- biodiversity study (Appendix E);
- surface water quality study and management plan (Appendix F);
- groundwater study (Appendix G);
- heritage, cultural and palaeontological study (Appendix H);
- air quality impact study (Appendix I);
- soils and land capability study (Appendix J);
- traffic impact study (Appendix K);
- economic study (Appendix L);
- conceptual engineering design (Appendix M); and
- financial provision (Appendix N).

## **25 CAPACITY TO MANAGE AND REHABILITATE THE ENVIRONMENT**

### **25.1 AMOUNT REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT**

The mine proposes to manage the environmental and social impacts throughout the value chain and preventative and mitigating measures will be in place to achieve this. The capital budget provided by the mine to manage all identified environmental aspects for five year period from the 2015 financial year is R1.35 billion. The direct operational budget for the first year of production is R114 million.

### **25.2 AMOUNT PROVIDED FOR**

The amount required as per the above budget has been provided for in the current Leasing budgeting period.



**26 UNDERTAKING SIGNED BY APPLICANT****COMMITMENT/UNDERTAKING BY APPLICANT**

I,.....

the undersigned and duly authorised thereto by

.....

undertake to adhere to the requirements and to the conditions set out in the approved EMP with the exception of the exemption(s) and amendment(s) agreed to be relevant by the Regional Manager: \_\_\_\_\_ (include relevant province).

Signed at: .....

On: .....

Signature: .....

Designation: .....

**REGIONAL MANAGER:** \_\_\_\_\_ **REGION**

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) this document of ..... is approved subject to the conditions as set out in the letter of approval.

Signed at: .....

On: .....

Signature: .....

Designation: .....

**REGIONAL MANAGER:** \_\_\_\_\_

## 27 ENVIRONMENTAL IMPACT STATEMENT & CONCLUSION

This document presents the project plan as defined by Lehating, presents findings of specialist studies, identifies and assesses potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts, and identifies measures together with monitoring programmes to monitor and mitigate potential impacts.

A summary of the potential impact ratings (as per Section 7 of the EIA/EMP report) in the unmitigated and mitigated scenarios for all project phases is included in Table 69 below.

**TABLE 69: SUMMARY OF POTENTIAL CUMULATIVE IMPACTS ASSOCIATED WITH LEHATING MINE**

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
<b>Geology</b>	Loss and sterilization of mineral resources	M	L
<b>Topography</b>	Hazardous excavations and infrastructure	H	M
<b>Soils and land capability</b>	Loss of soil resources and land capability through pollution	H	M-L
	Loss of soil resources and land capability through physical disturbance	H	L (M for tailings and waste rock)
<b>Biodiversity</b>	General disturbance of biodiversity	H	M
	Physical destruction of biodiversity	H	M-H
<b>Surface water</b>	Alteration of natural drainage patterns	H	M (L for closure phase)
	Contamination of surface water	H	L
<b>Groundwater</b>	Reduction of groundwater levels and availability	M-L (borehole users)	L (borehole users)
		L for Kuruman River	L for Kuruman River
	Contamination of groundwater	H-M	L
<b>Air quality</b>	Air pollution	M (construction and decommissioning phase) H (operational phase) M-L (closure phase)	M-L (construction and decommissioning phase) M (operational phase) L (closure phase)
<b>Noise</b>	Noise pollution	M	M- L
<b>Blasting</b>	Blasting impacts	H	L
<b>Traffic</b>	Road disturbance and traffic safety	H	M
<b>Visual</b>	Visual impacts	H	M (L for closure phase)
<b>Heritage, palaeontological and cultural resources</b>	Loss of or damage to heritage, cultural, archaeological and palaeontological resources	M	L

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
<b>Socio-economic</b>	Economic impact	<b>H+</b>	<b>H+</b>
	Inward migration	<b>H</b>	<b>L</b>
<b>Land use</b>	Land use impacts	<b>H</b>	<b>M (L for closure phase)</b>

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

The economic impact assessment concluded that the development of the project will have significant positive economic impacts.

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

**Victoria Tucker**  
Project Manager

**Brandon Stobart**  
Project Reviewer

*SLR Consulting (Africa) (Pty) Ltd*

## 28 REFERENCES

- Airshed Planning Professionals, July 2013: *Air Quality Impact Assessment for Lehating Mine in Northern Cape, South Africa*
- ARC Institute for Soil, Climate and Water, May 2013: *Soil Information for Proposed Mining Operation for Lehating Mine, Near Hotazel*
- ARC Institute for Soil, Climate and Water, 2004: *Overview of the status of the agricultural natural resources of South Africa (First Edition)*.
- Barnes, 2000: *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. Bird Life South Africa, Johannesburg.
- Branch, 1988: *South African Red Data Book – Reptiles and Amphibians*. NMB Printers, Port Elizabeth.
- Dreyer, J.G. and Paterson, D.G., 2006. *Soil Survey for proposed mining operation at Botha 313, Smartt 314 and Rissik 330, Near Hotazel*. Report No. GW/A/2006/86, ARC-Institute for Soil, Climate and Water, Pretoria
- Ecological Management Service, July 2013: *Ecological survey for the proposed manganese mine on the property Lehating 741, near Black Rock, Northern Cape*
- Endangered Wildlife Trust, 2004: *Red Data Book of the Mammals of South Africa: A conservation Assessment*. Johannesburg.
- Metago Environmental Engineers, September 2010: *Environmental Impact Assessment and Management Programme Report for a manganese mine*. Kudumane Manganese Resources (Pty) Ltd
- Metago Environmental Engineers, April 2011: *Groundwater Report for Lehating 741*.
- Minter L.R., Burger M., Harrison J.A., Braak H.H., Bishop P.J., and Kloepfer D., 2004: *Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland*. SI/MBA Series #9. Smithsonian Institute, Washington DC.

Mucina & Rutherford, 2006: *The Vegetation Map of South Africa, Lesotho and Swaziland*. SANBI, Pretoria.

Parsons and Conrad, 1998: *Explanatory notes for the aquifer classification map of South Africa*; WRC Report No. 116/98, Water Research Commission, Pretoria.

Partridge, T.C., Botha, G.A. and Haddon, I.G. (2006): *Cenozoic deposits of the interior*. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J. (Eds.). *The Geology of South Africa*. Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria, 585 – 604.

Professional Grave Solutions (Pty) Ltd (PGS), July 2013: *Heritage Impact Assessment for Lehating Mining (Pty) Ltd for the proposed underground manganese mine on portions of the farm Lehating 714, approximately 20km northwest of Hotazel, Northern Cape Province*

Schoeman, J.L., van der Walt, M., Monnik, K.A., Thackrah, A., Malherbe, J. & le Roux, R.E., 2000: *Development and application of a land capability classification system for South Africa*. Report No. GW/A/2000/57, ARC Institute for Soil, Climate and Water, Pretoria.

Metago Environmental Engineers (Pty) Ltd, May 2009: *Environmental Impact Assessment and Environmental Management Programme For the Proposed Ntsimbintle Manganese Mining Project*

Metago Environmental Engineers (Pty) Ltd, September 2010: *Environmental Impact Assessment and Management Programme Report for a Manganese Mine: Kudumane Manganese Resources (Pty) Ltd*

Siyazi Gauteng (Pty) Ltd, July 2013: *Traffic Impact Assessment for the Proposed Manganese Mining Operation on Portion 1 of the Farm Lehating 741 near Hotazel, Northern Cape Province*

SLR Consulting (Africa) (Pty) Ltd, October 2011: *Lehating Mine Flooding Assessment*

SLR Consulting (Africa) (Pty) Ltd, February 2012: *Lehating Manganese Mine Acid Rock Drainage and Geochemical Report*

SLR Consulting (Africa) (Pty) Ltd, March 2012: *Lehating Mine Surface Water Management Plan*

SLR Consulting (Africa) (Pty) Ltd, April 2012: *Lehating Hydrology Report for Lehating Bankable Feasibility Study*

SLR Consulting (Africa) (Pty) Ltd, June 2013: *Surface Water Management Plan for Lehating Mining Pty Ltd*

SLR Consulting (Africa) (Pty) Ltd, August 2013: *Groundwater Assessment for Lehating Mining Pty Ltd*

Statistics South Africa, 2012: *Census 2011 Municipal report – Northern Cape*

Strategy4Good, July 2013: *Lehating Mining Economic Impact Analysis, Alternative Land Use Analysis and Integrated Development Analysis*

TWP, May 2012: *Lehating Manganese Mine Bankable Feasibility Study*

## **APPENDIX A: INFORMATION SHARING WITH AUTHORITIES**

- NEMA application submitted to DENC (21 August 2012)
- DENC application acknowledgment (3 October 2012)
- Regulatory Authorities notification letter (6 November 2012)
- Invitation to Scoping Meeting (11 November 2012)
- Letter to Regional Land Claims Commissioner (12 November 2012)
- Response from the Regional Land Claims Commissioner (14 November 2012)
- Minutes of authorities meeting held on 27 November 2012
- Signed authorities meeting attendance registers
- Proof of submission of scoping report to regulatory authorities
- Scoping report comments received by regulatory authorities
- NEMWA application submitted to DEA (26 July 2013)
- Updated response from Regional Land Claims Commissioner (14 August 2013)
- DEA application acknowledgment (21 August 2013)

**APPENDIX B: IAP DATABASE**



**APPENDIX C: INFORMATION SHARING WITH IAPS**

- Proof of landowner notification
- Site notice in English and Afrikaans
- Photographs showing the placement of site notices
- Advertisements (Kalahari Bulletin and Kathu Gazette)
- Background Information Document (English)
- Social Scan Questionnaires (9 and 10 October)
- Minutes of public meeting held on 27 November 2012
- Scoping report summary (English and Afrikaans)
- Comments received from IAPs

**APPENDIX D: ISSUES TABLE**

## **APPENDIX E: BIODIVERSITY STUDY**

## **APPENDIX F: SURFACE WATER QUALITY STUDY**

- Lehating Surface Water Management Plan (June 2013)
- Lehating Flooding Study (October 2011)

## **APPENDIX G: GROUNDWATER STUDY**

- Lehating Groundwater Impact Study (August 2013)
- Lehating ARD Geochemical Report (February 2012)

## **APPENDIX H: HERITAGE, CULTURAL AND PALAEOLOGICAL STUDY**

## **APPENDIX I: AIR QUALITY STUDY**

## **APPENDIX J: SOIL AND LAND CAPABILITY STUDY**



## **APPENDIX K: TRAFFIC IMPACT STUDY**

**APPENDIX L: ECONOMIC STUDY**

## **APPENDIX M: CONCEPTUAL ENGINEERING DESIGN**

**APPENDIX N: FINANCIAL PROVISION**



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