Naledzi Group (Pty) Ltd

DRAFT ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME

Geluk Mine Project

Development of an Iron and Vanadium Ore surface mine on farms Geluk 512KS, Geluk Oos 513KS & Ironstone 847KS at Magnet Heights, Magisterial District of Sekhukhune, Limpopo Province

DMR Reference no *LP 30/5/1/2/3/2/1/10107EM*

July 2016

Prepared for: Rakhoma Mining Resources Pty Ltd

DRAFT ENVIRONMENTAL IMPACT REPORT (EIR) AND ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

Compiled in terms of Appendix 3 and 4 of the Environmental Impact Assessment (EIA) Regulations of 2014 (GNR. 982) and submitted as contemplated in Regulations 23 of the EIA Regulations of 2014 for:

An Application for Environmental Authorisation and Waste Management License in terms of the National Environmental Management Act 107 of 1998 and the National Environmental Management: Waste Act 59 of 2008, EIA Regulations of 2014 and its associated Listed Notices GNR 983, R984, R985 and GNR 901 List of Waste Management Activities which have been triggered in terms of the Mineral Petroleum Resources Development Act 2002

DECISION MAKING AUTHORITY:
Limpopo Department of Mineral Resources
Sub-Directorate: Mine Environmental Management
DME Building, 101 Dorp Street, Polokwane, 0699

PREPARED BY: (ENVIRONMENTAL ASSESSMENT PRACTITIONER)
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ONBEHALF OF THE APPLICANT:

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DOCUMENT CONTENT

DISCLAIMER

Naledzi Group Pty Ltd has prepared this Draft Environmental Impact Report (EIR) for the sole use of Rakhoma Mining Resources Pty Ltd and the appointed mine contractors/subcontractors to this project, in accordance with generally accepted consulting practices and for the intended purposes, as stated in the agreement under which this work was prepared. The report is also intended for review by the relevant competent authorities. Interested & Affected Parties (I&APs) are also privy to the review of the report to provide input to the Environmental Impact Assessment (EIA) process. This report may not be relied upon by any other party without the explicit written agreement of Rakhoma and Naledzi. No other warranty, expressed or implied, is made as to the professional advice included in this report.

NALEDZI PROJECT INFORMATION CLAUSE

Report Title: Draft EIR&EMPR - Geluk Mine Project: Proposed development of an iron-and vanadium ore mine with associated infrastructure
Location: Farm Geluk 512, Geluk Oos 513KS and Ironstone 847KS at Magnet Heights, south west of Steelpoort, Sekhukhune District, Limpopo Province
Type of operation proposed: Surface Mine
Application Type: Environmental Authorisation and Waste Management License
Decision Making Authority: Limpopo Department of Mineral Resources (DMR)
Date of Report: June 2016

Details of Persons who developed this EIR & EMPr:

This report has been compiled by Naledzi Group (Pty) Ltd on behalf of Rakhoma Mining Resources Pty Ltd. Naledzi Group Pty Ltd is a Polokwane based company providing services in the environmental management industry. It comprises two subsidiaries namely Naledzi Environmental Consultants (NEC) and Naledzi Waterworks (NWW) www.naledzigroup.com

Naledzi offers a wide range of services in the field of Environmental Management and was founded in 2003 on the basis of providing quality and professional Environmental Consulting Services. We have conducted Basic Assessment processes and Environmental Impact Assessment processes for multiple projects in both the public and private sector. Our projects are located throughout the provinces of South Africa from Gauteng, Mpumalanga, North West, Northern Cape, Eastern Cape and Limpopo.

The responsible consultants for the Geluk Mine EIA project comprise senior environmental impact practitioners Mrs. Marissa Botha and Mr. Desmond Musetsho. The consultants' details are:

Mrs. Marissa Botha and Mr. Desmond Musetsho
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Postal address: Suite 320, Postnet Library Gardens, Private Bag X 9307, Polokwane, 0700
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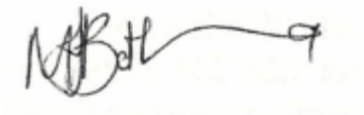
Email: botham@naledzi.co.za / dmusetsho@naledzi.co.za

Report Author 1: Marissa Botha



Marissa Ilse Botha
Senior EAP
Project Consultant

Report Author 2: Desmond Musetsho

Khangwelo Desmond Musetsho
(CEAPSA, SAIEES)
Senior Environmental Scientist and Managing Director

Expertise of Environmental Assessment Practitioners:

Name: Mr Kwangelo Desmond Musetsho
Responsibility: Project Reviewer, Overall Project Management, Quality Control
Degree: MBL (GSBL, UNISA); MEnVM (UNIVEN)
Professional Registration: Environmental Assessment Practitioners of South Africa
Southern African Institute for Ecologists and Environmental Scientists (SAIEES Registration number 277)
Experience in years: 13 years
Experience: He has been involved in environmental consulting since 2003 and is currently the Managing Director of Naledzi Group Pty Ltd. He has expertise in the field of Integrated Environmental Management, both on a project and management level. He has experience in a wide range of environmental disciplines, including Environmental Impact Assessments (EIA), Environmental Management Plans/Programmes, Environmental Planning & Review, Environmental Auditing & Monitoring, Environmental Control Officer services, and Public Consultation & Facilitation. He has managed numerous prospecting and mining related EIA's in South Africa. He further has extensive experience in projects related to power lines, roads, landfill sites, sports and recreational developments, property developments, water pipelines, sewage treatment plants and cemeteries.

Name: Mrs Marissa Botha
Responsibility: Project Management, public participation, report writing and specialist study review
Degree: 12 years working experience
Experience in years: 12 years
Experience: Marissa Botha has been involved in environmental consulting since 2004. She is a Senior Environmentalist and Public Participation Consultant. She has over 12 years' experience in environmental management in multiple projects and is responsible for the management of environmental projects, such as Environmental Impact Assessments processes (EIA), Environmental Management Plans / Programmes, and Public Consultation and Facilitation. She has conducted related work in South Africa. She has expertise in a wide range of projects relating to mining (borrow pits, prospecting), housing and industrial developments, filling stations, waste management facilities (transfer station, landfill site), cemeteries, infrastructure projects (power lines, water pipelines).

Please refer to attached Appendix 1 - CV's for experience and qualifications as well as a Declaration of Independence.

DECLARATION OF INDEPENDENCE

Naledzi Group is an independent environmental consultancy with no vested interested (either business, financial, personal or other) in the proposed development proceeding other than remuneration for work performed in terms of NEMA and its EIA Regulations of 2014.

Rakhoma is responsible in the concluding stages of the planning phase of the project (post issuance of applied for permits/licenses) to ensure that all relevant landowners, surface right owners have been consulted and land lease agreement are entered into with such parties of the application farms, including other relevant agreements with affected parties residing on the farms.

PURPOSE OF DRAFT ENVIRONMENTAL IMPACT REPORT

Rakhoma Mining Resources (Pty) Ltd (Rakhoma) proposes to establish an iron-and vanadium ore surface mine operation to be referred to as "Geluk Mine".

The project area is known as Magnet Heights situated in the Eastern Limb of the Bushveld Igneous Complex. It covers the farms Geluk 512KS, Geluk Oos 513KS and Ironstone 847KS some 20km south west of Steelpoort in the municipal jurisdiction of Makhuduthamaga and Greater Tubatse in the Sekhukhune District of the Limpopo Province.

The ore body to be mined is close to surface, and comprises four magnetite seams with a mineral deposit containing Vanadium-bearing titaniferous magnetite. The economic interest lies in the vanadium bearing magnetic concentrate. The maximum mining depth will be 20m. The mine will produce a raw ore product which will be shipped off site to Vanchem Vanadium Producers in Witbank for processing.

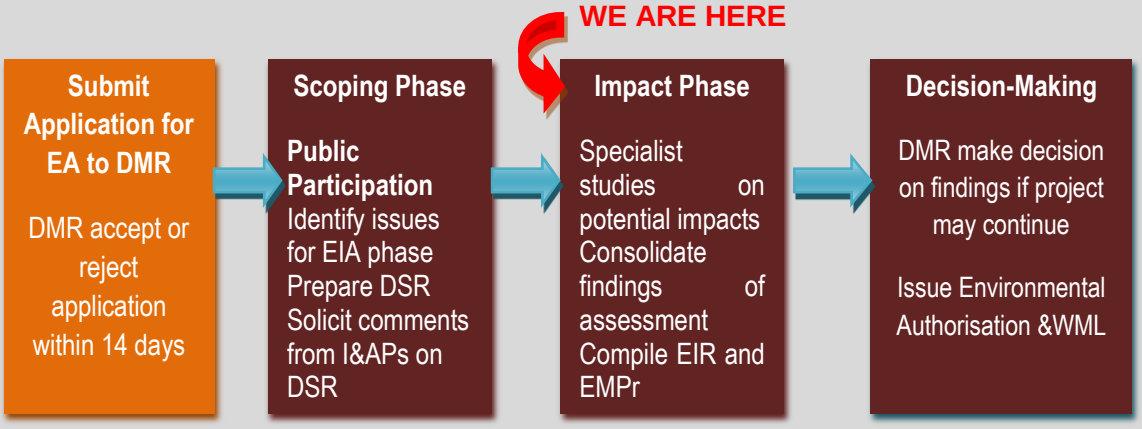
Rakhoma is majority owned by Vanchem Vanadium Products (Pty) Ltd which is a South African based vanadium producer with vanadium processing plants in Emalahleni (Witbank), Mpumalanga Province. The company has been forced to stop production due to a lack of ore supply from its long term supplier Mapochs Mine. Vanchem now aims to secure its own ore supply through Rakhoma's proposed Geluk mine operation. Rakhoma has applied to DMR for a Mining Right in terms of Section 22 of the Mineral Petroleum and Resources Development Act, 2002 (Act 28/2002) (MPRDA) to mine Vanadium-bearing titaniferous magnetite.

The mine operation requires environmental authorisation in terms of the National Environmental Management Act, 1998 (Act 107/1998) (NEMA) from the DMR as well as a waste management license (WML) under the provisions of the National Environmental Management: Waste Act (Act 59/2008). To obtain the environmental authorisations an integrated Environmental Impact Assessment (EIA) process must be undertaken as per the NEMA EIA Regulations of 2014.

Naledzi Group Pty Ltd has been appointed by Rakhoma as the independent environmental assessment practitioner to undertake the integrated EIA process. The findings of the EIA Process have now been consolidated in this Environmental Impact Report (EIR). The report contains an independent assessment with specialist studies of the proposed project's impacts on the environment and recommends ways to reduce the impact of the project by imposing mitigation/management measures.

The EIR is the most important document of the EIA process. It forms the basis for decision making and is a tool for communicating with interested and affected parties (I&AP's). The EIR will help the Department of Mineral Resources (DMR) to understand the environmental consequences of approving the project, the public in understanding the likely impacts of the proposal and the proponent in managing these impacts.

The EIA Process is conducting in phases



OPPORTUNITY TO COMMENT ON THE DRAFT EIR & EMPR

I&APs are hereby requested to comment on this Draft EIR. Comments and responses received on the EIR will be consolidated into an Issues and Response Report to from part of a final EIR. The Final EIR to be compiled will give due consideration to the comments received. Consequently the Final EIR will be submitted to DMR for approval.

PUBLIC REVIEW PERIOD:

This draft EIR and EMPr is available for public review for 30 calendar days, from **12 August 2016 to 12 September 2016**. Copies of the Report are available at the following public venues:

Table1: Public Venues for Draft EIR&EMPr review

PUBLIC VENUE	CONTACT PERSON	TELEPHONE
MOGASHOA-DITLHAKANENG TRIBAL OFFICE Stand 788, Ga Mogashoa-Dithlakaneng Village Magnet Heights	Ms. Evah Mamaile Tribal Office Administrator	Cell: 072 085 8482
BAHLAKWANA BA MAPHOPHA TRIBAL OFFICE Stand 6745, Moshate Section, Ga Maphopha, Ngwaabe	Ms Ramontja Tribal Office Administrator	Cell: 082 540 9929
BAHLAKWANA BA MALEKANE TRIBAL OFFICE Stand 1, Moshate Section, Ga Malekane, Ngwaabe (close to Steelbridge)	Ms. Meisie Sello Tribal Office Administrator	Cell: 082 355 0830
KONI-MALOMA TRIBAL OFFICE Ga-Maloma Village, Koni-Maloma Tribal Authority Street, Schoonoord	Mr. Vincent Maloma Tribal Office Administrator	Tel: 013 260 1006
NALEDZI GROUP PTY LTD OFFICE No 145 Thabo Mbeki Street, Fauna Park, Polokwane	Desmond Musetsho / Thendo Matsenene	Tel: 015 296 3988 Cell: 083 410 1477

Interested and Affected parties wishing to comment on the Report may do so by:

- Comment by email, facsimile or telephone;
- Any written submission

DIRECT YOUR COMMENTS TO:

COMMENTS AND ENQUIRIES
Please address any written comments/enquiries to:
Mrs. Marissa Botha or Mr. Desmond Musetsho
Naledzi Group Pty Ltd
145 Thabo Mbeki Street, Fauna Park, Polokwane
Tel: 015 296 3988
Fax: 015 296 4021
Cell: 084 226 5584 or either scan and email your comments to
botham@naledzi.co.za / dmusetsho@naledzi.co.za

All comments can be sent to the offices of Naledzi Group no later than 12 SEPTEMBER 2016.

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PLANS / MAPS

PLAN A: GELUK MINE DRAFT LAYOUT PLAN
PLAN B: RAIL SIDING INFRASTRUCTURE PLAN
PLAN C: OVERALL SENSITIVITY PLAN

VOLUME 1 - APPENDICES:

ABREVIATIONS

DMR	Department of Mineral Resources
MPRDA	Mineral and Petroleum Resources Development Act, 28 of 2002
Naledzi	Naledzi Group Pty Ltd
SAJV	South African Japan Vanadium Pty Ltd
EAP	Environmental Assessment Practitioner
NEMA	National environmental Management Act, 1998 (Act 107 of 1998)
EIA Regulations	Environmental Impact Assessment Regulations
GNR	Government Notice Regulation
WML	Waste Management License
NEM:WA	National Environmental Management: Waste Act 59 of 2008
NEM:WAA	National Environmental Management: Waste Amendment Act 26 of 2014
NWA	National Water Act 36 of 1998
NEM:AQ	National Environmental Management: Air Quality Act 39 of 2004
NHRA	National Heritage Resources Act, 25 of 1999
WUL / WULA	Water Use License / Water Use License Application
IWWMP	Integrated Water and Waste Management Plan
DWS	Department of Water and Sanitation
DEAT	Department of Environmental Affairs and Tourism
SANBI	South African National Botanical Institute
IEM	Integrated Environmental Management
EIA	Environmental Impact Assessment
DSR	Draft Scoping Report
SR	Scoping Report
FSR	Final Scoping Report
EMPr	Environmental Management Programme
I&APs	Interested and Affected Parties
IRR	Issues and Response Report
EA	Environmental Authorisation
Km	kilometres
M	metres
Mm	millimetres
km^2	Square kilometre
Kg	kilograms
Ha	Hectare / hectares
Kt	Kilo ton (kilo means 1000 tons eg. 20 kt = 20 000 tons)
Ktpa	Kilo ton per annum
°C	Degree Celsius
m/s	Metres per second
m^3/a	Cubic metres per annum
m^3	Cubic metres
l/s	Litres per second
PM10	Particulate Matter up to 10 micrometres in size (dustfall out)
PM2.5	Fine Particulate Matter is less than 2.5 micrometres in diameter
D	Dust fall rate
$Mg/m^2/day$	Milligrams / square metre / day
dBA	Decibels A (measurement for sound)
MAP	Mean Annual Precipitation

LPI	Land Property Information
Absl	Above sea level
LUPO	Land Use Planning Ordinance Ord. 15 of 1985
BIC	Bushveld Igneous Complex
MCP	Mine Closure Plan
ROM	Run of Mine
MML	Main Magnetite Layer
QDR	Quaternary Drainage Region
DWAF	Department of Water Affairs and Forestry (former Department of Water and Sanitation)
IDP	Integrated Development Plan
US EPA	United States Environmental Protection Agency
ASTM	American Standard Testing Methodology
MLM	Makhuduthamaga Local Municipality
GTM	Greater Tubatse Local Municipality
SDF	Spatial Development Framework
SDM	Sekhukhune District Municipality
DRDLR	Department of Rural Development and Land Reform
IUCN	International Union for Conservation of Nature
BID	Background Information Document
SAHRA	South African Heritage Resources Agency
LIHRA	Limpopo Heritage Resources Agency
GPS	Global Positioning System

1. INTRODUCTION

Before any mining/mining related activity can take place, a mining company requires a Mining License and an Environmental Authorisation from the Department of Mineral Resources (DMR). In order to get the license and authorisation, the company is required to assess the environment and learn about the community affected by the proposal and consult everyone who would be affected by the proposed mining through an Environmental Impact Assessment (EIA) Process. Results of the assessment need to be submitted to DMR for decision making to substantiate the issuance of a Mining License.

A mining company, Rakhoma Mining Resources Pty Ltd (hereafter Rakhoma), has submitted an application for a Mining License to the DMR: Limpopo Region seeking the right to mine iron-and vanadium ore through a surface mine operation to be known as "Geluk Mine". The application area is located some 10km south east of Jane Furse town in the Sekhukhune District of Limpopo Province. **See Figure 1 for a Regional Locality Map.**

Naledzi Group (Pty) Ltd has been appointed by Rakhoma, as the independent Environmental Assessment Practitioner (EAP) to compile an application for Environmental Authorisation for the project. The application was lodged with the DMR in terms of Section 24 D (1) of the National Environmental Management Act 107 of 1998 (NEMA) on 16 July 2015. The application is subject to an integrated Scoping and EIA process.

Regulation 21 – 24 of Government Notice R.982 (EIA Regulations 2014) published under NEMA sets out the procedure for the Scoping and EIA Process. It is subject to the following:

- A Public Participation Process in terms of Regulations 40 – 44;
- Scoping Report ito Appendix 2;
- Environmental Impact Report ito Appendix 3;
- Environmental Management Programme ito Appendix 4
- Closure Plan with Financial Provision for rehabilitation ito Appendix 5

The EIA Process status quo is as follows: On 31 July 2015, a notice was issued relating to the commencement of the Geluk Mine EIA Process followed by a series of public interactions, namely:

- Distribution of Background Information Documents (BID),
- Newspaper advertisements and site notices displayed in the project area;
- The Scoping Report was made available for public review from 14 August to 11 September 2015 and was subsequently submitted to DMR for approval;
- **DMR approved the Scoping Report on 6 October 2015 which permitted the Impact Phase to start**; (Refer to Appendix 2 – Scoping Approval)
- A Key Stakeholders Workshop was hosted on 4 December 2015 to discuss the project with organs of state, key stakeholders;
- In March 2016 the Geluk area Traditional Leadership was consulted which was followed by on site specialist investigations in April 2016;

The findings of the EIA Process have now been consolidated in this Environmental Impact Report (EIR). The report describes the process followed to date and provides a description of the proposed project, and the pre-mining environment. It also presents the findings of the specialist studies and provides an assessment of the potential impacts of the project.

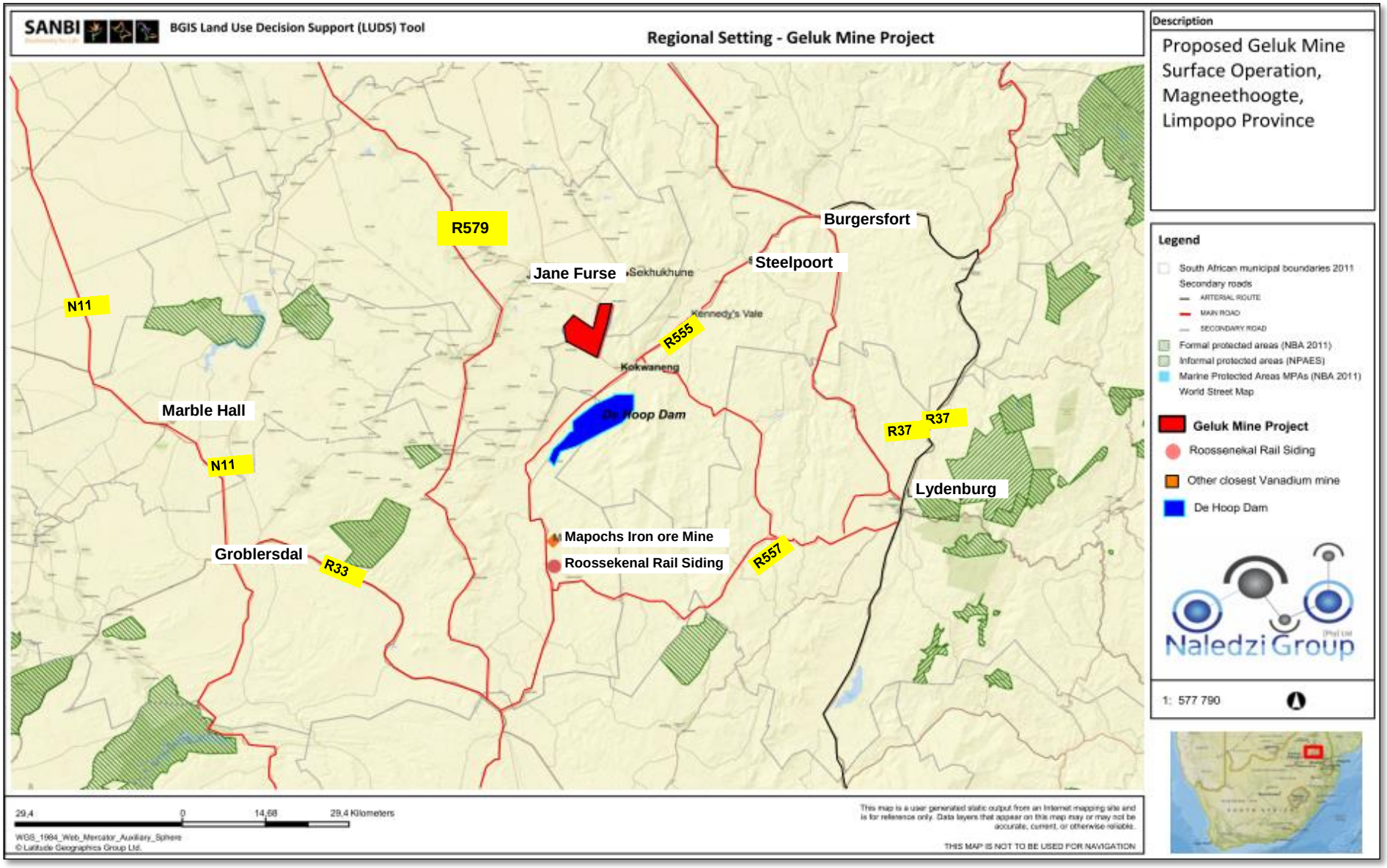

Figure 1: Regional Locality Map of Geluk Mine Project site

1.1. Purpose of EIR and EMPR

This Draft EIR is being distributed for public review and comment as part of the EIA Process as per the NEMA EIA Regulations of 2014. Regulation 40 of NEMA states that the public participation process must give all potential or registered Interested and Affected parties, including organs of state, a period of 30 days, to comment, in writing on all reports, plans prepared as part of the EIA process. The EIR does not define whether the project should be approved or not. It provides a neutral, independent assessment of the proposed project's impacts on the environment to help the DMR make a decision on the application.

1.2 Environmental Assessment Practitioner who prepared the EIR & EMPr

EAP's: Mrs Marissa Botha and Mr Desmond Musetsho
Company: Naledzi Group (Pty) Ltd
Registration number: 2015/134095/07
Postal address:
Suite 320, Postnet Library Gardens,Private Bag X 9307, Polokwane, 0700
145 Thabo Mbeki Street, Fauna Park, Polokwane, 0699
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Table 2: EIA Projec Team

Project EAP's	Responsibility	Contact numbers
EAP1: Mr Desmond Musetsho	Project Management Report writing Quality Control	Cell: 083 410 1477 Email: dmusetsho@naledzi.co.za
EAP2: Mrs. Marissa Botha	Project Management Fieldwork Public Participation Report writing	Cell: 084 226 5584 Email: botham@naledzi.co.za
EAP3: Mr Thendo Matsenene	Fieldwork & Public Participation Assistant	Tel: 015 296 3988 Email: thendo@naledzi.co.za

1.3 Key Authorisation requirements

The commencement of a mining activity or any activities incidental thereto, requires Rakhoma to ensure compliance with provisions of South African legislation relevant to the project. The DMR is the key licensing authority in this application. The key authorisation requirements for the Geluk Mine project are scheduled in Table 3.

Table3: Key Authorisation requirements for Geluk Mine

Authorisation Required	Relevant Legislation	Competent Authority
Environmental Authorisation (EA)	National Environmental Management Act, 1998 (Act 107/1998) (NEMA	Department of Mineral Resources (DMR): Limpopo Region
Waste Management License (WML)	National Environmental Management: Waste Act (Act 59/2008) (NEMWA)	Department of Mineral Resources (DMR): Limpopo Region
Water Use License	National Water Act, 1998 (Act 36/1998 (NWA)	Department of Water and Sanitation (DWS) – Olifants Catchment Agency
Protected Tree Removal Permits	National Forest Act 1998 (Act 30/1998)	Department of Agriculture Forestry and Fisheries (DAFF): Limpopo

The EIA Regulations of 2014 published in Government Notice R982, R983, R984 and R985 of 4 December 2014 under Section 24 (5) of the NEMA, requires that an EA is obtained from the delegated authority, DMR, for an application for a Mining Right. In order for the DMR to consider the application for authorisation, a Scoping and EIA process (S&EIA) must be undertaken.

A WML is also now required under NEM: WA for the creation of residue stockpiles/deposits incidental to mining as inserted under the list of waste management activities by GNR 633 of 24 July 2015 published under Section 19 of the act. The delegated authority for decisions related to mining waste is the DMR. A full S&EIA process is required for waste generated by activities requiring a mining right.

Both NEMA and NEM:WA requires that the same process is followed in terms of the current EIA Regulations to obtain authorisations. To avoid duplication, the S&EIA process is integrated.

1.4 Key organs of state who will evaluate and approve the EIR&EMPr

NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment and institutions that will promote co-operative governance. Thus in compliance of NEMA and Mineral Petroleum Resources Development Act, 2002 (MPRDA), DMR will consult with other key organs of state that administers laws to matters affecting the environment relevant to this application.

The key organs of state in this application are:

- Department of Mineral Resources (DMR) – Licensing authority
- Department of Water and Sanitation: Olifants Management Catchment Agency (DWS)
- Limpopo Department of Economic Development, Environment &Tourism (LEDET)
- Department of Agriculture Forestry and Fisheries (DAFF)
- Limpopo Department of Rural Development and Land Reform (DRLR)

DRLR is considered the key landowner of the regional project area. Land ownership in the affected municipal jurisdiction is predominantly under SA Development Trust (DRLR) under custodianship of local traditional authorities.

LEDET is the custodian of the environment in the Limpopo Province and primary implementing agent of the NEMA, the Limpopo Conservation Plan and therefore will be a key commenting authority.

2. PROJECT BACKGROUND

2.1 Details of the Applicant

Applicant:
Rakhoma Mining Resources Pty Ltd,
Company Registration number: 2005/012691/07
Contact person:
Mrs. Mbavhi Ngobeni (Company Secretary / Internal lawyer)
Registered Address:

Van Eck Road, Ferrobank, Emalahleni, South Africa
Postal Address:
P O Box 567, Emalahleni, 1035
Tel: 013 696 6004 **Fax:** 013 696 6217
Email: mbavhin@vanchem.co.za

2.1 Project Background

Rakhoma proposes to establish an open cast mine operation on the farms Geluk 512KS, Geluk Oos 513KS and Ironstone 847KS situated in the Sekhukhune District Municipality. The site is located in both Makhudutamaga and Greater Tubatse Local Municipalities in the Limpopo Province. The mine will be referred to as "Geluk Mine".

The company has applied for a Mining Right in terms of Section 22 of the MPRDA to mine vanadium-bearing titaniferous magnetite ore, of which the application was accepted on 16 July 2015. The total proposed mining right area is 3165.32 hectares of which 395 hectares have been modelled and explored. The 395 hectares will be the focus area for mining and infrastructure.

Geological exploration was undertaken in 2012 over the farms Geluk, Geluk Oos and Ironstone under Prospecting Right Licence no. LP30/5/1/1/3/2/1/629EM (LP 629 PR) held by Rakhoma. The license expired in March 2015. The exploration drilling determined a feasible reserve of vanadium-bearing titaniferous magnetite deposits occurring in four magnetite seams. The mineral resource available is 14 million tons of ore which can be mined economically.

Rakhoma further holds a Mining Permit (Permit no. 62/2014) since 16 October 2014 issued in terms of Section 27 of MPRDA. The permit is valid for 2 years and covers an area of 5 hectares comprising the farm Geluk 512KS. Rakhoma will start mining under the mining permit and at the same time finalise the mining right application on the farms Geluk 512KS, Geluk Oos 513KS and Ironstone 847KS.

The proposed Geluk Mine operation will be opened up immediately as a small scale mining operation which will ramp up its mining scale by year 6. The proposed operation will not grow to the scale of the platinum and chrome mines in the regional area of Steelpoort. The mine will only supply a captured customer, Vanchem Vanadium Products Pty Ltd (*hereafter Vanchem*).

Rakhoma is majority owned by Vanchem which is a South African based vanadium producer with Vanadium Processing Plants in Ferrobank Witbank (Emalahleni) in Mpumalanga Province. Vanchem requires vanadium containing raw ore to produce a series of vanadium products at their chemical processing plants. Vanadium is mainly used to make alloy steels and is exported to key markets in Europe and secondly Japan. Figure 2 and 3 shows the raw ore and end product.

Figure 2: Raw ore product from Geluk Mine

Figure 3: Vanadium Sheet metal produced at Vanchem

Recently, Vanchem has been forced to stop production at its Emalahleni plant due to a lack of ore supply from its long term supplier Mapoch's Mine. It is Vanchem's aim to secure its own supply of ore through Rakhoma by obtaining a mining license.

All vanadium-bearing titaniferous magnetite ore that will be mined from the proposed mine operation will be crushed and screened onsite, then sent to Vanchem's processing plants. The mine will produce a raw ore product and production will be based on Vanchem's ore requirements of 20 000 tons/month.

The ore product from the Geluk Mine will be loaded onto a 34 ton inter-link tipper trucks and transported via the D2219 and R555 Road to the Roossenekal Rail siding product stockpile for loading and shipment via train to Witbank.

3 DESCRIPTION OF PROJECT SITE / PROJECT LOCALITY

3.1 Regional locality

The project area is situated in the Eastern Limb of the Bushveld Igneous Complex, 20km south west of Steelpoort town in the Sekhukhune District of the Limpopo Province. The proposed mining right application site is located at Magneethoogte/Magnet Heights, 10km south east of Jane Furse and 40km north-east of Roossenekal train station.

Refer to Figures 4 Aerial Locality Map.

3.2 Distance AND DIRECTION TO NEAREST TOWNS

Table 4: Distance to nearest towns

TOWN	DIRECTION	DISTANCE (km)
Within a 60km driving distance from site		
Jane Furse	North West	10km
Steelpoort	North east	20km
Burgersfort	North east	40km
Roossenekal railsiding	South	40km
Further than 60km driving distance from site		
Polokwane (provincial seat)	North West	140km

Witbank (Rakhoma client base)	South	172km

3.3 Affected farms

The application is made with respect to farms Geluk 512KS, Geluk Oos 513KS and Ironstone 847KS. The details of the farms are listed in Table 6. See Figure 4 for the Project site Aerial Locality Map.

A rail siding product stockpile will created at Roossenekal Train Station within Transnet Servitude on Portion 5 farm Vlaklaagte 146JS. This does not form part of the application area yet will be taken into consideration in terms, traffic impacts and air quality associated with the shipment methods.

Table 5: Geographical Reference points for project area

Site	Longitude	Latitude
Proposed Mining Right Area	S 24° 49 ' 54.65 "	E 29° 58 ' 32.08 "
Railsiding Product Stockpile	S 25° 11 ' 24.86 "	E 29° 53 ' 52.48 "

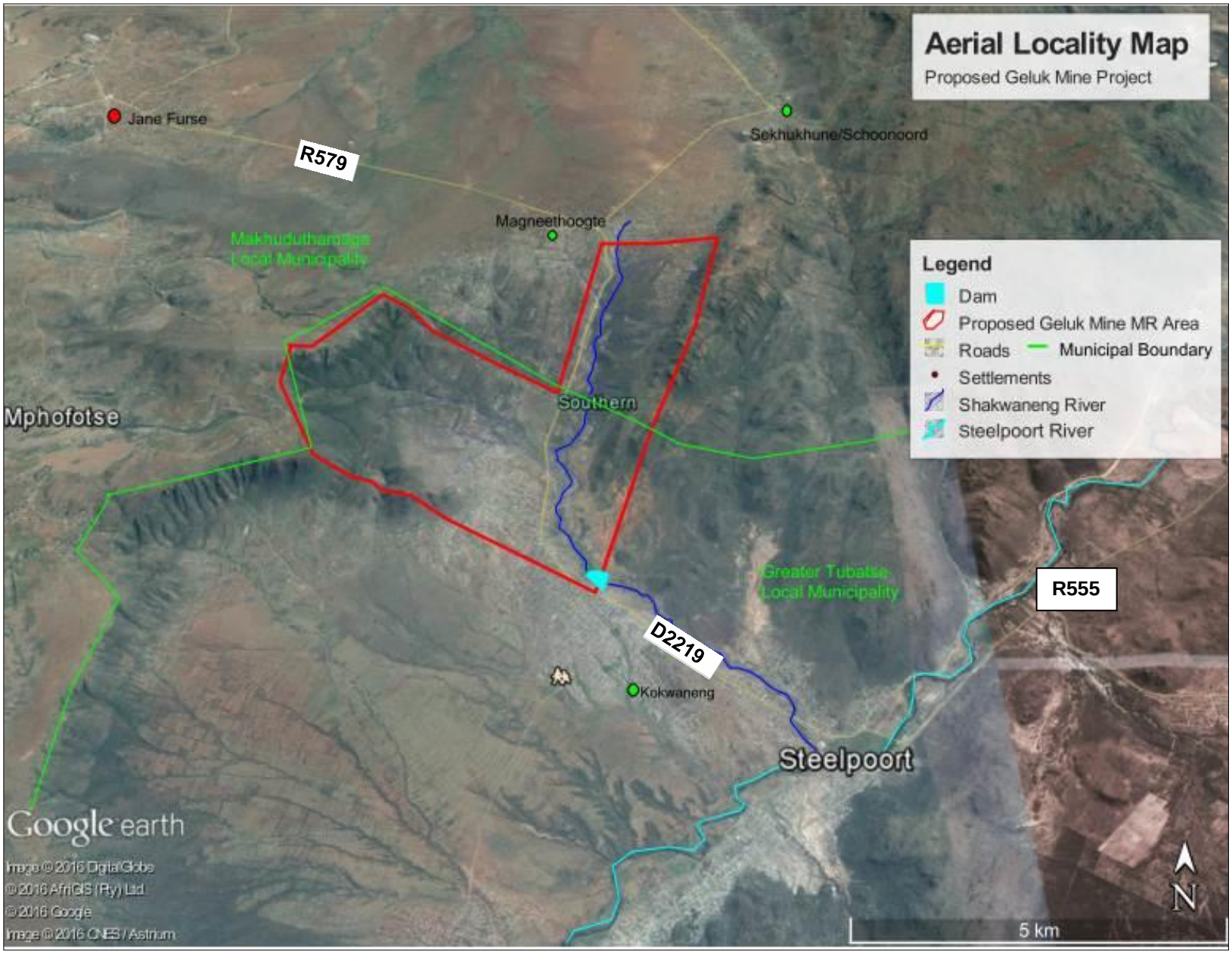

Figure 4: Aerial Locality Map

Table 6: List of Geluk Mine Application properties and ownership

	Farm name	Extent (Ha)	Title Deed	21 Digit SG Code	Registered Landowner
1	**Geluk 512 KS**	701.15	T28642/1971	T0KS00000000051200000	State owned **Department of Rural Development and Land Reform** (former DLA)
2	**Geluk Oos 513KS**	280.40	T41599/1982	T0KS00000000051300000	
3	**Ironstone 847KS**	2183.82	T14484/1989 T30881/2015	T0KS00000000084700000	
Application Area		**3165.32hectares**			

Refer to Figure 6 – Project Site Topographical Locality Map, indicating the project farms.

3.4 Magisterial District and Local Authority

Magisterial District: Sekhukhune
District Municipality: Sekhukhune District Municipality
Local Authority: It straddles two local authorities namely:

- Makhuduthamaga Local Municipality (Services Council- seat in Jane Furse)
- Greater Tubatse Local Municipality (seat in Burgersfort)

Tribal Authorities: The project site is under custodianship of several traditional authorities, which are listed under Section 3.6.2.

*Note: The Roossenekal rail siding is located in Greater Groblersdal Local Municipality (key stakeholder is Transnet)

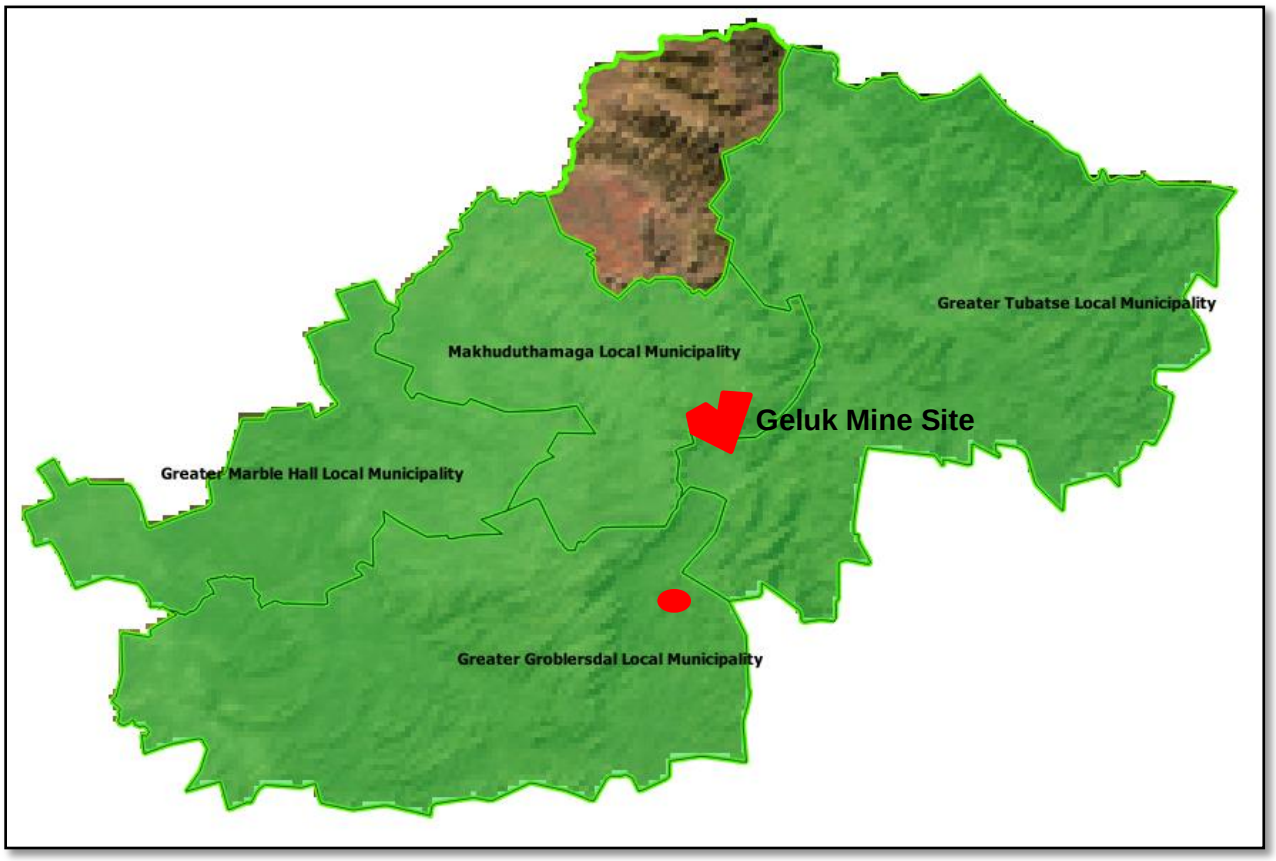

Figure 5: Project components in relation to municipal context in Sekhukhune District

3.5 Distance and direction to settlements

Table 7: Distance and direction to settlements

Settlement	DIRECTION	DISTANCE (km)
Ga-Mogashwa	North – on Geluk 512KS	0km
Magneethoogte	North west	1km
Tshehlwaneng	North	1.8km
Makgane	West	2.5km
Jane Furse	North West	11km
Ironstone Informal Settlement	South – on Ironstone 847KS	0km
Maphopha	South – on Ironstone 847KS	900m from mining resource
Ga-Masha	South	3km
Ga-Maepa	South west	4.5km
Kokwaneng	South south east	4.8km
Ga-Malekane	South east	5.2km

Table 8: Distance and Direction to nearest houses (rail siding):

Receptors	DIRECTION	DISTANCE (m)
Informal settlement - Vlaklaagte	North	60m
Individual houses	south	30m

3.6 Land use & land tenure of the proposed project site

3.6.1 Land use

The proposed project site is largely natural, characterised by steep, mountainous terrain on the eastern and western portions. The mountains on the east rise rapidly from the Shakwaneng River. The river is the most prominent topographical feature, extending north south through the study site.

Urban sprawl has transformed the northern and southern extent of the project site namely, Ga-Mogashwa and Maphopha settlements. There is further degradation on site as the communities' engage in subsistence -, livestock farming (grazing) on lower lying areas.

A reasonable percentage of the application area is still vacant and mining activities will be focussed to unoccupied areas. A 500m restriction to mining from residential dwellings will be implemented. **No resettlement will be required**. Refer to Figure 7 for a Land Use Map.

3.6.2 Surface Rights – Geluk 512KS and Geluk Oos 513KS

The surface rights of both Geluk farm 512KS and Geluk Oos 513KS are state owned and have been allocated to several tribal councils. There are a total of 25 traditional leaders in the immediate vicinity of Geluk farms which have allocation rights to use the farms. The details are scheduled in Table 9.

Table 9: Schedule of Tribal Councils with rights to use farms Geluk 512KS and Geluk Oos 513KS

No.	Traditional Council	Kgoshi/ Kgoshigadi
1	Bahlakwana Rantho Traditional Council (T/C)	Kgoshi N.J. Rantho

2	Bahlakwana Malekane T/C	Kgoshi N.M. Malekane
3	Koni Legare T/C	Kgoshi R.K. Mashegoana
4	Koni Maloma T/C	Kgoshi M.G. Maloma
5	Tau Tswaledi T/C	Kgoshi M.F. Mashegoane
6	Ratau Makgane T/C	Kgoshi M.E. Ratau
7	Koni Seopala T/C	Kgoshigadi N.J. Seopala
8	Baroka Masha T/C	Kgoshi P.L. Masha
9	Baroka Ba Ratau T/C	Kgoshi L.J. Ratau
10	Senamela T/C	Kgoshi Paul Senamela
11	Maphopha Makgane T/C	Kgoshi M.L. Maphopha
12	Ga Moretsele T/C	Kgoshi M. R. Moretsele
13	Mogashwa Manamane T/C	Kgoshi M.E. Mogashwa
14	Mogashwa Ditlhakaneng T/C	Kgoshi D.S / P.J Mogashwa
15	Bakwena Bafokeng Ba Makua T/C	Kgoshi N.J. Makua
16	Masha T/C	Kgoshi P. Masha
17	Masha T/C	Kgoshi Mante (Moses) Masha
18	Masha Mkotwane T/C	Kgoshi Mohube Masha
19	Marota Makgane T/C	Kgoshi Nokana Makgeru
20	Bakwena Ba Makua T/C	Kgoshi Mashego P. Makua
21	Batubatse Ba Mohlogopela T/C	Kgoshi M.B.H. Tshesane
22	Ba Morebele T/C	Kgoshi Mohube Enos Morebele
23	Batlokwa Ba Magolego T/C	Kgoshi M.J. Magolego
24	Tswako Maepa T/C	Kgoshi M.V Maepa
25	BaHlakwana Ba Maphopha T/C	Kgoshigadi E.M. Maphopha

3.6.3 Surface Rights – Ironstone 847KS

The surface rights of Farm Ironstone 847KS are recognised by the Department of Rural Development and Land Reform (DRDLR) to have been allocated to 3 tribes namely:

Table 10: Schedule of surface rights owners for farm Ironstone 847KS

Gazetted	Tribe	Traditional Council	Kgoshi/ Kgoshigadi
Land Claimants of Farm Ironstone 847KS			
GN680/1968	Tswako (Maepa)	Tswako Maepa	Kgoshi M.V Maepa
GN687/1968	Hlakwana (Rantho)	BaHlakwana Rantho	Kgoshi NJ Rantho

Refer to Appendix 3 for Land Claim Results and feedback from the DRDLR.

Rakhoma is required to enter into a land lease agreement with the surface right owners of Ironstone 847KS for the surface areas impacted by the intended mining activities. They also intend to enter into same agreement with affected parties who resides on Geluk farm 512KS.

3.6.4 Land Tenure of adjacent properties and Mineral Rights

The immediate adjacent properties to the proposed mining right area comprise rural settlements as detailed in section 3.5. and 3.6.

Table 11: Schedule of Surface ownership of adjacent properties

Farm name	Surface right owner	Contact person	Contact details
Government Grounds 846KS	Republic of South Africa Limpopo Department of Rural Development and Land Reform (DRDLR)	Mr Tinyiko Makamu Manager – Limpopo State owned land&Property Management (Mines)	015 297 3539 Tinyiko.makamu@drdlr.gov.za
Corndale 330KT			
Steelpoortdrift 365KT			
Landsend 364KT			

The mineral rights of the farm Steelpoortdrift 365KT have recently been allocated to Vanadium Resources Pty Ltd.

Table 12: Schedule of Mineral Right Holders on adjacent properties

Farm name	Holder	Mineral Right License	Mineral	Contact person
Steelpoortdrift 365KT (Portions 1-6)	Vanadium Resources Pty Ltd	LP 30/5/1/2/2/10095MR	Vanadium ore	Mr Nick von der Hoven Tel: 011 699 5720 Cell: 082 332 4973 Nick@minresources.com

3.6.5 Servitudes

Table 13: Schedule of Servitude Holders

Farm name	Servitude	Holder	Contact person and details
Roossenekal Train Station Portion 5 Vlaklaagte 146JS	T32875/983 Train Station, railway line	Transnet Freight Rail	Tshilidzi Mavulwana Environmental Management Risk Department Tel: 013 658 2256 Cell: 083 797 1392 tshilidzi.mavulwana@transnet.net
Ironstone 847KS Geluk 512KS	D2219 Jane Furse Tar Road	RAL – Roads Agency Limpopo	Mr Phuti Montjane Tel: 015 284 4600 Cell: 082 442 4143 Email: MontjanePE@ral.co.za

3.7 Zoning of Geluk Mine Project Site

Rakhoma would need to lodge a Rezoning Application with the local authorities for a change in land use from agriculture to industrial use in terms of the Spatial Planning and Land Use Management Act 16 of 2013 (SPLUMA). SPLUMA operates alongside the MPRDA of 2002 with the result that once a person has been granted a mining right in terms of Section 23 of the MPRDA he or she will still not be able to commence mining operations in terms of that right unless SPLUMA allows for that use of the land in question.

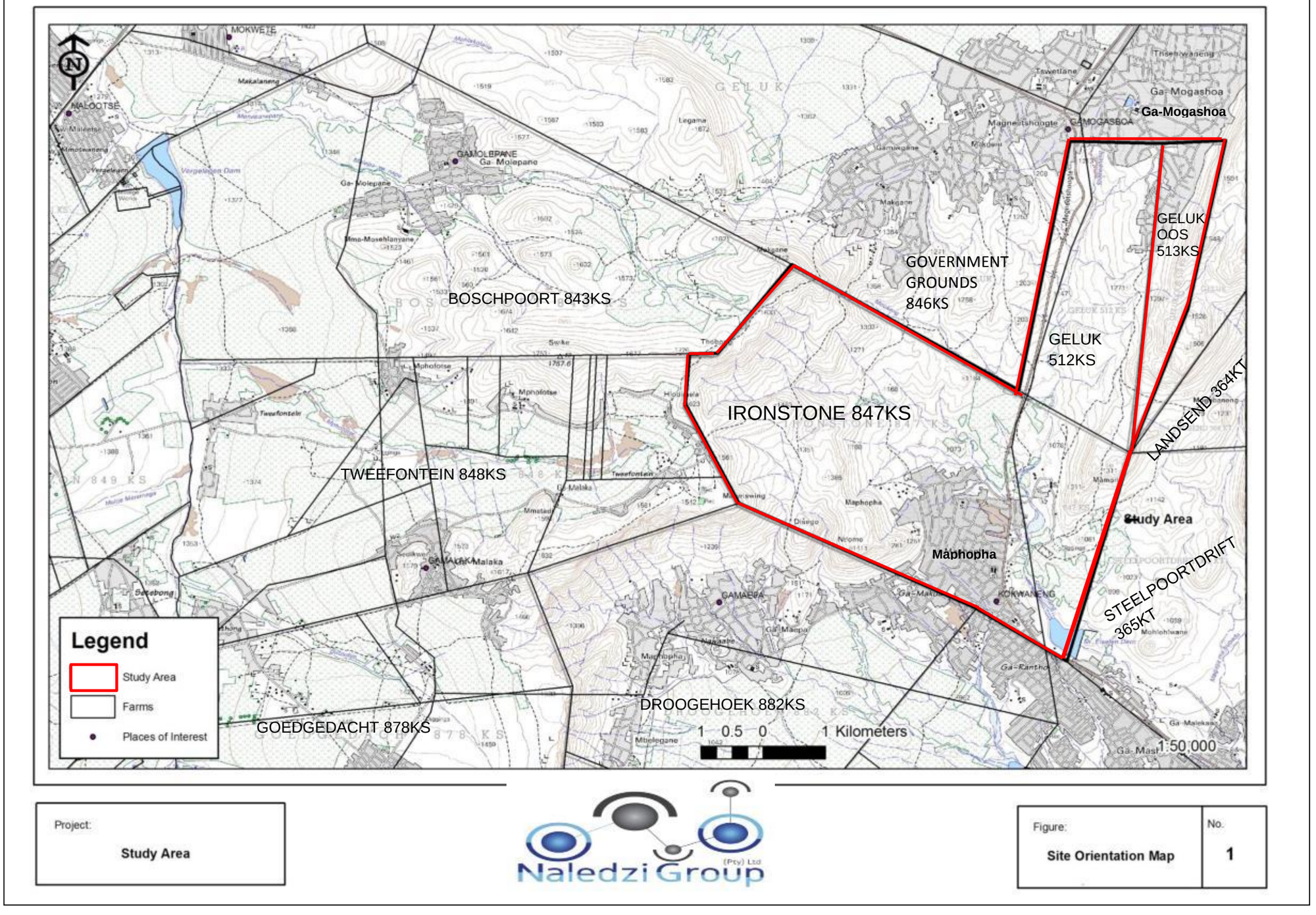

Figure 6: Topographical Locality Map - Project Site

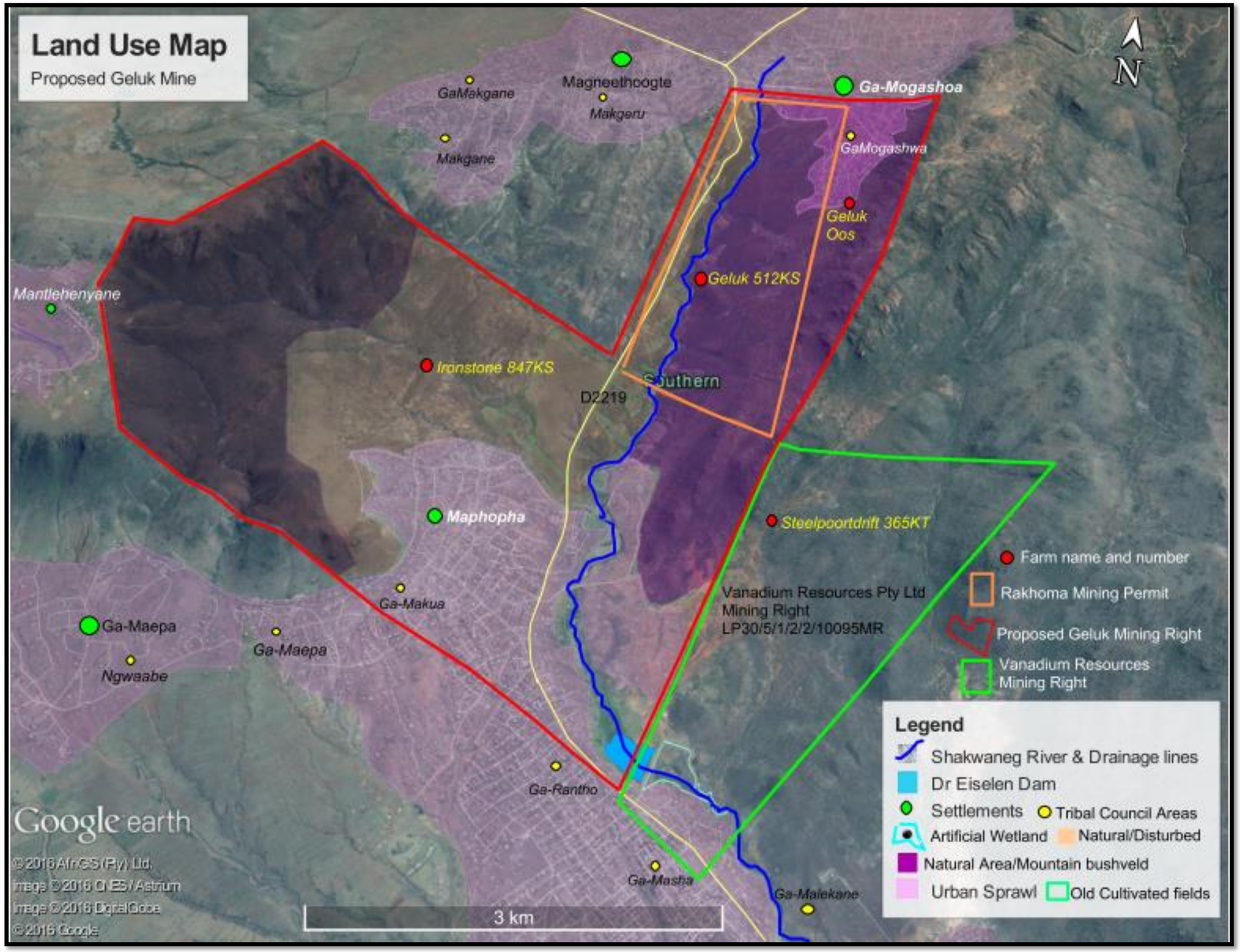

Figure 7: Land Use Map for Mining Right Area and surround area

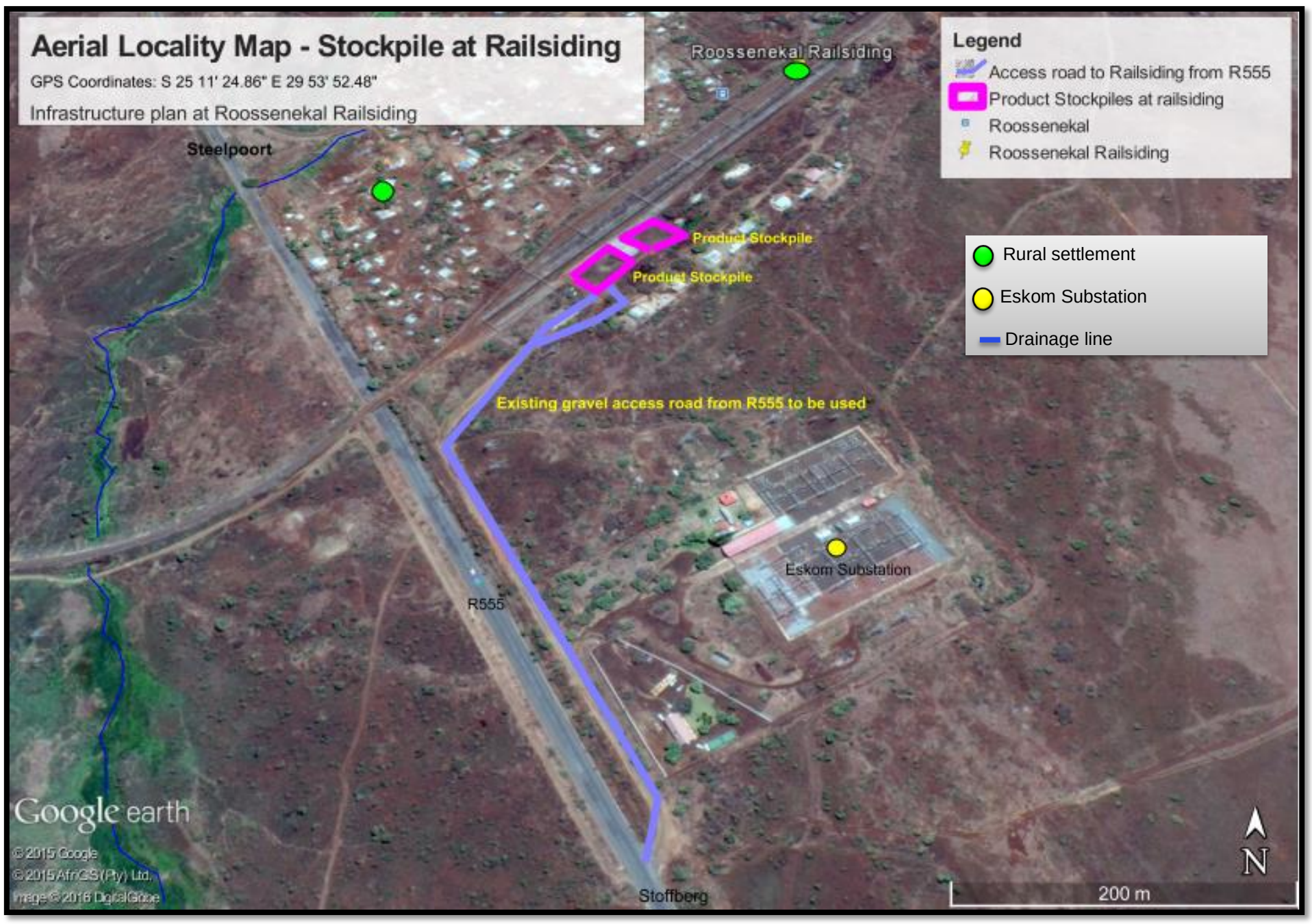

Figure 8: Locality Map of Product Stockpile at Roossenekal Rail Siding

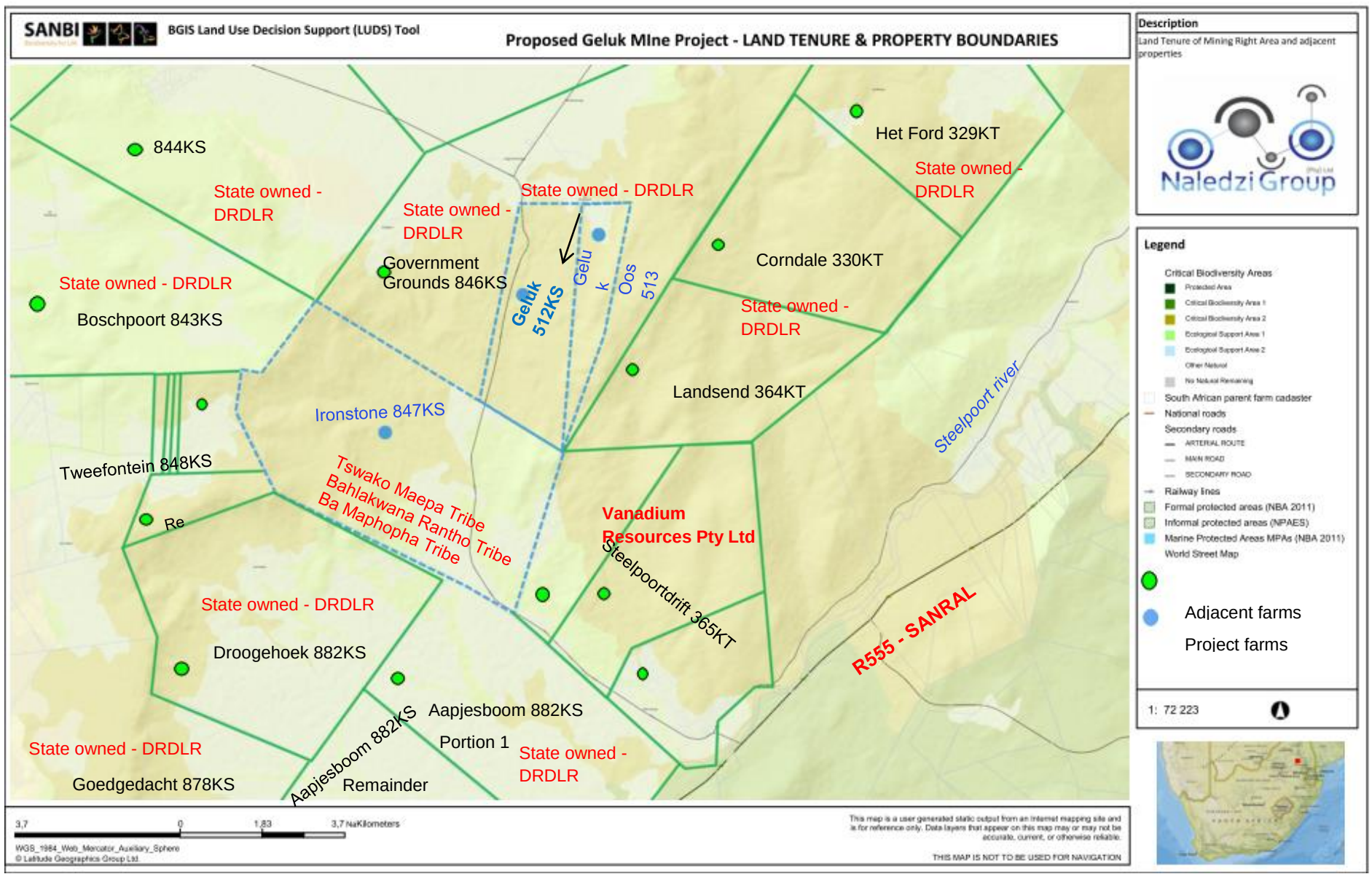

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Figure 9: Farm Boundaries and Land Tenure

SECTION B: DESCRIPTION OF THE SCOPE OF THE PROPOSED ACTIVITY

4 DESCRIPTION OF THE PROJECTSECTION

4.1 Geluk Mine Project

Rakhoma Mining Resources currently holds a Mining Permit to extract vanadium bearing iron ore on 5 hectares on the farm Geluk 512KS. The permit area is located close to Magnet Heights 10km south east of Jane Furse in the magisterial district of Sekhukhune, Limpopo Province.

The mineral resource available extends over 395 hectares. Rakhoma intends to start mining under its mining permit and at the same time finalise a Mining License over the farms Geluk 512KS, Geluk Oos 513KS and Ironstone 847KS, in order to mine the greater part of the resource.

The Geluk Mine will have one captured client, Vanchem who is a vanadium producer with processing plants based in Witbank. Vanchem is securing its own ore supply by obtaining a Mining License through Rakhoma.

The project will entail an open cast mine operation which will target some 395 hectares of modelled mineral resource containing vanadium bearing iron ore in the eastern portion of the proposed mining right area. The resource lies in four magnetite layers close to the surface which will be accessed via a "shallow mine pit" progressively excavated in strips according to the mineral resource. Mining will be paired with simultaneous rehabilitation. Project detail is provided in Section 4.3.1

All vanadium-bearing titaniferous magnetite ore that will be extracted from the proposed mine will be crushed and screened onsite, then sent to Vanchem Vanadium Products Pty Ltd for processing.

The logistical movement of product between Geluk Mine and Witbank will take place as follows:

Interlink tipper trucks will transport the saleable product from the mine site product stockpile to the Roossenekal Rail Siding product stockpile. The product will be offloaded, and then reloaded for shipment via rail to Witbank. The Roossenekal rail siding is 40km south of the mine site and will be accessed via the R555 Steelpoort/Stoffberg Road.

4.2 Listed and Specified Activities triggered under NEMA and NEM:WA

Before the Geluk Mine project can be commissioned, Rakhoma is to obtain an Environmental Authorisation for listed activities triggered by the project in terms of the EIA Regulations of 2014 under Section 24 (5) of NEMA under Government Notice R983, R984, and R985.

The mining operation will further require a WML as it triggers listed activities under the list of waste management activities in GNR 633 of 24 July 2015 and GNR 921 of 2013 published under Section 19 of the NEM: WA.

2.1 Triggered activities ito NEMA and NEM: Waste Act

DMR has determined a format contained in their EIR & EMPR template according to which main and listed activities are to be scheduled. The format has been adopted and is included as Table 14. The department also requires that a Plan is provided showing the location and area of all listed activities, and infrastructure to be placed on site. A detailed layout plan for the mine is not yet available which indicates positions of infrastructure and extent of activities.

Table 14: List of triggered activities under NEMA Listed Notices GNR 983, 984, 984 and NEM: Waste Act GNR 921/2013 and GNR 633/2015

NAME OF ACTIVITY	AERIAL EXTENT	LISTED ACTIVITY	LISTING NOTICE
Activities triggered ito NEMA – EIA Regulations of 2014: Government Notice R983, R 984 and R985			
An open cast mine operation is being proposed on farms Geluk 512KS, Geluk Oos 513KS and Ironstone 847KS for which a mining right (Ref LP30/5/1/2/2/10107MR) has been applied for in terms of Section 22 of the MPRDA 28/2002.	The application area extent is 3165.32 hectares. Only, 395 hectares of the total extent have been explored and modelled for mineral extraction and mine infrastructure.	**Activity 17** Any activity including the operation of that activity which requires a mining right as contemplated in Section 22 of the Mineral and Petroleum Resources Development Act 28/2002, including such infrastructure, structures and earthworks, directly related to the extraction of a mineral resource, including activities for which an exemption has been issued in terms of Section 106 of MPRD Act 28/2002	GNR 984
The Geluk Mine will use recycled mine water for dust suppression and may store stockpile waste water if any in pollution control dam. There activities may detrimentally impact on a water source as per a Section 21 (g) water use license application.	The quantity of waste water to be disposed is not known at this stage.	**Activity 6** The development of facilities or infrastructure for any process / activity which requires a permit/license in terms of national or provincial governing the generation or release of emissions, pollution or effluent- i. Activities identified in Listing Notice 1 of 2014; ii. Activities included in the list of waste management activities published under NEM:WA; iii. The development of facilities or infrastructure for the treatment of effluent, wastewater or sewage where such facilities have a daily thoughput capacity of 2000 cubic metres or less.	GNR 984
Indigenous vegetation will be cleared during site preparation to establish the Geluk Mine project's infrastructure, roads, access the ore body to be strip mined.	The area to be cleared of indigenous vegetation to create the mining pit/strips and associated infrastructure will cover an area of more than 20 hectares. The definite area to be cleared is not	**Activity 15** The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation required for-	GNR 984

NAME OF ACTIVITY	AERIAL EXTENT	LISTED ACTIVITY	LISTING NOTICE
	known at this stage.	(a) The undertaking of a linear activity; or (b) Maintenance purposes undertaken in accordance with maintenance management plan;	
The broken ore extracted from the mining strips will be hauled to the Run of Mine and then crushed and screened (primary for size reduction) then shipped via trucks to Roossenekal Rail siding.	The crushing and screening plant will be a mobile LT 105 Jaw Crusher with LT200 Cone Crusher including a screen, moving along as mining progresses. The crushing and screening plant will process 800 tons of ore per day. The aerial extent/footprint area required for the operation at each new pit created is not known at this stage.	**Activity 21** Any activity including the operation of that activity associated with the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening and washing but excluding smelting, beneficiation, refining, calcining or gasification of the mineral resource.	GNR 984
Overburden will be removed from the mining pit area, the haulage roads, overburden stockpiles, crusher and screening area, and associated other mine infrastructure footprint areas. The soils will be rolled over into strips through progressive rehabilitation of disturbed areas.	In the first 0-5 years of mining, overburden to be removed is estimated at 2,988 811 tons (2 988.81 metric tons) for the period. In the second stage from 6-30 years of mining, overburden to be removed is estimated at 27, 786 673 tons (27 786.67 metric tons). The overburden and ore fines will be used to backfill mining strips as part of the simultaneous rehabilitation plan. Thus overburden piles will be created alongside the pit areas and will be rolled back into the pit areas once depleted.	**Activity 24** The extraction or removal of peat or peat soils, including the disturbance of vegetation or soil in anticipation of the extraction or removal of peat soils, but excluding where such extraction or removal is for rehabilitation of wetlands in accordance with a maintenance management plan.	GNR 984
One permanent haulage road will be created from the mine weighbridge to the mining blocks/strips. The haulage road will require a bridge to cross the Shakwaneng River. It is expected that all pollution control dams, storm water run-off control structures	The bridge which will cross the Shakwaneng River is expected to exceed 100m^2 to cater for mine vehicles (dump trucks, excavators etc). The full dimensions thereof are not known at this stage.	**Activity 12** The development of – (i) Canals exceeding 100m^2 in size (ii) Channels exceeding 100m^2 in size (iii) Bridges exceeding 100m^2 in size (iv) Dams, where the dam, including infrastructure and water surface area , exceeds 100m^2 in size;	GNR 983

NAME OF ACTIVITY	AERIAL EXTENT	LISTED ACTIVITY	LISTING NOTICE
and mine infrastructure will be placed 100m away from any drainage lines on site and 200m away from the Shakwaneng River as recommended by the Aquatic & Wetland Impact Assessment.		(v) Bulk storm water outlet structures exceeding 100m^2 in size (vi) Buildings exceeding 100m^2 in size (vii) Infrastructure/structures with a physical footprint of 100m^2 or more; Where such development occurs- (a) Within a watercourse (b) In front of a development setback line, or; (c) If no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	
The dirty water from the mine site will be collected in a pollution control dam.	The capacity of the PCD and extent of area required for the PCD is not known at this stage.	**Activity 13** The development 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, uless unless such activity falls with the ambit of Activity 16 of Listing Notice 2.	GNR 983
The mine will require storage of explosive magazines, diesel, grease and oils.	The mine will require storage of diesel, fuel oil, ammonium nitrate and an explosives magazine. The capacity has not been determined yet. It is not expected to exceed 500m^3.	**Activity 14** The development of facilities or infrastructure, or handling of a dangerous good, where such storage occurs in containers with a combined capacity of 80m^3 or more but less than 500m^3.	GNR 983
A haulage road and bridge over the Shakwaneng River is required which will require the infilling/depositing of any material/removing of soil, sand, pebbles or rock from the river.	The infilling or depositing of material is expected to exceed 5m^3.	**Activity 19** The infilling or depositing of any material or more than 5 m^3 into, or the dredging, excavation, removal or moving of soil, sand, shell grit, pebbles or rock from (ii) a watercourse	GNR 983

NAME OF ACTIVITY	AERIAL EXTENT	LISTED ACTIVITY	LISTING NOTICE
The mine will require the construction of one permanent haulage road & several temporary roads for hauling of broken ore, overburden, topsoil and product.	It is expected that the mine haulage road which will be created will exceed 6m in width to cater for large dumper trucks.	**Activity 24** The development of- (ii) a road with a reserve wider than 13.5m or where no reserve exists where the road is wider than 6 metres.	GNR 983
The mine operation will also require the development of roads wider 4m but less than 13.5m to access offices and workshops. The majority of the mining application area corresponds to an area identified as a Critical Biodiversity Area 2 in the Limpopo Conservation Plan. The exact placement of new roads (except for the 1 major haulage road) is not known at this stage.	The extent in hectares is not known and will be determined with the preparation of the final Mine Plan. The roads widths will exceed 4 metres and fall within the CBA 2 area of the LCP.	**Activity 4** Development of a road wider than 4 metres with a reserve less than 13.5metres. (a) Limpopo Province (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or bioregional plans.	GNR 985
National Environmental Management: Waste Act in terms of Section 19 under GNR 921 of 2013 and GNR 633 of 2015			
The establishment and maintenance of overburden stockpiles. Further, overburden and ore fines which are uneconomical to transport as product will be used to backfill strip mined areas. The waste and ore material has a low potential for metal leaching however may have a detrimental effect on groundwater quality. The waste sample classification for the project waste material is Type 3 waste (Moderate risk/Hazardous) and requires a Class C Landfill site	The extent required for stockpiling of hard and soft overburden and ore fines are not known. The area to be backfilled with Type 3 waste (moderate risk/hazardous) will be greater than 20 hectares It will be done progressively. Hard and soft overburden will be piled next to the mine strips for ease of backfilling for concurrent rehabilitation.	Category B – Activity 7 The disposal of any quantity of hazardous waste to land (**Waste classification was based on review of similar cases. Once lab testing is conducted it should be determined if waste material is actually hazardous).**	GNR 921/2013
The establishment and maintenance of overburden stockpiles.	It is expected that approximately 31 000 metric tons of inert (overburden) waste will be stockpiled for the period of the LoM. However	Category B – Activity 9 The disposal of inert waste to land in excess of 25 000 tons, excluding disposal of such waste for	GNR 921/2013

NAME OF ACTIVITY	AERIAL EXTENT	LISTED ACTIVITY	LISTING NOTICE
Overburden and ore fines from the crushing and screening plant will be used to backfill the strip mined areas.	overburden will be used to backfill strip mined areas as part of a simultaneous rehabilitation plan.	purposes of levelling and building which has been authorised under other legislation. **(Waste classification was based on review of similar cases. Once lab testing is conducted it should be determined if waste material is inert** / hazardous).	
The waste material to be piled on overburden stockpiles is considered Type 3 waste (moderate risk/hazardous) which requires the design and construction of a Class C landfill site facility. (old GLB_+ landfill facility)	The extent of the class C facilities required is not known at this stage	Category B – Activity 10 The construction of a facility for a waste management activity listed in Category B	GNR 921/2013
The mining operation will result in creation of overburden stockpiles and run of mine stockpiles including ore fine piles uneconomical to transport as product. Overburden, ore fines will be used to backfill strip mined areas as part of the mines rehabilitation plan (strip mining with simultaneous rehabilitation).	The extent of overburden and ore fine stockpiles is not known at this stage.	Category B - Activity 11 The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right in terms of the MPRDA (Act 28 of 2002)	GNR 633/2015

4.3 Commodity to the mined

Vanadium-bearing titaniferous magnetite

4.4 Ore body of the project area

The ore body forms part of a vanadium-bearing titaniferous magnetite deposit that occurs as more than twenty-five magnetite layers in the Upper Zone of the BIC. Four magnetite layers occur on site and have been graded as the Main Seam, First Seam, Second Seam and Third Seam. The Main seam is located at the bottom of the succession. The ore body is dipping approximately 11° in a direction between 265° to 280°. A normal fault with a throw of between 30m and 50m, and a strike of 200°, was found to coincide with a river gorge that forms the most prominent topographical feature of the project area.

The average depths of each seam below surface are: Main Seam - 10.77m, First Seam - 10.03m, Second Seam - 7.85m, Third Seam - 6.41m. The Main Seam is of primary interest and is the bottom-most of the four seams. It is found over approximately 80% of the drilled area. The average depth of the main seam is 11m and a maximum depth of 88m. The maximum mining depth will be 20m.

Only 395ha of the proposed mining right area has been explored and modelled, which accounts for 12.5% of the total area of approximately 3,165ha for all three properties. Refer to Figure 8 for the location of the Ore body / mineral resource within the proposed Mining Right Area.

4.5 Produce of the mine

The produce at the mine will be vanadium-bearing titaniferous magnetite ore (a raw ore product).

All the vanadium-bearing titaniferous magnetite ore that will be mined will be crushed and screened onsite, then sold and shipped to Vanchem's Processing Plants. Vanchem will in turn produce Vanadium Peroxide, Vanadium Trioxide, Ferrovanadium and Vanadium Chemicals for export.

4.6 Expected Life of Mine (LoM)

The economic mining reserve, when targeting all available economic seams outside the 500 m striction to mining from settlement, is 13 million tons, yielding approximately 10 million tons of vanadium concentrate. Refer to Figure 10 for the location of the mineral resource in relation to the mining restriction area.

The expected life of mine (LoM) is 30 years.

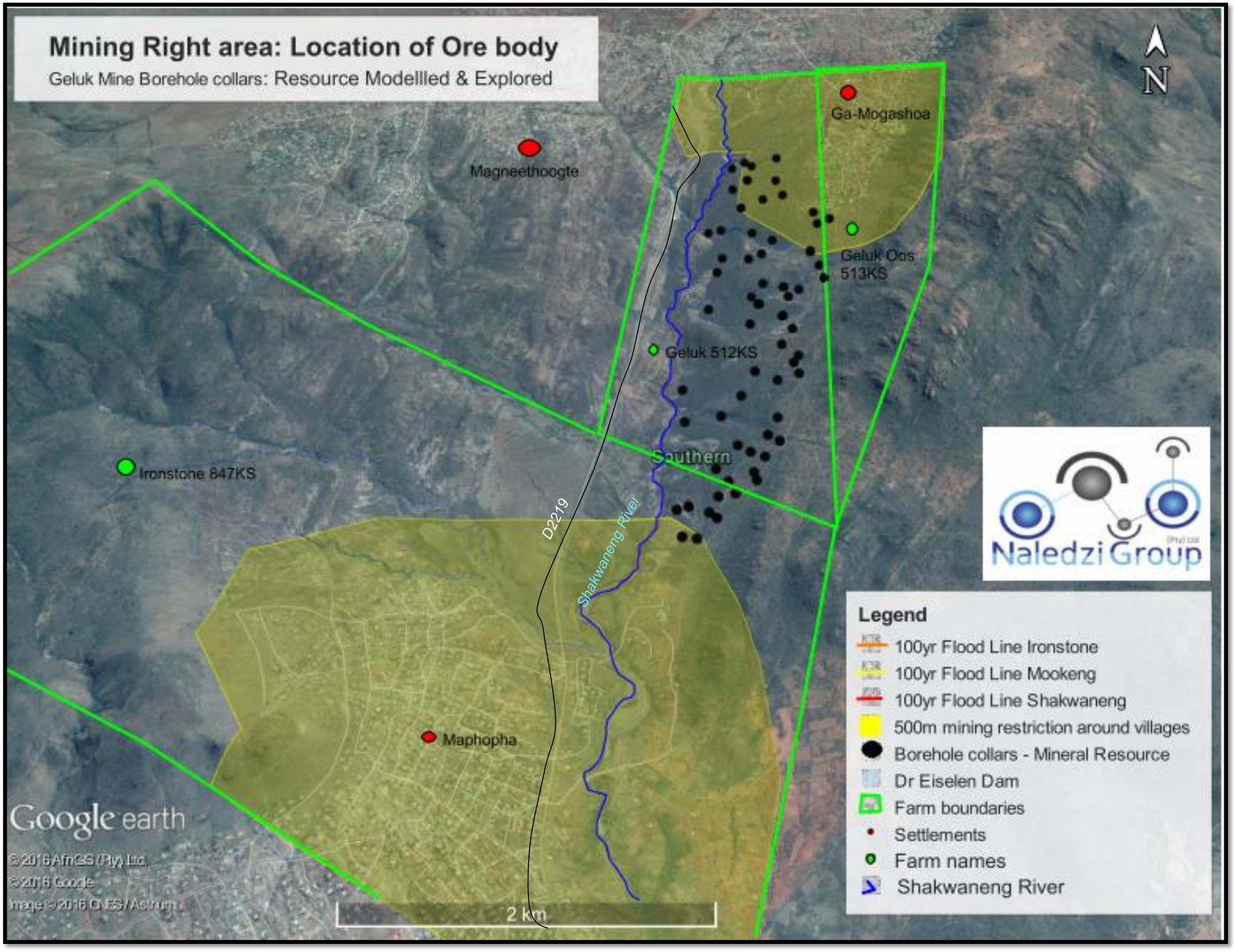


Figure 10: Location of ore body modelled and explored within the propsed mining right area

4.7 Production Rate

Production at the Geluk Mine will be based on Vanchem's ore requirements, which is 20kt per month.

In the first 5 years the mine will produce 200 000 tons of raw ore on an annual basis, thereafter production will ramp up to 700 000 tons per annum until the LoM is reached.

Table 15: Production rates at proposed Geluk Mine

Activity	Production Rates			
	Daily	**Monthly**	**Yearly 1-5**	**Yearly 6-30**
Total Run of Mine	800tons	20 000 tons	240 000 tons	700 000 tons
Crush&Screen Plant yield	90-95%	90-95%	90-95%	90-95%
Saleable Product	**800t**	**20kt**	**200kt**	**650-700kt**

4.8 Production and any decline period

With the current anticipated annual production of 200kt/annum and a ramp up to 700kt the available resources still have an additional 50 years; as such there is no grade decline expected during the first 50 years (Geluk Mine Mining Works Programme, 2015) . The expected LoM is 30 years.

4.9 Mining Method and Activities

Mine Method

This will be a shallow surface mine operation consisting of strip mining and simultaneous rehabilitation. It will consist of a "mine pit" progressively excavated in strips according to a mineral resource and mine schedule. The maximum mining depth of the pit area will be 20m. Strips of approximately 20m wide will be mined in the strike direction. Initial mining will focus on the areas where the Main Seam forms outcrops at the surface.

The mining method is similar to the one used at the nearby Mapochs Mine. Three terms are used to define the types of ore mined, namely (a) seam ore, (b) pavement ore and (c) rubble ore.

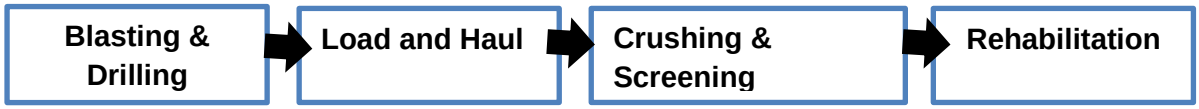
(a) Seam ore is ore which is over-lain by gabbro norites and ore which has not been badly weathered and is relatively homogenous. This ore dips westward at angles of between 4° and 10°. Seam thickness of the Main Seam averages 3.19m. Much of the Main Seam outcrops in the form of seam ore. Seam ore would require blasting in order to reduce it to a size that is able to be loaded and transported to the crushing and screening plant.

(b) Pavement ore is seam ore that has been exposed by a weathering process. This ore is not overlain by gabbro norites. Large portions of the ore have collapsed as a result of the weathering of the anorthosite layer below the seam. Large blocks of ore can be found on the western slopes of the hills and vary in size from 250mm to as large as 2m. Some of the Main Seam and much of the first seam outcrop on the Geluk/Ironstone properties in the form of seam ore.

(c) Rubble ore is pavement ore which has further weathered and has been disseminated down the slopes of the hill. This ore is spherical in nature and is generally sized between 250mm to 10mm. Topsoil is deposited between the boulders and the pebbles of the rubble. Much of the outcrops of the upper seams on the Geluk/Ironstone properties occur in the form of rubble ore.

Activities to be undertaken at the mine

The general mining practice would include removing of overburden to provide access to the seam/pavement ore. The seam/pavement ore would thereafter be drilled and blasted and removed by excavator and dump trucks to the mine stockpile. The Run of Mine will be crushed and screened before being transported to Vanchem in Emalahleni. A raw ore product will be produced. No on-site processing will take place. The basic flow of mine activities area as follows:



The activities as part of the basic flow of the mining operation are discussed below and illustrated in Figure 11.

4.9.1 Vegetation Removal and Site preparation

To get to the minable ore body, the mining pit area will first be cleared and prepared. This involves excavation and removal of overburden to get to the ore body. Toe trenches would be created and silt traps built to stop run-off water draining into water features and the river. Vegetation will be dozed to the side and roads created on contour. Topsoil will be dozed off/where thicker, taken off with excavators and dump trucks and placed on a stockpile for later use during rehabilitation. Usually close to the open pit/strip for progressive rehabilitation.

A roll-over methodology will be used where stripped overburden is placed directly back into the previous strip that was mined. Some overburden needs to be stockpiled for final covering and some needs to be drilled and blasted due to the hardness.

4.9.2 Drilling and Blasting

Seam ore would require blasting in order to reduce it to a size that is able to be loaded and transported to the mobile crushing and screening plant. Blast holes will be required as part of the excavation activities. Hole diameters of 89mm are proposed. Explosives will be placed down the hole. Drill and blast designs are as follows:

Drill Hole Diameter: 89mm
Burden 1.8m
Spacing 2.0m
Stemming 0.5m
Sub-Drill 0.1m
Approximate powder factor: 0.37kg/tonne

Fly rock is typically thrown from the collar of the blast hole. It can be controlled by correctly controlling designing blasts. Fly rock will be experienced at site specific level. Blasting will take place during daytime at around 13h00 twice (2) a week.

A distance of 500m will be maintained between residential areas, the onsite water pipeline and the blast site. An earthberm of 10m will be erected in vicinity of residential properties. The D2219 Jane Furse Road will be closed for traffic during blasting.

4.9.3 Loading and Hauling

Broken ore would be loaded by means of an excavator onto a dump truck and transported to the crusher plant stockpile/RoM on the property. For this type of operation, a combination of 45 to 65 tonne excavators and 30 to 40 tonne articulated dump trucks would be used. A typical fleet for overburden stripping and production would consist of drill rigs, dozers, excavators, dump trucks, a grader, a water cart and a rock breaker.

4.9.4 Crushing and Screening

The Run of Mine (ROM) will be crushed and screened before being transported to the client, Vanchem. This process will be mainly for size reduction and a 90-95% yield is expected. The crushing and screening plant will move along as mining progresses. The crushing and screening plant will be a mobile plant and contain the following equipment:

- Cone crusher ,
- Grizzly, Pegger ,
- Conveyor belts

Table 16: Crushing and Screening Plant operating capacity

Activity	Production Rate				
	Daily	**Monthly**	**Yearly**	**Yearly**	**Yearly**
Total RoM (per period)	800t	20kt	240kt	480kt	700kt
Total working days (per period)	1	22	254	254	254
Total mining working hours (per period)	8	176	2032	3480	3480
Plant availability	90%	90%	90%	90%	90%
Plant utilization	60%	60%	60%	60%	70%
Plant working hours per day	8hrs	8hrs	8hrs	8hrs	8hrs
Mining losses	5%	5%	5%	5%	5%
Plant Yield (% recovery of ore)	90-95%	90-95%	90-95%	90-95%	90-95%
Total Saleable product (t/per period)	**800t**	**20kt**	**240kt**	**480kt**	**700kt**

4.9.5 Rehabilitation

The process of reshaping and re-vegetating the land to restore it to a stable condition with a land-use that is appropriate for the particular location will be conducted progressively with the mining.

The general region is characterised by grazing activities and due to this, the land affected by mining would be suited for grazing activities for an end land use (post-mining).

About 350mm of topsoil will be replaced, levelled and contoured to facilitate water flow. Grass runners and indigenous trees and aloes can then be planted in the contours.

4.9.6 Mining Equipment to be used

Table 17: Mining Equipment to be used

Mining Equipment	Supporting Equipment	Crushing and Screening Plant
- CAT - Cat 740 ADT's - Cat 374 Excavator - DM 30 Drill - Scalping Screen	- Dozer D8 - Loader Cat 966 - Grader 140h - Water Bowser ADT 18 000 litre - Diesel Truck	- LT 105 Jaw crusher - LT 200 Cone Crusher - LT 358 Screen - Cat 336 Excavator - Cat 950 Loader

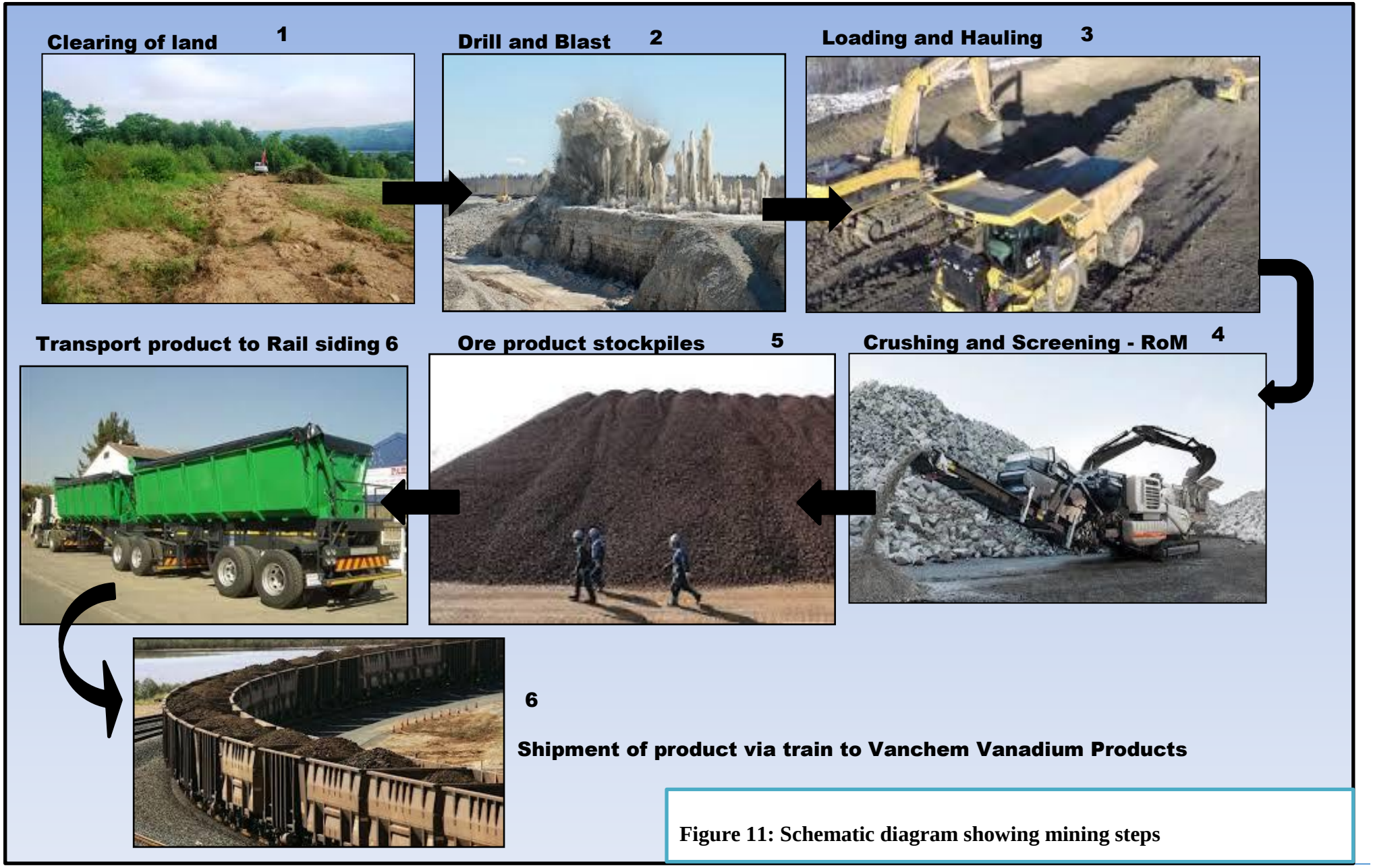


Figure 11: Schematic diagram showing mining steps

4.10 Mine Design and Infrastructure

A concept layout plan inclusive of mine infrastructure has been developed. Only a draft mine design/scheduling is available. The mine design is as previously stated; (a) open mining pit (b) surface infrastructure.

See Plan A attached to the EIR.

The key components expected to form part of the proposed mining operations are:

- Access road from the D2219 Jane Furse Road
- Weighbridge
- Offices and Workshop
- Haul roads: 1 permanent Haulage Road with a bridge crossing over the Shakwaneng River and several smaller temporary haulage roads
- Mining pit/strips
- Mobile Crushing and Screening Plant
- Run of Mine and Product Stockpile
- Overburden and Topsoil stockpiles

4.10.1 Mining Pit Area

The mineral resources will be accessed via a mining pit area to be excavated and strip mined (Figure 12). The mining will take place in sequences according to the four seams identified on site. The main seam is of primary interest. 6 Mine blocks have been scheduled, namely:

- Year 1-5, Year 6-10, Year 11-15,
- Year 16-20, Year 21-25, Year 26-30

In year 1-5 the pit area design will be scheduled for extraction of 200kt/ annum of ore and would ramp up production from year 6-30 to 700 kt/annum.

200kt Production – In situ tonnages and modifying factors:

The in situ ORE tonnes to be mined for the first 5 years are 1, 301 861 tonnes. Mining recovery will be at 90% and Mining dilution at 5%. The total ore tonnages to makeup the RoM to the crushing and screening plant will be 1, 230 258 tonnes of ore. The plant will have 90-95% yield at which 1, 000, 000 tons of raw ore product will be produced.

The total waste material from the 200kt production rate operations in tabled in Table 19.

Table 18: Waste Material for production period Year 1-5

Year	Total Insitu tonnes	Waste tonnes (overburden)	Waste BCM	Waste Stripping
1	2, 171, 575	1, 911, 440	637, 147	735%
2	591, 416	331, 511	110, 504	128%
3	466, 491	206, 312	68, 771	79%
4	487, 614	227, 131	75, 710	87%
5	571, 904	310, 746	103, 582	119%
Total	**4, 289, 000**	**2, 987, 140**	**995, 714**	**229% average**

The 700kt Production In situ tonnages and modifying factors were not available. The mining pit area and its associated infrastructure will remain 500m from any settlements and above the 1:100 year floodline of any river or stream or at least 100m away from such features, whichever is greater.

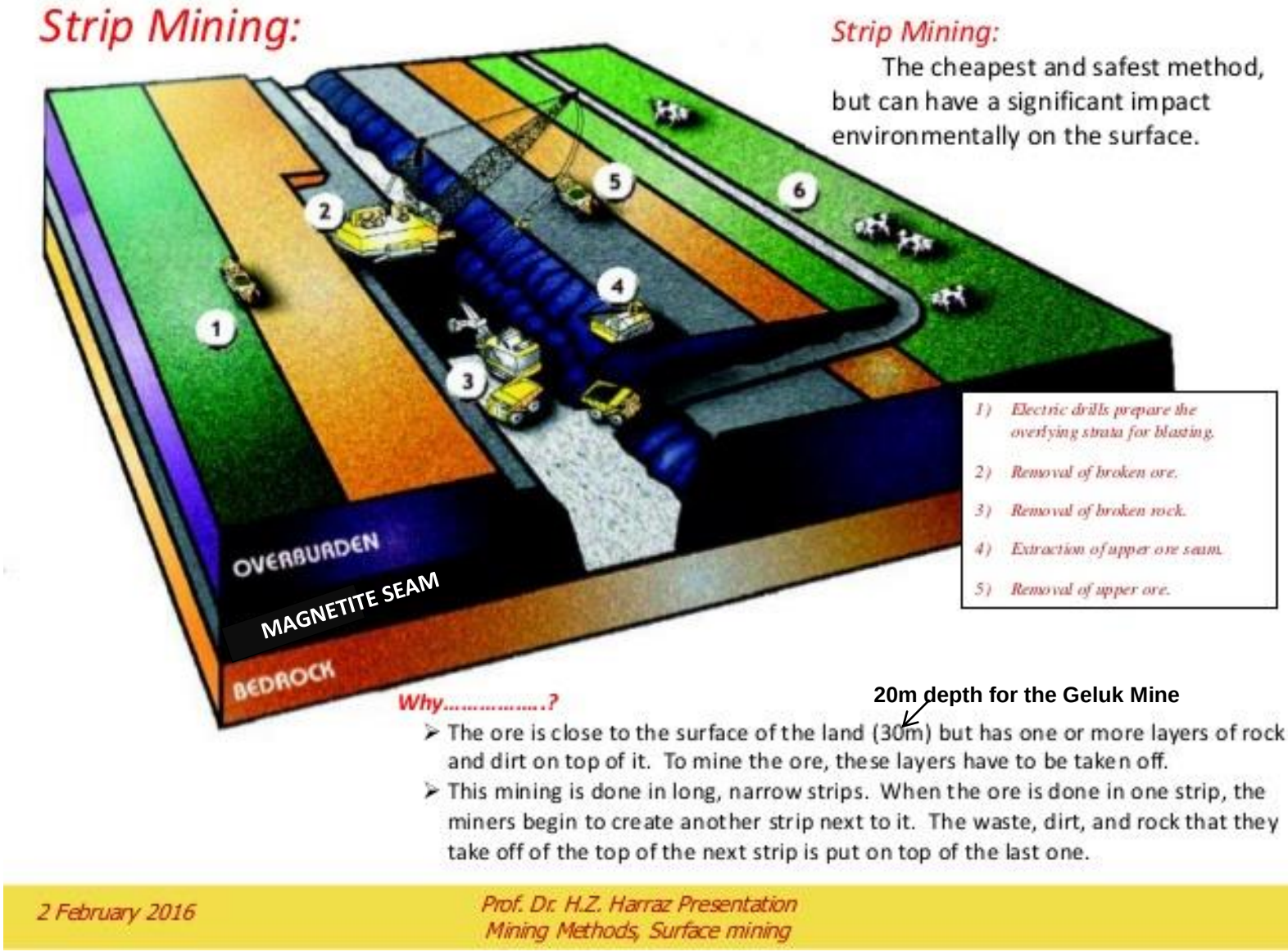


Figure 12: Schematic illustration of strip mining method and pit design

4.10.2 Overburden, Topsoil, Waste rock Stockpiles

Two (2) stockpile areas will be established for topsoil, overburden and waste rock (if any) excavated as part of the mining operations. Overburden and topsoil will be piled as close as possible to the mining pits

Topsoil will be dozed off/where thicker, taken off with excavators and dump trucks and placed on a stockpile for later use during rehabilitation.

Stripped overburden and waste rock will be temporarily stockpiled and later placed directly back into the previous strip that was mine. Some overburden will be stockpiled for final covering. Soil stockpiles will be placed as close to the open pit/strips as possible to reduce soil handling. The dimensions of the stockpiles have not been determined yet.

The average seam depths are; Main Seam - 10.77m, First Seam - 10.03m, Second Seam - 7.85m and Third Seam - 6.41m. The preliminary average strip ratios (waste to ore ratio) calculated for seams above the main seam are 2.68 and for depths less than or equal to 20m is 1.63 over 25 fault blocks.

4.10.3 RoM and Product Stockpile

A RoM pad will be established and will consist of broken ore, loaded and hauled from the mining pit to the product stockpile for later crushing and screening. The pad will be created in proximity of mining pits.

The processed Final product will be loaded and hauled, from the crushing and screening plant, to the final Product Stockpile to be established just east of the D2219 Jane Furse Road close to a weighbridge. The total area to be covered by the final product stockpile will be 1 hectare. The total area to be covered by the RoM pad less than 10 hectares.

4.10.4 Access Road, Weighbridge and Haul roads

Access Road

The Geluk Mine will be accessed from a proposed entry road via the D2219 Jane Furse road. The proposed access is planned on current gravel land which is not in use and falls within the proposed mining right area. The access road intersection will be a two-way priority stop controlled intersection on the D2219.

Weighbridge

A heavy duty off road weighbridge and control room will be constructed to take stock of the raw ore shipped from the mine site to Vanchem. The weighbridge and control room will be located some 130m east of the D2219 tar road along the proposed mine access road.

Haulage Road over Shakwaneng River

A stream crossing will need to be constructed over the Shakwaneng River to provide a haulage route for mine vehicles/trucks to haul material over the river from the mine pits to the final product stockpile. This will be the only permanent haulage road constructed from the mine entry to the mining pit areas east of the Shakwaneng River. The stream crossing design will be based on the 1: 100 year floodline and estimated flow at the river crossing. A water use license application is required for the river crossing.

Further temporary haulage roads will be constructed to connect the mine pits, stockpile yards and workshop areas including the RoM pad.

4.10.5 Roossenekal Rail siding Infrastructure Plan

The raw ore product from Geluk Mine will be transported with 34 ton interlink tipper trucks to Roossenekal Rail Siding and shipped via rail to Vanchem in Witbank. Infrastructure will be created to stockpile and load the product onto the train. This will include:

- The existing gravel access road from the R555 Steelpoort/Stoffberg Road to the rail siding will be widened by 6m as it enters the stockpile areas (final road width 15m);
- Three (3) product stockpile areas will be established for product offload and loading at the siding varying in size (Area D-1437m^2; Area E-454m^2 and Area F-583m^2);
- A retainer wall will be constructed to contain product stockpiled along the rail siding including a loading station.

See Plan B for the Railsiding Infrastructure Plan.

4.10.6 Water Pollution Management at proposed Mine

Sewage Handling

Rental chemical toilets would be used for ablution facilities. The facilities would be placed close to the areas of mining and in proximity of change rooms, offices and workshop areas. The effluent from the chemical toilets would be emptied on a regular basis (vacuumed from the toilets by vacuum trucks) by a contracted waste collector. Once emptied the sewage waste will be disposed of at the closest Waste Water Treatment Plant at Jane Furse. A service agreement letter will need to be obtained by Rakhoma from Makhuduthamaga Local Municipality in this regard.

Storm Water Control at Mine

The proposed Geluk Mine project is situated in the Shakwaneng River catchment. The river is the main collector flowing from north to south. It has two tributaries Mookeng and Ironstone Stream entering the river from the west. It is a very small catchment area and has a high drainage density. The terrain is steep giving rise to flashy floods, yet flood lines for the river are close together and have narrow drainage channels.

Storms with return periods of 100 years will fall over four catchments at the project area. It will produce discharges of 149.69, 159.19, 73.12 and 100.48 m^3/s for the Shakwaneng North, Shakwaneng South, Mookeng and the Ironstone Streams respectively. In all instances the time of concentration (TC - i.e. the time from the beginning of the storm until the maximum discharge is reached) will be very short (39.4, 62.5, 51.4 and 43.9 min respectively for the Shakwaneng North, Shakwaneng South, Mookeng and Ironstone Streams). This very short TC is mainly attributed to the comparatively small catchments and the steep topography at the study area. All mine infrastructure, pollution containment dams, stockpile areas will be set above the 1: 100 year floodline calculated for the Shakwaneng River and its tributaries.

The proposed Geluk Mine project has the potential to impact on the Shakwaneng River and Dr Eiselen Dam mainly through increased sedimentation levels into the river and its tributaries. Therefore the mine will have a properly constructed storm water management

system which will separate clean and dirty storm water from the catchment areas and trap silt and sediment from its operations.

Toe trenches will be created below strip mine areas and silt traps will be built to stop run-off water from entering the river and its tributaries. All raw ore laydown areas will be designed with storm water control and a liner, an impervious layer. The storm water system will capture all contaminated storm water from the stockpiles and convey it to the silt traps and finally the Pollution Control Dam (PCD). This will prevent ingress of contaminants into the groundwater and material from running into the water bodies.

Pollution Control Dam (PCD) / Mine return water dam
The reuse of "dirty water" will be maximized at the mine. Dirty water will be collected in a pollution control dam.

Any Mine return water from the mining operations will be pumped back to surface via a return water system. The return water will comprise water used by drill rigs, wash down water and groundwater encountered in mining pits. The mine return will be recycled and used as mine service water; this will allow maximum re-use of water in the mine process.

The storm water management system will be designed to isolate dirty water sources such as workshops, stockpile areas, mining pit area, RoM pad, drilling rigs and crushing and screening plant.

The PCD will be designed to have the capacity for a 1:50 year flood event (with 0.8m freeboard), as stipulated in Regulation 704 of the National Water Act 36/1998 for dirty water containment and freeboard requirements. The regulations state that a PCD must have the capacity to contain water in the event of a 1: 50 year storm / flood event over and above its mean operating level. The PCD will accordingly also be located above the 1:100 year floodline. Refer to Figure 13 for an indication of the requirements for PCD design.

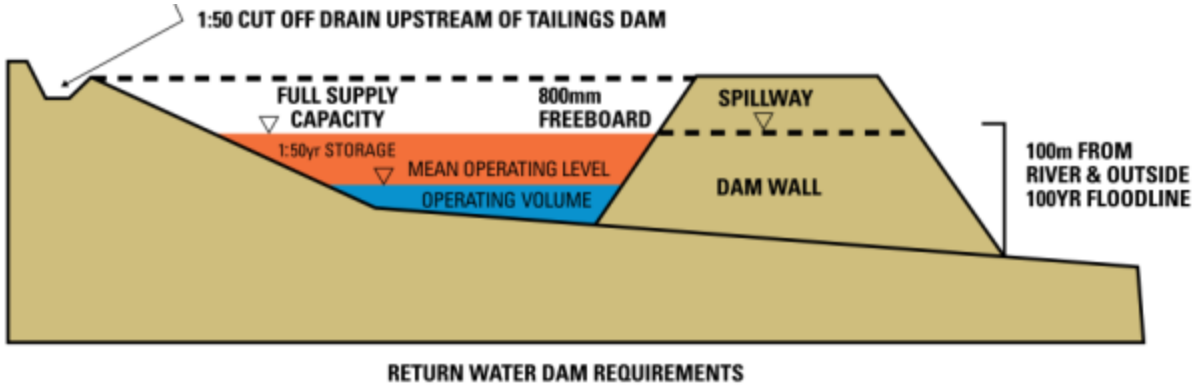


Figure 13: Illustration of Return Water Dam requirements ito Regulations 704 of NWA 36/1998 (image courtesy of SRK Consulting Engineers) (

4.10.7 Waste Storage and Management

General/domestic and hazardous mining/industrial waste produced at the Geluk Mine will be collected and stored in demarcated areas on site.

Sufficient collection points will be identified with adequate capacity and be serviced frequently. These collection areas will be properly designed and secured with appropriate pollution prevention measures in place i.e. storm water control and used oil storage areas should be adequately bunded and lined and should have working oil traps.

General / Domestic Waste
The Geluk Mine project will generate domestic waste, office waste, and organic waste. Reclaimable and recyclable waste may also be generated such as tyres, wood, plastic, pipes, cables, conveyor belts, bricks, building rubble, etc.

Domestic waste will be collected in skips in a designated area on the mine site and removed by a competent contractor on a regular basis. There is a landfill site at Jane Furse which could be used to dispose of the mines general waste. The mine will however according to its IWMP as much as possible recycle or reuse waste. Conventional recyclable materials (wood, paper, plastics, and glass) will be accumulated to warrant transportation to a recycling facility.

Waste tyres will be removed by the contracted tyre companies whom each time replace tyres on machinery and mine vehicles.

Hazardous waste
Hazardous waste to be generated by the mine operations will include hydrocarbons, hydrocarbon contaminated material from construction and operational areas, workshop and wash bay area. Polychlorinated Biphenyl (PCB) waste or PCB containing waste (>50mg/kg or 50ppm) other assorted waste from hydraulic mining activities, spent process chemicals, domestic chemicals, spent gas cylinders, batteries, fluorescent tubes may also be generated during the construction and operation of the mine.

Hazardous waste bins will be provided onsite and stored on concrete floors and be roofed.

A suitable disposal point would need to be identified for hazardous wastes emanating from mine. At this stage it is proposed that such waste be taken to the Holfontein Hazardous Waste Landfill in Gauteng. It is however proposed that as much of the hazardous waste as possible be recycled, delisted or reused which in turn could also have a significant impact on costs of transporting these wastes to the Holfontein Hazardous Waste Landfill.

Mine Waste
The mining waste will include waste and materials such as overburden, waste from the crushing and screening for operational areas.

Overburden Stockpile
Overburden and ore will be stockpiled temporarily for the LoM.

Overburden excavated from strip mined areas will be used as backfill and placed directly back into the previously mined pits, some overburden needs to be stockpiled for final covering. Thus two stockpile yards will be created during the operational phase. Topsoil will be stripped ahead of mining and stockpiled separately from the soft and hard overburden. Generally close to the open pit/strip for progressive rehabilitation.

The waste material and ore to be generated as part of the project needs to be sampled and analysed in accordance with the NEM: WA and DWS legislative guidelines to determine the waste management facility requirements. A Geochemical Assessment (Digby Wells) desktop study was undertaken, based on case studies of similar projects with the same geology and mineralogical settings in the eastern limb of the BIC; also with magnetite and vanadium bearing ore being the target mineral.

The results of the study indicated a low metal leach (ML) potential from waste material. The overburden/waste material and ore has been cautiously classified as Type 3 waste (moderate risk/hazardous) and would require a facility design according to a Class C landfill site.

All ore laydown areas would hence need to be designed with storm water control and a liner, an impervious layer. The storm water management system should capture all contaminated storm water from the stockpiles and convey it through silt traps and finally the PCD.

Crusher and Screening Plant – waste ore

The RoM will be crushed and screened on site. No washing of ore will be undertaken; hence no silt will be generated at this operation. The only waste expected from crushing and screening would be ore fines, uneconomical to transport to the end user. The ore fines will be backfilled along with overburden into strip mined areas.

Table 19: Estimated waste ore fines from the Crushing and Screening Plant

Run of Mine	Plant Yield Scenario	Plant waste ore (%)	Waste ore fines (tons/period/scenario)
800 tons / day	90%	10%	80t / day
	95%	5%	40t / day
	98%	2%	16t / day
200kt/annum	90%	10%	20kt / annum
	95%	5%	10kt / annum
	98%	2%	4kt / annum
700kt/annum	90%	10%	70kt / annum
	95%	5%	35kt / annum
	98%	2%	14kt / annum

Run of Mine and Product Stockpiles

The RoM and saleable product will consist of broken ore product namely, vanadium-bearing titaniferous magnetite. The final product stockpile on the mine site has been planned close the weighbridge with an extent of 7881m^2.

All ore laydown areas need to be designed with storm water control and a liner, an impervious layer. The storm water management system should capture all contaminated storm water from the stockpiles and convey it through silt traps and finally the PCD.

Product Stockpile at Roossenekal Railsiding:

A final product stockpile is planned at the Roossenekal Railsiding with a combined surface area of 2474m^2. Raw ore product will be offloaded at the stockpile area for reload onto the train wagons for shipment to Vanchem. There is an existing gravel access road from the R555

Steelpoort/Stoffberg Road leading the siding. A distance of 15m of this road (specifically at the stockpile area) will be widened to 15m to accommodate the tipper trucks.

4.10.8 Water and Electricity Requirements

NRR Mining and Consulting Engineers have prepared a Water & Electricity Estimation Report dated 31 March 2016. The report sets out the water and electricity requirements for the Geluk Mine project. Refer to Appendix 4: Water and Electricity Estimation.

4.10.8.1 Water Requirements

The mine will require potable water and mine service water. The water will be sourced from recycled mine return water and Sekhukhune District Municipality. The latter, is still be confirmed through a services agreement.

Makhuduthamaga LM is not a water service provider/authority, Sekhukhune District is. Water supply would need to be requested from the district municipality.

The potable water demand has been estimated to be 5280 litres per day (5.28m³/day) which includes a 10% loss allowance. Due to the mining method proposed, the mine will require minimal amounts of drilling water. When the mine is at full production rate an estimated total workforce of 100 people will be on site. This will bring a potable water demand high and for this reason, a Braithwaite tank will be built in a close proximity of the mine. The tank will be sized accordingly to support the mine operations with water. Water will be gravity fed from the elevated tank via steel pipelines to surface infrastructure and down the mining pit area. Where water pressure is low a booster pump will be installed. Pipelines will pass under roadways through culverts.

The mine service water consumption has been estimated to be a maximum requirement of 370m³/day. Any Mine return water will be pumped back to surface via a return water system. The return water will comprise water used by drill rigs, wash down water and groundwater encountered. The mine return will be recycled and used as mine service water. Due to water losses through evaporation, wasted potable water from the district/local municipality will be used as makeup water.

Table 20: Potable and Mine Service Water Consumption Estimate

Potable Water			**Mine Service Water**		
Consumers	**Rate**	**Volume**	**Uses**	**Rate**	**Volume**
Staff consumption and ablution Kitchen Sensitive machines Waste/Water losses	5litres/person@ 100 people 100l/kitchen 4200l/machine 10%	5280l/day OR 5.28m^3/day	Drillling water Dust suppression Washing of vehicles/Wash down water	333m^3/day 49m^3/day	370m^3/day
Total water usage envisaged		**375.28m^3 / day**			

According to the Geohydrological Investigation for the Geluk Mine project conducted by Naledzi Waterworks, the simulated groundwater inflows into mining blocks during the LoM

will be low between years 1-25 and increase rapidly in years 26-30. The inflows will be range as follows:

- 0 - 6m^3/day in Year 1-15;
- 6-31m3/day in year 15-25;
- 161m3/day in Years 26-30

The above inflow results indicate that the mine will mostly depend on municipal water supply for 80% of its LoM (according to the groundwater model and mining scheduling). Only by year 26 of operation will the mine cut its water requirement from the local municipality by 50% due to available groundwater encountered.

4.10.8.2 Electricity Requirements

Several installations and equipment on the mine will source power from Eskom's electricity supply through the sub-station to be constructed on the mine. The estimated bulk power requirement of the mining operation is 4 MVA. Eskom is yet to confirm its capacity to service the mine.

Eskom supply required for reticulation to load areas on the mine property is as follows:

- 11kV, 50Hz, 3 phase
- 525V,50Hz, 3 phase
- 220V, 50Hz, 1 phase + neutral
- 110V, 50Hz, 1 phase (L plus N)

The mine will require the construction of a substation on site and reticulation line for its operational electricity supply. (It does not form part of this EIA process).

Temporary power is however required for construction purposes prior to availability of Eskom intake supply. This power will be required for the contractor's camp, surface reticulation and development power for the belt conveyors, crushing and screening plant. Electrical pumps will be used for the dewatering of pits, including pumps for pollution control dams. It is recommended that diesel generators be used during the initial stage of the project and once the project has reached the steady state Eskom power will be available at that time.

4.10.9 Offices

A mobile office will be established (4x10m) for the weighbridge to serve as a control room.

4.10.10Stores and Material

A containerized store will be provided by the contractor, in the contractor's yard, to hold a limited store of high use items such as oils, grease, air filters etc.

4.10.11Maintenance / Workshop

A workshop (10m x 10m) will be established in the contractor's yard. The workshop will have a concrete floor and will be enclosed. The workshop will be used for servicing of vehicles and other on-site repairs and maintenance.

4.10.12Project Labour Requirements

The mine and operations staff complement has been utilised to determine the volume of services / water required per day. When the mine is at full production rate (700 000 tons/annum) an estimated total workforce of 100 people will be on site (Table 21).

Table 21: Proposed Mine Labour requirements according to production rate

Year Number	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6-30
Mine Plan	Site establishment and mining operation commences	Strip mining continues- main seam	Mining continues- main seam	Mining continues- main seam	Mining continues- main seam	Mining continues – main seam
Tons Product Mined	240 000	240 000	240 000	300 000	480 000	700 000
Total Staffing	7 + 22 core contractors	7 + 22 core contractors	7 + 22 core contractors	7 + 22 core contractors	7 + 43 core contractors	100

4.10.13Operating hours / Operating Shifts

The mine will operate as follows:

Year 1-5: 8 hours/day = 1 shift / day
The estimated annual shifts will be 254. The operational hours per year are estimated at 1740 hours/annum. The operation shift will be from 07:00hrs – 16:00hrs.

Year 6-30: 16 hours / day = 2 shifts; 8 hour day shift and 8 hour night shift
By Year 6 the shift configuration will change from 1 shift to 2 shifts bringing the total shifts per annum to 508 and possible hours to 3480. Thus when the mine ramps up its capacity there will a night shift as well. The alternative shift times being considered are: 16:00pm – 01:00 am OR 08:00pm – 06:00 am.

Blasting activities will take place during the day shift (13:00pm twice a week). Transportation of raw ore product to the Roossenekal Rail siding will also only be undertaken during the day shift.

4.10.14Construction Camp

The construction phase of the project will require the establishment of a construction camp. These areas will only be established within the development footprint of proposed mine infrastructure, once topsoil and vegetation stripping has taken place. Each yard will be fenced off and include the following:

- Temporary ablution
- Material storage areas
- Fuel storage tanks
- Waste storage containers
- Concrete batching areas
- Vehicle Workshops and washbays

It is anticipated that construction staff will commute to and from site on a daily basis via transport provided by the construction contractor.

Some of the construction infrastructure may/will remain for the operation phase of the mine.

4.11 PROJECT METHOD STATEMENT

There are four phases relevant to the proposed project, namely;

- Construction Phase
- Operational and Maintenance Phase
- Rehabilitation phase
- Decommissioning and Closure Phase

The mining activities and estimated timeframes for implementation are scheduled below.

Table 22: Phases of the Geluk Mine Development

Activity	Duration
a. CONSTRUCTION PHASE:	
Construction of haulage roads and stream crossing, establishment of mine&water infrastructure	12 months Year 0
Establishment of product stockpiles at rail siding (concurrent to mine establishment)	
Create toe trenches and silt traps	
Construct / establish stockpile yards according to liner and storm water requirements	
Construction of pollution control dam	
b. OPERATIONAL PHASE:	
Topsoil removal and Overburden Stripping	30 years Year 1-30
RoM through Crushing and Screening Plant	
Continued mining operation and mineral processing	
c. **REHABILITATION PHASE:**	
The mining activity will consist of strip mining and simultaneous rehabilitation. Roll-over methodology will be used where stripped overburden is place directly back into previously stripped mined areas.	On-going during LoM
d. **DECOMMISSIONING AND CLOSURE PHASE**	
Application for mine closure	5 years
During the LoM overburden stripped from mining strips, ore fines from the crushing and screening plant will be backfilled into previously strip mined areas. Limited waste will be left in stockpile yards when production halts. The mining pit areas will be landscaped to mimic the topography and topsoil will be spread over these areas to re-establish vegetation.	
Demolish and removal of mine infrastructure, rehabilitation of roads and removal of fences.	
Maintenance and aftercare post mine-closure	

a. CONSTRUCTION PHASE:

The mining operations, including construction and establishment of the mine infrastructure will commence immediately after the granting of the Environmental Authorisation and Mining Right by the DMR. (Rezoning of land permit from the local authority also in place).

Rakhoma will mobilize the skills and capital equipment in preparation for the commencement of the mining activities. It is after this date that the timeframes and scheduling of the implementation phases for the mine and production build-up commence. The construction phase will involve the following:

- Clearing of vegetation for mine infrastructure establishment and perimeter fence.
- Installation of perimeter fence line;
- Construction of an access road and intersection from the D2219 Jane Furse Road to mine;
- Installation of boom gates on the D2219 to implement road closure during blasting activities to be undertaken during the operational phase;
- Civil construction works;
- Construction of the weighbridge, internal haulage road and bridge over the Shakwaneng River;
- Construction of further internal haul roads;
- Building activities;
- Hauling material to and from specific areas;
- Construction of storm water system, pipe system and pollution control dam;
- Construction of water infrastructure;
- Construction and preparation of stockpile yards and RoM pad with liners:
- Construction of waste management facilities, establishment of temporary chemical toilets;
- Widening of the existing gravel road by at the rail siding product stockpile;
- Construction of retainer wall, loading station and stockpile area at rail siding;
- Construction/Establishment of containerized materials store, mobile office ;
- Construction of fuel storage and handling areas
- Creation of laydown yards;

b. OPERATIONAL PHASE:

The life of the mine will be 30 years. The operational phase will include the following activities;

- Site preparation through vegetation clearance
- Creation of toe trenches and silt traps;
- Topsoil removal and overburden stripping to open up mining strips;
- From here the exposed ore blocks will be drilled and blasted to reduce its size;
- The blasted/broken ore will be loaded and hauled to the Run of Mine pad;
- Crushing and Screening of Run of Mine through a mobile plant;
- From the Crushing and Screening plant will be moved to the final Product Stockpile;
- Loading product onto 34 ton interlink tipper trucks and weighing the trucks for shipment to Vanchem;
- Transportation of product the Roossenekal Rail siding product stockpile with interlink tipper trucks;
- Offloading of product at the rail siding product stockpile and reloading product onto train wagons;
- Continuous rehabilitation of strip mined areas by placing overburden, ore fines directly back into strip mined areas;

c. DECOMMMISSIONING AND CLOSURE PHASE

Closure' refers to the process for ensuring that mining operations are closed in an environmentally responsible manner, usually with the dual objectives of ensuring sustainable post-mining land uses and remedying negative impacts on biodiversity and ecosystem services.

Upon depletion of the economic reserve of the mine it will be closed down and the mining areas will be rehabilitated to state suitable for grazing activities. The general area/region is characterised by grazing and due to this the acceptable final land use was considered grazing.

During the life of mine, stripping and rehabilitation will be done simultaneously. This includes reshaping and re-vegetating the land to restore it to a stable condition for grazing purposes. Grass runners and indigenous trees and aloes can then be planted in the contours. The decommissioning and closure phase will consist of the following activities:

- Application for a Mine Closure Certificate from DMR;
- Backfill of mined areas: During the LoM overburden stripped from mining strips as well as ore fines from the crushing plant will be backfilled into previously strip mined areas;
- Testing of soils for contamination, removal to a waste disposal facility if necessary;
- Planting of grass and vegetation at the rehabilitated areas;
- Removal of mine infrastructure
- Rehabilitation of access roads;
- Removal of mobile and temporary structures, fences;
- Alien vegetation removal
- Maintenance and aftercare post mine closure (5 years);

SECTION C: POLICY AND LEGISLATIVE REQUIREMENTS,

1. POLICY AND LEGISLATIVE REQUIREMENTS OF PROJECT

The EIA Regulations of 2014, Appendix 3 require that the EIR include a description of the policy and legislative context within which the development is proposed including an identification of all legislative, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.

South Africa has sound environmental legislation aimed at achieving sustainable development, including laws that support public participation, impact assessment and environmental management. Mining companies also need to comply with a range of other laws which regulate mining impact on the environment. These include amongst others:

- National Legislation;
- Provincial Legislation,
- Biodiversity Conservation Plans, Environmental Management Frameworks;
- Municipal Planning Frameworks
- Guideline Documents

The requirements of the applicable legislations or acts are outlined below.

5.1 NATIONAL LEGISLATION

5.1.1 Constitution of the Republic of Southern Africa Act No 108 of 1996

The Constitution of South Africa is the supreme law of the country of South Africa. It provides the legal foundation for the existence of the republic, sets out the rights and duties of its citizens, and defines the structure of the government.

Section 24(a) of the Constitution states that everyone has the right 'to an environment that is not harmful to their health or well-being'. Mines must comply with South African constitutional law by conducting their activities with due diligence and care for the rights of others.

5.1.2 Mineral Petroleum Resources Development Act No 28 of 2002

In terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act No. 28 of 2002) and its subsequent amendments of 2008, 2014 and the MPRDA Regulations R. 527, an application for a mining right must be supported by an EIA process.

In terms of Regulation 48 of R. 527 – MPRDA Regulations of 2004, a mining right must be supported by an EIA process ito Regulations 39 (1) which results in the following environmental reports: a Scoping Report conforming to Regulation 49(1) of R.527 must be submitted to the DMR, followed by an EIA report conforming to Regulation 50 and an EMPr conforming to Regulation 51.

As part of the EIA process in terms of Regulation 3 of R. 527), consultation must take place with interested and affected parties (I&APs).

The application for a mining right must be submitted simultaneously with an Application for Environmental Authorisation to DMR. DMR as of 04 December 2014 has been delegated the powers to act as the competent authority in respect of activities relating to mining in terms of the National Environmental Management Act, 107 of 1998. An application for a Mining Right and Environmental Authorisation has been submitted to DMR.

The MPRDA thus requires mining operators to obtain environmental approval in advance of operations. It imposes on-going environmental management and mitigation obligations throughout the mine life cycle through a management programme. The EMPr also requires the applicant to set out the financial provision for mitigation. Regulations 51 (a)(i) of MPRDA further requires environmental objectives and goals for closure to be included in the EIR and EMPr which highlight the need to plan for closure of the operations.

5.1.3 National Environmental Management Act No 107 of 1998

The National Environmental Management Act, 1998 (Act 107 of 1998 (NEMA) provides for the co-operative, environmental governance by establishing principles for decision making on matters affecting the environment, institutions that will promote cooperative governance and procedures for co coordinating environmental functions exercised by organs of state.

The Environmental Management principles set out in NEMA should guide decision making throughout the mining life cycle to reflect the objective of sustainable development.

In terms of EIA Regulations published in Government Notice R982, R983, R984 and R985 of 4 December 2014 under Section 24 (5) of the National Environmental Management Act No. 107 of 1998 (NEMA) the application for a Mining Right is subject to an Application for Environmental Authorisation. Government Notice R983, R984 and R985 schedules listed activities which require environmental authorisation. The proposed mining operation triggers, mainly, Activity 17 (activities and operations related to mining right) under GNR 984 which is subject to a full Scoping and EIA process. Rakhoma has applied to DMR for environmental authorisation in this regard.

Rakhoma is required to undertake an EIA process and submit a Scoping Report, and EIR and EMPr, which describe the potential environmental impacts of the proposed mining project, how such impacts will be managed and how the disturbed area will be managed.

The EIR and EMPr have been prepared in accordance to Appendix 3 and 4 of the EIA Regulations 2014. It is currently being distributed for public review before submission to the DMR for decision making.

Section 28 of NEMA is also of key importance and places "Duty of care and remediation of environmental damage" on the developer/applicant.

Section 28 (1) of NEMA states:
"Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment."

(2) *Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-*

a) any activity or process is or was performed or undertaken; or
b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.

(3) The measures required in terms of subsection (1) may include measures to-

(a) investigate, assess and evaluate the impact on the environment;
(b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
(c) cease, modify or control any act, activity or process causing the pollution or degradation;
(d) contain or prevent the movement of pollutants or the causing of degradation;
(e) eliminate any source of the pollution or degradation; or
(f) remedy the effects of the pollution or degradation."

Accordingly, Rakhoma is undertaking an Environmental Impact Assessment to investigate and evaluate the potential impacts associated with the proposed mining operation and identify means to mitigate/contain negative impacts and prevent unacceptable impacts on the

environment. Specialist evaluations and recommendations are sourced on all aspects of the biophysical and social environment to determine such. This is considered a "reasonable step" to prevent pollution or degradation of the environment which may result from the proposal.

5.1.4 National Environmental Management Waste Act No 58 of 2008 (NEM: WA)

The National Environmental Management Waste Act no 58 of 2008 (NEMWA) is the principal act governing waste management within South Africa since 2009. The objectives of the act involve the protection of health, wellbeing and the environment. It provides measures for to avoiding and minimising the generation of waste, reducing, recycling and recovering waste, and treating and safely disposing of waste. It further requires that all waste management activities must be licensed and are subject to a Basic Assessment or full EIA process.

Activities which require a waste management license (WML) have been published under GN R921 of 29 November 2013 and GNR 633 of 24 July 2015 in terms of Section 19 of the NEMWA. GNR 633/2015 recently inserted residue deposits resultant from mining as a Category B activity which requires a WML under the provisions of NEM: WA. The Geluk Mine project will result in overburden, ore fines and ore stockpiles which will be temporarily stockpiled for the LoM. The project thus requires a WML and is subject to a full EIA Process.

Table 23: Residue Deposits and Residue Stockpile wastes

1. Wastes resulting from exploration, mining, quarrying, and physical and chemical treatment of minerals	a) Waste from mineral excavation
	b) Wastes from physical and chemical processing of metalliferous minerals
	c) Wastes from physical and chemical processing of non-metalliferous minerals
	d) Wastes from drilling muds and other drilling operations

Rakhoma has applied for an integrated Environmental Authorisation and WML. As, the project is already subject to an EIA process under NEMA, Section 44 of the NEM: WA makes provision for integration of the processes. Hence an integrated EA&WML EIA Process is followed for the project.

Post July 2015, NEM: WA has become the regulator of mineral waste and predefines it as hazardous. The act applies technical requirements of small landfills to large mine residue deposits. It also further requires that liners (pollution control barriers) for certain mineral waste facilities be implemented. The type of facility can only be determined by classifying the proposed mine's waste material and product. As a result the act requires the assessment of waste products, to determine the mineralogical and chemical nature of the material and its potential hazard to the environment.

Accordingly, the waste to be disposed at the Geluk mine has been cautiously classified through a Desktop Geochemistry Assessment as Type 3 waste (moderate risk/hazardous) with low metal leach potential. The conclusion is that stockpile yards for mine waste will require a Class C Landfill facility design/liner. This is however still to be confirmed by official laboratory testing.

Note that the overburden stockpile/ore fine pile facilities will not be permanent disposal sites; strip mining with concurrent rehabilitation will be implemented where the strips are opened up resulting in a stockpile of material that will be placed back into the mine pits and used for rehabilitation on site. Facility design will thus be for a temporary period 1 year and for the final product stockpile for 1-30 years.

5.1.5 National Water Act No 36 of 1998 (NWA)

The principles and objectives of the NWA are to guide the protection, use, development, conservation, management and control of water resources in a sustainable and equitable manner for the benefits of all persons.

Section 19 of the National Water Act, 36 of 1998 deals with prevention and remedying effects of pollution in particular where pollution of water resources occurs or might occur as a result of activities on land. The person who owns controls, occupies or uses the land in question is responsible for taking measures to prevent pollution of water resources. If these measures are not taken, the catchment management agency concerned may itself do whatever is necessary to prevent the pollution or to remedy its effects, and to recover all reasonable costs from the persons responsible for the pollution.

In terms of Section 19 the following is stated:
(1) An owner of land, a person in control of land or a person who occupies or uses the land on which -

a. any activity or process is or was performed or undertaken; or
b. any other situation exists, which causes, has caused or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring.

(2) The measures referred to in subsection (1) may include measures to -

a. cease, modify or control any act or process causing the pollution;
b. comply with any prescribed waste standard or management practice;
c. contain or prevent the movement of pollutants;
d. eliminate any source of the pollution;
e. remedy the effects of the pollution; and
f. remedy the effects of any disturbance to the bed and banks of a watercourse.

The proposed mining operation requires a water use license application (WULA) in terms of Section 21 of the National Water Act, 1998 (Act 36 of 1998) (NWA). WULA will be submitted to the Regional office of the Department of Water and Sanitation (DWS): Olifants Management Catchment Agency under the provision of the NWA. The application process is integrated and conducted parallel with the EIA Process. The potential water uses include:

- Section 21 (a): taking water from a water resource (water from dewatering of pits);
- Section 21 (b): Storage of water (clean water in Braithwaite tanks and return water dam for dewatering of mine pits)
- Section 21 (c): Impeding or diverting the flow of water in a watercourse (Water crossing for the permanent haulage road over the Shakwaneng River; other access roads to cross drainage streams)

- Section 21 (i): altering the bed, banks, course or characteristics of a watercourse (Water crossing for the permanent haulage road over the Shakwaneng River; other access roads to cross drainage streams);
- Section 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource; and (dust suppression, and storing of stockpile waste water if any)
- Section 21(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 (dewatering of mining strips)

5.1.6 Integrated Water and Waste Management Plan (IWWMP)

NWA also requires that an Integrated Water and Waste Management Plan (IWWMP) be prepared for the project and submitted with the application for an Integrated Water Use License. The IWWMP will be prepared and submitted to DWS: Olifants Catchment Agency with the IWULA.

An IWWMP is compiled in order to promote the environmentally sustainable and equitable use of water in relation to proposed mining operations. The IWWMP is intended to be a simple, feasible, implementable plan for the Mine based on site specific programmes, also taking into account the National Water Resource Strategy (NWRS), relevant Catchment Management Strategy (CS), Resource Quality Objectives (RQO) and the sensitivity of the receiving water resources and down-stream water users in the vicinity of the mine.

5.1.7 Mine-Water Regulation 704 National Water Act No 36 of 1998 (NWA)

Government Notice (GN) No. R. 704 published under NWA are considered the “Mine-water Regulations”. It is aimed at ensuring the protection of water resources through restrictions on locality, material, and the design, construction, maintenance and operation of separate clean and dirty water systems. Restrictions to locality refers specifically to placement of mine infrastructure and pollution control above the 1: 50 and 1: 100 year flood zones or within a horizontal distance of 100m of any watercourse or estuary, borehole or well.

Detailed regulations on the use of water for mine-related activities were issued in 1999 under the National Water Act framework.

The Shakwaneng River and 3 other small streams drain through the Geluk Mine project site. The 1: 100 year flood line has been calculated for these four catchments. It is higher and safer than the 50-year flood line. As long as mine infrastructure is located outside the 100 year flood line it would automatically also locate outside the 50-year flood area of inundation.

Due to the deeply incised stream channels of the four catchments the flood lines are less than 100m from the centre line of the streams, as prescribed in GN704, thus in this instance, the 100m buffer zone would apply in any case. It's only in the lower reaches of the Shakwaneng and Ironstone Streams that the flood lines actually exceed the 100-m buffer zone in places, and therefore the flood lines would be the "greater distance" ("*whichever distance is the greatest"*) in terms of the legislation.

In terms of Regulation 6 of GNR 704 there is a capacity requirement for clean and dirty water systems. It requires that water from dirty mine areas, seeping from mining operations need to

be collected into a dirty water system. The mine design will cater for a mine return water dam/pollution control dam (PCD). The PCD design capacity and freeboard will comply with the specifications as set out in regulation 6 (e) and 6(f).

5.1.8 National Heritage Resources Act No. 25 of 1999

The National Heritage Resources Act, 1999 (NHRA) protects all structures and features older than 60 years (Section 24), archaeological sites and material (Section 35) and graves and burial sites (Section 36). Potential impacts on heritage and archaeological resources during the construction phase include the likelihood of unearthing of heritage and archaeological resources especially during the construction phase of the project. The NHRA thus protects:

- Burial sites
- Buildings of more than 60 years
- Paleontological objects
- Special geological features (fossil prints, bushman rock art)

A Heritage Impact Assessment was prepared in terms of section 38 of the National Heritage Resource Act (Act 25 of 1999). It is attached to this EIR.

The study identified the following:

- Three isolated cemeteries in association with built up areas (settlements of Maphopha, Ga-Mogashoa) and should be avoided;
- Two stone wall sites were noted and geo-referenced one in close proximity to a soccer field and the other one at the western Shakwaneng river bank, these stone walling sites seem to represent recent past activity periods.

The cemeteries will not be affected by mining, as it is located outside the mining footprint. The stone wall sites are in proximity of the mining resource and must be avoided by the mining activities.

The Limpopo Heritage Resources Authority has also indicated the requirement for inclusion of an Anthropological Assessment. Interviews will be conducted with communities in this regard during the EIA public consultation meetings (EIR public review meetings).

5.1.9 National Environmental Management: Air Quality Act No 39 of 2004

The National Environmental Management: Air Quality Act, 2004 (NEM: AQ) regulates air quality to protect the environment by providing measures for prevention of pollution and ecological degradation and securing ecological sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring. It further requires that all activities resulting in atmospheric emissions and which have a detrimental impact on the environmental require an Air Emissions License (AEL)

A list of activities resulting in atmospheric emissions requiring an AEL has been published under Government Notice 893 of 22 November 2013 in terms of Section 21 of NEM: AQA. The proposed mining operation will not include any such listed activities and no AEL is therefore required.

A set of National Dust Control Regulations were gazetted on 1 November of 2013 in terms of Section 53 (o), read with Section 32 of the NEM:AQA (39 of 2004). These regulations prescribe a standard for acceptable dust fall rate for residential (<600mg/m2/day) and non – residential areas (< 1200mg/m^2/day). The method to be used to measure dust fall rate and the guideline for locating sampling points shall be according to the American Standard Testing Methodology (ASTM) D1739:1970 or equivalent. In addition to the dust fall limits, the National Dust Control Regulations prescribe monitoring procedures and reporting requirements.

For the Geluk Mine project, an Air Quality and Dust Impact Assessment were undertaken as part of the EIA process to evaluate the potential main air emissions from the project and its impact on the ambient air quality. In the evaluation of air emissions and ambient air quality impacts reference is made to National Ambient Air Quality Standards (NAAQS). These standards generally apply only to a number of common air pollutants, collectively known as criteria pollutants. Criteria pollutants typically include sulfur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO),inhalable particulate matter (including thoracic particulate matter with an aerodynamic diameter of equal to or less than 10 µm or PM10 and Inhalable particulate matter with an aerodynamic meter equal to or less than 2.5 µm or PM2.5), benzene, ozone and lead.

Particulates represent the main pollutants of concern in the assessment of operations from the proposed project. Hence, the impacts were assessed against published NAAQS and National Dust Control Regulations (NDCR).

5.1.10 National Environmental Management: Biodiversity Act No 10 of 2004

The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed.

The list of threatened and protected species issued in terms of Section 56 (1) of the NEMBA has been considered in this application and occurrence of species on site has been assessed.

South Africa also uses the internationally endorsed World Organisation-International Union for Conservation of Nature (IUCN) **IUCN Red List Categories and Criteria** in the Red List of South African plants.

An Ecological Impact Assessment study focussing on Fauna and Flora was conducted for the project site and is attached to the EIR. The study identified two species of conservation concern which were identified during the ecological specialist site visit. Species of conservation concern are those species that are facing a risk of extinction. *Crinum macowanii* (River lily) and *Ilex mitis* (Cape holly) were identified along the Shakwaneng River. Both these species are classified as Declining according to the SANBI Red List of species. A permit is required to remove these plants should they fall within the construction site. The authority controlling the issuing of permits in the Limpopo province is the Limpopo Department of Economic Development, Environment and Tourism (LEDET).

Three red listed avifaunal species have been recorded on site, *Eupodotis senegalensis*, *Sagittarius serpentarius* and *Gyps coprotheres* with *Ciconia nigra* being observed on site. Reptile species of concern are the Soutspansberg Flat Lizard, Sekhukhune flat lizard (*subspp. Fitzsimons*) and South African Rock Python.

The location of proposed projects in terms of ecological ecosystems is essential in the Sekhukhuneland due to the regions high ecological integrity. In view of this, the majority of the Geluk Mine project site falls within the Sekhukhune Mountain Bushveld. Its ecosystem status in terms of the NEM: BA 2011 is least threatened. Its ecosystem status in terms of provincial sector plans are correspondingly least threatened. The project site is located within the Sekhukhune Centre of Plant Endemism (*particularly the ridge and mountain system in the eastern portion of site*).

The project site is not situated in a national threatened ecosystem. It is located north, outside **the Sekhukhune Mountainlands vegetation region which is an endangered National Threatened Ecosystem. Refer to Figure 14.**

The Aquatic Ecosystems Impact Assessment focussed on the impact of the project on aquatic ecosystems and wetlands and is attached to this EIR. The study examinated the National Freshwater Ecosystem Priority Areas (NFEPA's) database. The project is located within a Phase 2 FEPA and associated sub-quaternary catchment. This FEPA refers to moderately modified (C) rivers. The condition of this Phase 2 FEPA's should not be degraded further. It is dicussed further under Section 6.4.5.

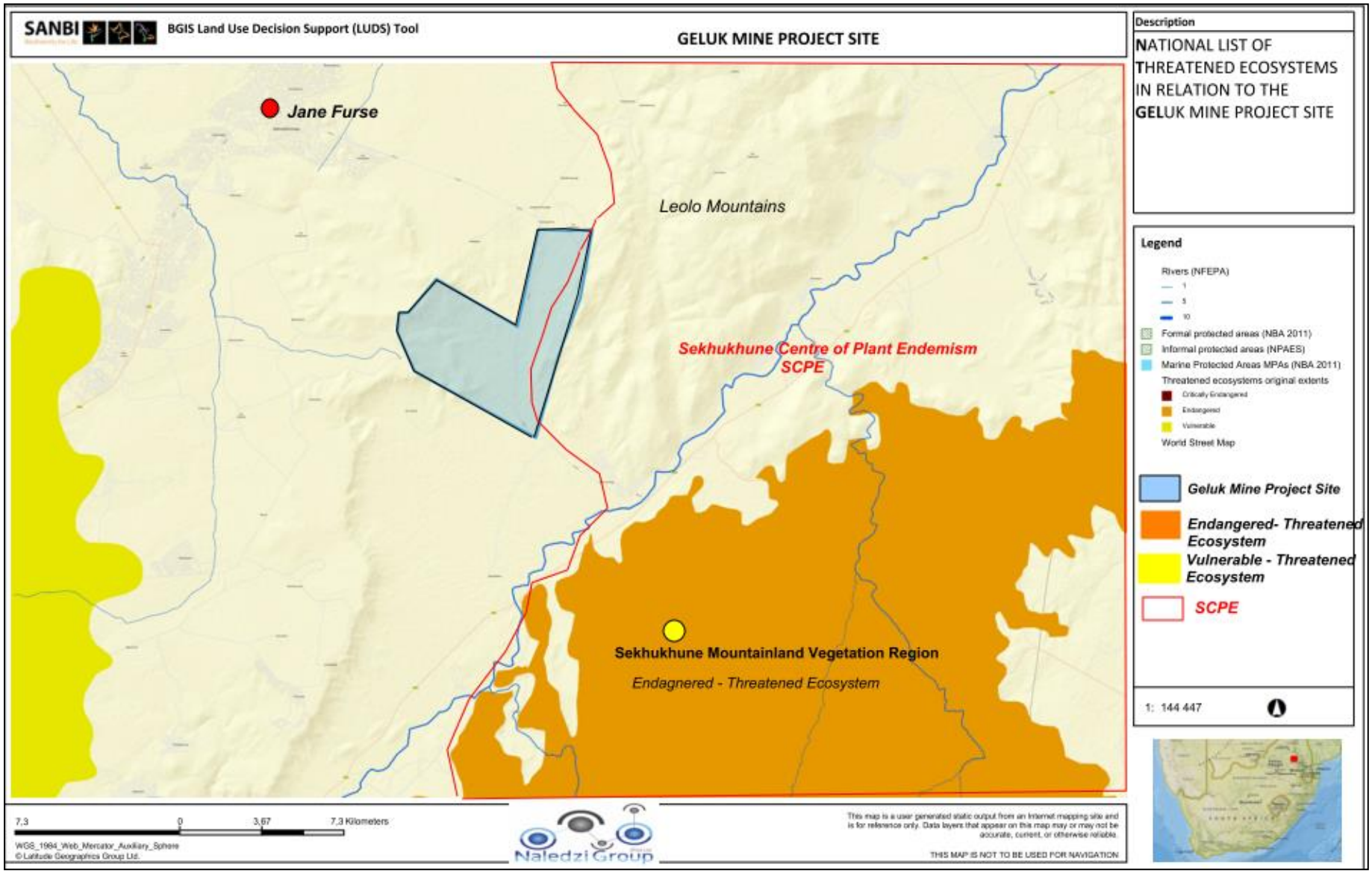


Figure 14: Nationally Threatened Ecosystems in relation to the Geluk Mine Project Site

5.1.11 National Forest Act No 84 of 1998

The purpose of the Forest Act is to protect natural forests and woodlands as it forms an important part of that environment and need to be conserved and developed according to the principles of sustainable management. Plantation forests play an important role in the economy and have an impact on the environment and need to be managed appropriately.

In terms of Section 15(1) of the act, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated.

Protected tree species were identified on site by Naledzi, such as the Marula (Sclerocarya birrea.subsp. caffra), Shepards Tree (Boscia Albitrunca). Protected species identified within the project area will require removal permits/licenses from controlling authority Department of Agriculture, Forestry and Fisheries (DAFF).

It was highlighted by DAFF during a Key Stakeholders Workshop that two tree species will occur in the application area, namely, Cartha Edulis and Cartha Transvaalenis (Lyenburgia assinoides) / Sekhukhuni Bushman's Tea, also a protected tree species, only confined to Sekhukhune Mountainlands. However, these tree species was absent during the ecological field investigations. The investigation was undertaken over 4 days in April 2016. An ecologist can reaffirm its absence/presence via a survey prior to site establishment.

5.1.12 Noise Control Regulations (R154 GG 13717 10 January 1992)- (NCR)

The NCR was promulgated in terms of the Environmental Conservation Act. It defines nuisance noise as; "any sound which disturbs/impair the convenience/piece of any person" and "any noise level which exceeds the zone sound level / or a noise level which exceeds the ambient sound level at the same measuring point by 7dBA or more".

SABS 0103 is South African Bureau of Standards document guideline which is replacement from time to time and was replaced by the SANS 10103: 2008 Edition 6 "*The measurement and rating of environmental noise with respect to annoyance and to speech communication*".

The ambient noise ratings levels are indicated as per Table 24 of SABS 10103:2008.

Table 24: Ambient noise ratings levels (SABS 10103:2008)

1	2	3	4	5	6	7
Type of district	**Equivalent continuous rating level ($L_{Req,T}$) for noise dBA**					
	Outdoors			**Indoors, with open windows**		
	Day/night $L_{R,dn}$[a]	**Daytime $L_{Req,d}$[b]**	**Night-time $L_{Req,n}$[b]**	**Day/night $L_{R,dn}$[a]**	**Daytime $L_{Req,d}$[b]**	**Night-time $L_{Req,n}$[b]**
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

5.1.13 Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)

The Conservation of Agricultural Resources Act (Act 43 of 1983) – (CARA) is an act which provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants and for matters connected therewith.

A Soil and Agricultural Assessment was conducted by Afzelia Environmental Consultants as part of the EIA process. It indicates that the majority of the study site has been categorised as Class VII indicating that most of the site has severe limitations for successful crop yields due to the shallow, rocky soil types. The mine is not expected to have an impact on agricultural production due to agricultural limitations of the site. It indicated that the mine will have a limited negative impact on the surrounding agricultural resources and can be mitigated by management measures through the EMPr.

5.1.14 Decision Making Authority

DMR is the decision making authority for the mining right application, environmental authorisation and waste management license. The WUL application will be submitted to DWS. The applications and its submission to the key authorities is summarised below:

Table 25: Authorising Authorities and authorisations required

AUTHORITY	LEGISLATION	COMPETENCE
Department of Mineral Resources (DMR)	EIA Regulations 2014 under Section 24 of NEMA (GNR. 982) Regulations 21-24, 40-44; EIA Regulations	Decision making authority for mining related activities which require environmental authorisations
	Section 19 of NEM:WA 59/2008 as inserted by 2014 amendment	Decision making authority for activities relating to residue stock piles to mining which require WML
Department of Water and Sanitation	Section 21 water use - National Water Act, 1998 (Act No. 36 of 1998)	Decision making authority on matters related to water

5.2 PROVINCIAL LEGISLATION AND MANAGEMENT PLANS

5.2.1 Limpopo Environmental Management Act No 7 of 2003

The Limpopo Environmental Management Act no 7 of 2003 (LEMA) was written to consolidate and amend the environmental management legislation of the Province. It includes Regulations which call for the protection of indigenous plants, animals which require a permit from provincial authority, LEDET for its pick, sell, removal, donate, in and or export in the province.

The lists of plants and animals are itemized under Schedule 8, 11 and 12 of the act. The lists of species have been considered and included in the Ecological Impact Assessment (Fauna and Flora) conducted by Afzelia Environmental Consultants which is attached to this EIR.

5.2.2 Limpopo Conservation Plan, 2013

LEDET is the custodian of the environment in the Limpopo Province and primary implementing agent of the Limpopo Conservation Plan version 2. The conservation plan informs land use planning, environmental assessments, land and water use authorisations as well as natural resource management, undertaken by a range of sectors whose policies and decisions impact on biodiversity.

This is done by providing a map of biodiversity priority areas, referred to as Critical biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), with accompanying land use planning and decision making guidelines.

The biodiversity priority areas inform land use planning guidelines. Its intent is to provide guidance on what types of land-use activities are compatible with biodiversity management objectives for each CBA map category.

The proposed Geluk project site corresponds to three such biodiversity areas, namely:

- Critical Biodiversity Area 2 (CBA's - Optimal)
- Ecological Support Area 1 (ESA 1)
- Ecological Support Area 2 (ESA 2)

Land use guidelines for the above biodiversity areas corresponding to the project site are discussed in Table 26. The guideline indicates compatible and incompatible land-uses which aid planners to identify appropriate zones to impose on CBA's and ESA's when developing Spatial Development Frameworks, Environmental Management Frameworks, and Land-use management schemes. It also gives evaluators of EIA an indication of appropriate land-use with each area.

Table 26: Project area biodiversity Priority Areas land use guidelines

CBA Map Category	Description	Land Management Objective	Land Management Recommendations	Compatible land use	Incompatible land use
CBA (2)	Best design selected site. Selected to meet biodiversity pattern/ecological process targets.	Maintain in natural state with limited to no biodiversity loss. Maintain current agricultural activities. Land use should not be intensified. Minimise impact on threatened species	Avoid conversion of agricultural land to more intensive land uses which may negatively impact on threatened species / ecological processes.	Agricultural practices (arable, intensive&extensive animal production, game and ecotourism (populations of threatened species maintained and ecological process which support them).	Residential, Business, Mining and Industrial, Infrastructure; More intensive agricultural production than currently undertaken)
ESA (1)	Natural, near natural and degraded areas supporting CBA's by maintaining ecological processes.	Maintain ecosystem functionality and connectivity allowing for limited loss of biodiversity pattern	Implement appropriate zoning and land management guidelines to avoid impacting ecological processes. Avoid intensification of land use and	Conservation and associated activities. Extensive game farming and eco-tourism operations. Extensive livestock production. Urban Open Space System. Low density rural residential, small holdings, resorts	Urban land-use including residential, business, Mining &industrial, infrastructure (roads, power lines, pipelines)

			fragmentation of natural landscape.	where development design and overall densities allow maintenance of ecological functioning.	
ESA (2)	Areas with no natural habitat that is important for supporting ecological processes.	Avoid additional/new impacts on ecological processes.	Maintain current land-use. Avoid intensification of land use, which may result in additional impact on ecological processes.	Existing activities (eg. Arable agriculture) should be maintained, but where possible a transition to less intensive land uses or ecological restoration should be favoured.	Any land use / activity that results in additional impacts on ecological functioning mostly associated with the intensification of land use in these areas (eg. Change of flood plain from arable agriculture to urban land use)

Refer to Figure 15 for a map indicating the Biodiversity Priority Areas corresponding to the project site.

In terms of the LCP, the Geluk Mine proposal is a deviation from the land-use planning objectives for the affected biodiversity priority areas. Mining is considered an incompatible land use for all three biodiversity units.

T**he general recommendations for CBA2 areas are = KEEP IN NATURAL STATE**

- Loss of natural habitat should be minimized i.e. land in this category should be maintained as natural vegetation cover as far as possible;
- These areas of land can act as possible biodiversity offset receiving areas;
- Control of illegal activities (such a hunting and dumping), which impact biodiversity should be prioritized in CBA areas.

<u>Where development proposals other than the preferred biodiversity compatible land uses are submitted in terms of the NEMA: EIA regulations or Land Use Planning Ordinance (LUPO)/SPLUMA:</u>

- A Screening Exercise should be undertaken by an Ecologist to verify the CBA map category on site;
- If the site is verified as a CBA, developments other than the preferred land uses, should be investigated in detail and the mitigation hierarchy applied in full;
- If the application is pursued they should be informed by a specialist biodiversity assessment

Aquatic Ecosystems:

- Maintain water quality and flow regimes should be maintained as close to natural as possible.
- Where Environmental Reserves or Environmental Flow Requirements have been determined these should be strictly adhered to.
- All effluent (including municipal, mining and industrial waste water) as well as acid mine drainage should be treated to required specifications before release.
- Stormwater flow should be managed to avoid damage to CBA2 areas.
- Where CBA2s include floodplains (e.g. areas within the 1:100 year floodline), riperian areas (e.g. as a minimum, the 32m around rivers) or buffers around wetlands, particular attention should applied to ensure that these remain in a natural state or are rehabilitated to this state in order to maintain ecological function. Do not permit infilling, excavation, drainage, hardened surfaces (including buildings and asphalt), intensive agriculture or any new developments within a river or wetland.
- Areas that are degraded or disturbed should be rehabilitated, through programmes such as Working for Water, Working for Wetlands and a systematic alien vegetation eradication programme implemented. Rehabilitation work should be undertaken in a way which does not negatively impact on the survival of threatened species.

The general recommendations for ESA1 areas are – Maintain in an ECOLOGICALFUNCTIONAL STATE.

Similar as for CBA 2, if an application is pursued in terms of NEMA for an inconsistent land use other than specified the EIA study should be informed by a specialist biodiversity assessment.

The general recommendations for ESA2 areas are - Maintain existing and restore ECOLOGICAL FUNCTIONING

Development guidelines in this area indicated where infrastructure is proposed, it should be designed to avoid additional impacts on ecological processes. Current land uses should be maintained, intensification of use (agriculture to urban) should be avoided.

Developments should be screened to ensure that they do not have an unacceptable impact on ecological processes.

An Ecological Impact Assessment has been conducted as part of the EIA study in accordance with the LCP requirements.

However the status quo of these earmarked areas on the proposed mining right area is as follows:

- The majority of the ESA2 areas on site have been transformed by urban sprawl, old cultivated lands, subsistence farming, livestock grazing and gravel roads;
- The ESA1 earmarked area is slowly being transformed by low density urban sprawl in low lying areas, yet still remains largely intact.
- The CBA 2 earmarked area make-up the majority of the project site and is still in natural state. The target area for mining is focused to the eastern portion of the mining right area.

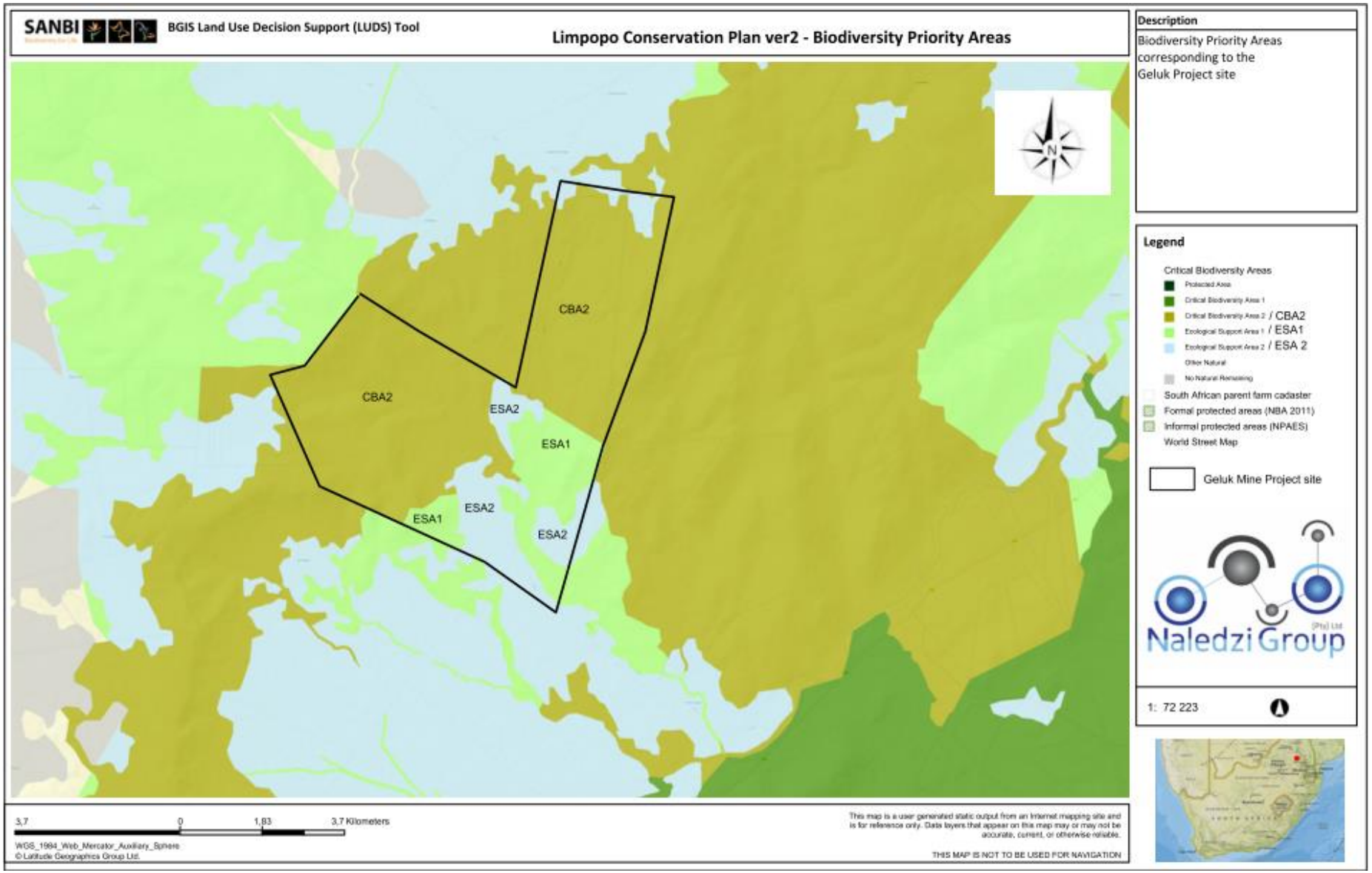


Figure 15: Biodiversity Priority areas in terms of the LCP v2 covering the Geluk Mine project site

5.2.3 Olifants and Letaba River Environmental Management Framework

DEA initiated a process in partnership with the DWS to create a guide for future development and to inform levels of acceptable change for the Olifants River catchment and Letaba River catchment. It was agreed that it is logical to develop EMF as such a guide.

According to the EMF the proposed Geluk Mine project is in an area identified as area focused for mining developments namely Zone E: Rural Sekhukhune/platinum mining focus area (Figure 16). Large sections of natural vegetation of this zone have been removed reducing conservation potential drastically. A large part of the Sekhukhune Centre of Endemism falls within this zone and should be conserved where possible. The mining sector should recognise the importance of the vegetation in this area and that biodiversity offsets should become a part of every mining application that is authorised.

The Geluk Mine project must still also meet the objectives of the Limpopo Conservation Plan.

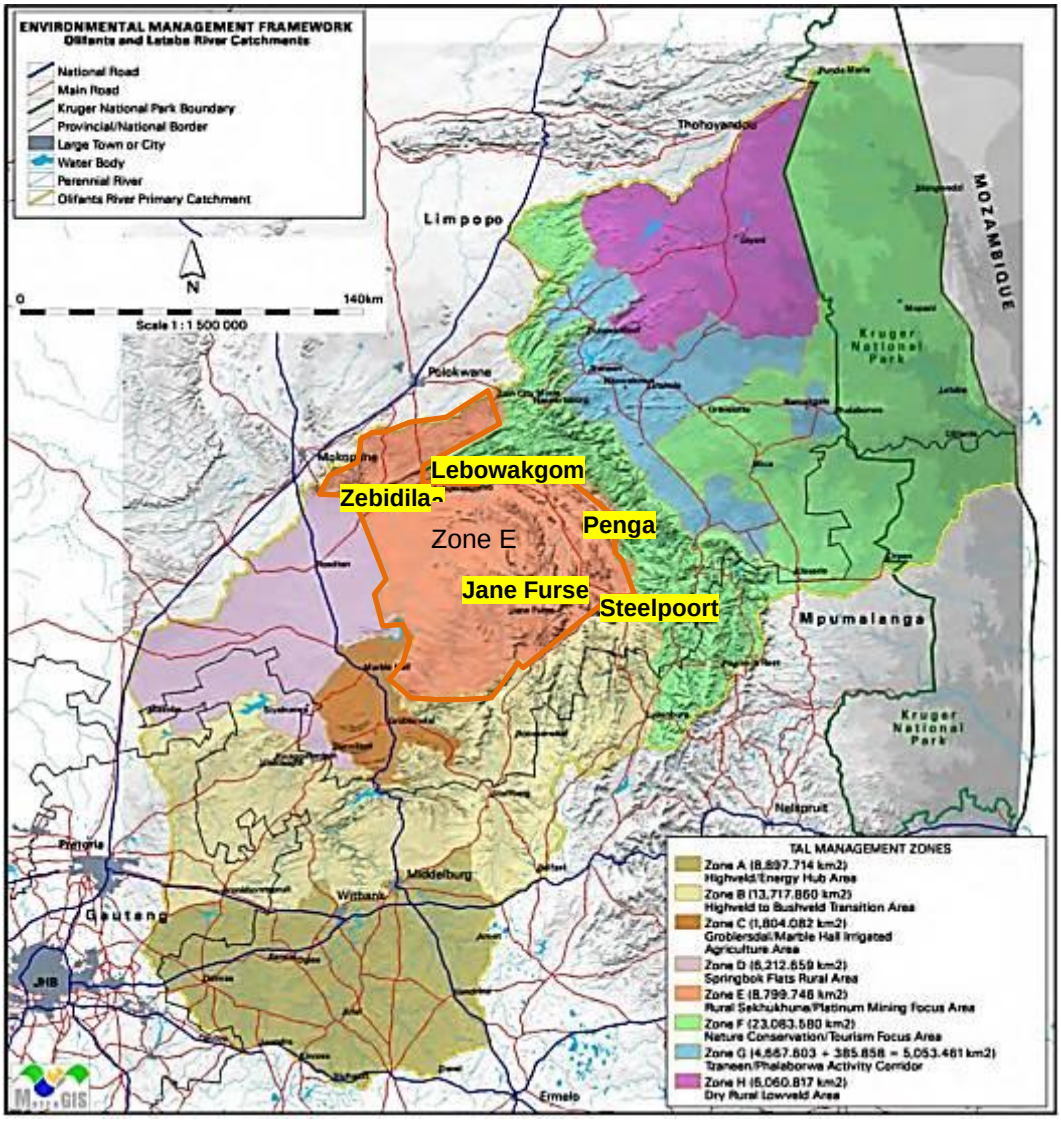


Figure 16: Environmental Management Framework for Letaba Olifants Catchment

5.2.4 Mining and Biodiversity Guideline 2013 (MBG)

The MBG: Mainstreaming the biodiversity into the mining sector (2013) highlights the areas that are legally protected and has a high biodiversity importance. It interprets best biodiversity knowledge and science in term of the implications and risks for mining in a practical and user friendly guideline for integrating relevant biodiversity information into decision making. It was initiated by SAMBF, DEA and DMR with technical input from SANBI.

The guideline provides direction as to where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining. It tells between four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining.

The Geluk Mine project site, according the guideline interactive map (SANBI BGIS), is affected at its western portion by an area classified as "High biodiversity importance – high risk to mining". Refer to Figure 17 for the project's position in terms of areas of high biodiversity importance.

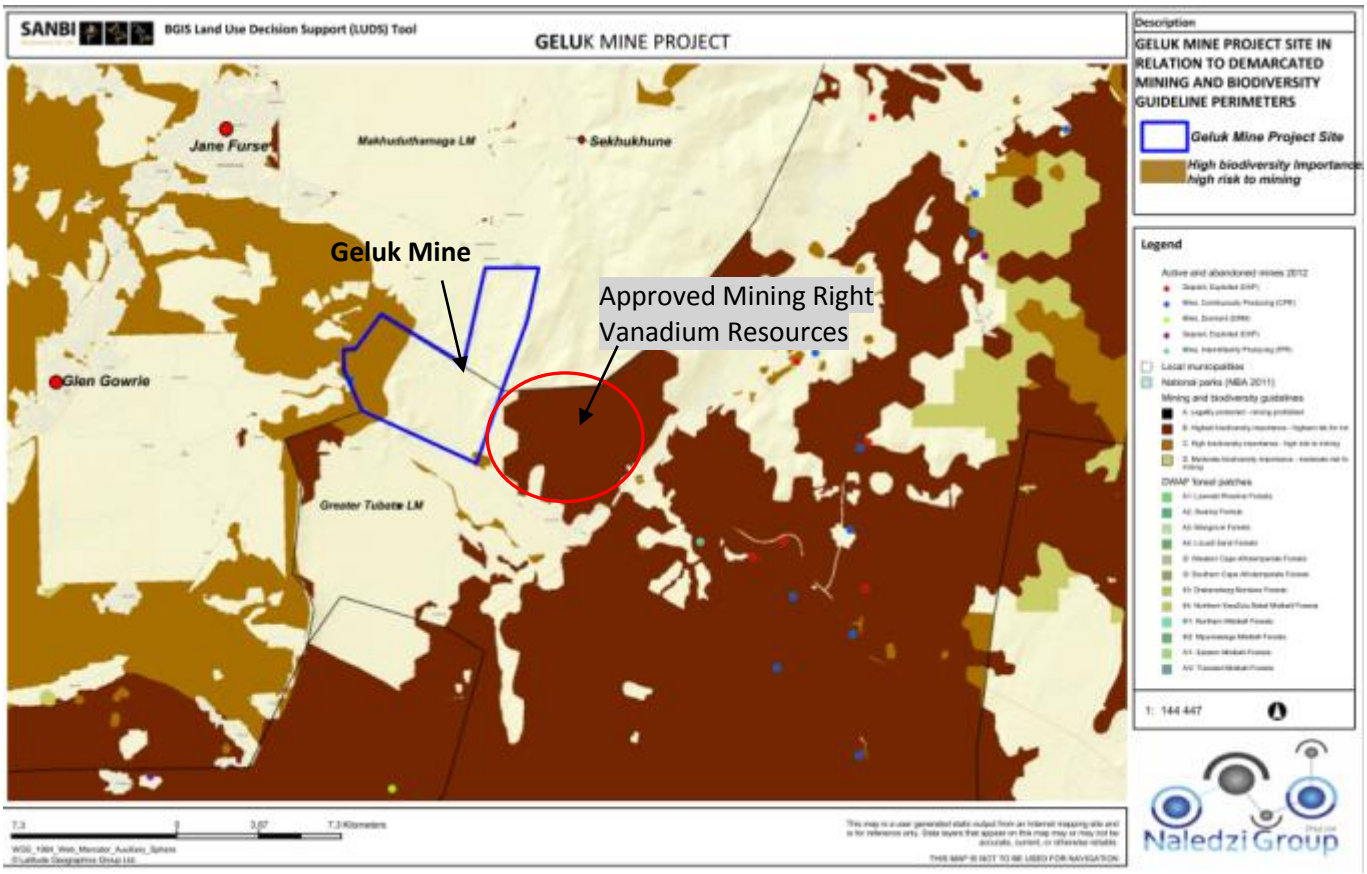


Figure 17: Important Biodiversity Areas at risk for mining in relation to the Geluk Mine Project site

The mineral resource to be mined through the Geluk Mine project is located on the eastern portion of the project site. The demarcated "high biodiversity importance" as per the Mining and Biodiversity Guideline map will not be affected. It will remain intact.

An approved Mining Right/ License has been issued to Vanadium Resources (Pty) Ltd in 2015 to mine for vanadium via open cast methods just east of the Geluk Mine Project Site, farm Steelpoortdrift 365KT. The license area corresponds to "Highest biodiversity importance – highest risk to mining".

5.3 MUNICIPAL PLANNING FRAMEWORKS

Greater Tubatse and Makhuduthamaga are the affected authorities, the latter being the key authority. MLM is predominantly rural. The project site is some 10km south east of Jane Furse, which is the main node. The site is surrounded by rural villages. The area is mountainous; urban sprawl occurs mostly in the flatter Shakwaneng valley in the northern and southern portions of the project site. The settlements in the project area are under control of traditional authorities. Tribal authorities bordering the project site either have allocation rights to use the site or certificates.

5.3.1 Spatial Planning Land Use Management Act No 16 of 2013

South Africa has a single national piece of legislation, the Spatial Planning and Land Use Management Act 2013 (SPLUMA), which creates an overarching framework for spatial planning, policy and land use management for the entire country, including rural and informal settlements. Spatial plans linked to zoning schemes are at the heart of this planning system.

As per Section 3.9; the proposed project site requires land use rezoning from agricultural/natural to industrial use before mining can be commissioned. Rakhoma will need to submit a rezoning application to both Makhuduthamaga Local Municipality and Greater Tubatse Local Municipality for approval.

5.3.2 Limpopo Spatial Planning and Land Use Management Bill 2012

Limpopo SPLUM Bill introduces planning and development principles for land development and spatial planning in the province; to set out the responsibilities of the municipality, provincial department and traditional authorities with regards to spatial planning and land use management.

Responsibilities of the municipality

(1) A municipality is responsible for the activities involved in conducting all aspects of spatial planning and development management in its municipal area

a) regulate the development, adoption, amendment and review of a spatial development framework for the area of the municipality;
b) regulate the development, adoption, amendment and review of a land use scheme for the area of the municipality;
c) regulate the procedure in terms of which the municipality receives, considers and decides on land development applications;
d) regulate the procedure in terms of which the municipality facilitates public participation in its consideration of land development applications and spatial planning;
e) determine the criteria for deciding on land development applications and spatial planning; and

f) Determine the criteria for investigating contraventions of inter alia the policy documents, land use schemes and by-laws of the municipality pertaining to spatial planning and development.

Responsibilities of the Traditional Authorities

Traditional Authorities are responsible for –

a) providing an input in all policies, by-laws, spatial frameworks and other documents relating to land use and spatial planning applicable to that traditional area under the management of a traditional authority; and
b) providing an input in all land development applications applicable to that traditional area under the management of a traditional authority;

No residential develop is planned for the Geluk Mine project site from the local and traditional authorities' side.

5.3.3 Makhuduthamaga Spatial Development Framework (SDF)

The Makhuduthamaga SDF is a framework that seeks to guide overall spatial distribution of current and desirable land uses within the municipality in order to give effect to the vision, goals and objectives of the municipal IDP. The MLM is the main local authority, yet as indicated settlements are under control of traditional authorities. Tribal councils and the municipality (try to) cooperate in development of land use procedures and orderly development.

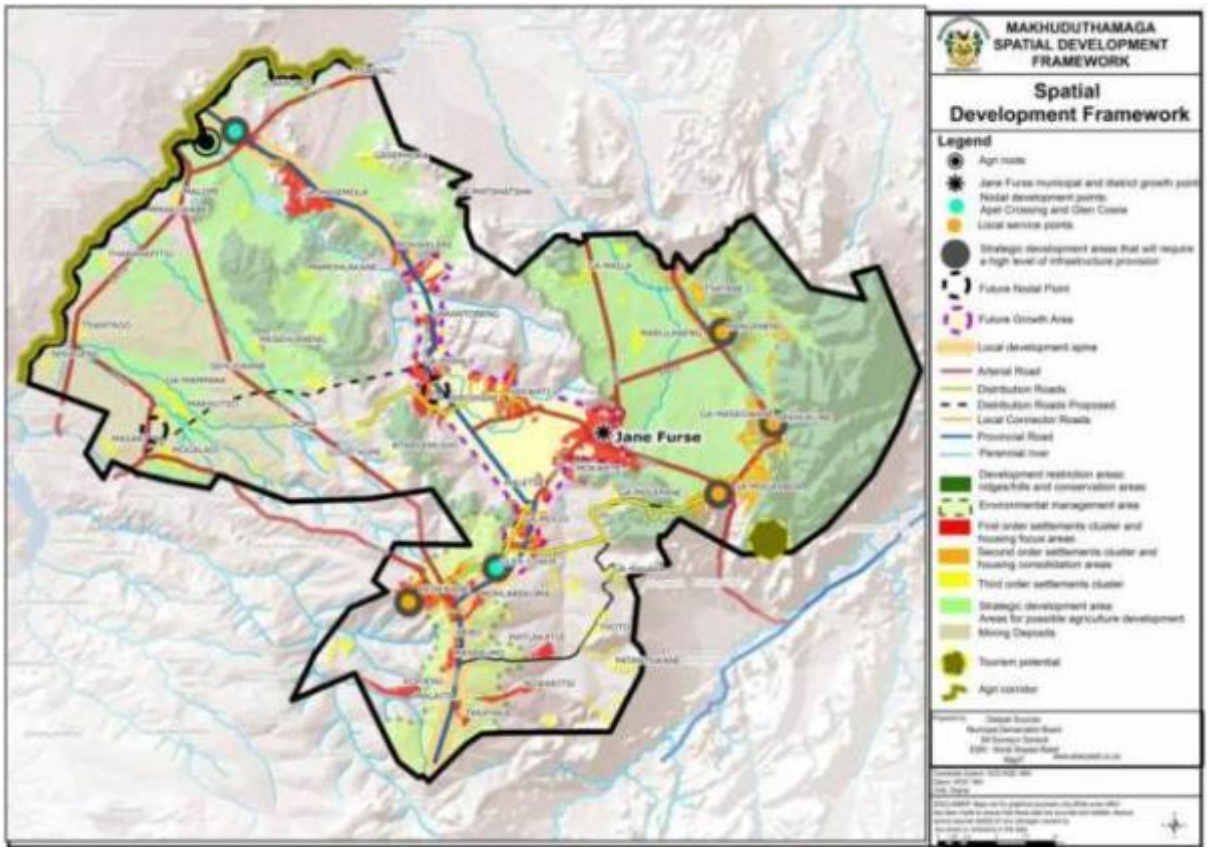


Figure 18: MLM Spatial Development Framework

SDF:

The farm Geluk 512KS and Geluk Oos 513KS is affected by urban sprawl in its northern extent.

In terms of the MLM SDF draft of January 2015, prepared by Akanya Development Solutions, there is currently no development/residential expansion plans onto the project site, due the terrain.

The SDF indicates in its Conceptual Growth Management Framework that the site corresponds to the following planning perspective:

- **Green area**: Ridges/Hills as possible conservation area and Environmental protection. Ridge has possibility for eco-tourism (mountainous area on eastern portion of project site);
- **Grey area**: Prohibit any development or infrastructure provision (valley along the Shakwaneng River and distributed bushveld areas on either side of its banks up to D2219 road)
- **Second order Settlement Cluster:** Ga-Mogashoa settlement in the northern portion of the project site is a housing consolidation area/Potential housing focus area;
- **D2219 arterial route:** Strategic district linkage / road to be strengthened

The document further indicates that the municipality experiences various issues due to a lack of basic services. It considers mining and agriculture as heavy water users. It also indicates that the potential reliance on mining is a risk to the long term sustainability of the economy, as illustrated by recent downturns in the mining sector.

However, Makhuduthamaga Municipality promotes agriculture, tourism and mining as the key growth sectors. There are a number of mining exploration exercise that are taking place within the municipality. If mining does indeed prove feasible, it will have an added impetus on the creation of much needed jobs in particular and the growth of the economy in general. The mine can then also be encouraged to improve services in the area as part of their social development and responsibilities.

Although the proposed project is not in line with the planning perspectives of the MLM SDF, the project can contribute to economic growth in the local area and job creation for a substantial period of 30 years.

Environmental Development Framework
The natural environment is key to address issues in the following matters:

- It holds the potential to expand the current very narrow economic base (e.g. growing agriculture activities);
- It contributes to basic services, i.e. water sources;
- It must as such be protected to ensure human well-being, i.e. prevent pollution of scarce water sources, prevent encroachment on and over-utilisation of agricultural land, and protect potential tourism sites.

Development Restricted Areas in terms of EMF
The EMF identifies Development Restricted Areas in MLM which comprise the ridges, conservation areas and river ways in need of protected against any formal development.

Refer to Figures 19 and 20 overleaf.

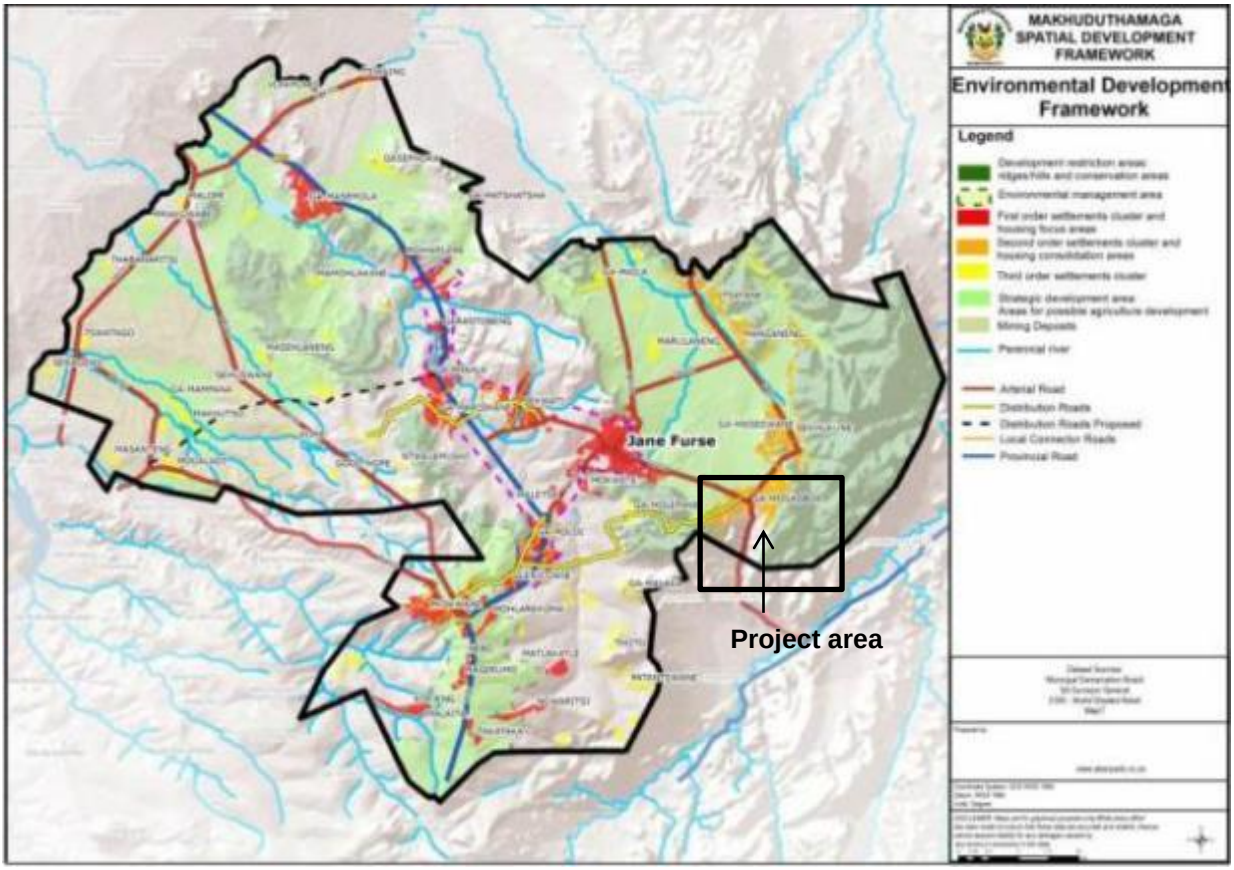


Figure 19: MLM Environmental Development Framework

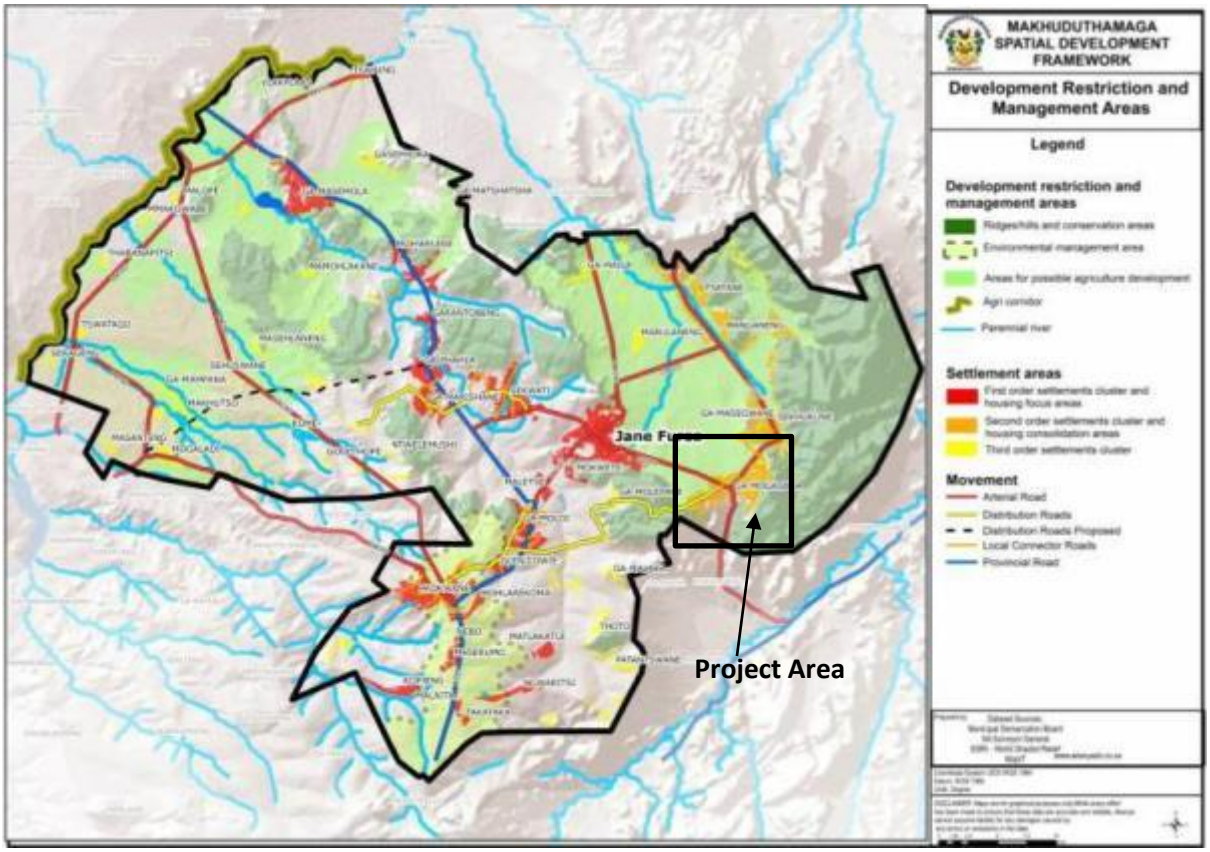


Figure 20: Development Restricted and Management Areas ito MLM SDF

The following principles are regarded as integral for environmental management:

- Ridges, rivers and dams are regarded as zones of conservation together with areas of high conservation sensitive areas. The unmanaged tapping of water from the rivers or other water sources for mining, farming or own use should be managed to ensure the sustainability of the water source and availability thereof for the general public.

The MLM earmarks the ridges/hills forming the eastern portion of the Geluk Mine project site as "Development restricted areas: ridges/hills and conservation areas".

There is urban sprawl on the northern and southern extent of the proposed mining right area, which would require control measures to uphold a 500m restriction to mining from residential dwellings. Control measures are discussed under Section 5.3.5 under Greater Tubatse Local Municipality SDF.

Most of the mineral resource to be mined at the Geluk Mine is located below the ridge on the eastern portion of the project site with limited to no mining scheduled in these areas. The Ecological Impact Assessment recommends a 200m buffer zone from the ridge system on the eastern portion of the site. The Aquatic Impact Assessment recommends a 200m buffer zone from the Shakwaneng River and a 100m buffer zone from streams. These recommendations will be adhered to and implemented on the mine layout plan. However, all development will be set above the 1: 100 year flood zone or 100m from the centre line of the rivers/streams whichever is greater. There will be a stream crossing over the Shakwaneng River to access the eastern section of the project site, east of the river.

5.3.4 Makhuduthamaga Integrated Development Plan

Makhuduthamaga Local Municipality (MLM) Integrated Development Plan (IDP) is the principal strategic planning instrument which guides and informs planning, budgeting, management and decision making processes in the municipality. The IDP reviewed for this report was the MLM Draft IDP for 2016/2017.

It is stated in the IDP that the municipality is characterised by:

- Weak economic base
- Poor infrastructure
- Major service delivery backlog
- High poverty levels

The IDP wishes to facilitate sustainable economic empowerment for all communities within Makhuduthamaga and enable a viable and conducive economic environment through the development of related initiatives including job creation and skills development.

The Geluk Mine project will contribute to the much needed job opportunities and allow growth of the economic base for the local area.

The IDP report highlights that water scarcity is a huge development challenge in Sekhukhune District and constraints economic and social activities. MLM is also not a water services provider/authority, Sekhukhune District Municipality is. Sekhukhune District has in turn allocated its responsibility to Lepelle Northern Water. The project site falls within an area rated as a Class 3 area in terms of water provision due to no access to the commodity and due to functional problems. It is also indicated that Ga-Mogashoa Dithlakaneng and Ga-

Mogashoa Manamane experience water shortages. These areas are directly north of the Geluk Mine site.

In context of the need for water supply for the mine and communities; The De Hoop Dam is 14km south west of the project site. It was constructed to provide bulk water to the expanding mining sector and surrounding communities. An associated bulk water pipeline was further constructed from the De Hoop dam to Jane Furse along the D2219 Road. The pipeline servitude with associated pump station routes along the D2219 road which passes through the Geluk Mine Project site. (It will not be affected by the project, the servitude will be honoured.)

Presently the pipeline does not service the study area. The Steel Bridge Water Treatment Works were given the responsibility by Lepelle Northern Water to purify the raw water supply from the dam and convey to the communities. This facility is not ready yet. Once set, the responsibility of the local water service provider will be to construct distribution pipelines to convey the water to the communities and other users. Geluk Mine will need to go into discussions with water service provider to construct a distribution pipe to deliver water to the mine site, once the supply is available.

The mine will also in principle recycle and reuse water as much as possible in order to lower water consumption and water demand.

The environmental problems and development constraints in MLM include:

- Alien Plant Invasion
- Air pollution
- Fires
- Water Pollution
- Erosion
- Deforestation
- Overharvesting, overgrazing
- Cultural heritage
- Waste (general and medical waste)

The proposed project EIA process has assessed the potential impacts related to the mine relating to water-, air pollution, erosion, alien plant invasion, cultural heritage and its anticipated waste management. The EIR& EMPr prescribed management measures to either curb or minimise anticipated negative impacts which are considered environmental problems/constrains in the MLM.

5.3.5 Greater Tubatse Municipality Spatial Development Framework (SDF)

The project site straddles two municipalities. Greater Tubatse Municipality (GTM) affects the southern extent of the project site. GTM has three components, the first being the physical/spatial dimension, which is to develop the municipal area as a Platinum City. The concept denotes that development of the municipal area is driven by mining and processing of platinum-group metals and presumably the associated minerals such as chrome and vanadium.

The GTM SDF was prepared by SJN Development Planning Consultants, and is dated November 2007. As per the report, currently the major economic drivers are mining and agriculture with mining being the primary contributor to GDP and employment. Mines have been identified as the driving force for economic development in conjunction with their

associated manufacturing industries within the area. The proposed Geluk Mine project does not fall within an area identified as mining belt in terms of the SDF, yet is in close proximity of its zone boundary. (maybe due to no knowledge of resource availability in the specific area).

The farm Ironstone 847KS is affected by Maphopha settlement and Ironstone informal settlement The GTM SDF has earmarked this area as existing settlements to be clustered. Areas further south of Maphopha have been identified as settlement expansion areas/affordable housing. This does not affect the mining proposal. Mining will be focussed to unoccupied areas, east of the D2219 Road. Refer to Figure 21.

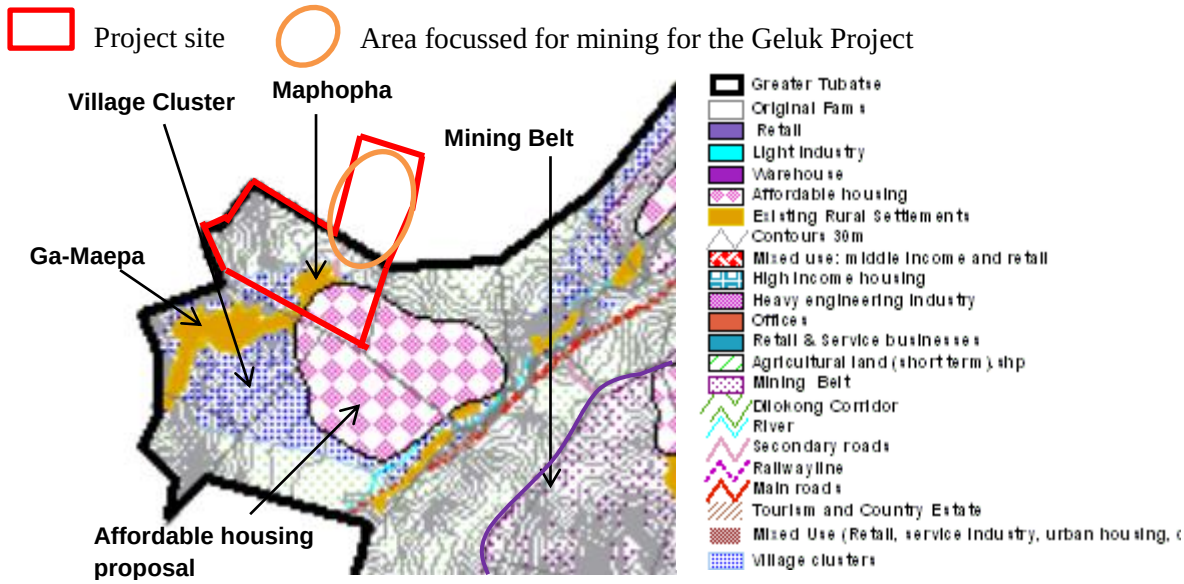


Figure 21: Extract of GTM SDF Development Planning relevant to the Geluk Mine project area

The traditional authorities and local municipality would need to control urban sprawl towards the proposed mining right area to uphold the 500m "mining/blast free zone" from settlements. This can be achieved by the following:

- Greater Tubatse Local Municipality and Makhuduthamaga Local Muniicpality are to enforce an urban edge along the settlements of Maphopha and Ga-Mogashoa;
- The urban edge is to be communicated to traditional authorities through the local municipalities and traditional council via ongoing community engagement and dialogue;
- Early detection of key driving forces for the urban sprawl, should it occur;
- Development of cluster requirements as part of planning tools for the settlements;
- Establish green belts (corridors) in terms of land use zoning along the northern and southern peripheries of Maphopha and Ga-Mogashoa settlements. The belt is to be 500m wide to maintain the 500m restriction to mining from residential settlement;
- The greenbelts on the mining right area must include the 200m buffer zone along the Shakwaneng River, 100m along drainage lines and the 200m buffer area along the eastern and western mountains.

The SDF further states that "the increased development of mines and associated concentrator plants in GTM area have positive spin offs in terms of job creation. The potential of the mining sector creates more direct jobs which exceeds any other sector".

It also indicated that mine water needs are likely to increase further in the medium term. The spatial plan should take cognisance of the need to expand water infrastructure to meet water requirements of mines and households.

The development of the Geluk mine will have positive spins offs in terms of job creation in the specific rural area proposed due to lack of jobs and poverty.

5.3.6 Greater Tubatse Municipality Integrated Development Plan (IDP)

GTM IDP is the principal strategic planning instrument which guides and informs planning, budgeting, management and decision making processes in the municipality. The IDP reviewed for this report was the GTM Draft IDP for 2016/17 – 2020/21.

The IDP indicates that the eastern limb of the Bushveld Igneous Complex (mining belt) is emerging as important structuring element of the municipality's spatial development, being more dominant in future. Retail and services businesses will respond to the opening of mines; housing will locate close to these areas. This will create large urban settlements.

In terms of conservation areas in the GTM, the report indicates the largest portion of land in the municipal area (excess of 80%) is still natural. Mining, agriculture and urban sprawl have barely encroached on these areas. Nonetheless its preservation is important. High-lying areas should be conserved to retain the natural vegetation and characteristics with the aim of accommodating possible future tourism.

In terms of water requirements; the De Hoop Dam constructed in the Steelpoort River has major benefits for agriculture and general development in the region. Water needs are to be carefully assessed, taking into consideration the development of the mining industry. An expansion of storage facilities needs to be investigated.

In terms of mine waste; mine waste is in total, in GTM, collected by private contractors. Most of general waste that is generated by mines is recycled.

The IDP also indicates that the existing mineral resources remain unexploited and that investment in the sector brings forth investment in infrastructure, result in job creation and other economic spin-offs.

5.3.7 Sekhukhune District IDP

The Sekhukhune District IDP Final Report dated 2015/2016 is a legislative mandate and a strategic planning instrument that guides and informs planning and development as well as decisions with regard to planning, management and development throughout the district.

The six objectives for the IDP are:

- Economic growth, development and job creation
- Access to basic services and infrastructural development
- Spatial development and sustainable land use practices
- Active community participation and Inter-Governmental Co-operation
- Community development and social cohesion
- Effective, Accountable and Clean Governance

The leading sectors in the Sekhukhune economy are agriculture, mining and tourism. The district has chosen to explore the potential of these three sectors up to year 2025. Shifting commodity prices have however affected the opening, closing and, occasionally, re-opening of mines in the area. The variable nature of the mining sector needs to be considered when providing infrastructure and housing to expanding mining operations.

According to the IDP, mining in the district has not yet reached its full production. A number of new developments are expected to take place. The district SDF has three development objectives relevant to the sector, which include:

- the protection, enhancement of natural environmental resources to ensure viable balance between mining, tourism and agricultural industries in the area;
- Maximally utilise the mining potential in the district by developing the Dilokeng Corridor;
- Promote industrial development with specific emphasis on agri-processing (Groblersdal), and mining/ore-processing in the mining belt and agricultural belt to one another;

The key environmental aspects that require management in the district include:

- Noise Pollution: Factories, industries, formal premises, musical instruments, construction sites, machineries, etc;
- Air Pollution: boilers, incinerators, fireplaces, refuse burning
- Land/Soil Pollution: Landfill, burning of waster, farming, mining and factories.
- Water Pollution: Mining and Mining activities, unprotected landfill sites, illegal dumping.

The proposed Geluk Mine project will form part of the mining/ore-processing in proximity of the mining belt. It will further contribute to the mining potential of district, which is considered one of the key sectors with growth potential which will be explored up to 2025. The EIA processes has assessed the project's impact on natural environmental resources and provide mine design recommendations to protect environmentally sensitive areas identified within the proposed mining right area and recommend management measures for its protection.

The proposed mine will also require water provision from the Sekhukhune District Municipality which is both the Water Service Authority (WSA) and Water Service Provider (WSP). Water scarcity is an issue of major concern in the district. The mine design will need to cater for recycling and reuse of as much as possible of its mine service water to lower water consumption and demand.

Environmental aspects including noise, air, land and soil and water pollution have been assessed for the proposed Geluk Mine operation in this EIR. Management measures for anticipated impacts have been recommended in the EMPr to ensure the minimisation of such impacts to an acceptable level.

5.3.8 Provincial Noise Control Regulations

These noise control regulations are applicable in the study area and the main aspect of these noise control regulations is that one may exceed the prevailing ambient noise levels by 7.0dBA before a noise disturbance is created.

5.4 GUIDELINE DOCUMENTS USED FOR THE EIA PROCESS & PUBLIC PARTICIPATION

The National Department of Environmental Affairs, other provincial government departments, including DMR and DWS have formulated guideline documents to assist applicants, authorities and environmental assessment practitioners on the requirements of considering various aspects in the EIA process.

Guidelines consulted during the preparation of the Environmental Impact Report include:

Impact Assessment & Specialist Studies:

- GDARD: Mining and Environmental Impact Guide (2008)
- Mining and Biodiversity Guideline: Mainstreaming the biodiversity into the mining sector (2013);
- Western Cape: DEA&DP Involving specialists in EIA (2013)
- DEA IEM Guideline Series 11: Criteria for determining alternatives

Public Participation:

- DMR Guideline for Consultation with Communities and Interested and Affected Parties in terms of Sections 10 (1)(b), 16(4)(b), 22(4)(b), 27(5)(b) and 39 of MPRDA, 2002
- DEA: Integrated Environmental Management Guideline 7: Public Participation in the EIA Process (2012) (*read due regard of Regulation 41-44 of NEMA EIA Regulations 2014*)

SECTION D: NEED AND DESIRABILITY OF PROJECT

6 NEED AND DESIRABILITY OF THE PROJECT

In terms of Appendix 3 of the EIA Regulations of 2014, the EIR is to describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location.

As per the NEMA EIA Regulations *IEM Guideline Series 9 for Determining need and desirability of a project*, the concept of "need and desirability" relates to, *nature*, *scale* and *location* of the development being proposed, as well as the *wise use of land*. Need primarily refers to the time and desirability to place (eg. *The right time and is it the right place for locating the type of land use*).

6.1 Nature and need for the Geluk Mine development - local context

The need for any product is determined by global also local supply and demand trends. An activity/development is driven by market needs and economic interests of producing the product in demand.

In context of global market, SA produced 19, 000MT of vanadium in 2015 (Vanadium Investing News article 10 June 2015). It produces 23% of the global vanadium supply and is considered a world leader in its production. Many countries import vanadium from SA. Accordingly, the bulk of the world's vanadium supply comes from South Africa's Bushveld

Complex, which produces >20% of global supply. While China accounted approximately 53% of all vanadium production in the world in 2013, it retains much of its supply.

Only a handful of SA companies produce vanadium to the global market, which amongst others include Vanchem Vanadium Products (Pty) Ltd. Vanchem is the second largest producer of vanadium in SA, preceded by Evraz Highveld Steel.

Both these companies obtained their long-term ore supply from Limpopo based Mapochs Mine. Mapochs mine has ceased production since its main client Evraz Highveld Steel stopped production when it was placed under business rescue in April 2015. Highveld Steel consumed two thirds of the mines production while Vanchem took the balance. With the closure of the mine Vanchem is left without ore supply.

Accordingly, Vanchem made temporary arrangements, yet the ore reserves ran out in September 2015. Vanchem has therefore ceased production as well. There are no other alternative sources of ore for Vanchem. The supply from mines owned by competitors is low grade ore resulting in higher productions costs deemed not economically viable.

As a result, Vanchem is securing its own ore supply by obtaining a Mining License through Rakhoma Mineral Resources Pty Ltd.

The Geluk Mine aims to produce vanadium-bearing titaniferous magnetite ore. The proposal to start up the mine operation will sustain Vanchem's production and address the local/global demand it supplies for. The timing of the proposal is driven by the recent lack of ore supply and void left by its key ore supplier Mapochs in 2015.

6.2 Demand for raw ore supply for vanadium production- International Context

South Africa is the second largest vanadium producer in the world and a leading player in the international ferro alloys industry. SA has vast reserves of chromite, manganese ores and vanadium bearing magnetite ores. This places SA in a dominant position due to an abundance of natural resources situated within its Bushveld Complex.

The main driver of vanadium demand is its use to increase the tensile strength of steel while reducing its weight, which represents about 90% of the market. (http://www.miningweekly.com/article/bushveld-moving-fast-to-enter-buzzing-vanadium-market-with-low-cost-flakes-2014-08-07).

The outlook for the vanadium market in 2015 appears to be strong. Demand for steel is projected to increase through 2016; mandates for higher steel quality, specifically in China, and the potential for a growing battery market are expected to contribute to increasing consumption of vanadium. (World Steel Association, 2015)

6.3 Need for the scale of the proposed Geluk Mine

The Geluk Mine will only have one captured client, Vanchem. Hence its scale will not reach that of platinum and chrome mines in the Steelpoort area. The scale of the mine production will be based on Vanchem's ore requirements, at 20 000 tons of raw ore supply/ month. The mine will start up as a small-scale mine and ramp up its production by year 6 to 700 000 ton/annum.

The need for the scale of the mine was determined by considering some options:

- To purchase Mapochs Mine and fund its start-up, yet the mine is large scale in relation to Vanchems ore requirements. It would be uneconomical to pay the high

operational costs, environmental duties for the mine in relation to the ore requirements from Vanchem.

- To start up a small scale iron-and vanadium ore mine to only provide for its ore requirements. Vanchem considers this the most preferred due to cost effectiveness; lower operational costs of small scale mine viz. Mapochs high operational costs;

6.4 The need and desirability of the project in terms of its proposed location

6.4.1 Location in terms of Mineral Resource

The Geluk Mine project is proposed in the eastern limb of the Bushveld Igneous Complex, west of Steelpoort. The BIC contains the world's largest reverses of PGM's along with amongst others iron and vanadium. The project is desired at the planned locality as a feasible reserve of vanadium-bearing titaniferous magnetite deposits have been identified through an extensive drilling program on the farms Geluk 512KS, Geluk Oos 513KS and Ironstone 847KS. Four magnetite seams were identified. There is an estimated economical reserve of 14 million tons of ore to be mined at the proposed project site. The main seam of ore is also close to the surface which contains the majority of ore reserve identified. The raw ore product is thus required by a large scale vanadium producer and the product can only be sourced on location of a feasible / economical ore deposit which has been delineated on above mentioned farms.

6.4.2 Existing Mining Permit on farm Geluk 512KS

Rakhoma already holds a Mining Permit on the farm Geluk 512KS. The company wishes to extend it operations onto the greater resource by obtaining the mining license. The obtaining of the permit within the proposed mining right boundary was the precursor for determining the proposed mining license location.

6.4.3 Wise use of land

The project is proposed on a pristine site with high ecological sensitivity. It comprises natural areas and steep hilly terrain. In terms of the SDF for Makhuduthamaga the planning guidelines for the area are conservation, tourism. The land uses taking place are small scale subsistence farming and grazing. Current land uses taking place are limited.

The project site would either be prone for further residential expansion (limited due to terrain), agriculture and or conservation/tourism. Given the site characteristics the agricultural potential of the site is limited to grazing. Crop production is limited due to shallow soils. Hence potential agricultural activity lost due to proposed mining is limited to grazing.
The area is not a tourism destination and no tourism attraction activities are located on or near the site.

From an economic point of view the gained economic activity in mining is much higher than the potential agricultural value of the site. The value of mining to sales and employment is higher than agriculture and tourism, yet tourism and agriculture have a longer life span. The population in the local trade area is decreasing due to rural-urban migration due to lack of job opportunities and low living standards. The use of the land for mining has the potential to play a crucial role in eradicating poverty in the area.

6.4.5 Project location in terms of Sensitive ecosystems, wetlands

Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

Examinations of the National Freshwater Ecosystem Priority Areas (NFEPA)'s databases were undertaken for the proposed project through the Aquatic Impact Assessment. The project site is located within a Phase 2 FEPA and associated sub-quaternary catchment. This FEPA refers to moderately modified (C) rivers. The condition of these Phase 2 FEPAs should not be degraded further, as they may in future be considered for rehabilitation once good condition FEPAs (in an A or B ecological category) are considered fully rehabilitated. (Technical Report: NFEPA, Aug 2011, WRC Report no. 1801/2/11). Refer to Figure 22 for the NFEPA in relation to the Geluk Mine project.

No wetlands were delineated within the project site. The project site is affected by the Shakwaneng River which flows from north to south through the site. There are several non-perennial streams draining from the mountainous area towards the Shakwaneng river catchment. The Dr Eiselen Dam is located on the southern tip of the project site. Its dam wall has seepage which created an artificial wetland. Refer to Figure 23 for a map indicating Rivers and artificial wetland associated with the project site.

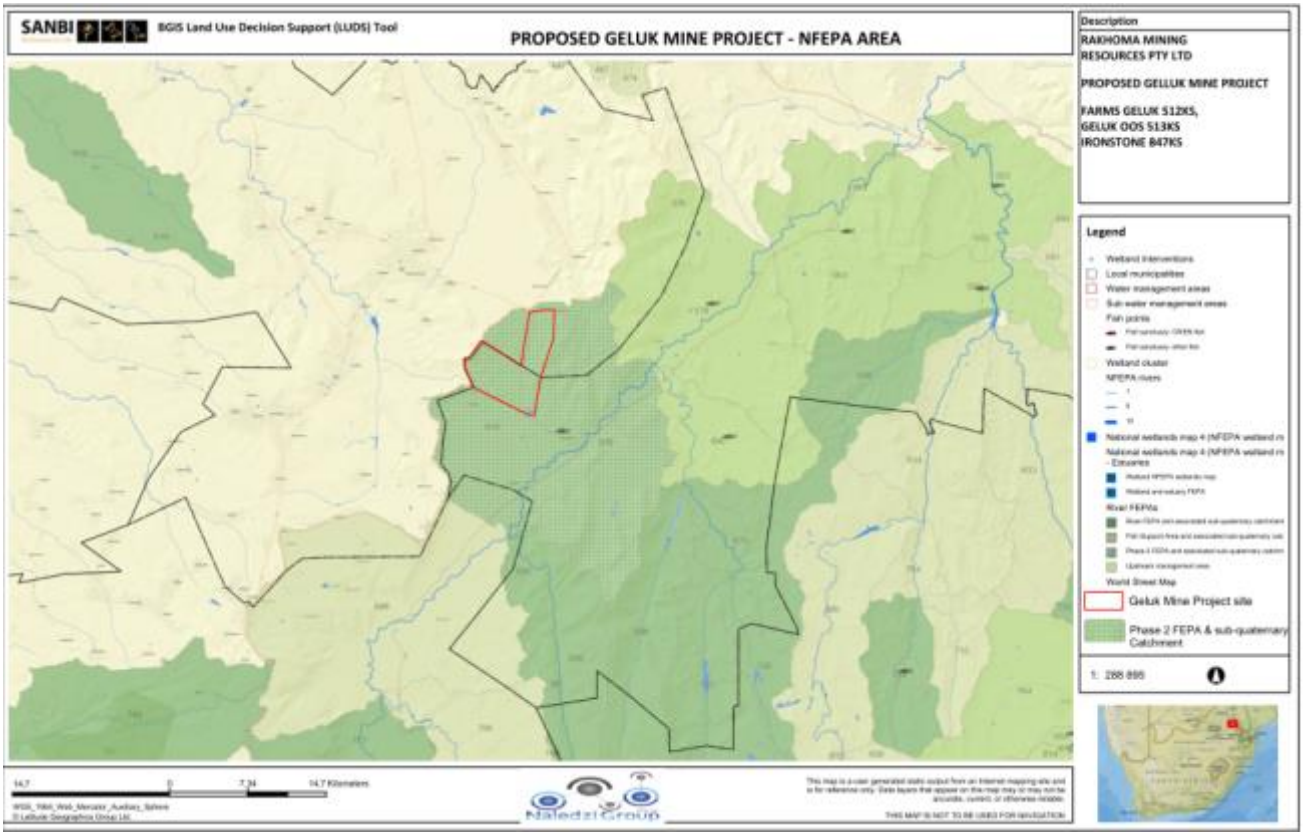


Figure 22: Freshwater Ecosystem Priority Areas in terms of Geluk Project Site

Figure 23: Aerial Map indicating rivers and wetland associated with Geluk Mine project site

A large portion of the project area has been assessed as being of high ecological sensitivity. The area in which the proposed mining activities will occur is considered to be of high sensitivity, particularly the mountainous areas. Refer to Figure 24.

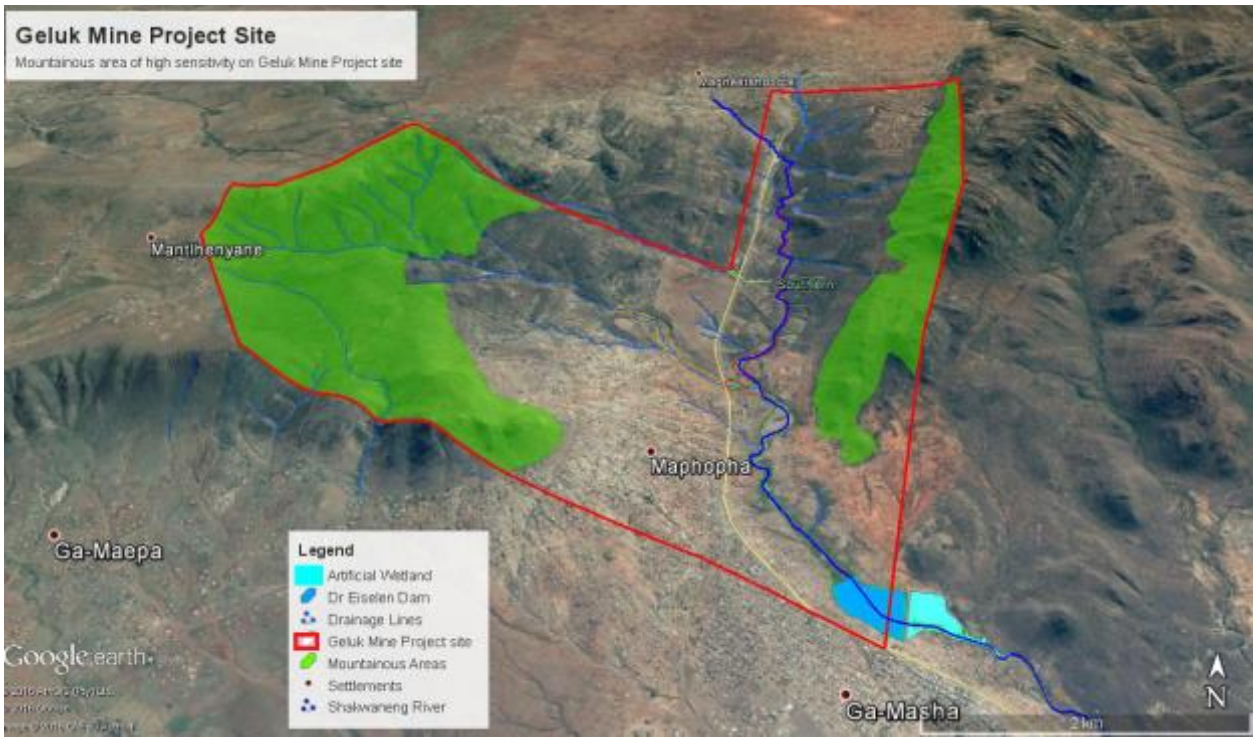


Figure 24: Mountainous areas of high sensitivity on Geluk Mine Project Site

The proposed project will have significant negative impacts on the proposed location of the mine. The potential impacts predicted on aquatic ecosystem and the fauna and flora on site

are not desirable. Hence the consideration of the placement of mine infrastructure and mine strips to find the preferred / more environmentally desirable development footprint is essential and buffer zones for protection of environmentally sensitive areas are essential.

6.4.4 Location of mine in proximity of residential dwellings

The proposed Geluk Mine activities will be focussed to unoccupied areas. No relocation or resettlement of residential dwellings will be undertaken. For safety purposes a 500m restriction to mining from residential dwellings will be upheld due to the requirement for blasting to dislodge/lift overburden and seam ore. Accordingly the mineral resource located within this 500m restriction area has been excluded from the mineral resource statement and will not be mined. Refer to Figure 25 which illustrates the restriction area to settlements.

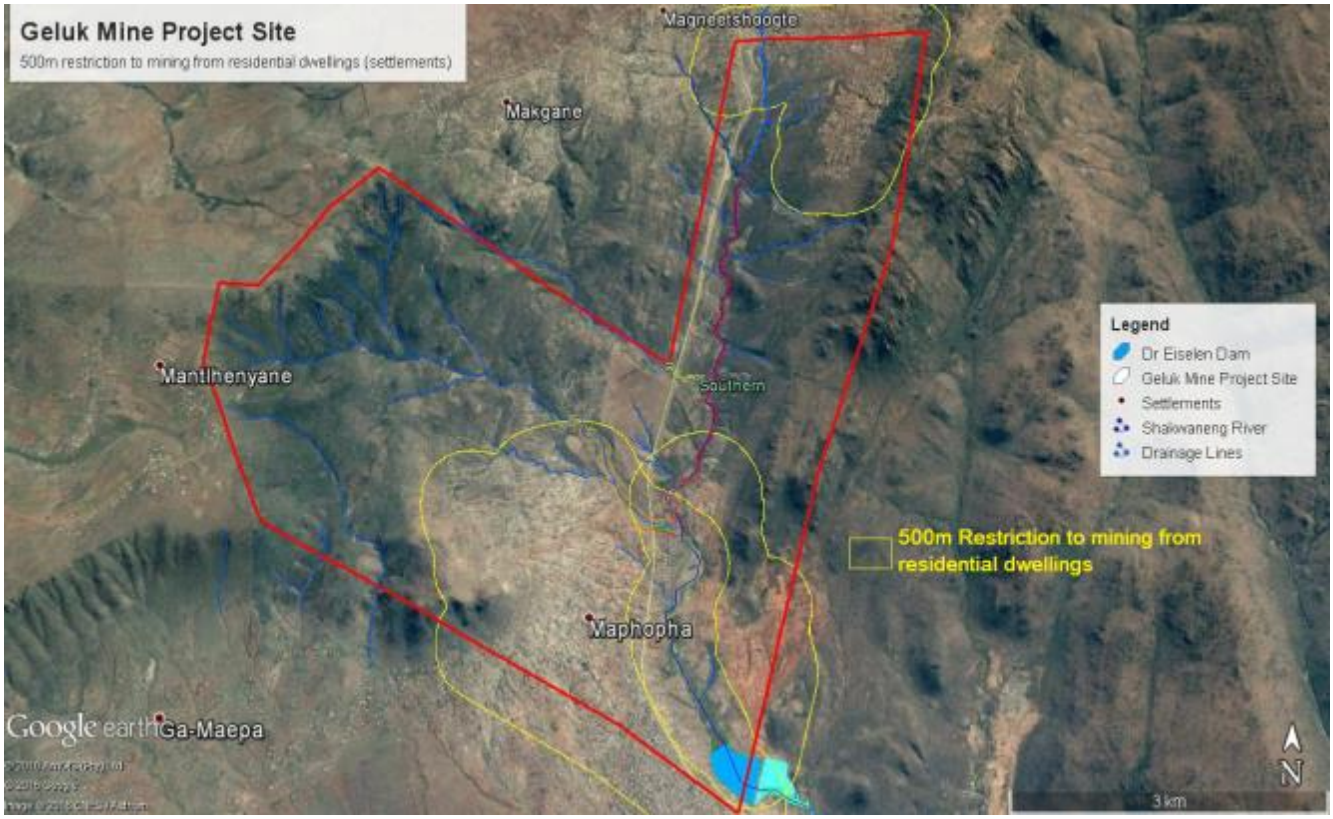


Figure 25: 500m Restriction to mining from residential dwellings applicable to the Geluk Mine Project Site

Greater Tubaste Local Municipality and Makhuduthamaga Local municipality will need to enforce an urban edge along the periphery of Maphopha and Ga-Mogashoa settlements to stop potential urban sprawl from occupying the 500m restriction zone.

7 PROJECT ALTERNATIVES

Alternatives are different means of meeting the general purpose and need of a proposed activity, taking into account location or site alternatives, activity alternatives, processes or technology alternatives, layout alternatives, temporal alternatives, operation aspects alternatives and the no-go alternative. Evaluation of alternatives also allows the relative impact of different project alternatives on the environment to be considered. (DEAT (2006) Guideline 5: Assessment of Alternatives and Impacts in support of the EIA Regulations, 2006-IEM Guideline Series)

In terms of NEMA, if the competent authority considers an application for environmental authorisation, it must take into account all relevant factors, which may include, *inter alia* "any feasible and reasonable alternatives to the activity which are the subject of the application and any feasible and reasonable modifications or changes to the activity that may minimise harm to the environment".

7.1 Motivation for preferred development footprint within the approved site

For proposed mining projects, the delineated mineral resource determines the surface infrastructure placement. No alternative layout has been considered.

In this instance the outcomes of the specialist studies were used to delineate environmental sensitive areas which need to be avoided and considered NO-GO areas for mining and infrastructure. The preferred development footprint within the approved site is hence directed by the specialist recommendations.

The mine layout will adhere to the following;

- Mining will be scheduled outside the 500m blasting restriction area to settlements;
- The mine will adhere to a 200m bufferzone, as recommended in the Ecological Impact Assessment conducted by Afzelia EC, from the mountain /ridge area on the eastern portion of the project site which is essential to maintain biodiversity
- Further, the Aquatic Impact Assessment Report recommends that a 200m buffer is implemented from the Shakwaneng River and 100m buffer from drainage channels;

The proposed stationary mine infrastructure will be placed outside the 500m restriction to mining from settlements and outside the recommended buffer zone areas (200m from Shakwaneng River and 100m from drainage lines as well as 200m from the mountainous area on the eastern portion of site).

7.2 Development Footprint Alternatives considered

7.2.1 Project Scale Alternative (Size)

Vanchem considered different means to obtain its ore supply required for its vanadium production plant, (1) funding the start-up of Mapochs mine or (2) starting up a small scale

mine to supply for its ore requirements. The latter was preferred due to cost effectiveness, lower operational costs.

No project scale alternatives were however considered. Vanchem is securing its own ore supply by obtaining a Mining License through Rakhoma.

The Geluk Mine size is determined by the ore requirements of Vanchem, its captured client. Vanchem requires 20 000 tons of raw ore supply per month. The proposed mine plan, scheduling and production rate is therefore based on it.

Rakhoma will start with a small scale mine with 30 employees. The mine will produce 240 000 tons of ore per annum for the first 5-6 years of operation. By year 6 the produce will be ramped up to 700 000 tons. Mapochs Mine supplies Vanchem with 700 000 tons per annum thus the stated produce. The Life of Mine (LOM) will be 30 years.

7.2.2 Alternative Routes to transport ore product

Haulage Route:
The haulage route for transportation of ore product from the Geluk Mine site to the Roossekenal Rail siding includes departing from the mine and turning south to the D2219 from the proposed D2219/access road intersection. From the D2219 the truck joins the R555 Steelpoort/Stoffberg Road. For the 34 ton interlink tipper truck to join the R555, it needs to cross the Steelpoort River using the Malekane Steelbridge. Yet this bridge is not suitable for mine haulage trucks. This is the shortest route from the mine to railway station at 50km.

The Malekane Steelbridge is a one land steel bridge which only accommodates trips from one direction at a time. The bridge dimensions are 3.7m wide x 100m long.

The alternatives are:

A. Use alternative routes; or
B. Replace the existing steelbridge

Consideration of alternative routes:

Alternatively the trucks can divert before the existing bridge by turning left to the D1392 from the D2219 (Alternative Route I-Green to blue) or turn towards the north from the mine's access and proceed straight with the D2219 (Alternative Route II Red). See Figure 25.

Route I is 100km in distance and Route II is 125km in distance. In terms of cost the shorter route is preferred. The total estimated additional expense by travelling the longer haulage route is R 1, 288 billion for the duration of LoM (additional 45km).

Figure 26: Alternative routes considered for haulage of product to rail siding

Replace the existing steel bridge:

The cost to replace the existing steelbridge is estimated at R 20 million rand.

It is evident that the cost to replace the steelbridge along the shortest haulage route would be significantly lower than using alternative Route I for the duration of mining operations.

It can be concluded that constructing of a new bridge is a better solution than traveling longer distances. It is proposed that a new two lane bridge is constructed to replace the existing. The shortest haulage route 55km is then the preferred along with the new bridge construction to the railsiding.

7.2.3 Alternative Mine Depletion Schedule

Mineral Depletion schedule alternative refers to the consideration of the extent of mineral resource to be scheduled for mining taking consideration of adjacent land uses. It considers both the extent of resource economic to mine against the extent of mineral resource which is safe to mine in relation to its position to other land uses.

Option A: Mine all the resource that would be economic to mine. However resources would be in the vicinity of settlements (Ga-Mogashoa, Ironstone settlement and school) and too close for conventional blasting. Free-digging methods could be implemented.

The initial mining schedule is neither practical nor desirable in terms of managing the mines environmental impacts. The mineral resource falls within 500m of existing settlements and infrastructure, there may thus be a blasting restriction imposed on the mining of that part of the resource.

Option B: Restrict mining to areas outside a 500m radius of settlements and existing infrastructure. Hence these areas are excluded from the SAMREC compliant reserve statement.

Option B is the preferred alternative in terms of community safety, noise, ground vibration, flyrock and air quality impacts.

7.2.4 Site Alternatives

Site alternatives can be referred to the consideration of either alternative location (relocation) for the entire proposal or relocation of only components of the project to different locations with the project site.

The consideration of site alternatives for mining projects are however restricted and mainly dismissed in the EIA process.

7.2.5 Mining Activity Alternatives

No feasible mining activity alternatives are considered. The ore body to be excavated is relatively near the surface. The maximum depth of mining is in the order of 20m. Strip mining is the most effective/practical approach to mining the ore seams due to the project areas hilly terrain and geometery.

7.2.6 Alternative Land Uses

Alternative use of the project site is limited to residential expansion, subsistence farming and localised tourism. Two land uses namely mining verses agriculture were considered from an economic point of view.

Agriculture is of less intensive nature in the study area and is largely focussed on subsistence. The potential of the project site is light to medium grazing. The project site has shallow soils not favourable for crop production. Agriculture land use on the study site will have a lower annual sale and output. It will also have a lower gross geographic product with lower employment levels and salaries compared to mining. There is also currently very limited grazing or subsistence farming taking place on the project site.

In terms of mining the annual sales and output are extensively higher with much higher salaries compared to agriculture. More employment opportunities will be derived from mining.

7.2.7 Mine Layout or Design Alternatives

The consideration of mine layout and design alternatives is to find the best possible location for proposed mine infrastructure. The preferred mine design option is based on the ore reserve delineation. The mining method proposed will result in mining activities, roads, stockpiles, mobile crushing and screening plant to move around throughout the life of mine.

Rakhoma already has an infrastructure plan for its Mining Permit (62/2014) activities. This includes an access road, weighbridge, workshop, office (weighbridge control room), and stream crossing and 1 permanent haulage road. Its location within the proposed Mining Right Area is indicated in Figure 27. The mining right activities to be undertaken as part of the proposed Geluk Mine would therefore capitalise on this infrastructure.

A draft mine plan proposed by NRR Mining and consulting is available, however requires finalisation to adhere to recommended environmental bufferzones. It does also not provide a location for a PCD, return water system or water infrastructure.

The specialist recommendations will be adhered to provide direction in the final placement of mine infrastructure and mineral resource to be scheduled for mining.

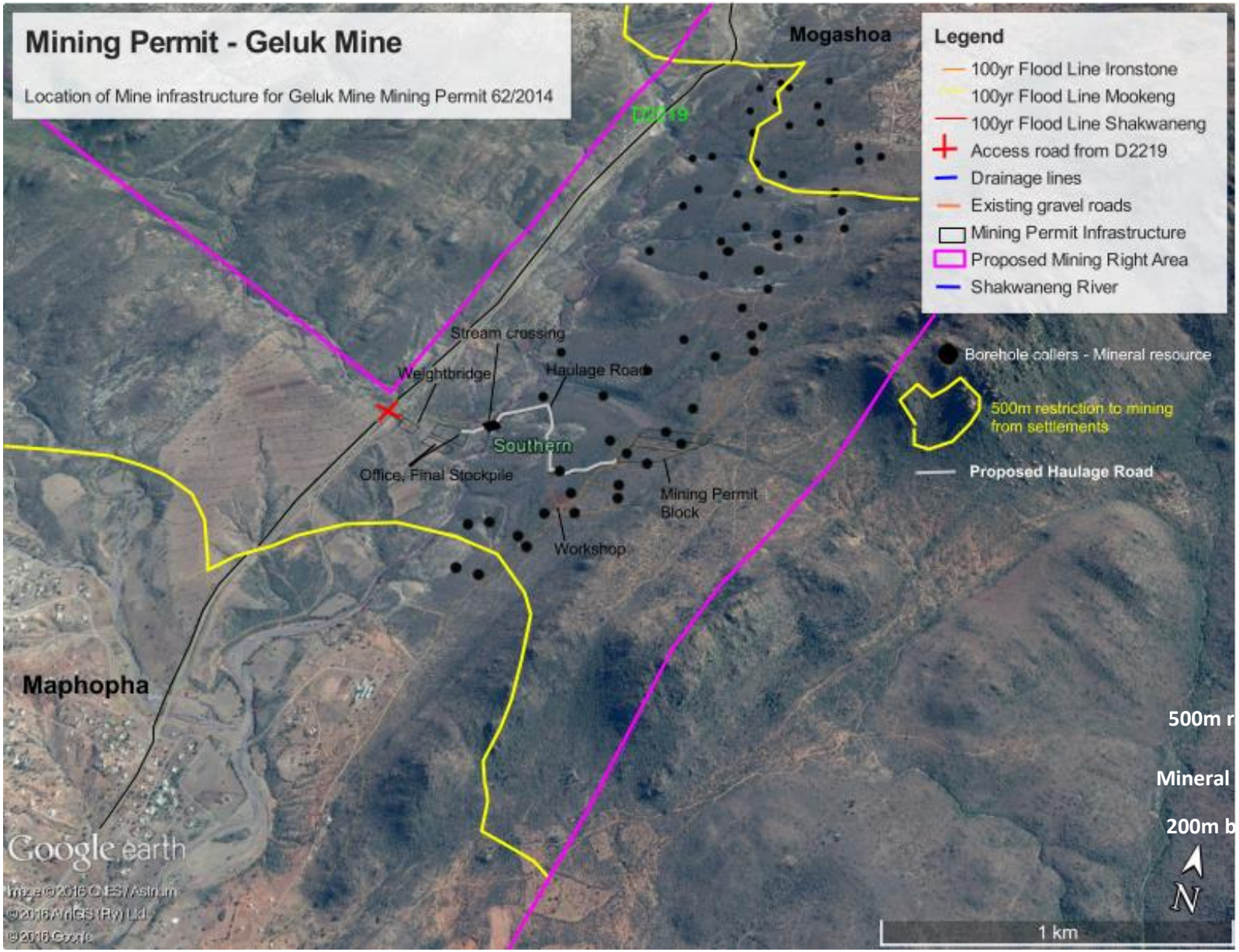


Figure 27: Location of Mining Permit Infrastructure on Geluk Mine Project Site

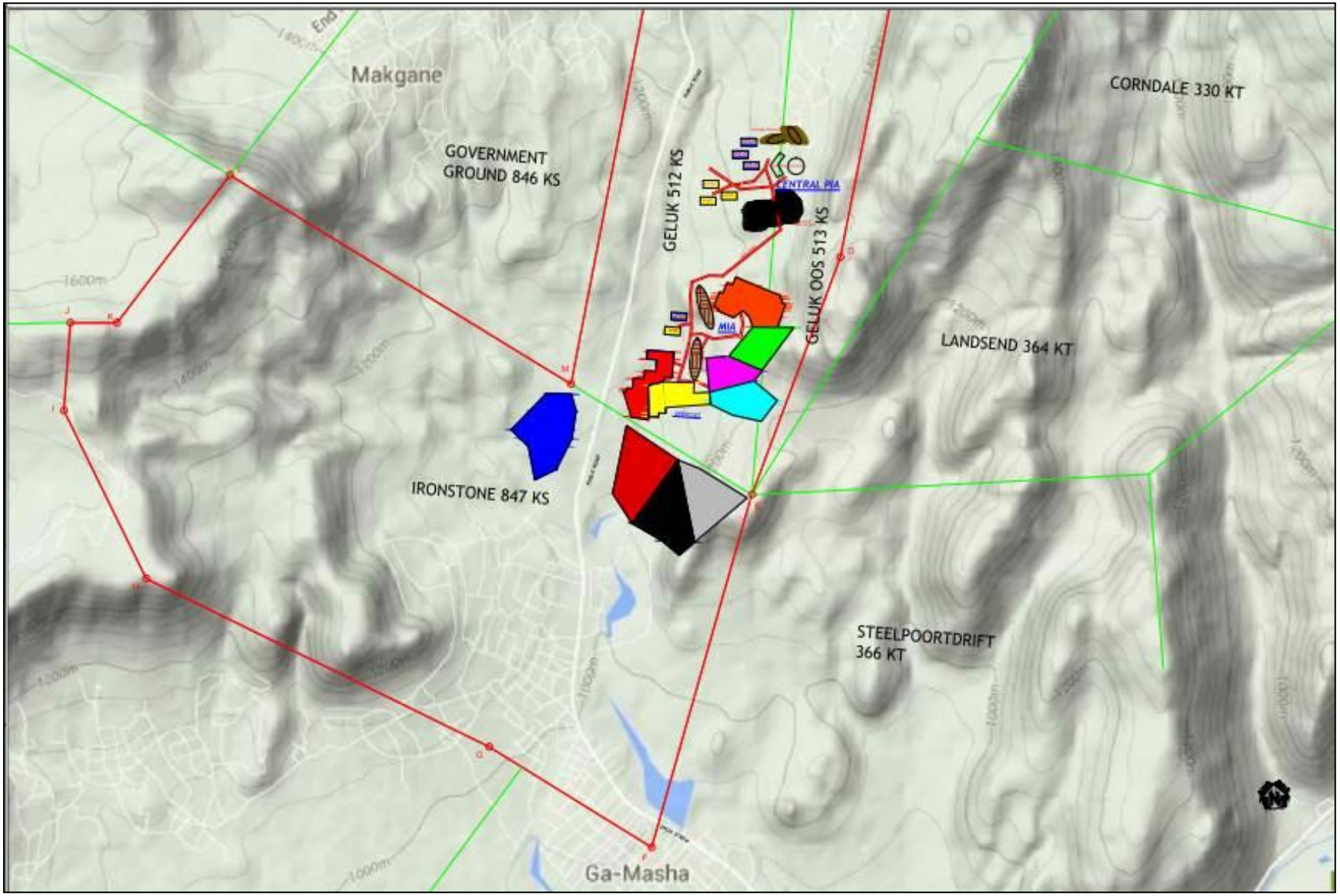


Figure 28: Draft Mine Layout plan and Schedule

The mine layout should adhere to the following;

- Mining must be scheduled outside the 500m blasting restriction area to settlements;
- According to the Ecological Impact Assessment conducted by Afzelia EC a 200m buffer zone must be implemented from the mountain and ridge area on the eastern portion of the project site, this is essential to maintain biodiversity
- Further, the Aquatic Impact Assessment Report recommends that a 200m buffer is implemented from the Shakwaneng River and 100m buffer from drainage channels;

Proposed stationary mine infrastructure must be placed outside a 500m restriction area from settlements. It must be placed outside recommended buffer zone areas (200m from Shakwaneng River and 100m from drainage lines).

7.2.8 No-go Option

The no-mining option is for the current land use to continue. The current land is predominantly natural, small-scale subsistence farming along the river with settlements in the northern and southern extent.

The prospecting activities currently undertaken on the project site will cease and the available ore body will not be extracted. Vanchem will seek other possible ore bodies and prospecting rights to delineate other ore bodies in order to supply the vanadium processing plant ore requirements. The local communities will not benefit from the associated additional employment opportunities.

SECTION F: DESCRIPTION OF THE BIOPHYSICAL AND SOCIAL ENVIRONMENT

The content of the Draft EIR is outlined under Section 23 (3) and Appendix 3 of the NEMA Regulations of 2014. It is indicated that a description of the environment that may be affected by the activity and the manner in which the activity may affect the environment should be considered. The receiving environment consists of different component such as the biophysical and socio-economic environment.

Information pertaining to the receiving environment and its social surroundings has been sourced through site investigations, desktop analysis and use of tools such as Geographic Information Systems and specialist investigations. NEC conducted a site visits on two occasions (1) 21 August 2015, (2) 3 day site visit on 20-22 April 2016 to the study site. Specialist studies were conducted to further investigate potential impacts foreseen during the months of November – December 2015 and April 2015. The majority of aquatic and biodiversity assessment field investigations were undertaken on 20-22 April 2016.

The specialist investigations include:

- Visual Impact Assessment by Axis Landscape Architects, dated November 2015. The assessment was undertaken by Visual Specialist, Mr Gerhard Griesel;
- Noise and Vibration Impact Assessment by dBAcoustics, dated January 2016. The assessment was undertaken by Environmental Noise Specialist, Mr. Barend van der Merwe;

- Traffic Impact Assessment by ITS Engineers Pty Ltd, dated January 2016.The assessment was undertaken by a team of traffic engineers under leadership of Senior Engineer Dr. Pieter Pretorius;
- Air Quality and Dust Impact Assessment by Airshed Planning Professionals, dated May 2016. The assessment was undertaken by Air Quality Specialist Mrs. Renee von Gruenewaldt;
- Ecological Impact Assessment (Fauna & Flora) by Afzelia Environmental Consultants, dated May 2016. The assessment was undertaken by Ecologists Ms. Astika Bhugeloo and Ms. Paige Potter;
- Aquatic and Wetland Ecological Assessment by Afzelia Environmental Consultants, dated May 2016. The assessment was undertaken by Aquatic Specialists, Mr Jacob Schrijvershof and Mr Andrew Husted with wetland specialist Ms. Rowena Harrison;
- Soil and Agricultural Assessment by Afzelia Environmental Consultants, dated May 2016.The assessment was undertaken by specialist Ms. Rowena Harrison;
- Flood line Determination Report by African Environmental Development dated May 2016. The report and flood determination by done by Aquatic Specialist Mr. Garfield Krige. The flood line determination was signed off by an Engineer Mr A. A Zylstra;
- Social and Economic Impact Assessment by Demacon Market Studies dated June 2016. The assessment was undertaken by Social Specialist Mr Hein Du Toit and Market analyst Ms. Karien Louw;
- Heritage Impact Assessment by Millennium Heritage Group, dated November 2015. The assessment was undertaken by archaeologist Mr Eric Mathoho;
- Geohydrological Investigation by Naledzi Waterworks, date May 2016. The assessment was undertaken by geohydrologist Mr Duncan Munyai.

8 ENVIRONMENTAL ATTRIBUTES OF THE PROJECT AREA

This section described the pre-mining environment and social context relevant to the proposed Geluk Mine project site.

DESCRIPTION OF THE BIOPHYSICAL ENVIRONMENT

8.1 Topography

The regional project area comprises valleys of the Steelpoort River as well as surrounding ridges/mountains. The slopes vary from 1% to 5%. The project site is located on the western extreme of the Steelpoort Valley River Basin. Its terrain is undulating and characterised by mountains and flat-bottomed valleys. The Shakwaneng River flows north to south through the project area and constitutes the lowest laying area on site. The river has two tributaries; the Mookeng, entering the Shakewaneng from the west and Ironstone stream, draining the farm Ironstone and also entering the Shakwaneng from the west.

The project site has natural and steep terrain on the eastern and western portions. The mountains on the east rise rapidly from the Shakwaneng River. The terrain on site is steeper with general slopes of 30% to 80%. The higher laying portions of the site are at an altitude of over 1700m above sea level, while the lower parts comprising the Shakwaneng River are at approximately 940m.

The topography of the project site is illustrated in Figure 29 were abstracted the Flood line Determination Report by AED. The topography was created using 0.5m LiDAR surveyed data provided by Rakhoma/Vanchem.

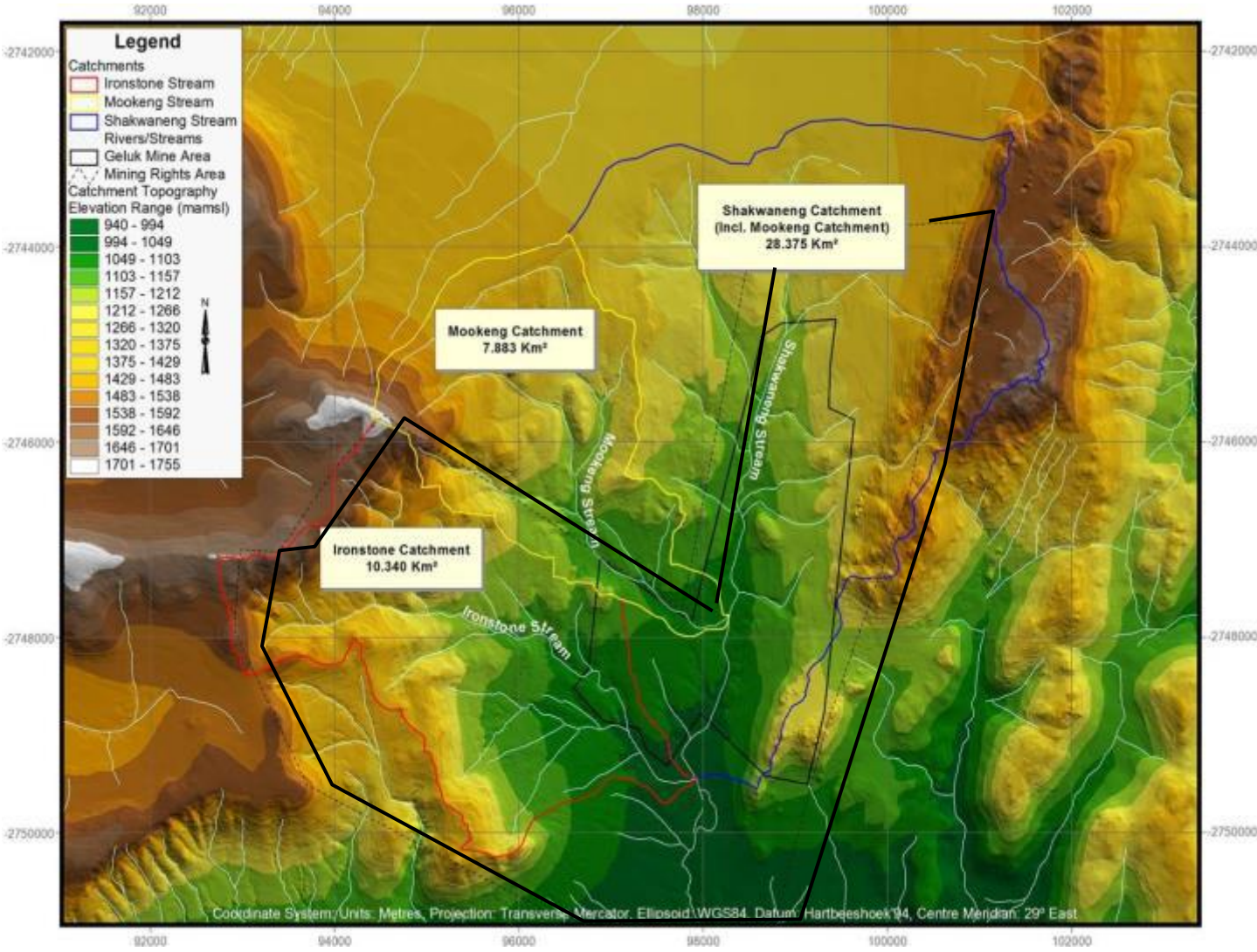


Figure 29: Topography of Geluk Mine Project Site (courtesy of AED)

8.2 Current onsite activities

The topography of the project site restricts its land uses. The majority of the site comprises natural habitat and degraded areas. It is covered in dense thickets. Traditional and rural settlements are located on the northern and southern extents of the proposed mining right area. The Sengange Secondary School is located on the southern extent of the project site. The community engage in small scale subsistence farming along the floodplains of the Shakwaneng River and use the bulk of the project site for grazing. Overgrazing by domestic livestock has seriously degraded the vegetation in the densely populated areas. Population pressure is also adversely affecting the flora in the valley. (Figure 30 and 31). There are also signs of erosion and donga formation.

There are several unpaved access roads on site. The D2219 Jane Furse main road is located on the western boundary of the farm Geluk 512KS. The D2219 routes alongside the Shakwaneng River on the farm Geluk 512KS and Ironstone 847KS. The local community

does their laundry within the Shakwaneng River and collects water from it. Furthermore they dam up some of the river water for purposes of washing and bathing.

Rahoma has been granted a Mining Permit 62/2014 on the farm Geluk 512KS. Mining activities have however not commenced.

The Shakwaneng River will not be diverted for the purpose of the Geluk Mine operation. There is enough mineral resource available throughout the mining right area to exclude the river from mining activities. Community members will also still have access to the Shakwaneng River in its lower reaches towards Maphopha, outside the fenced off mining right area. Grazing can be accommodated within the Mining Right Area on an agreement between Rakhoma and traditional council. There would be areas with low to no mining activity for several years within the mining right area which can still be used for grazing by locals if required.

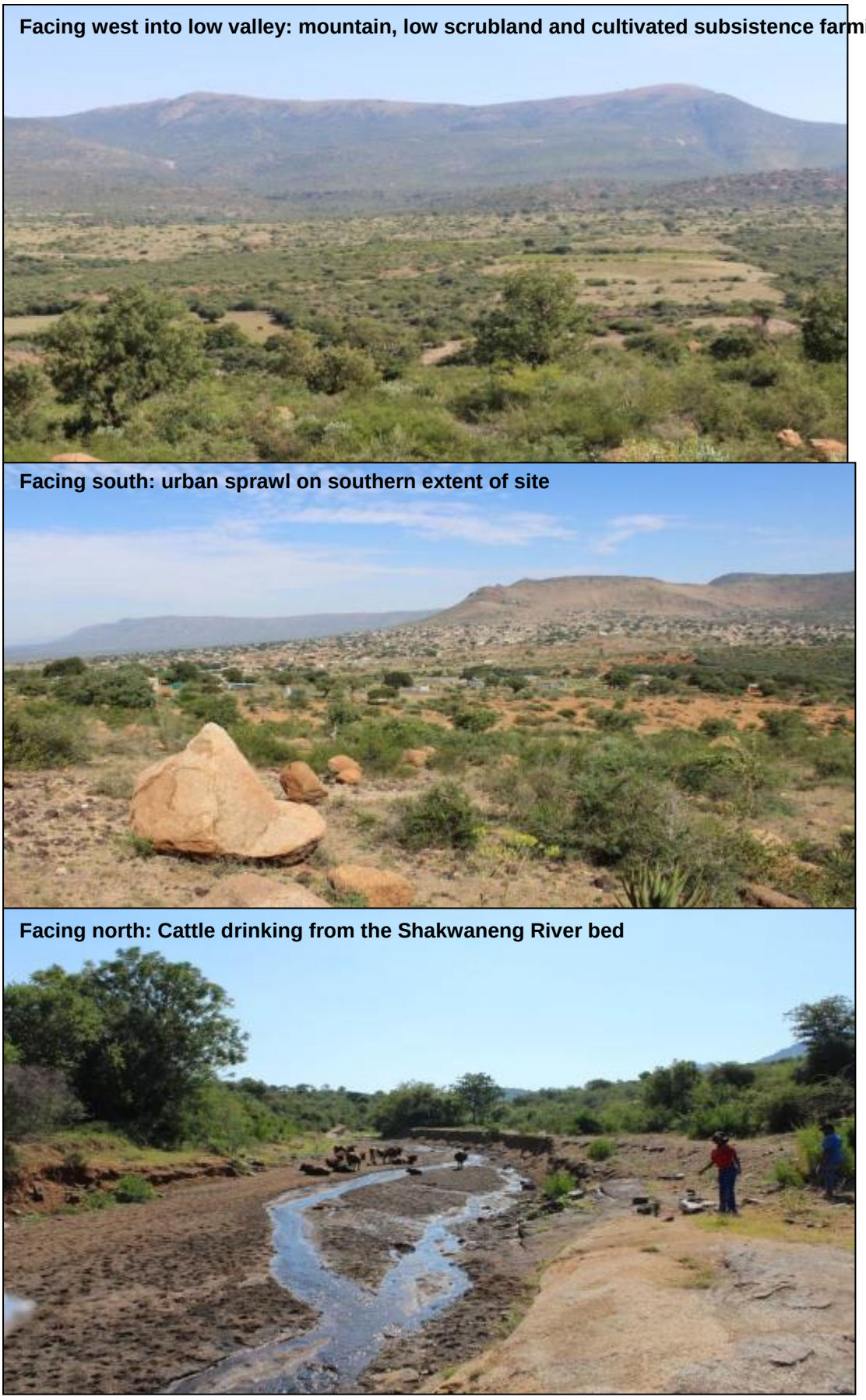


Figure 30: Photos illustrating current onsite activities

Figure 31: Ridge system on eastern portion of project site

8.3 Land use and land cover of the study area

According to 2014 National Land Cover Map generated in SANBI BGIS for the project site the following land cover corresponds to farms Geluk, Geluk Oos and Ironstone (Figure 32):

- Urban Village (settlements)
- Cultivated subsistence (low)
- Low Shrub land
- Woodland / Open Bush
- Thicket / Dense Bush
- Water Seasonal (Dam)
- Erosion, Donga formation

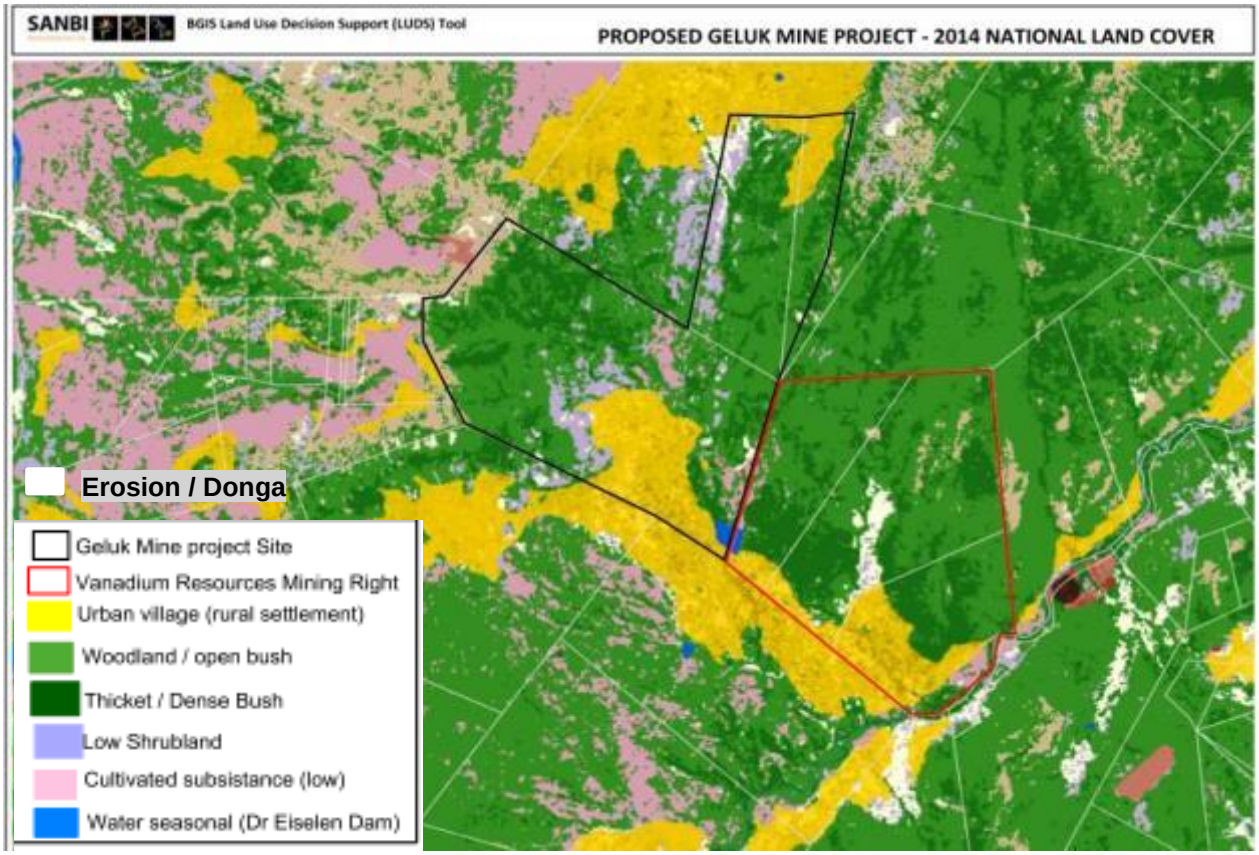


Figure 32: Land Cover of study site, 2014 National Land Cover (DEA)

The land cover for the study site indicates that the majority of the site is still natural covered in open to dense bush with ridges on its western and eastern boundaries. The Shakewaneg River flows from north to south along the D2219 route dividing the study area into a western and eastern portion. The balance of the site is populated in the northern and southern extent. There are some small patches of cultivated subsistence farming along the river.

The regional study area mimics the study site land cover, being mostly natural and intermixed by urban sprawl and subsistence farming.

A Mining License (LP30/5/1/2/2/10095MR) was granted to Vanadium Resources (Pty) Ltd on the farm Steelpoortdrift 365KT directly south-east of the proposed Geluk project area. Mining has not commenced. The site is too bordered by the Leolo Mountain rage, covered by natural vegetation and urban sprawl in the low lying areas.

8.4 Climate Data

8.4.1 Climate and Temperatures

The project area is located in the Sekhukhune District of Limpopo Province. The site climate is characteristic of the Highveld Climatic Zone. Daily temperatures vary considerably at different localities, with high temperatures in lower-lying areas and lower temperatures on southern aspects on mountains. Temperature data for the local area was obtained for the period 2000 - 2012 for the Maphopha area. (www.worldweatheronline.com) Refer to Table 27.

Table 27: Temperature Data indicating Max, mini and mean temperature for study site

Temperature Data (provided in °C)													
	Annual	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Min Temp	13.42	17	17	17	14	10	9	8	10	12	14	16	17
Max Temp	26	28	28	28	26	25.	23	23	24	26	27	27	27

From Table 28 it is evident that the annual average maximum and minimum temperatures for the study site is 26°C and 12.6°C respectively.. Average daily maximum temperatures range from 29.7°C in February to 23°C in July, with daily minimum ranging from 17.5°C in December to 4.8°C in July.

Furthermore, during December 2015, the noise and vibration specialist from dBAcoustics took a reading of the temperature at the Geluk Mine project site. The readings were as follows:

Daytime: 28.5 °C, the humidity was 30%.
Night-time: 19.5°C, the humidity was 40%

8.4.2 Rainfall data and Evaporation

Rainfall data was abstracted from the AED Floodline Delineation Report and the Water Resources Study of South Africa (WR2005, 2012) was used to obtain rainfall and evaporation data described in the sections below.

8.4.2.1 Rainfall data

The study area falls within the B41H quaternary catchment. This catchment receives a mean annual rainfall or precipitation (MAP) of **621.42 mm/annum** in terms of the Water Resource of South Africa 2005 Database.

The highest rainfall is experienced during November to January, and the lowest rainfall from June to August.

8.4.2.2 Evaporation Data

The evaporation data obtained from the WR 2005 database indicates a mean annual evaporation (MAE) for the study area of between 1600mm – 1700mm.

Yet, the measurements of the WR2005 database are taken on Symons pan evaporation measurements and need to be converted to Lake Evaporation. The Symons pan needs to be multiplied by a lake evaporation factor. An overall evaporation factor of 0.8 is applied to the 1600mm – 1700mm. **Consequently the MAE is considered to be between 1280mm – 1360mm.**

The highest monthly evaporation occurs in the summer months from October to March, whilst during April to September lower monthly evaporation is observed.

8.4.2.3 Wind Direction &Speed

The wind direction and speed measurements taken by dBAcoustics during December 2015 were as follows:

During the day the wind speed on site was less than 2.3m/s. The wind direction was blowing from a south-easterly direction. The reading conducted at night indicated a wind speed of less than 1.8m/s. The wind direction was blowing from a south-easterly direction.

The predominant wind direction for the area is east-northeast (>16 frequency of occurrence) and northeast (>16 frequency of occurrence. Wind speeds generally vary between 2m/s and 5m/s with an average wind speed of 3.2m/s. Day-time and night-time wind flows vary for the site with an increase in frequency of winds from the west-southwest during night-time conditions. Refer to Figure 33 for wind roses for the proposed project site. Data obtained from Air Quality Impact Assessment 2016, Airshed.

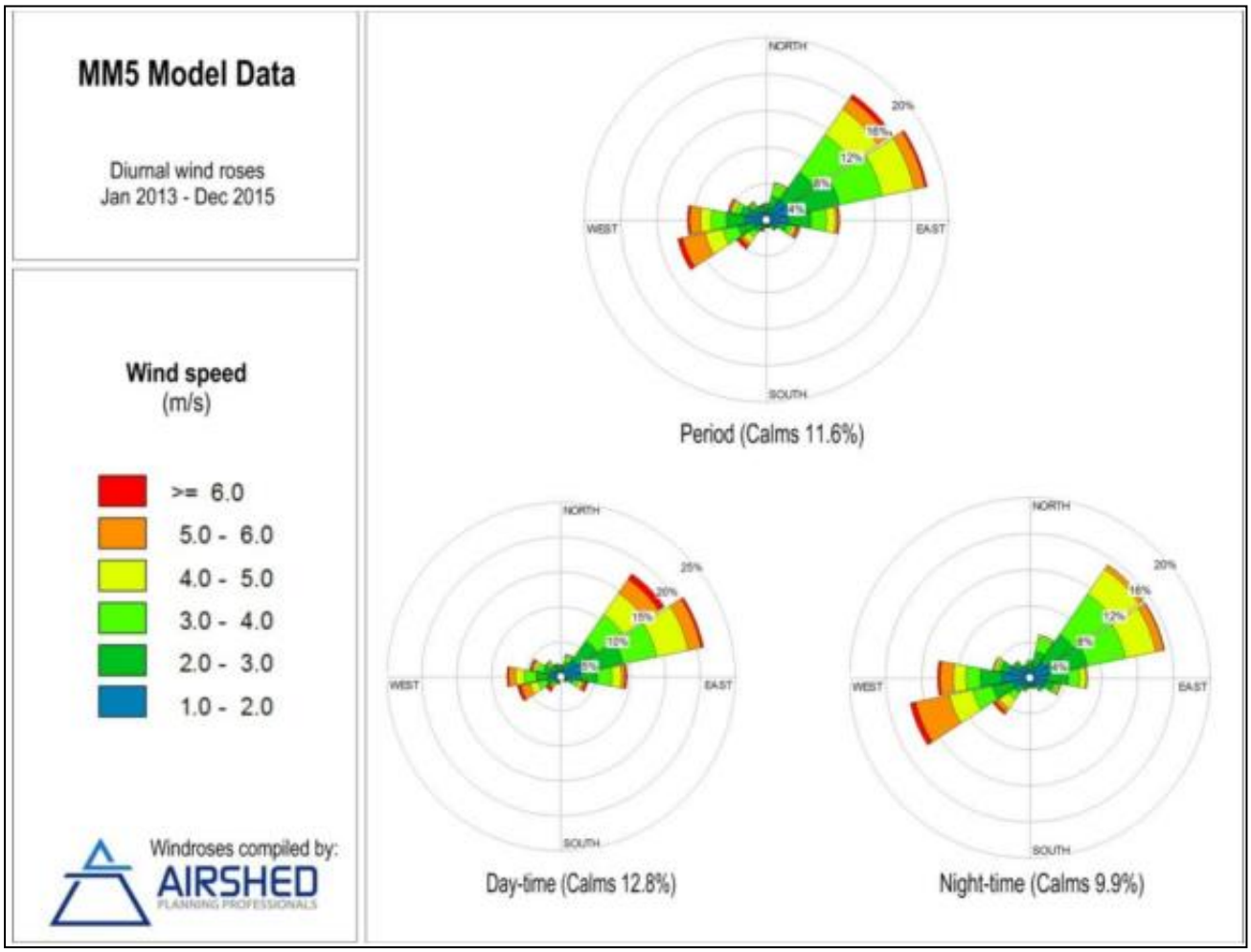


Figure 33: Period, day-and night time wind roses for period 2013-2015 (Airshed Planning Professionals, May 2016)

8.5 Geology

8.5.1 Regional Geology

The Geluk Mine project area is situated in the eastern lobe of the Bushveld Igneous Complex (BIC). It is described as a basin-shaped mass of igneous rocks. It is dominated by the Lower, Critical, Main and Upper Zones of the eastern Rustenburg Layered Suite of the BIC (Vaalian). The three sub zone, namely Croydon, Dwars River and Dsjate consists of norite, peroxenite, anorthosite and gabbro and are characterised by localised intrusions of magnetite, diorite, dunite, bronzitite and harxburgite.

The base rock in the study area comprises magmatic, Archaean Granite and Gneiss. The layered suite is overlain by the Lebowa Granite suite comprising Nebo Granite representing the final stratigraphic unit of the BIC.

Thus the regional geological setting of the area is highly diverse and ranges from intrusives gabbros and granites of the Roossenekal and Lebowa Granite Suite, respectively, through to the sedimentary lithologies of the Pretoria Group. (Figure 34)

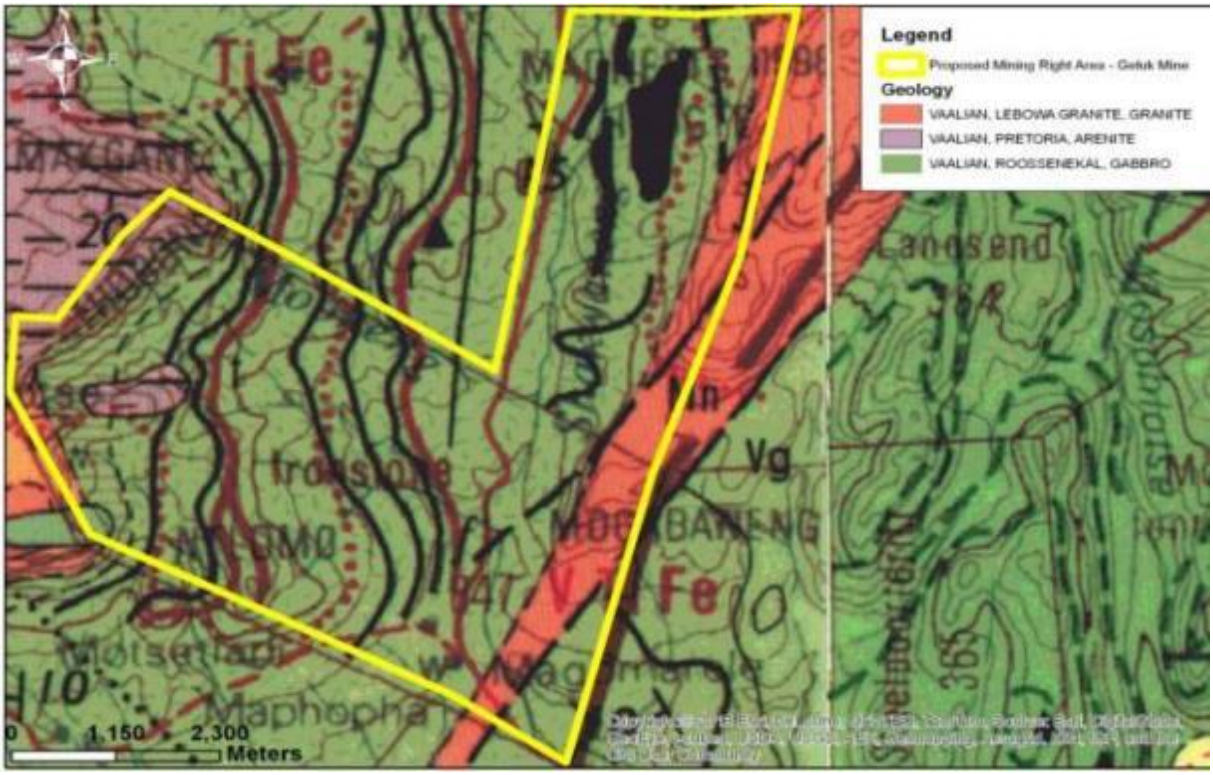


Figure 34: Geological Setting of project area (1: 250 000 Geological Map Series of SA - 2428 Nylstroom):

8.5.1.1 Pretoria Group:

The group is dominated wide variety of sedimentary rock units ranging from mudrocks alternating with quartzitic sandstones, significant interbedded basaltic-andesitic lavas, subordinate conglomerates, diamictites and carbonate rocks. Magaliesburg Arenites are overlain by mudrock and sandstone formations in the area.

8.5.1.2 Lebowa Granite suite

This suite corresponds to the ridge/mountains on the eastern portion of the study site. It is underlain by the Nebo Granites from the acidic phase of the Bushveld Complex. These rock units are coarse grained; pink to grey in colour; and mainly made of alkali feldspars and quartz, with minor mafic minerals.

8.5.1.3 Roossenekal Sub-Suite

The proposed Geluk mine area is mostly underlain by the gabbro ranges of the Roossenekal Sub-suite belonging to the Upper Zone of the Rustenburg Layered Suite. In the eastern limb, the Sub-suite is divided into three ferrogabbroic rock units viz; Luipershoek Olivine Diorite, Ironstone Magnetite Gabbro and the Magnet Heights Gabbro.

8.5.2 **Ore body at project site**

The project site is located at Magnet Heights, where the ore body forms part of a vanadium-bearing titaniferous magnetite deposit that occurs as more than 25 magnetite layers in the Upper Zone of the BIC.

Four magnetite layers were intersected during the prospecting drilling program. These have been defined as the Main Seam, First Seam, Second Seam and Third Seam. The Main seam is located at the bottom of the succession. The ore body is dipping approximately 11° in a direction between 265 ° to 280 °. A normal fault with a throw of between 30m and 50m, and

a strike of 200°, was found to coincide with the Shakwaneng River gorge that forms the most prominent topographical feature of the project area.

The average depths of each seam below surface are: Main Seam - 10.77 m, First Seam - 10.03 m, Second Seam - 7.85 m, Third Seam - 6.41 m. The Main Seam is of primary interest and is the bottom-most of the four seams. It is found over approximately 80% of the drilled area. The average depth of the main seam is 11 m with a maximum depth of 88 m. The maximum mining depth will be 20 m.

To date only 395 ha of the mining area has been explored and modelled, which accounts for 12.5% of the total area of approximately 3,165 ha for all three properties.

The drilling programme boreholes which intersected the magnetite layers were georeferenced. The aerial location of the boreholes and ore body intersected on the Geluk Mine project site is illustrated in Figure 35.

8.5.3 Mineral Resource Targeted

The Main Seam is of primary interest and is the bottom-most of the four seams. It is found over approximately 80% of the drilled area. It is also the thickest of the seams with an average thickness of 3.19m. V2O5 grade within the Main seam is the highest of the four seams with an average in situ grade of 1.38%. Upon magnetic separation it is shown to have 84.11% magnetic material with an increased V2O5 grade of 1.64%. This seam was found to have a high degree of continuity in terms of seam thickness, grade and aerial extent.

The three upper seams are found over smaller portions of the drilled area and contain a third of the Main Seam's thickness. V2O5 grades are lower, but they do contain magnetic portions of 70% to 77% with V2O5 grades of 1.41% to 1.54%. Their occurrence is sparser than the Main Seam.

Three ore types occur on site which will be mined, namely seam ore, pavement ore and rubble ore.

The average depths of each seam are as follows:

- Main Seam – 10.77m
- First Seam – 10.03m
- Second Seam – 7.85m
- Third Seam – 6.41m

When considering the Main Seam alone, 12.694 Mt of in situ seam is targeted for mining, yielding 9.651 Mt of concentrate at 1.75% V2O5. Targeting of all available economic seams results in the scheduling of 13.062 Mt in situ, yielding 9.898Mt of concentrate at 1.74% V2O5.

Figure 36 illustrates the Aerial extent of the respective seams.

Figure 37 illustrates the Section Plot of the seams intersected.

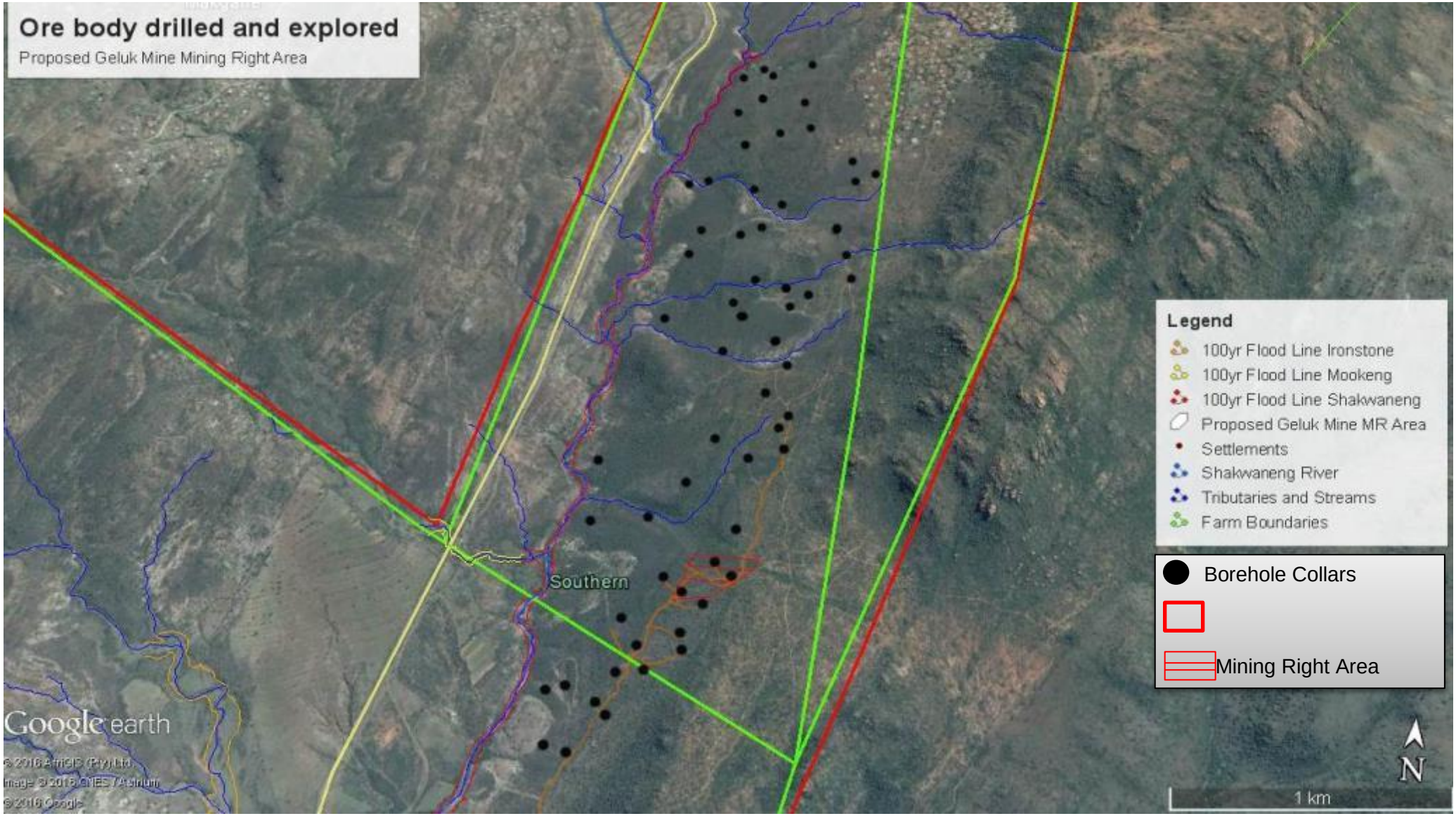


Figure 35: Aerial Locality Map of mineral resource (drilled area)

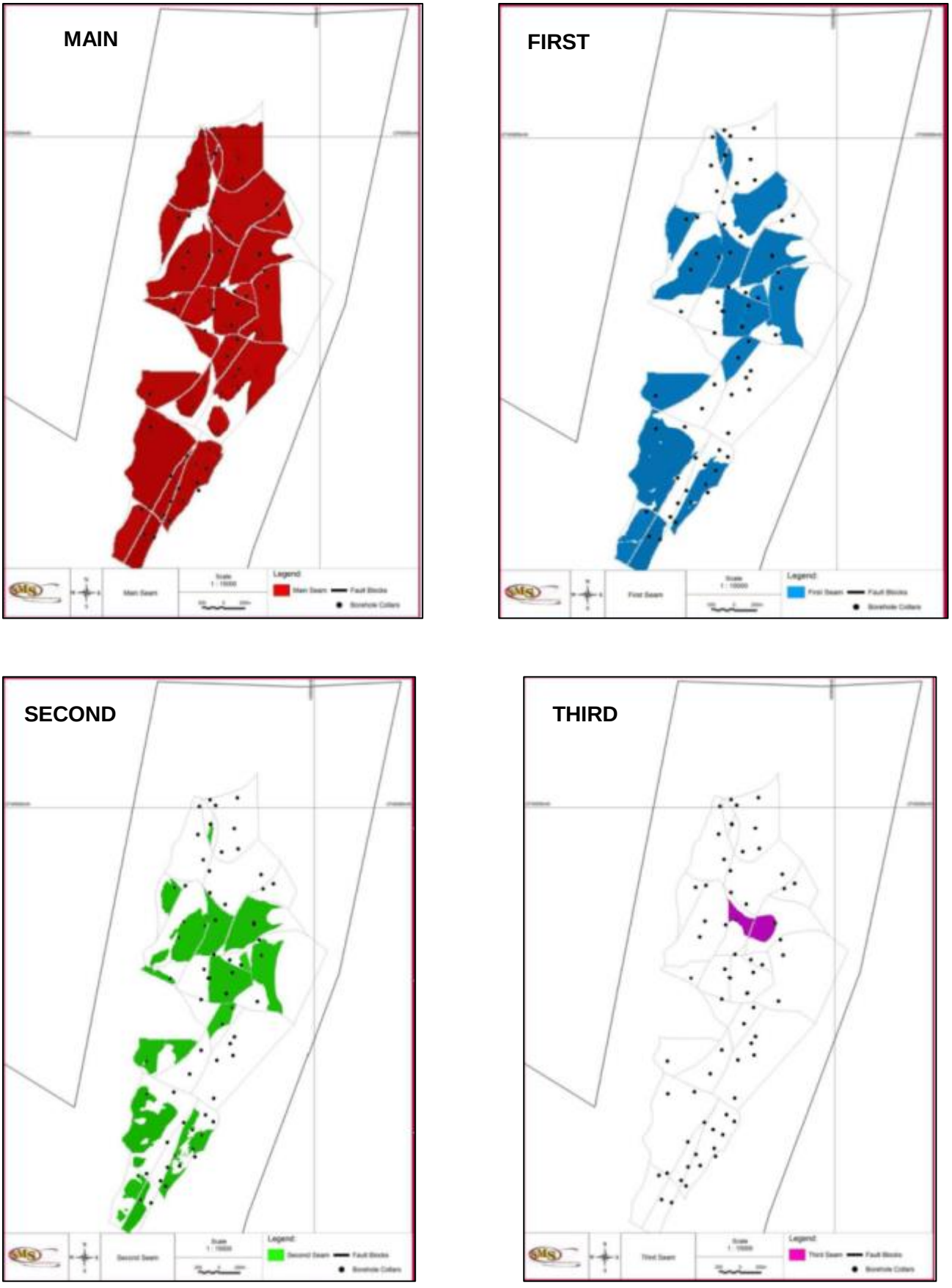


Figure 36: Aerial extent of seams

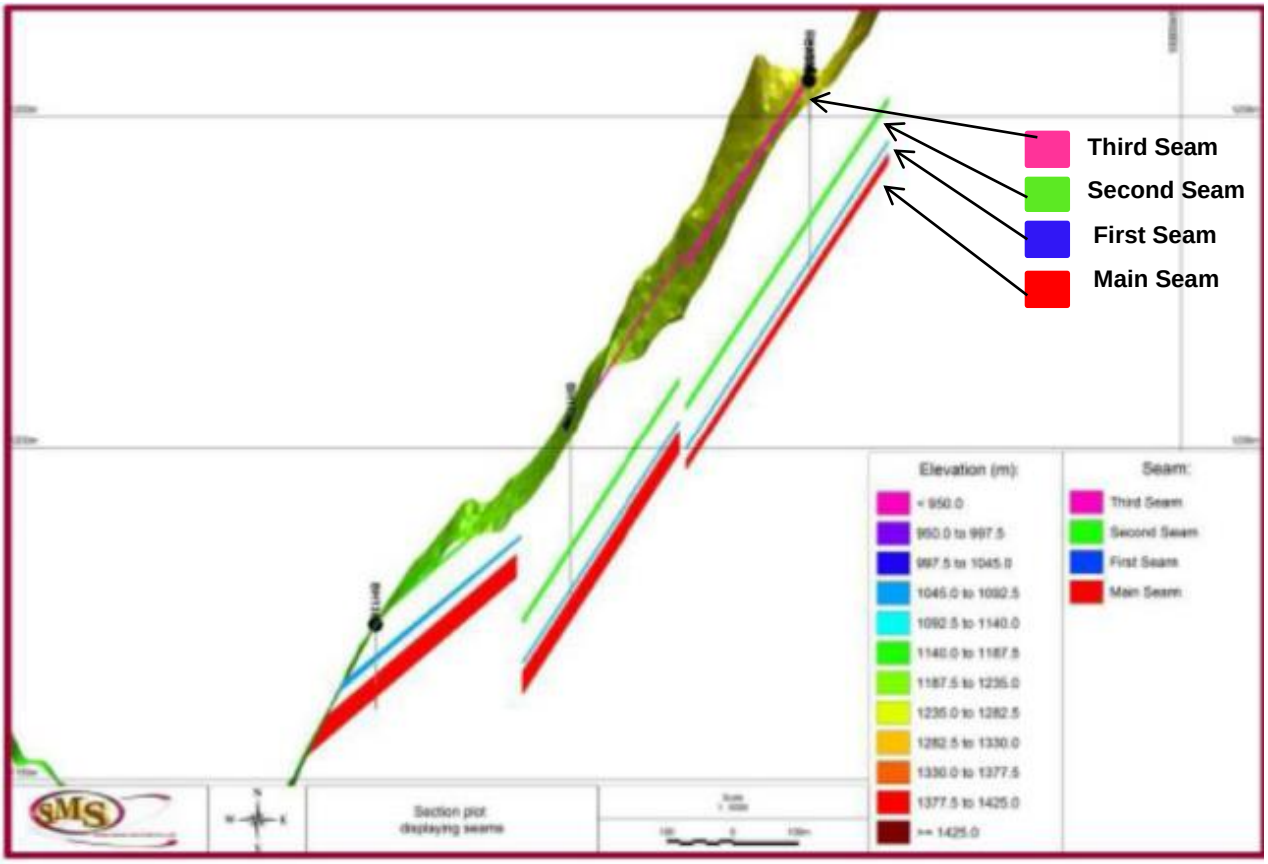


Figure 37: Section Plots of the seams intersected

8.6 Soils, Agriculture Potential and Land Capability

A Soil and Agricultural Impact Assessment Study was conducted by Afzelia Environmental Consultants (Pty) Ltd during January and April 2016. The SAIA is attached under Volume 2 –Specialist Reports; Appendix A.

The study tasks included assessing the soils in terms of texture, soil depth, subsoil permeability, slope, rockiness, surface crusting, and wetness. Using information gathered onsite and from a literature review a soil map was created. The soil information and land type information was then used to create a Land Capability Map.

8.6.1 Soil types

Six soil types were identified on the project site. It includes *Hutton* (Hu), *Oakleaf* (Oa), *Katspruit* (Ka), *Dundee* (Du), *Mispah* (Ms) and *Glenrosa* (GS). Table 28 provides a description of the soils identified and Figure 38 maps the soil types in relation to the site.

Table 28: Description of soils identified on site

Soil Form	Horizon	Soil Colour	Soil Texture	Depth (mm)	Observations
Hutton	Orthic A over Red Apedal B Horizon	A-5YR 4/6 B-5YR 5/6	sandy clay loam texture	A: 0-400 B: 400-800	Identified in localised areas adjacent to Dr Eiselen Dam in southern portion of site. The Shakwaneng River drains from north to south into the dam.
Oakleaf	Orthic A over a Neocutanic	A-7.5YR 3/3 B-7.5YR	sandy clay loam texture	A: 0-400 B: 400-800	Identified in a localised area next to the Shakwaneng River, central portion of study site.

	B horizon	3/4			
Katspruit	Orthic A over a G Horizon	A – 10YR 2/1 G-7.5YR 3/1	A-Clay G-Clay	A: 0-300 G: >300	Identified within channel associated with Shakwaneng River north of Dr Eiselen Dam.
Dundee	Orthic A over a Stratified Alluvium Horizon	A-7.5YR 3/4 B-7.5YR 3/2	A-Sandy B-Sandy Loam	A: 0-300 B: >300	Identified on banks of the Shakwaneng River.
Mispah	Orthic A Horizone	A-7.5YR 3/4	A-Sandy loam	A: 0-300	Identified through the site. They are very shallow in depth and non-arable
Glenrosa	Orthic A over a Lithocutanic B horizon	A-7.5YR 3/4	A-Sandy loam	A: 0-300 B: 300-500	Linked with the Mispah soil form. 70% of B horizon being hard and linked with parent bedrock that was partly weathered. Soil profile shallow and non-arable.

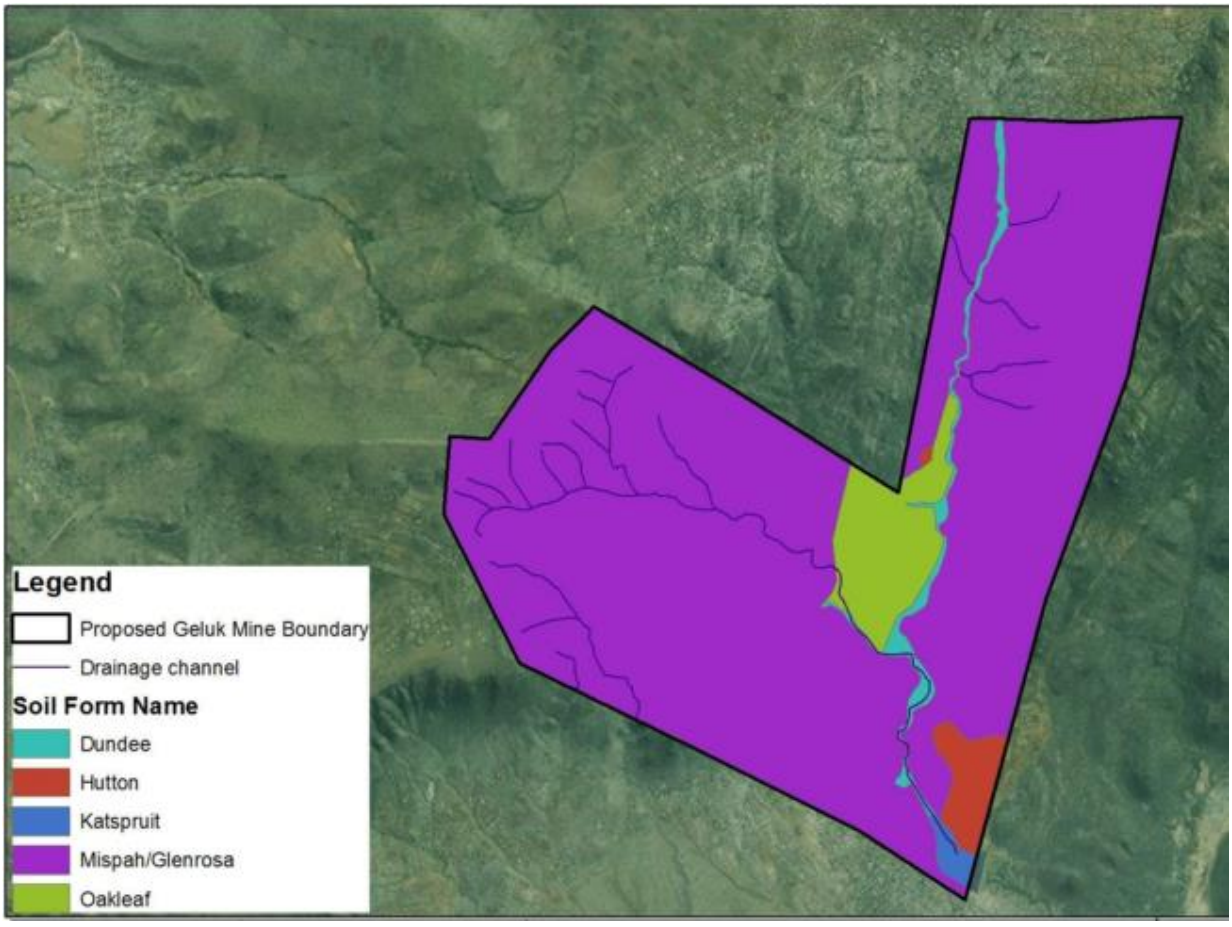


Figure 38: Soil Types on site

It is evident from Table 29 that soils of the project area are mainly shallow, rocky and clayey. A small part of the site next to the Shakwaneg River and the Dr Eiselen Dam specifies soils suitable for crop production (Hutton, Oakleaf). The soil textures are classified as sandy loam and sandy clay loam. The clay content was generally between 10-20%.The soil permeability is not a limitation to crop production with the Katspruit and Dundee soil only identified in association with the river and dam.

Limiting factors for crop production/plant growth are the steep slopes and soil depths, with most soils shallower than 300m. Slope profiles were perceived to be a limitation due to slope percentages between 20-25% in the majority of soils sampled and the presence of hard rock or a lithocutanic layer posing a limitation to deeper rooted vegetation.

8.6.2 Agricultural Potential and Land Capability

Land capability evaluation is an attempt to grade the potential of the land in terms of its best and worst uses in an arable situation. The land is classified according to its limitations, either on a permanent or temporary basis. The system is based on the negative features of the land. The classification is categorised on a scale of I – VIII. These are as follows:

Land Capability Class: (LCC)
I - III: Soils are suitable for arable crop;
VI: Sometimes be cultivated for annual crop under carefully controlled conditions;
V: Usually wetlands
VII and VIII: Suitable for domestic livestock and wild game only.

Please refer to the SAIA under Volume 2-Appendix A for a full description of the LCC classification.

The most important soil and landscape characteristics when applying the LCC are topsoil texture (Clay %), soil depth, subsoil permeability, slope, rockiness, surface crusting and wetness. At the study site these were found to occur according to the broad patterns scheduled in Table 29.

Table 29: Soil and Landscape characteristics of project site

Characteristic	Findings
Surface texture	Soils had a medium-low clay percentage (between 10%-20%) and have a generally sandy loam or sandy clay loam texture. Clay content does not limit crop production;
Soil depth	Generally shallow soils between 200-300mm overlying hard rock. This poses a limitation to deeper routed vegetation, not suitable for arable land;
Soil Permeability:	Soil permeability is low due to shallow soils and hard impermeable layers. The rock layer associated with the Glenrosa soil has limited subsoil permeability. The permeability of subsoils associated with the Hutton Oakleaf and Dundee forms were good as a result of deeper horizons related to the soils and low clay percentage;
Slope:	There is a wide range in slopes, which for the land capability classification, have been grouped. Two classes are applicable to the site: • 0-8% - land, which depending on soil profile characteristics is potentially in Class II • >20% - land, which is in Class VI or even VII, on slopes greater than 40%. The site consisted of steep terrain predominantly within the >20% category as the majority of the site is located within a valley. Soils identified adjacent to the Shakwaneng River are classified as having a 0-8% slope.
Rockiness:	In the field this was found to be a limitation to cultivation generally as a result of the identification of shallow soils overlying rock or a lack of soil.
Crusting:	In the field this was found to not be a limitation to cultivation. There is no need to consider this factor further.
Wetness:	Wet soils were identified in isolated patches associated with the Shakwaneng River as well as the Dr Eiselen Dam.

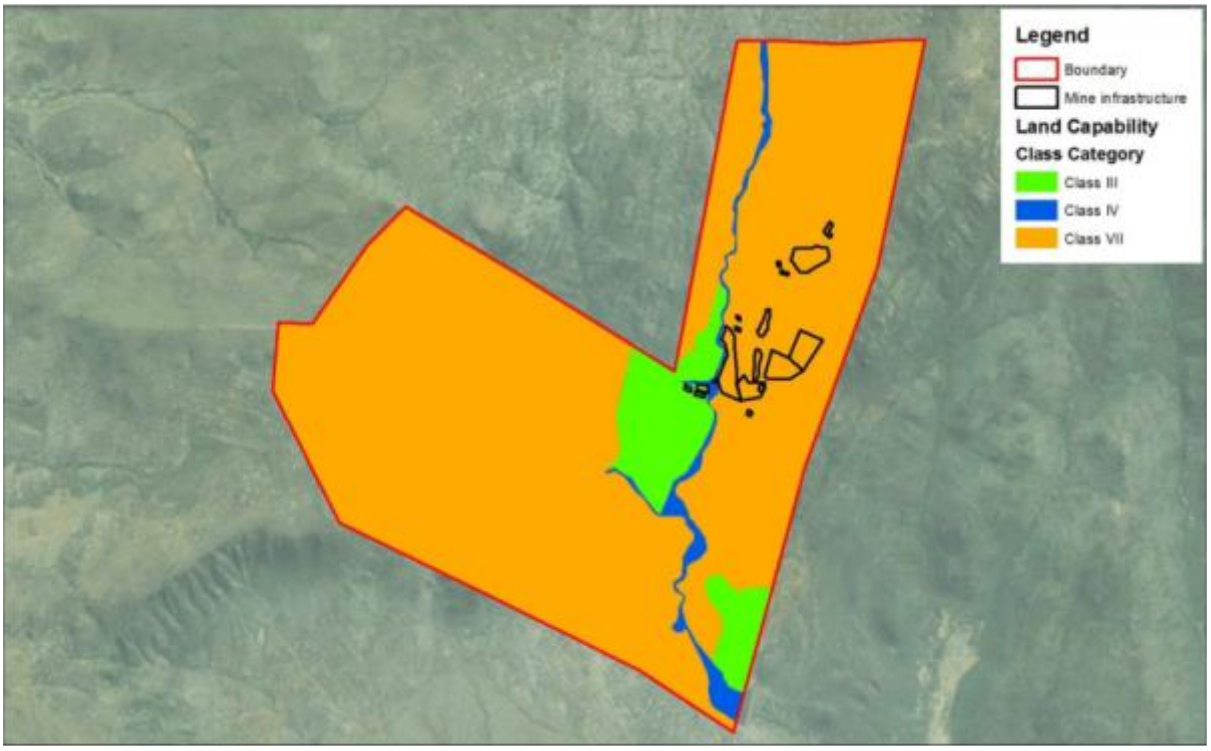


Figure 39: Land Capability Classes corresponding to the project site

As per Figure 39, the shallow nature of the soil, steep terrain, wet nature of some of the soils, the majority of the property has been classified as Class VII. The lower lying areas next to the Shakwaneng River are considered a Class III. The alluvial and wetland area soils are classified as Class V.

The proposed mine is not expected to have an impact on agricultural production in this area due to agricultural limitations of the site. Apart from the existing small scale subsistence gardens, there is no agricultural production in this area. It is also not envisaged that any future large scale agricultural production will occur on this site due to the abovementioned limitations.

8.7 Biodiversity

The services of Afzelia Environmental Consultants was commissioned to provide a combined team of terrestrial-, avifaunal-, aquatic and wetland ecologists to form part of the EIA project team to assist in determining the pre-mining ecological status quo for the study site, and to identify potential impacts thereon due to the proposed mining project.

The Biodiversity Reports have been attached under Volume 2 of the EIR as follows:
Appendix B: Ecological Impact Assessment (Flora and Fauna), May 2016
Appendix C: Aquatic Ecology and Wetland Impact Assessment, May 2016

The specialist reports detail the following:

- Plant and animal life occurring, or predicted to occur on the study site;
- Sensitive vegetation types and ecosystems occurring on the site; and
- Present ecological state, importance and sensitivity bof wetlands and aquatic environments identified on site.

8.7.1 **Terrestrial Ecology (Fauna and Flora)**

8.7.1.1 Flora

According to the national vegetation map (Mucina and Rutherford 2006; Scott-Shaw and Escott, 2011), the study area falls within the Sekhukhune Mountain Bushveld and Central Sandy Bushveld vegetation types (Figure 40).

8.7.1.1.1 Vegetation types

Sekhukhune Mountain Bushveld

The Sekhukhune Mountain Bushveld vegetation type is the dominant vegetation type of the area. It is characterised by mountains, undulating hills above lowlands, mixed bushveld, open to closed mountain bushveld and rocky outcrops (Mucina and Rutherford, 2006; NEMBA 2011). Approximately 15% of the Sekhukhune Mountain Bushveld vegetation type has been transformed through cultivation and urbanisation (Mucina and Rutherford, 2006). Furthermore, the broader area is under intense pressure from mining activities and urbanisation (Mucina and Rutherfors, 2006).

Central Sandy Bushveld

The Central Sandy Bushveld vegetation type occurs predominantly on the western portion of the study area. It is characterised by low, undulating areas, occurring between mountains and sandy plains. This vegetation type is considered vulnerable with less than 3% statutorily conserved in nature reserves. Approximately 24% of this vegetation type has been transformed through cultivation and urbanisation (Mucina and Rutherford, 2006; Scott-Shaw and Escott, 2011).

Land use on site

- Urban sprawl, Agriculture (subsistence farming, grazing)
- Shakwaneng River (utilised for washing, source of fresh water for humans, livestock and crops)

8.7.1.1.2 Vegetation units

The project site comprises four vegetation units (Figure 41), namely;

A. Vegetation surrounding Dr Eiselen Dam;
B. Riverine vegetation & Riverine Thicket;
C. Mountainous vegetation;
D. Disturbed Bushveld.

A description of each unit follows below.

A. Vegetation surrounding the Dr Eiselen Dam

The vegetation surrounding the dam is highly transformed and disturbed through cattle grazing and informal infrastructure (roads and footpaths). It falls within the Sekhukhune Mountain Bushveld on lower eastern portion of the site. The findings of the unit are detailed below.

Conservation priority: Low
Sensitivity: Low
Species richness: Low
Need for rehabilitation: High
Dominant Plant species: *Acacia karroo* (Sweet thorn), *Gomphocarpus fruticosus* (milkweed)
Red data species: None
Dominant alien species: *Senna didymobotrya* (Peanut butter cassia)

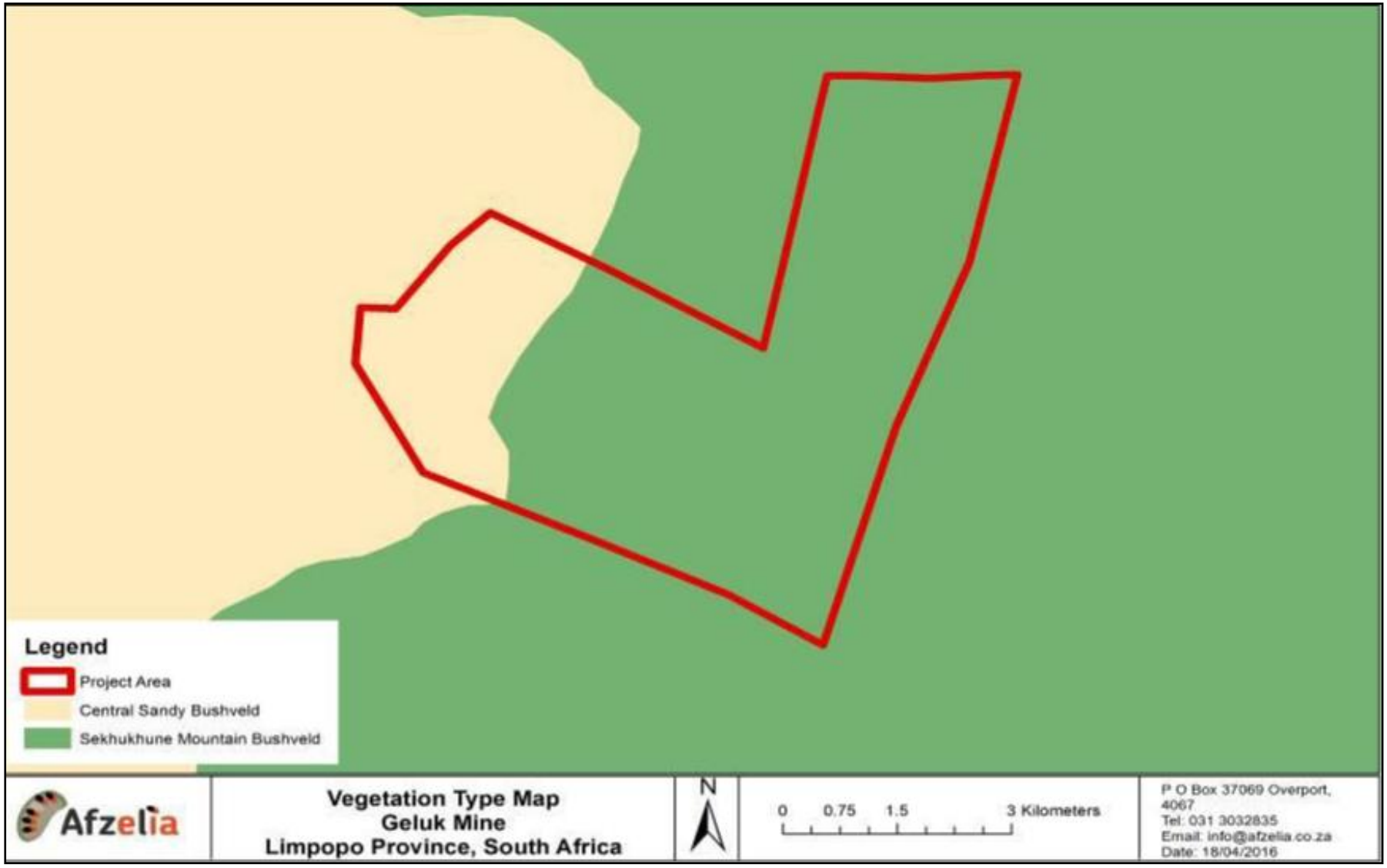


Figure 40: Vegetation types corresponding to the project site

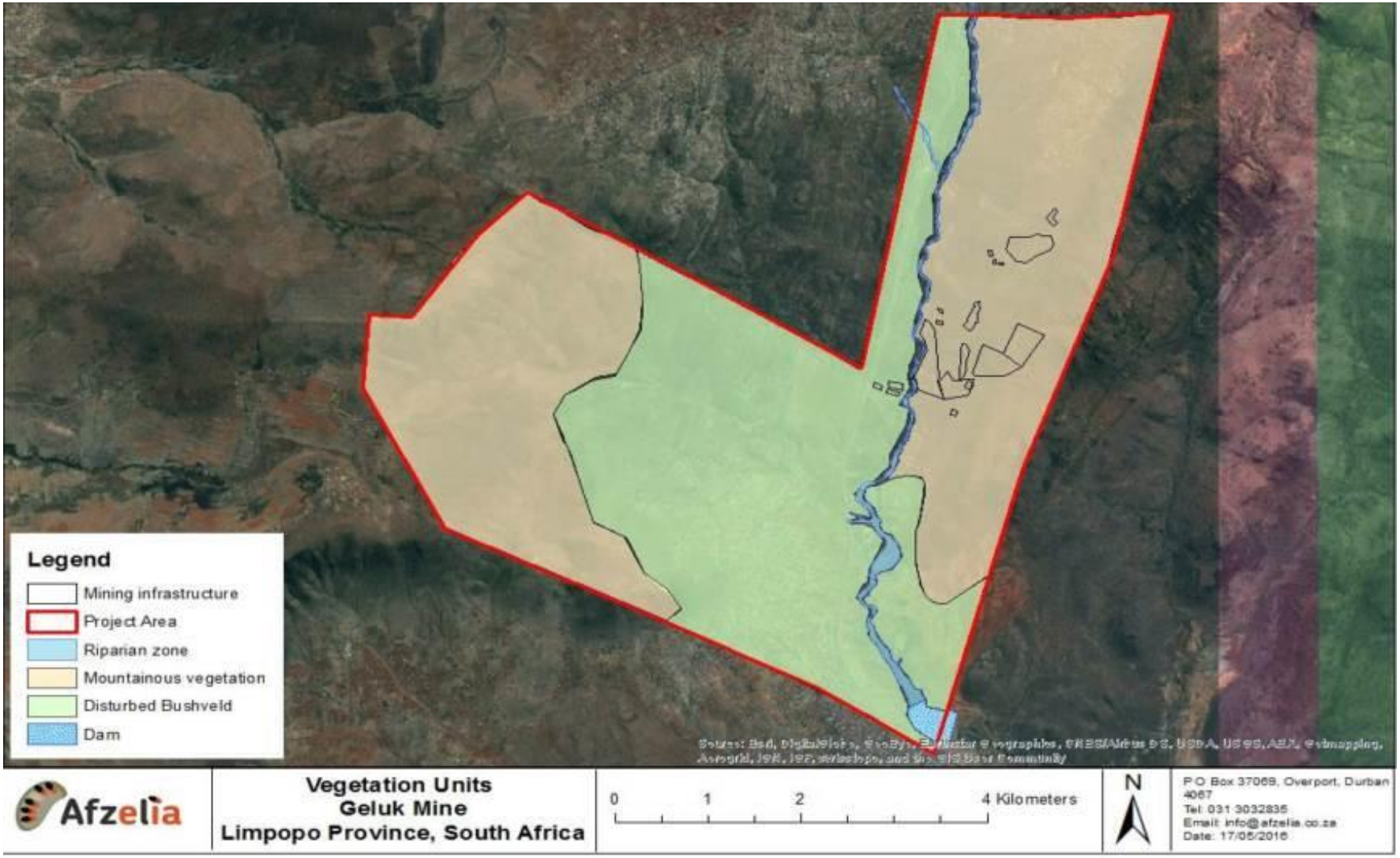


Figure 41: Vegetation units of the Geluk Mine Site

B. Riparian vegetation & riverine thicket

This unit corresponds also to the Sekhukhune Mountain Bushveld on the eastern portion of the site. The Shakwaneng River runs through the area from north to south. Riparian vegetation and riverine thicket is associated with the river.

Conservation priority: High
Sensitivity: Moderate-High
Species richness: High
Need for rehabilitation: High
Dominant Plant species: *Acacia ataxacantha (Flamethorn), Eragrostis curvula (weeping lovegrass), Gomphocarpus fruticosus* (milkweed), *Ficus burkei* (wildfig), *Ficus Salicifolia* (Willow-leaf fig);
Red data species: *Crinum macowanii* (river lily), *Ilex mitis* (Cape holly)
Dominant alien species: *Senna didymobotrya* (Peanut butter cassia), *Zinnia peruviana* (Redstar Zennia/Jakobregop), *Salix babylonica* (Weeping Willow), *Ricinus communis var. communis* (castor oil plant), *Populus species* (Poplar), *Melia azedarach* (white cedar)

C. Mountainous Vegetation

The upper north eastern portion of the site consist of mountainous land and forms part of the Sekhukhune Mountain Bushveld vegetation type. Informal roads and houses border the area.

Conservation priority: High
Sensitivity: High
Species richness: Medium
Need for rehabilitation: Low
Dominant Plant species: *Acacia nilotica (Scented pod),* Aloe arborescens (Krans aloe), Aloe marlothii (Mountain aloe) and Searsia species.
Red data species: None
Dominant alien species: *Opuntia ficus-indica (Prickly Pear), Ricinus communis var. communis* (castor oil plant), *Senna didymobotrya* (Peanut butter cassia)

D. Disturbed Bushveld

The western portion of the study area was classified as disturbed bushveld. Sekhukhune Mountain Bushveld and Central Sandy Bushveld are the two vegetation types present. This area is highly transformed through urban development, such as houses and roads. Parts of the area are also being used for agriculture, particularly for mealie fields.

Conservation priority: Medium
Sensitivity: Low
Species richness: Low
Need for rehabilitation: Medium
Dominant Plant species*: Acacia* species (Acacia trees&shrubs), *Euphorbia species (spurges), Ficus species (*Fig trees)
Red data species: None
Dominant alien species: *Ricinus communis var. communis* (castor oil plant), *Senna didymobotrya* (Peanut butter cassia)

8.7.1.1.3 Red Data Species

Species of conservation concern are species that are facing a risk of extinction. In terms of the SANBI Plants of SA (POSA) database for the QDGS 2429 contains 200 potentially occurring plant species. Only two such species were identified during the site visit (Table 31). Removal permits from LEDET will be required if they fall within the mine or its infrastructure footprint.

A summarised list of species that may occur on site of which there are herbarium specimens housed in the National Herbarium are also included in table 30.

Table 30: Red List species identified/may occur on the study site

Scientific name	Status – SANBI Red List	Habitat
Species identified on site		
Crinum macowanii (River lily)	Declining	Shakwaneng River
Ilex mitis (Cape holly)	Declining	Shakwaneng River
Species that may occur on site		
Dicliptera fruticosa	Near Threatened	Open Woodland
Searsia sekhukhuniensis	Rare	Rocky hillside in bushveld
Zantedeschia jucunda	Vulnerable	Grassland
Elaeodendron transvaalense	Near Threatened	Open woodland and thickets
Euphorbia sekukuniensis	Rare	Closed woodland and thicket
Gladiolus rufomarginatus	Rare	Grasslands
Adenia gummifera var. gummifera	Declining	Forested ravines, forest patches

8.7.1.1.4 Protected Tree Species

There are 21 protected tree species believed to occur in the study area, and 2 of the species have been confirmed to occur on site (Table 31). Protected species identified will require removal permits/licenses from controlling authority Department of Agriculture, Forestry and Fisheries (DAFF).

Table 31**: Protected tree species confirmed to occur on site**

Scientific name	Common name
Sclerocarya birrea.subsp. caffra	Marula
Boscia Albitrunca	Shepards Tree

The project area must be thoroughly walked directly prior to the commencement of any mining activities, including moving onto site and any development of any associated infrastructure. If any protected trees are identified a permit is required from DAFF.

Other potentially occurring trees may include; the Acacia erioloba (camel thorn), Adansonia digitata (baobab), Afzelia quanzensis (Pod Mahogany), Balanites maughamii (torchwood), Breonadia salicina (Matumi), Catha edulis (Bushman's Tea), Combretum imberbe (Leadwood), Curtisia dentata (Assegai), Elaeodendron transvaalense (Bushveld Saffron), Lydenburgia cassinoides (Sekhukhune Bushmans Tea), Lydenburgia abottii (Pondo Bushmans Tea), Ocotea bullata (Stinkhout), Philenoptera violacea (Apple-Leaf), Pittosporum viridiflorum (Cheesewood), Podocarpus latifolius (Real Yellowwood), Podocarpus falcatus (Outeniqua yellowwood), Prunus Africana (Red-Stinkwood), Pterocarpus angolensis (Kiaat), Warburgia salutaris (Pepper bark tree).

The Pondo Bushman's Tea is more than likely not to occur in this area. It is very rare and corresponds only to two river gorges in Eastern Cape and KZN respectively.

8.7.1.1.5 Alien Invasive Species

Notice 3 of the NEM:BA, 2004 lists 379 plant species that are legally declared invasive species. Each species is assigned to one of three categories based on the level of threat posed by the species and the legal status assigned to each:

Category 1a – Plant species that must be combatted or eradicated.
Category 1b – Plant species that must be controlled. Complete eradication required
Category 2 – Plant species that must not be allowed to spread outside any property.
Category 3 – Plant species that when occurring in riparian areas must be considered to be category 1b

Listed Invasive Species and must be managed according to regulation 3 of NEM:BA, 2014.

13 Alien invasive species were identified onsite, which include Category 1b, Category 2 and other species. The species identified onsite area as follows:

Category 1b- Sweet prickly pear, Castor oil plant, Peanut butter cassia, Red sesbania, Queen of the night, Hairy white lettuce, Syringa.
Category 2 – White-, Grey Poplar, Black Wattle, Weeping Willow
Other – Redstar zinnia, Marigold/Astertjies.

8.7.1.2 Biodiversity Areas

According to the Limpopo Conservation Plan ver.2 2013 the Geluk Mine project site corresponds to three biodiversity property areas, namely;

- Critical Biodiversity Area 2 (CBA's - Optimal)
- Ecological Support Area 1 (ESA 1)
- Ecological Support Area 2 (ESA 2)

CBA's are those areas required to meet biodiversity thresholds. These can be terrestrial or aquatic features, which must be protected in their natural state to maintain biodiversity and ecosystem functioning.

ESA are supporting zones required to prevent the degradation of CBA and Protected Areas. An ESA may include an aquatic or terrestrial feature.

8.7.2 **Fauna**

8.7.2.1 Faunal micro habitat

Faunal habitats were classified into three broad micro-habitats that were identified on site: mountainous bush and rocky outcrops, wetland habitat including riverine, drainage lines, wetlands and dam and transformed habitats.

The mountainous habitats were the most natural. Riparian habitats support distinct floral and faunal species as it is a transitional zone between terrestrial and aquatic habitats. The least faunal activity was seen in the transformed habitats, with mostly human-exploiters being seen. From a mammalian perspective, the Serval and Brown Hyena are considered keystone species for the study area. Relatively unspoilt habitat exists within the area which has been proposed for the mine. This area is comprised of high biodiversity and supports the majority of plant and mammal species.

8.7.2.2 Important Bird Areas

No IBA's are situated in close proximity to the proposed mine site, however it is likely that birds may fly over and occasionally forage in the study area. The majority of the birds seen on the survey were in the mountains and along the riverine system. Four red listed avifaunal species have been recorded on site, *Eupodotis senegalensis*, *Sagittarius serpentarius* and *Gyps coprotheres* with *Ciconia nigra* being observed on site.

8.7.2.3 Present Impacts on Faunal species

There are high levels of human disturbance associated with the existing villages and habitat degradation due to grazing and subsistence farming resulting in limited faunal diversity around villages.

Villages, roads, pedestrian and livestock pathways occur south of the study area. Deteriorating water quality in the Shakwaneng River is owed to different water uses by villagers. Hunting has a high impact on remaining faunal species. These impacts have had a direct negative impact on the remaining fauna living within the study area.

During the site visit faunal presence was verified by visual sightings, burrows, calls and droppings and tracks. These are discussed in the below sections.

8.7.2.4 Mammals

During the site survey no species were seen. Spoor and dung encountered in the Sekhukhune Mountain Bushveld indicated the presence of several small to medium sized mammal species (namely Common Duiker and Klipspringer).

Species are absent due to surrounding human activities and has resulted in the decrease of available faunal habitat and diversity within the study site and surroundings. Mammalian species likely to occur in and around the settlement areas include feral cats, dogs, house rats and livestock. Numerous goats, cattle and dogs were found around the lower section of the river near Maphopha village.

Possibly 28 mammal species may occur within the proposed study. Some of these mammal species are highly sensitive to habitat. The study site is an ecological good area and likely to support these species. The key species that have been recorded in the study area are included in Table 32.

Table 32: Key Mammal Species recorded in the study area 2429QDGC

Common Name	Scientific name
Pangolin	*Smutsia temminckii*
Spotted necked Otter	*Hydrictis maculicollis*
South African Hedgehog	*Atelerix frontalis*
Juliana's Mole	*Neamblysomus julianae*
Gunning's Golden Mole	*Neamblysomus gunning*
Serval	***Leptailurus serval***
Brown Hyena	***Hyaena brunnea***

The Serval and Brown Hyena are considered keystone species for the study area. Both species are considered near threatened.

According to the South African Mammal Map indicates a further list of probable mammal species recorded with 2429DD QDGC these includes; Steenbok, Mountain Reedbuck, Common Duiker, Black-backed Jackal, Cape Fox, Caracal, Short-snouted Elephant Shrew, Eastern Rock Elephant Shrew, South African Spiny Mouse, Tete Veld Aethomys, Namaqua Rock Mouse, Bushveld Gerbil and Single Striped, Natal Mastomys, SA Pygmy Mouse, Angoni Vlei Rat, Acacia Rat, Gray Climbing Mouse, SA Pouched Mouse, Lesser Red Musk Shrew, Lesser Gray-brown Must Shrew, Lesser Dwarf Shrew and the Common Warthog. All these species are of least concern.

8.7.2.5 Avifauna

Red Data Listed Species (RDL)

Four RDL avifaunal species have been recorded on site (Table 33), Eupodotis senegalensis, Sagittarius serpentarius and Gyps coprotheres. Yet only one RDL, Ciconia nigra (Black Stork) was observed on site. It is likely to use the Shakwaneng River to forage but is not likely to breed onsite due to absence of cliffs.

Table 33: Avifaunal species of special concern recorded within the 2429DD QDGC (SABAP2, IUCN, 2014)

Common Name	Scientific name	Status
Black Stork	*Ciconia nigra*	Near Threatened
White-bellied Bustard	*Eupodotis senegalensis*	Unknown
Secretarybird	*Sagittarius serpentarius*	Vulnerable
Cape Vulture	*Gyps coprotheres*	Vulnerable

Overall species observation:

During the survey a total of 71 bird species were observed and recorded within the study site. The Sekhukhune Mountain Bushveld, riparian habitat and wetland areas were observed to have the highest species richness and abundance; sightings of Spotted Eagle Owl, Little Bee-eater, Crested Barbet, Dark Capped Bulbul and Steppe Buzzard were recorded. Along the banks of the river and in the riverine vegetation were Cut Throat Finch, Red Billed Queleas, Red Faced Mousebird, Amethyst sunbird and Fork Tailed Drongo. The wetland area next to the Dr Eiselen Dam had typically common wetland species such as Malachite Kingfisher, Southern Red Bishop and White Winged Widowbird.

8.7.2.6 Amphibian

No amphibians were observed during the survey. Amphibian species richness and abundance are particularly sensitive to pollution. This is of particular concern, as the acid mine drainage, from the potential mine, into the Shakwanang River (Shrijvershof 2016) will result in the drastic decrease of amphibian species in the river.

It is possible for some of the sand frog and toad species to occur on site within the Sekhukhune Mountain Bushveld, due to their hibernation habits. However, a more detailed investigation would be needed to verify this.

13 Frog species have been recorded within the Quarter Degree Grid Cell 2429DD according to the South African Frog Atlas Project (SAFAP). Common species which may occur within the wetland areas, drainage lines and riparian habitat close to the proposed mine and required roads are listed Table 34. No species of concern were recorded on in the study area according to SAFAP.

Table 34: Potential Amphibian Species occurring on the study site - SAFAP, 2429DD GDGC

Common Name	Scientific name

Bushveld Rain Frog	*Breviceps adspersus*
Raucous Toad	*Amietophrynus rangeri*
Painted Reed Frog	*Hyperolios marmaratus*
Guttural Toad	*Amietophrynus gutturalis*
Red Toad	*Schismaderma carens*
Broadbanded Grass Frog	*Ptychadena mossambica*
Flatback Toad	Amietophrynus maculatus
Bubbling Kassina	*Kassina senegalensi*
Snoring Puddle frog	*Phrynobatrachus natalensis*
Plain Grass Frog	*Ptychadenas anchietae*
Broadbanded Grass Frog	*Ptychadena mossambica*
Common river Frog	*Amietia quecketti*
Clicking Stream Frog	*Strongylopus grayii*
Natal Sand Frog	*Tomopterna natalensis*

8.7.2.7 Reptiles

Four reptile species were recorded during the survey which are listed in Table 35. A female Sekhukhune Flat Lizard was seen, yet could not be positively identified. There are two recognised subspecies, namely, *Platysaurus orientalis*, is considered Least Concern, while the second, *Platysaurus orientalis Fitzsimons*, is Near Threatened. The other threeobserved species are not in the Red Data List or threatened species list (Limpopo DFED, 2004).

As per SACRA (South African Reptile Conservation Assessment) database, 33 reptile species have been recorded within 2429DD QDGC (Table 35). Species of concern include the Soutspansberg Flat Lizard (Platysaurus relictus), South African Rock Python (Sebae natalensis), Swazi Rock Snake (Lamprophis swazicus) and Variegated Wolf Snake (Lycophidion variegatum) (Desmet et al., 2013; van Staden et al., 2014). The three snake species have a high chance of occurring within the study area as they inhabit rocky outcrops and well wooded rocky valleys.

Table 35: Reptile Species which occur / may occur on the study site

Common Name	**Scientific name**
A. Recorded during site survey	
Brown House Snake	(*Boaedon capensis*
Sekhukhune Flat Lizard	*Platysaurus Spp*
Variable Skink	*Trachylepis Mabuya varia*
Common Flap-necked Chameleon	*Chamaeleo dilepis*
B. Other species that may potentially occur on site	
Southern Tree Agama	Acanthocercus atricollis
Distant's Ground Agama	*Agama aculeata*
Southern Rock Agama	*Agama atra*
Wolkberg Dwarf Chameleon	*Bradypodion transvaalense*
Eastern Tiger Snake	*Telescopus semiannulatus*
Soutpansberg Flat Lizard	***Platysaurus relictus***
Sekhukhune Flat Lizard subspp.	***Platysaurus orientalis fitzsimons***
Van Dam's Girdled Lizard	*Smaug vandami*
Mozambique Spitting Cobra	*Naja mossambica*
Sekhukhuneland Flat Gecko	*Afroedura leoloensis*
Turner's Gecko	*Chondrodactylus turneri*
Common Dwarf Gecko	*Lygodactylus capensis*
Van Son's Gecko	*Pachydactylus vansoni*
Common Giant Plated Lizard	*Matobosaurus validus*
Bushveld Lizard	*Heliobolus lugubris*

Common Rough-scaled Lizard	*Meroles squamulosus*
Holub's Sandveld Lizard	*Nucras holubi*
Ornate Sandveld Lizard	*Nucras ornata*
Black File Snake	*Gonionotophis nyassae*
Short-snouted Grass Snake	*Psammophis brevirostris*
Western Yellow-bellied Sand Snake	*Psammophis subtaeniatus*
Striped Grass Snake	*Psammophis tritaeniatus*
Jacobsen's Thread Snake	*Leptotyphlops jacobseni*
Southern African Rock Python	***Python natalensis***
Cape Skink	*Trachylepis capensis*
Rainbow Skink	*Trachylepis margaritifer*
Leopard Tortoise	*Stigmochelys pardalis*
Delalande's Beaked Blind Snake	*Rhinotyphlops lalandei*
Puff Adder	*Bitis arietans*
Snouted Night Adder	*Causus defilippii*

Removal of natural vegetation and indigenous trees within the potential mining area must be kept to a minimum to decrease the impact on these species. It is highly recommended that as transformation takes place on site, a qualified herpetologist must be present to identify and safely remove all South African Rock Pythons, or other species, should they occur on the proposed mining site.

8.7.2.8 Terrestrial Sensitivity Assessment

A sensitivity map was compiled for the study area by making use of the results of the ecological assessment. (See Figure 42).

As per Afzelia's Ecological Impact Assessment a large portion of the study site is considered of high sensitivity. The area in which the proposed mining activities will occur is considered to be of a particularly high sensitivity. Parts of the site have been rated as moderately sensitive due to historic anthropogenic activities. However the sensitivity found on Geluk mine project site is similar to the regional landscape. The project site is located below the western edge of the Leolo Mountain range as appose to the majority of the southern and eastern land parcels being located within the Leolo Mountain range. (Figure 43) .

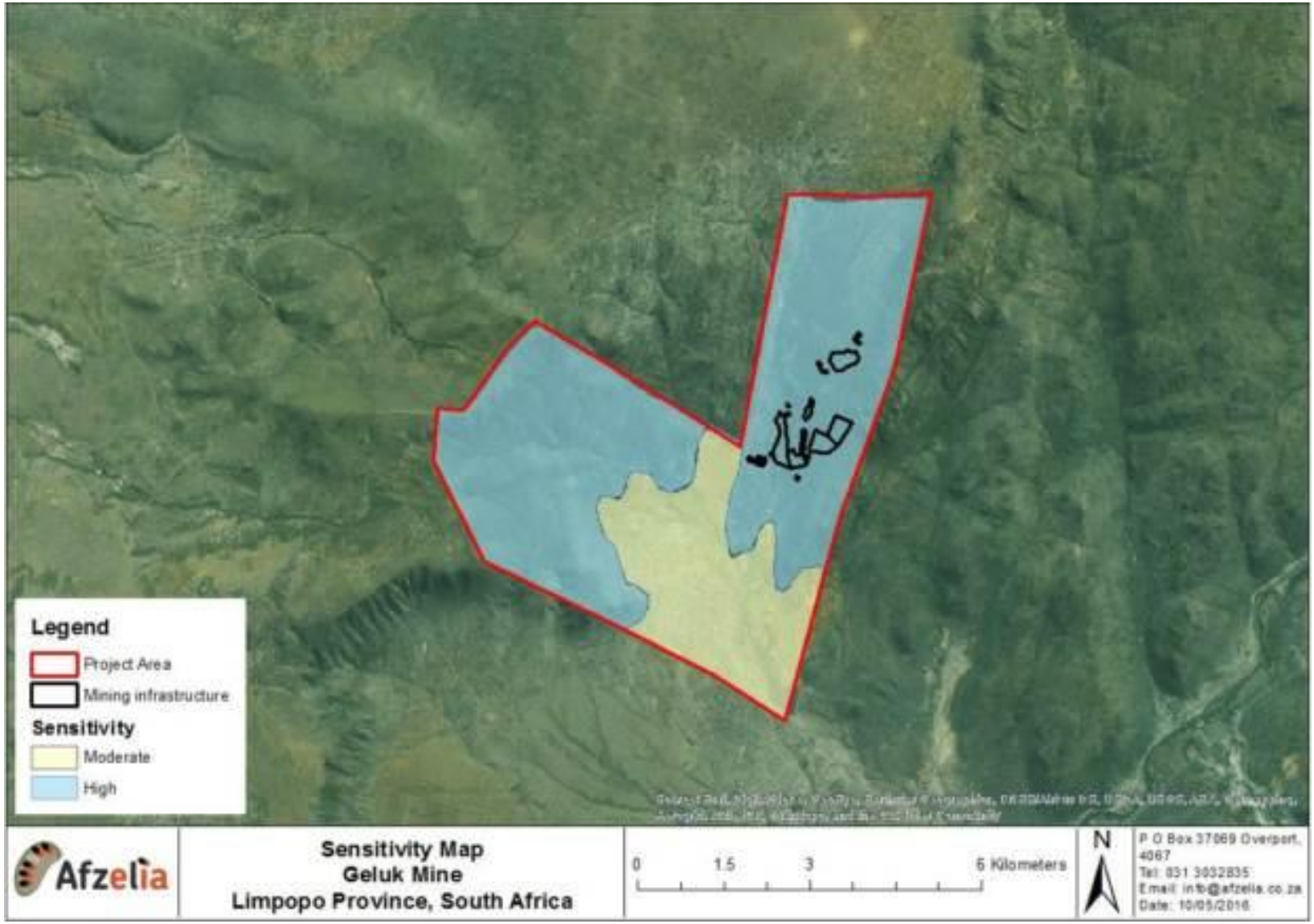


Figure 42: Terrestrial Sensitivity Map for Geluk Mine Project Site

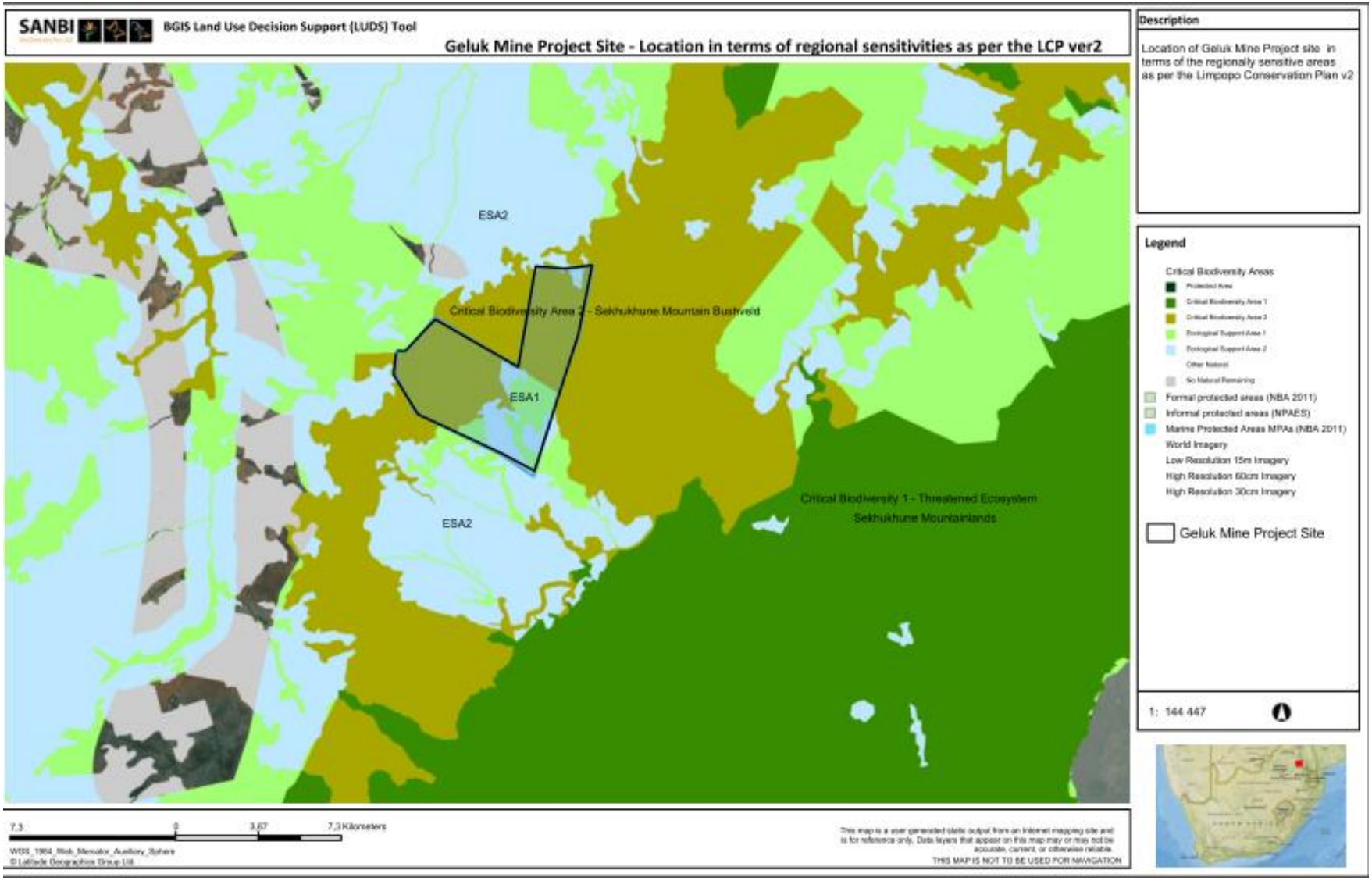


Figure 43: Sensitivity Map as per the Limpopo Conservation Plan v2 for the regional area

8.7.3 **Aquatic Ecology & Wetland Systems**

The aquatic ecological assessment was undertaken from the 19th to the 22nd of April 2016 to classify the present ecological state (PES) and Eco-status (EIS) of the aquatic ecosystems. This assessment covers the findings of visual findings, water quality assessment, diatom/benthic (SPI) analysis, riparian vegetation (VEGRAI) assessment, habitat assessment (IHIA and IHAS), macro invertebrate assessments (SASS5 and MIRAI) and fish assessments (FRAI) within the project boundary and downstream river systems all in accordance with the River Heath Programme (RHP).

The study area falls within the Olifants Water Management Area and the Steelpoort Sub-Water Management Area (B41H-primary drainage area). The aquatic ecosystems on site comprise the Shakwaneng River which originates within Ga-Mogashoa informal settlement and flows from north to south through the study site into the Dr. Eiselen Dam. Outside the project boundary the river flows south into the Steelpoort River. (See Figure 44)

Current existing impacts on the Shakwaneng and Steelpoort Rivers include:

- Impoundments (damming of drainage channels for washing & bathing)
- Erosion, open pit mining in local area
- Sewage, urban runoff
- Small scale subsistence farming;
- Overgrazing by domestic livestock has seriously degraded the vegetation in the densely populated areas;
- Pollution of rivers due to littering and locals doing laundry in river

The overall Present Ecological State (PES) for both the Shakwaneng and Steelpoort rivers was found to be a PES class C rating-***moderately modified*** mostly due to existing open pit mining in the local area, erosion, anthropogenic activities and lack of catchment management. The class C rating indicates a high Ecological Importance Sensitivity (EIS) rating. The overall rating was derived from several aspects which are discussed below.

8.7.3.1 Wetland

A wetland assessment was conducted. No wetland systems were identified within the project site.

One National Freshwater Ecosystem Priority Area (NFEPA) was identified within the study site and is associated with the Dr Eiselen Dam. Ground truthing for the presence of wetland conditions was undertaken and did not identify hydric soils outside of the Shakwaneng River channel throughout the study area and consequently no wetlands delineated within the site.

The Dr. Eiselen Dam seepage area is thus an artificial wetland situated outside the study site. It is created as a result of seepage from the dam wall. This artificial wetland forms part of the Shakwaneng River. (Figure 45).

8.7.3.2 *Insitu* Water Quality

The baseline water quality of the Shakwaneng and Steelpoort River were sampled to interpret the measured on-site variables for ecological requirements of the biota living in these systems. Sampling was undertaken at four points (Figure 44) to test the water quality, namely:

- Dr Eiselen Dam (Sampling Point 1), Shakwaneng River (Sampling point 2- up and 3-downstream), Steelpoort River (Sampling Point 4)

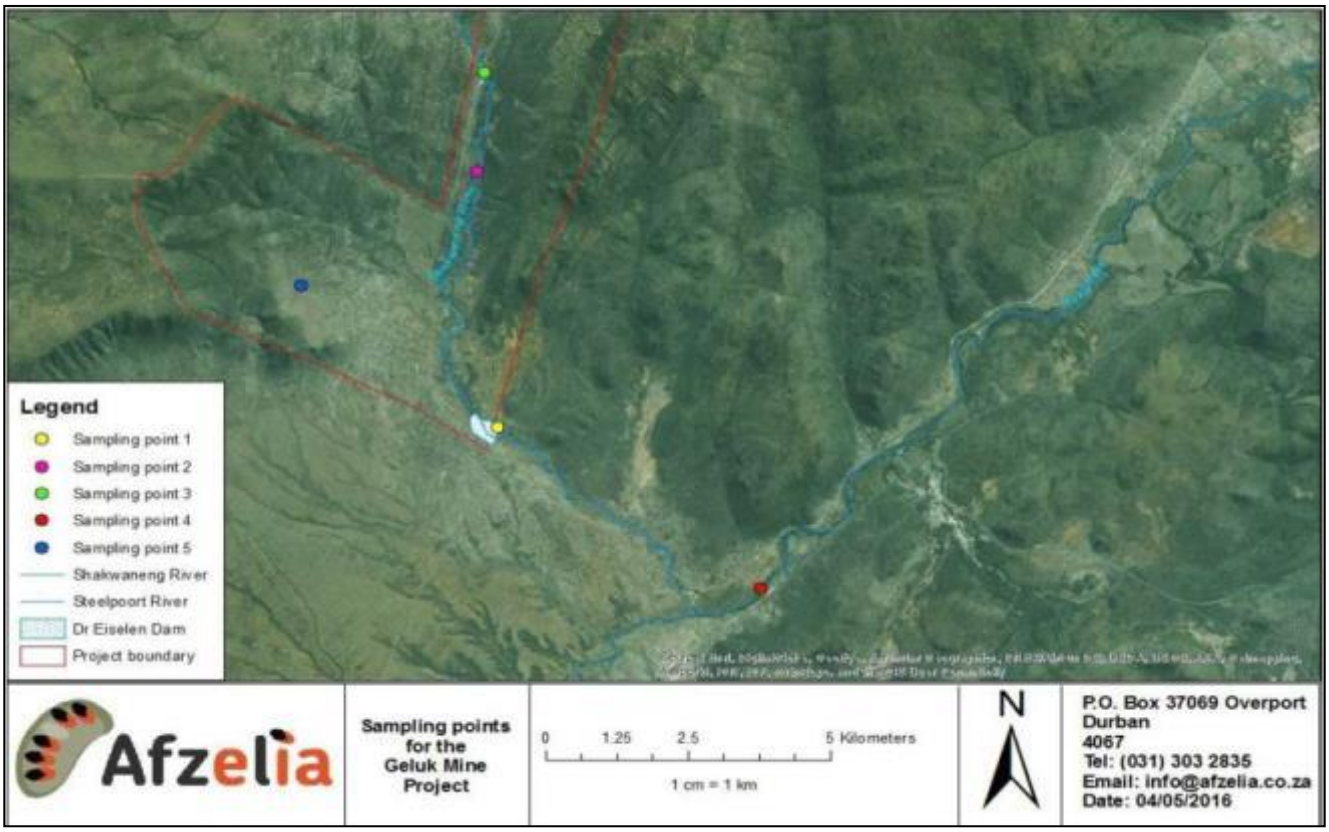


Figure 44: Sampling points for the Geluk Mine study site

Figure 45: Artificial Wetland Associated with Dr Eiselen dam seepage

Table 36: Insitu Water Quality data for Shakwaneng and Steelpoort Rivers

Site	Date	Co-ordinates	pH	Electrical Conductivity (µS/cm)	Temperature (°C)
Guideline levels			**6-9**	**<600**	
Sample point 1 Dr Eiselen Dam	20/04/2016	24°52'1.52"S; 29°58'34.17"E	8.76	590	26.8
Sample point 2 Downstream River	20/04/2016	24°49'32.75"S; 29°58'22.27"E	8.37	595	20.6
Sample point 3 Upstream River	21/04/2016	24°48'34.80"S; 29°58'26.35"E	8.82	572	27.2
Sample point 4 Steelpoort River (5km Downstream)	21/04/2016	24°53'35.50"S; 30° 01'03.43"E	9.2	300	25.5

As per Table 36, the water quality was good with an acceptable pH range (according to DWS Water Quality Guidelines) for both the Shakwaneng and Steelpoort Rivers, with the exception of high electric conductivity readings for the Shakwaneng River, potentially attributed to anthropogenic pressures on the river.

8.7.3.3 Diatoms

What are diatoms? Diatoms **are microscopic algae living in both fresh and salt water.**

The guide used to assess diatoms is the Specific Pollution Sensitivity Index (SPI) and the Biological Diatom Index (BDI). In addition, the percentage of pollution tolerant values (%PTV) is given, if above 20% may indicate presence of organic pollutants. The percentage of deformed values is also given, if it exceeds 2% it is considered significant, there may be a presence of heavy metals. The sample point results are listed in Table 37.

Table 37: Diatom results associated with Shakwaneng River and Dr Eiselen Dam within Geluk Mine study site

Site	Count	No. spec.	SPI	%incl. in SPI	BDI	%incl. in BDI	%PTV	% Deformed cells
Dr Eiselen Dam	400	18	14	95	15.5	78	1.6	12.5
Shakwaneng Upstream	400	24	13.1	96	14.5	71	3.3	4.8
Shakwaneng Downstream	400	22	15	100	13.9	86	2.7	2.0

Results indicate Dr Eiselen Dam had very high abundances of diatom *Archanthidium minutissimum (15.5)* which is considered to indicate clean (low nutrient) water, yet there were high levels of deformity (12.5%) found in cells indicating possible presence of a toxin/metal.

There is a shift in species composition from the Shakwaneng River up and downstream sampling points, indicating an increase in salinity at the Shakwaneng River downstream sampling point.

8.7.3.4 Macro invertebrate

8.7.3.4.1 SASS 5 Score

Aquatic macro invertebrates are good indicators of ecological integrity or the ecological status of a river. The South African Scoring System (SASS) 5 was used to determine the habitat availability and state of the sampled sites.

3 Sampling Points were established up and down stream of the Shakwaneng and Steelpoort Rivers. See Table 38 for results.

Table 38: SASS 5 Score of the three river sites for the Geluk Mine

	Shakwaneng River upstream	Shakwaneng River downstream	Steelpoort River
No of taxa	21	19	19
ASPT	5.14	4.58	6.37
SASS Score	108	87	121
EC Rating	D	D	B

The Steelpoort River (EC B) is within acceptable range (according to DWS Water Quality guidelines) with a largely natural state rating. The moderate (upstream) to largely (downstream) modified EC (D) rating of the Shakwaneng River indicates negative effects due to erosion, damming of water, urban runoff.

8.7.3.4.2 Mirai

MIRAI is the Macro invertebrate Response Assessment Index based on collective SASS 5 score of the site considered per reach of the rivers assessed. Modification metrics of the MIRAI include flow modification, habitat and water quality. Each factor is weighed and rated according to its reference condition.

The MIRAI scores were found to be moderately modified (Class C) for both Shakwaneng and Steelpoort Rivers. The macro invertebrate community present in the Shakwaneng River indicate modified water quality. The Steelpoort River received a moderately modified rating due to habitat degradation and anthropogenic pressures. Refer to Table 39.

Table 39: MIRAI Score for three river sites associated with Geluk Mine

	Shakwaneng River upstream	Shakwaneng River downstream	Steelpoort River
INVERTEBRATE EC	63.29370915	62.57631937	68.63247863
EC Rating	C	C	C

8.7.3.4.3 Fish

The present ecological state (PES) of fish in the river systems were determined by the FRAI (Fish Response Assessment Index). Dr Eiselen Dam was excluded as the protocol can only

be applied to rivers. A total of seven fish species (Table 40) were recorded in the Steelpoort River, of the 15 expected indigenous species. The Steelpoort river has a largely modified (Class C/D) FRAI score (Table 41).

The abundance of fish in general was very low during the survey. Existing impacts on the system include anthropogenic activities and sediments from surrounding areas.

Table 40: Fish Species collected during the survey including FROC (Frequency of Occurrence)

Common name	Species Scientific name	Frequency of occurrence
Sharptooth Catfish	*Clarias gariepinus*	1
Southern Mouthbrooder	*Pseudocrenilabrus philander*	1
Mozambique Tilapia	***Oreochromis mossambicus***	**1**
Banded Tilapia (Kurper)	*Tilapia sparmanii*	1
Shortspine Suckermouth	*Chiloglanis pretoriae*	1
Sidespot Barb	*Barbus neefi*	1
Lowveld Largescale Yellowfish	*Labeobarbus marequensis*	1

Table 41: FRAI Score for Steelpoort River

Steelpoort River FRAI score	
AUTOMATED	
FRAI (%)	60.9
EC: FRAI	C/D
ADJUSTED	
FRAI (%)	58.9
EC: FRAI	D

Fish Species of conservation concern:
Only the Mozambique tilapia (*Oreochromis mossambicus*) is considered 'Near Threatened' (IUCN 2010). Although this species is widespread and common, it is threatened by hybridization with the rapidly spreading alien Nile tilapia (Oreochromis niloticus). The six other recorded species are considered 'Least Concern' (IUCN 2010).

Most of the fish species recorded in the study area are classified as "full migrant" (IUCN 2010). Most of the Barbus species, *Clarias gariepinus and Tilapia sparmanii require movement between reaches, while the Pseudocrenilabrus philander* primarily migrate within a single reach.

8.7.3.4.4 Riparian Vegetation

The riparian vegetation was assessed according to the Riparian Vegetation Response Assessment Index (VEGRAI) methods. The Steelpoort River was found to be largely modified (PES C/D) and the Shakwaneng River moderately modified (PES C).

Table 42: VEGRAI score of Shakwaneng and Steelpoort River for riparian vegetation of the study area

	Shakwaneng River upstream	Shakwaneng River downstream	Steelpoort River
LEVEL 3 VEGRAI (%)	72.2	65.5	60
AVERAGE CONFIDENCE	2.8	2.8	2.8
EC Rating	C	C	C/D

The riparian zone is very narrow due to extensive erosion (Figure 46). Minimal alien invasive species were observed, abundance may be affected by drought. 28 Vegetation species (Table 43) were observed within the Shakwaneng and Steelpoort Rivers riparian zone.

Table 43: Vegetation species list for Shakwaneng and Steelpoort Rivers riparian zones

Scientific name	Common name
Crinum macowanii	River lily
Ilex mitis	Cape holly
Acacia ataxacantha	Flamepod thorn
Acacia Karoo	Sweethorn
Bulbostylis spp.	Plant type - Sedge
Combretum apiculatum	Red Bushwillow
Dichrostachys cinerea	Sicklebush
Dovyalis spp.	Plant type - woody
Eragrostis curvula	Weeping love grass
Euphorbia cooperi	succulent
Euphorbia ingens	Giant Euphorbia
Ficus burkei	Common wild fig
Ficus salicifolia	Wonder fig
Gomphocarpus fruticosus	Milkweed
Grewia spp.	Cross-berry
Imperata cylindrica	Cottonwool grass
Melia azedarach	Syringa
Mimusops zeyheri	Common red-milkwood
Morella spp.	Bayberry
Populus alba var. alba	White poplar
Populus canescens	Grey poplar
Salix babylonica	Weeping willow
Senna didymobotrya	Peanut butter cassia
Themeda triandra	Red grass
Typha capensis	Bulrush
Ximenia caffra var. caffra	Sourplum
Zinnia peruviana	Redstar zinnia
Ziziphus mucronata	Buffalo thorn

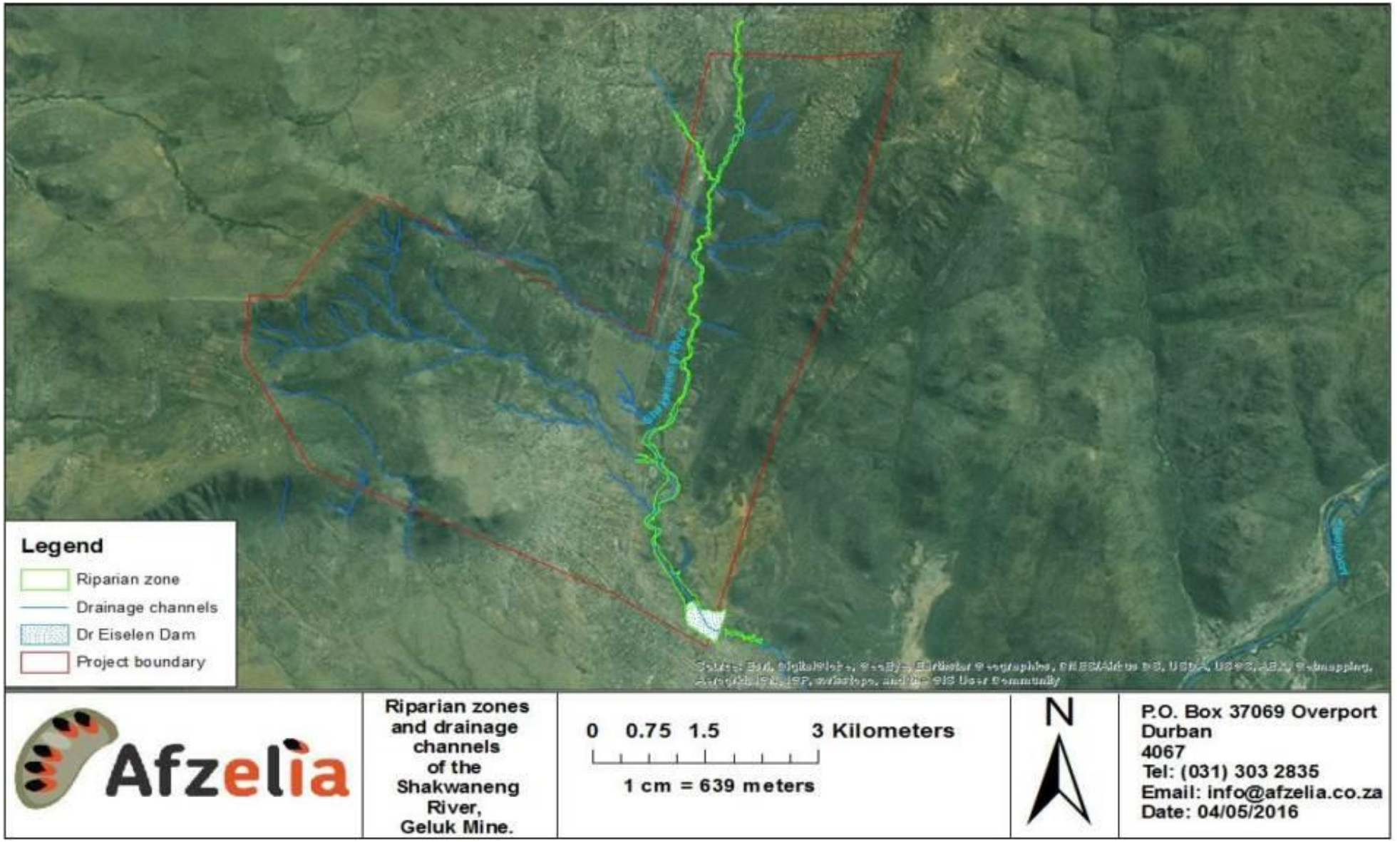


Figure 46: Riparian areas and drainage channels of the Shakwaneng River

8.7.3.4.5 Habitat Assessment (IHIA and IHAS)

The habitat assessment was used to evaluate the instream and riparian habitat of the study site. The findings of the IHIA and IHAS assessments revealed that the Shakwaneng and Steelpoort rivers were moderately modified (PES C) and the habitat diversity and structure are highly suitable habitats (80%) in respect of aquatic macroinvertebrate. The main impacts on riparian zone include rubbish dumping and extensive erosion.

8.8 Sensitive Features on the project site

The Biodiversity Impact Assessments undertaken by Afzelia Environmental Consultants (May 2016) includes sensitivity maps created to define sensitive habitats on the farms Geluk, Geluk Oos and Ironstone, subject to their current onsite status. The sensitivity maps were informed by field investigations and literature review. The findings of the specialist studies in terms of sensitivity analysis were used to inform the overall sensitivity map prepared by Naledzi Group.

Biodiversity features considered sensitive landscapes include:

- ***Shakwaneng River and associated drainage lines:*** The Riparian habitats support distinct floral and faunal species as it is a transitional zone between terrestrial and aquatic habitats. It is considered ecological support areas which support various ecological processes. The National Water Act (specifically GNR. 704) protects rivers, drainage lines from mining impacts and so does the National Environmental Management Act. The Shakwaneng River along the mountain range is considered a key support feature for most of the fauna and flora in the study area. The relative health of the Shakwanang River is important for the ecological integrity of the area. Two red data species, the River lily and Cape Holly are located within the riparian zone. It is also a principal water supply to surrounding communities. The river is rated as moderate-high sensitivity.
- ***Sekhukhune Mountain Bushveld (Sensitivity of vegetation types and habitats present on the study site):*** The majority of the project site comprises ecologically pristine mountain vegetation which is considered of high sensitivity. The mountainous vegetation corresponds to the Sekhukune Mountain Bushveld vegetation type. No Red Data species were recorded within this unit, yet some 7 species of conservation concern may occur.

  Parts of the site corresponding to disturbed bushveld have been rated as moderately sensitive due to historic anthropogenic activities. The site contains transformed areas in its northern and southern extent (settlements) which are considered of low sensitivity.
- ***Sensitive landscapes:*** The rocky outcrops, mountains and ridges on the eastern and western part of the study site are of very high sensitivity. It is the most diverse in faunal activity and floral diversity and is the most natural on the project site. These areas are vital to maintain biodiversity within the area. Birds, amphibians, reptiles, flora diversity is high in these regions.

The above factors have been taken into account in evaluating sensitivity within the study area. An aerial map was prepared to indicate the location of mining against the different sensitive areas identified on site. Figure 47 shows the sensitivity ratings of the site and Figure 48 indicates the location of mining infrastructure according to the sensitivity ratings on site.

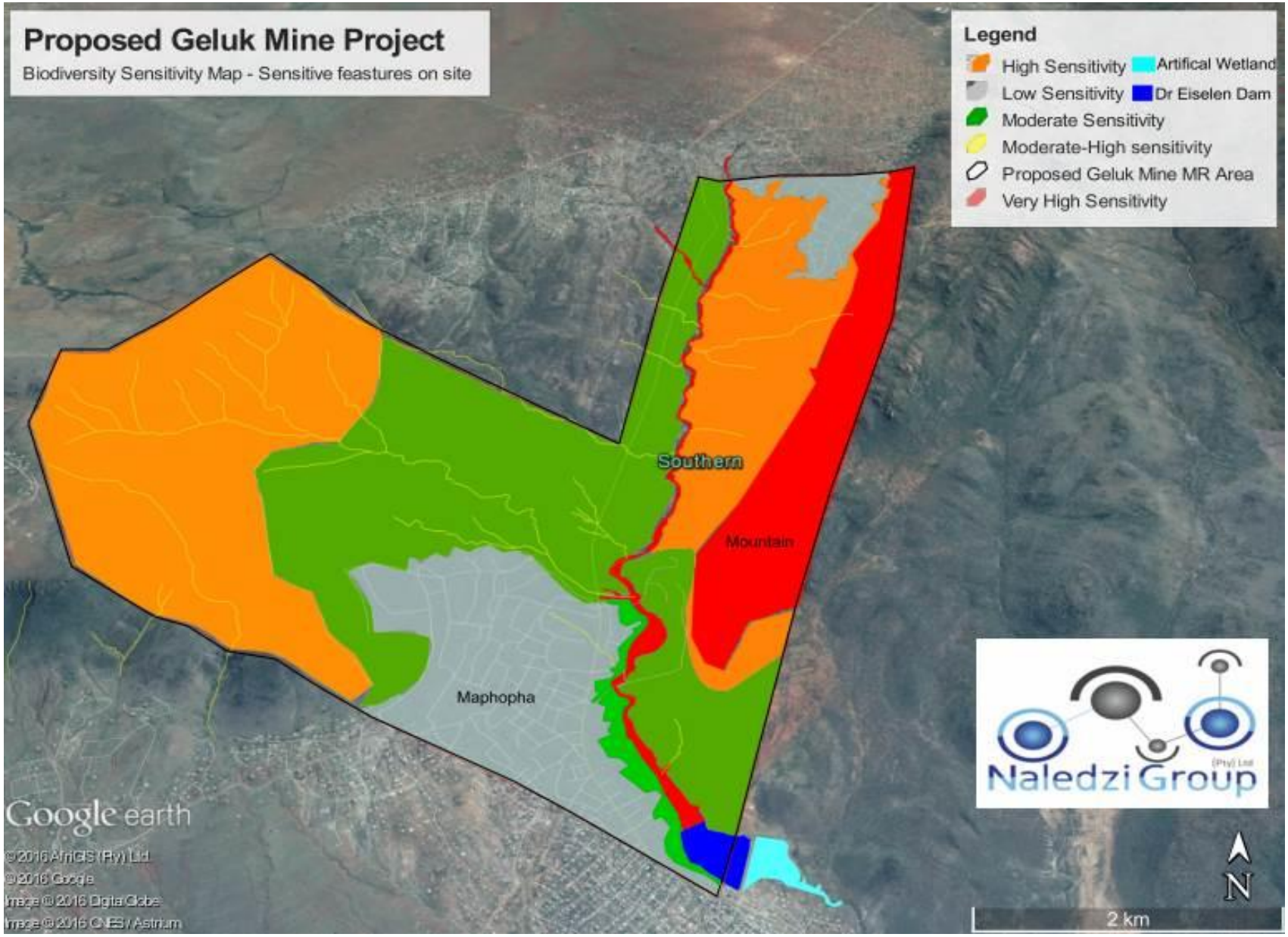


Figure 47: Biodiversity Sensitivity Map for Geluk Project Site

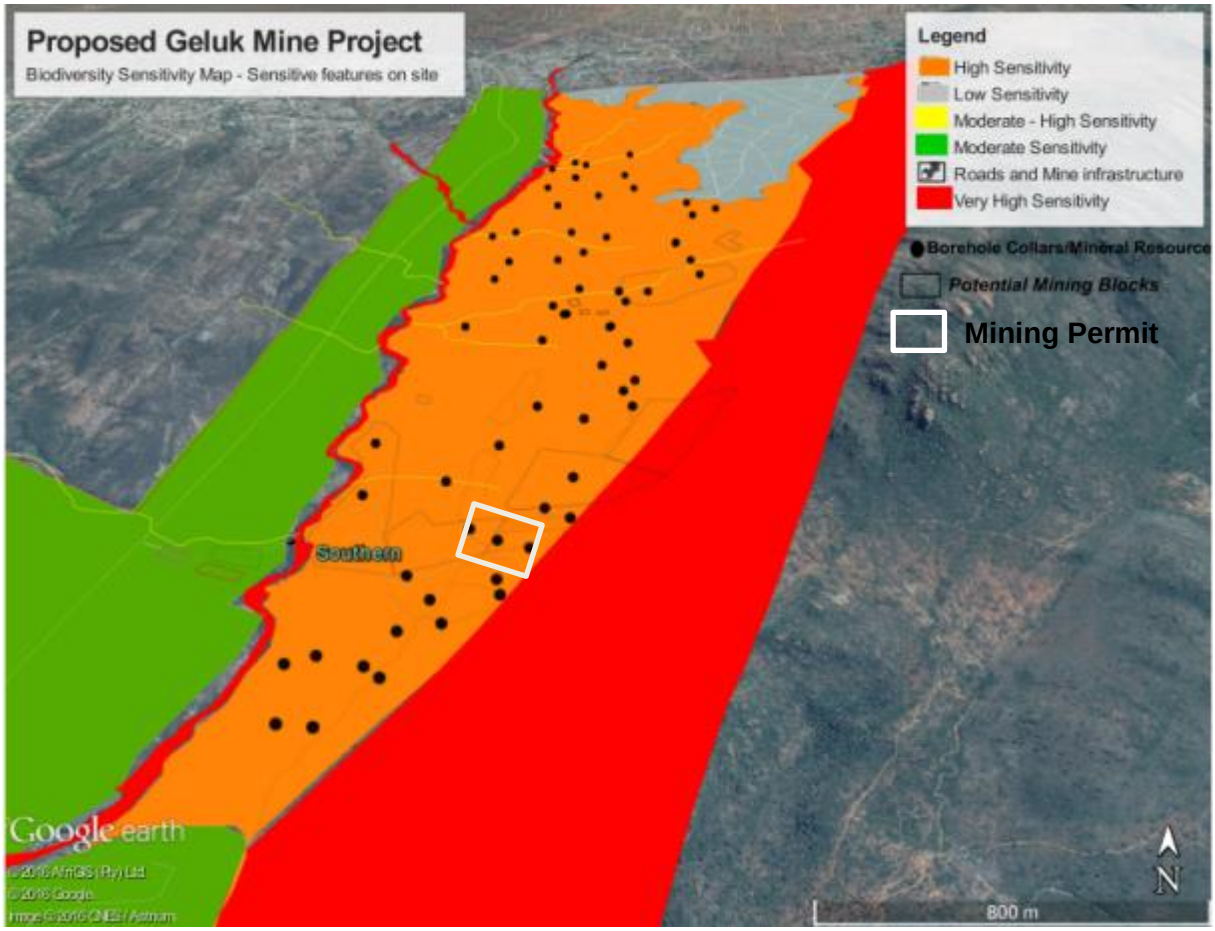


Figure 48: Mine infrastructure and mineral resource location in terms of sensitivity map

The proposed Geluk Mine draft layout plan is yet to be informed by the findings of the environmental impact assessment. The location of the mineral resource is presented by borehole collars and potential mining blocks (Figure 47). It is evident from the sensitivity map that mine infrastructure and blocks correspond to areas of moderate, moderate-high, high and very high sensitivity.

The current approved Mining Permit area for Rahkoma is located in the area of high sensitivity. The mine footprint will also be predominantly located in an area of high sensitivity. The ratings are defined as follows:

- Areas of Very High sensitivity – Mountain and ridge part of Leolo Mountains with majority of fauna and flora biodiversity, Shakwaneng River;
- Areas of High sensitivity – Sekhukhune Mountain Bushveld which is largely natural and of high biodiversity;
- Areas of moderate-high sensitivity – drainage channels associated with Shakwaneng River;
- Areas of moderate sensitivity – Disturbed bushveld areas
- Areas of low sensitivity – urban sprawl

8.9 Hydrology

Surface water aspects as it pertains to the aquatic ecology of the Shakwaneng and Steelpoort Rivers are dealt with in the specialist biodiversity assessment undertaken by Afzelia Environmental Consultants. African Environmental Development (AED) investigated the hydrology and delineated the floodlines for the respective catchments covering the project site. The specialist reports are attached under Volume 2:

Appendix C – Aquatic Ecology and Wetland Assessment

Appendix D – Floodline Delineation Report

8.9.1 Surface Water & Water bodies

The study area falls within the Olifants Catchment Management Area and the Steelpoort sub-water management area in B41H Quaternary Drainage Region (Figure 49).

One river is found on the Geluk Mine project site, the Shakwaneng River, it flows generally from north to south through the farm Geluk 512KS and Ironstone 847K S. It has two tributaries, the Mookeng, entering Shakwaneng from the west and Ironstone stream, draining the farm Ironstone and also entering the Shakwaneng from the west. The reaches of the three streams have very small catchments of only **28.375 Km²** for the Shakwaneng, of which **7.883 Km²** is covered by the Mookeng catchment. The Ironstone Stream has a similarly small catchment of **10.340 Km²**. (Figure 50)

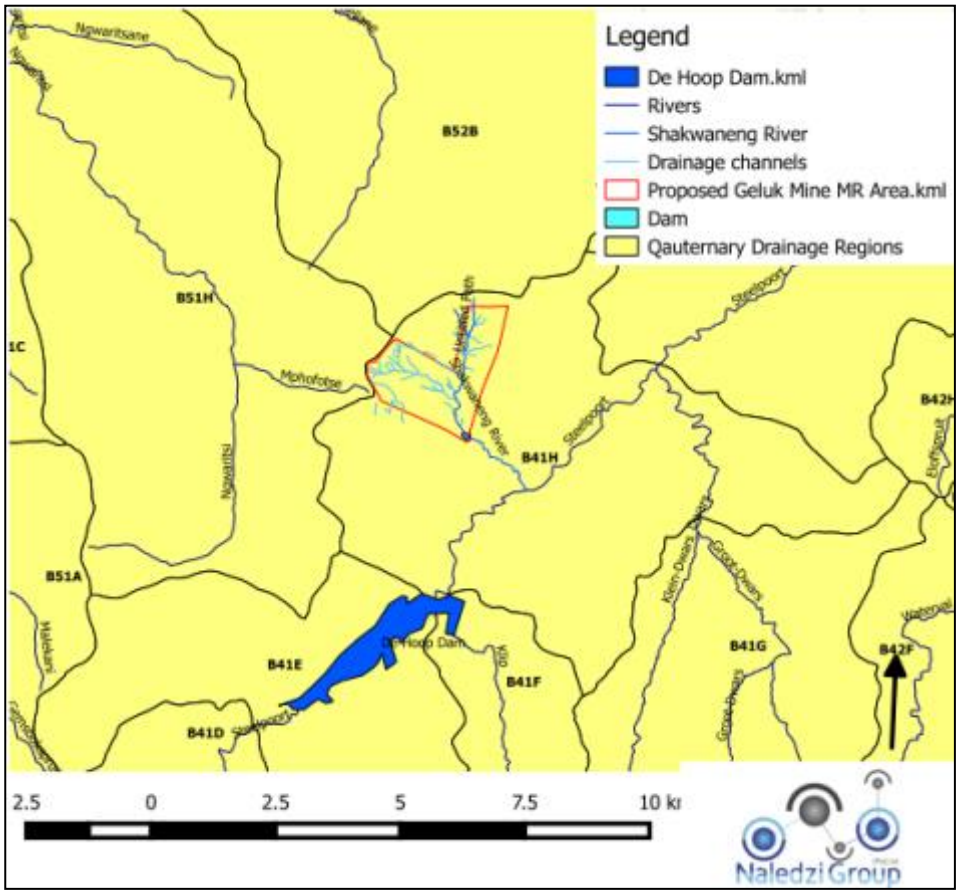


Figure 49: Quaternary drainage region of the Geluk Mine project site

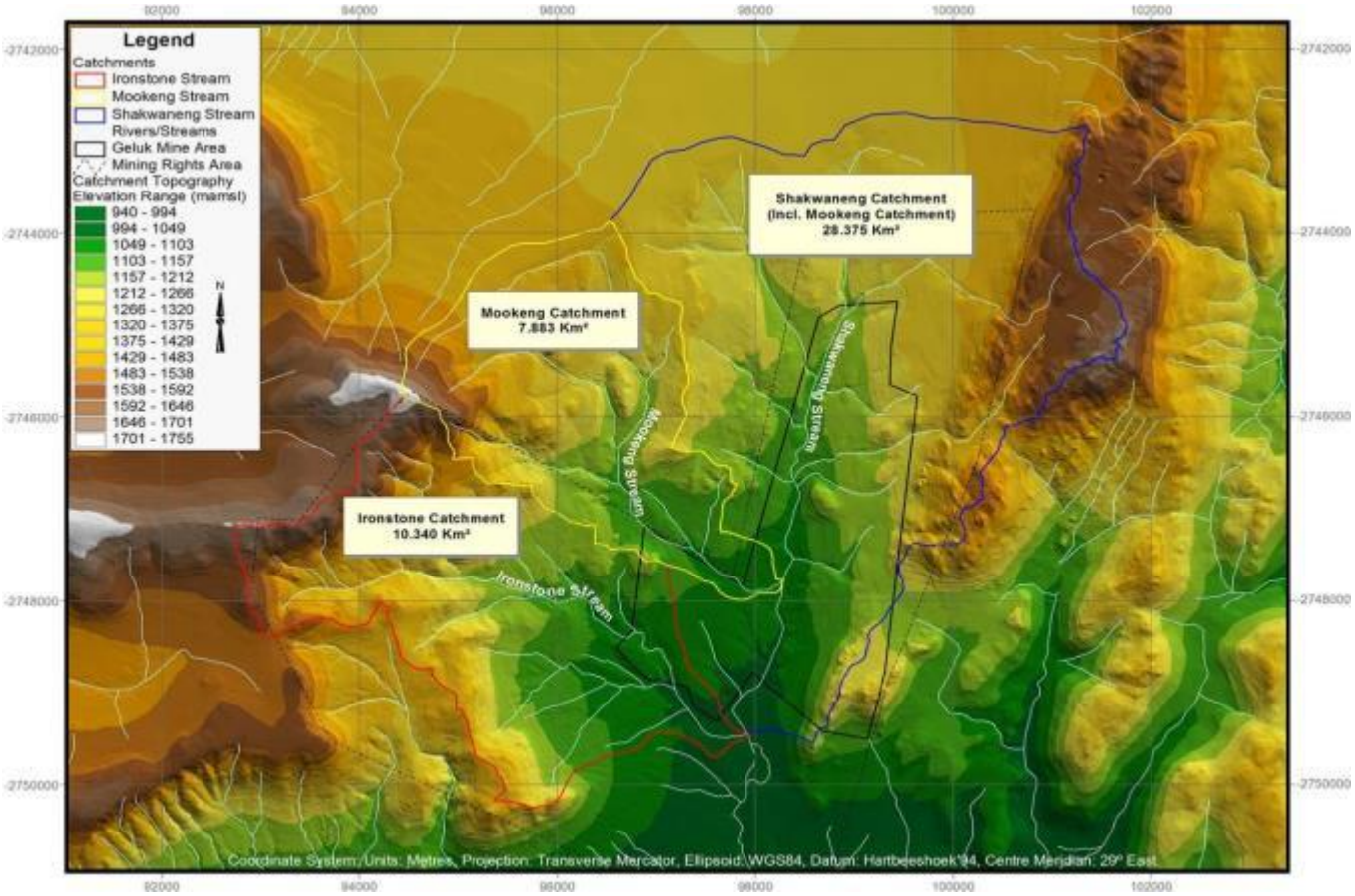


Figure 50: The three catchments corresponding to the Geluk Mine project site

A storage dam known as the Dr Eiselen Dam, constructed in 1971 by the Lebowa Dept. of Agriculture, Environment and Conservation, is located within the Shakwaneng River on the most southern extent of the farm Ironstone 847KS. The Shakwaneng River drains into the Steelpoort River 5 km downstream from the proposed mining area.

8.9.2 Surface Water Quality

Water samples were taken by Afzelia Environmental Consultants at 5 sampling points along the course of the Shakwaneng and Steelpoort Rivers.. Physical variables including water temperature, pH and electric conductivity, were measured in-situ with an AZ8602 multi-meter.

The samples were taken from the following points:

- Samping Point 1: Dr Eiselen Dam
- Sampling Point 2: Shakwaneng Downstream River
- Sampling Point 3: Shakwaneng Upstream River
- Sampling Point 4: Steelpoort River (5km downstream)

From a visual assessment the Shakewaneg River water is clear. No odours were evident at the time of sampling. Population pressure is affecting flora in the valley, with small scale subsistence farming in more fertile areas of the river. Pollution of the river was evident in the form of litter and locals doing laundry. Damming of water in drainage channels were identified for purposes of washing and bathing.

The water quality status of the Shakwaneng and Steelpoort Rivers were still within acceptable pH range (8.82pH upstream to 9.2pH 5km downstream). The Shakwaneng River showed a deterioration of water quality at both up-and downstream sites as a result of high electric conductivity (572 uS/cm - 595 uS/cm); it can be attributed to anthropological pressures (washing and bathing).

The Shakwaneng River SASS 5 score is rated D – Moderately to Largely modified due to negative effects and the presence of erosion, damming of water and urban runoff into the river. The Steelpoort River is still within acceptable range (300uS/cm), its SASS 5 score is B-largely natural state.

Altough impacts, predominantly impoundments, sewage and urban runoff are present upstream of the current sampling sites, the water quality is not overly impacted.

8.9.3 Surface Water Use

The Shakwaneng River and Dr Eiselen Dam are used by the surrounding community as principle water supply. Water is used for subsistence farming, livestock water supply, recreational (fishing), washing and bathing. There are also several boreholes in the populated areas used for domestic and stock water purposes. These boreholes are the sole source of reliable and clean domestic water. Daily groundwater abstraction rates in the communal boreholes range between 12.96m^3/day to the highest in Maphopha at 69.12m^3/day. (Naledzi Water works, June 2016-Hydrocensus)

The Steelpoort River's major water use within the region is domestic use from settlements, irrigation, subsistance farming, mining, industry, livestock, recreation.

The are no known allocation rights/ use from the Shakwaneng River. There are several water users along the Steelpoort River. The estimated water uses from the Steelpoort River upstream of the De Hoop Dam are 14.1 million m^3/annum for irrigation and 1.5 milion m^3/annum for domestic and industrial use. (Yield Analysis Report of De Hoop and Flag Boshielo Dam Report, November 2010 – P WMA 04/B50/00/8310/16)

8.9.4 Present Ecological State (PES) of Surface Water Bodies

The Present Ecological State refers to the overall health and integrity of rivers. The overall PES category for both the Shakwaneng and Steelpoort Rivers is a PES Class C rating, which is moderately modified and indicates a high Ecological Sensitivity (EIS) Rating.

The overall PES was informed by the Shakwaneng and Steelpoort Rivers SASS -, VEGRAI, IHIA and IHAS ratings.

Table 44: Present Ecological State of the Steelpoort and Shakwaneng Rivers

Surface Water body	Macroinvertebrates	VEGRAI	MIRAI	IHIA & IHAS
Shakwaneng	D	C	C	C
Steelpoort	B	C/D	C	C

8.9.5 Wetlands

For the purposes of this assessment, wetlands are considered as those ecosystems defined in the National Water Act as:

"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

A ground-truthing survey was undertaken for the presence of wetland conditions. Wetlands are mostly identified and delineated by hydric (wetland) soils. No hydric soils were identified outside the Shakwaneng River channel. Consequently no wetland systems were identified within the study site.

An artifical wetland was identified outside the study site resultant from seepage from the dam wall of the Dr Eiselen Dam. This artifical wetland forms part of the Shakwaneng River.

8.9.6 Hydrology and Flooding

8.9.6.1 Hydrology

The services of AED was commissioned to model the hydrology of the identifeid catchments of the study site and determine the 1: 100 year flood zone. The AED 1: 100 year floodline Report, May 2016 is attached under Volume 2 – Appendix D.

The Shakwaneng River originates from within Ga-Mogashoa village. Two streams, the Ironstone and Mookeng streams, feed the Shakwaneng River, feeding from the west, along with various smaller drainage channels from the mountains and ridges surrounding te Geluk project site. The drainage lines are rainfed and receive urban runoff. The river is impeded in the southern point of the study site by the instream Dr Eiselen Dam.

Flow within the river and streams would be highly seasonal. Peak flows are expected during the wetter summer months from November to January based on the WRS 2005 Database. The hydrology of the three catchments river and two streams is divided in four catchments (See Figure 51 for the purposes of discharge designs, namely:

- Shakwaneng River North (upstream)
- Shakwaneng River South (downstream)
- Mookeng Stream
- Ironstone Stream

It is important to note that the terrain of the catchments is steep and drainage channels are narrow. This gives rise to flash floods when the area receives heavy rains.

The design discharge calculations for the catchment areas are based on the MAP for the primary drainage area of 621.42mm/a. The calculations are based on a 100 year storm falling over the catchments.

Storms with return periods of 100 years falling over the catchments at the Geluk Mine will produce discharges of 149.69, 159.19, 73.12 and 100.48m^3/s for the Shakwaneng North, Shakwaneng South, Mookeng and Ironsteon Streams respectively.

The time of concentration (TC-i.e. time from the beginning of the storm until the maximum discharge is reached) is very short (39.4, 62.5, 51.4 and 43.9 min respectively for the Shakwaneng North, Shakwaneng South, Mookeng and Ironstone Streams). This very short TC is mainly attributed to the comparatively small catchments and the steep topography at the study area.

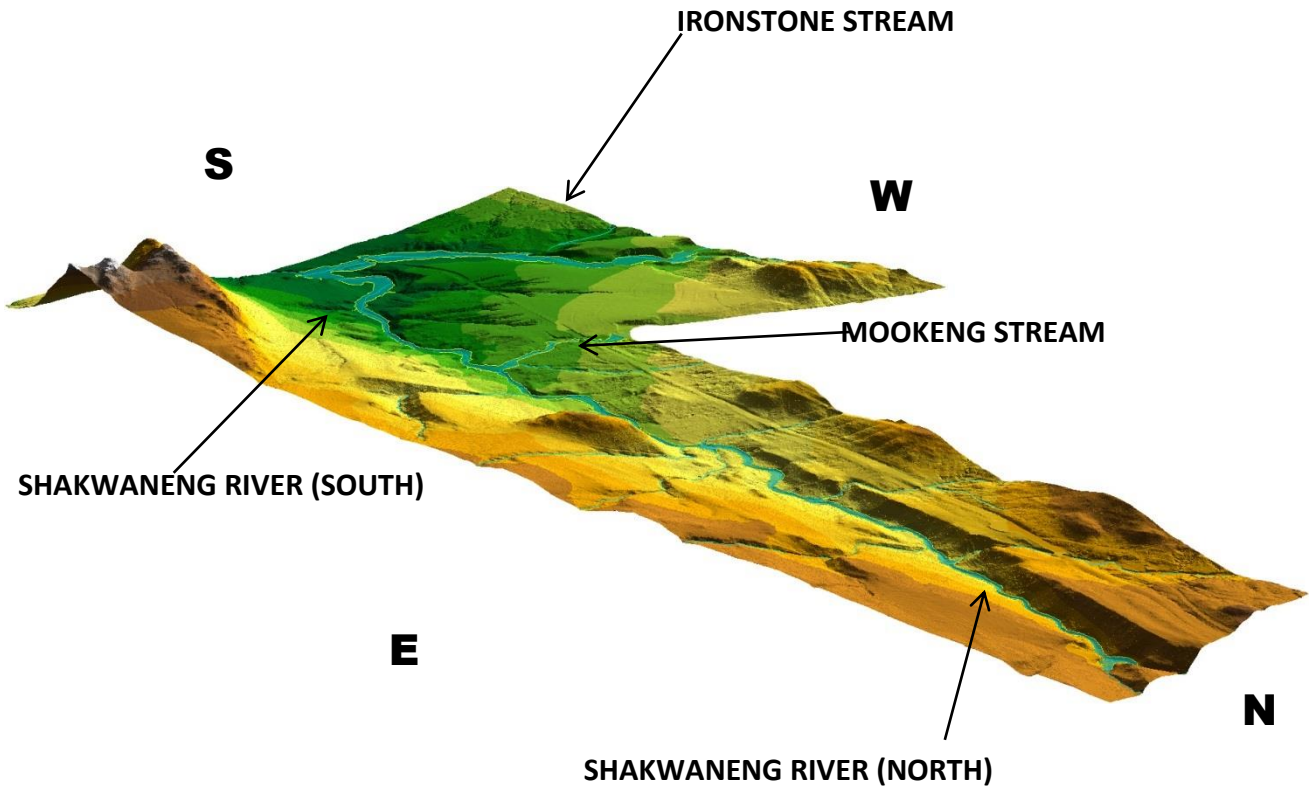


Figure 51: Four Catchments corresponding to the Geluk Mine study site

8.9.6.2 Floodline

The flood line for the Geluk Mine project site (area of mining activity) was modelled by AED during May 2016. The project site contains 3 streams which required modelling, Shakwaneng, Mookeng and Ironstone Streams. The flood line was determined based on the MAP for the quaternary drainage region and ½ meter LiDAR surveyed data.

The study found that the catchment's nature is of steep slopes with narrow and deeply incised stream channels. As a result, the 50 – and 100 year flood lines are very close together. Therefore AED recommended modelling only the 1: 100 year flood line which is the higher and safer of the two lines (Figure 52).

The study found that 90% of the flood lines are less than 100m from the centre line of the streams. Therefore a 100m buffer zone would need to be applied to the river and streams as regulated in Government Notice 704 under NWA. (Figure 53) GNR704 imposes a 100m buffer zone from the centre line of a river, or placement above the 1: 100 year and 1: 50 year flood line (*whichever is greater*) when placing mining infrastructure.

It is being highlighted that the steep topography have contributed to highly flashy nature of the 1: 100 year floods. The time from the beginning of the storm until its maximum discharge is reached (flooding) is just over 1 hour down to ½ an hour for all four streams. This limits evacuation times for mining machiners and infrastructure removal (if mobile).

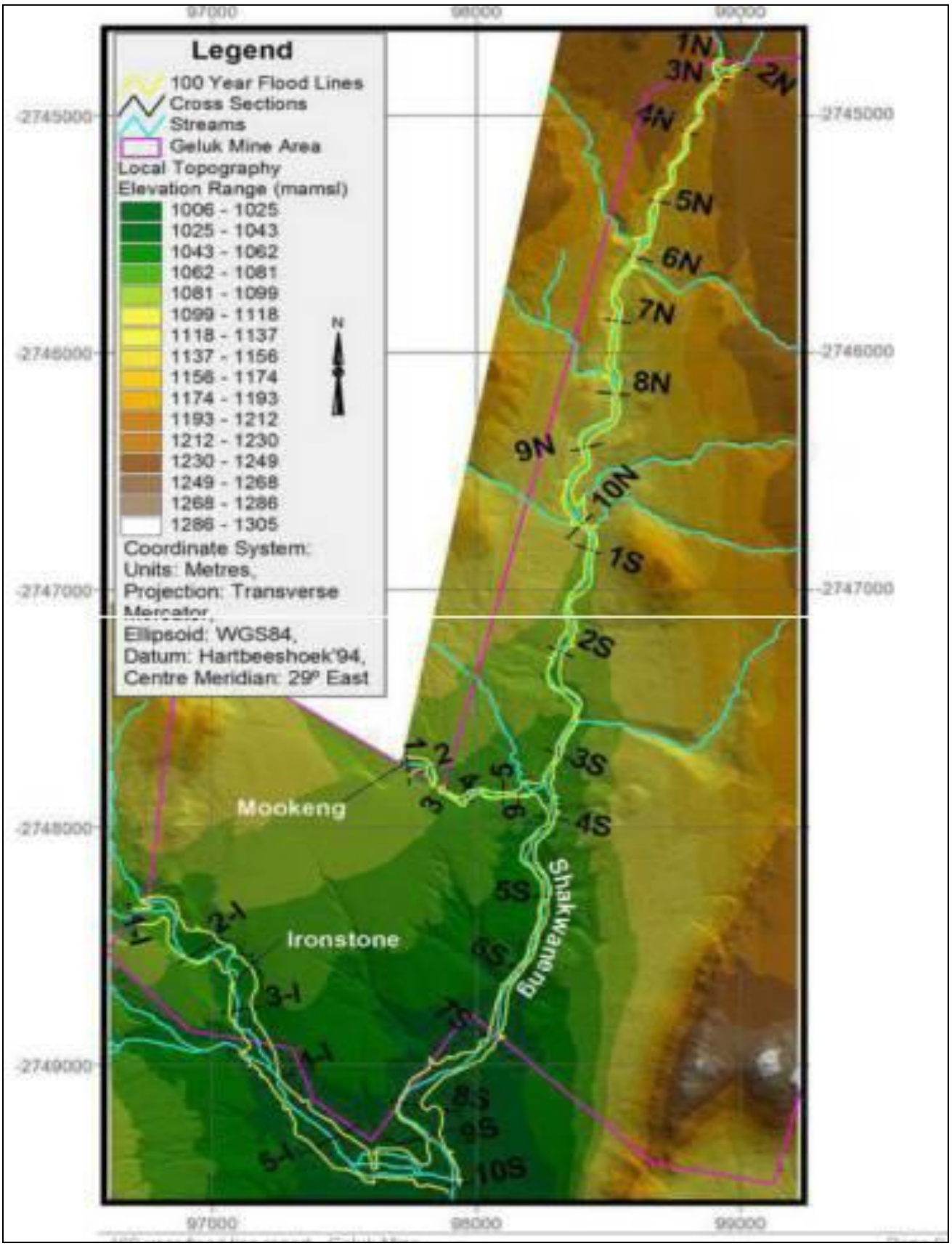


Figure 52: The 1: 100 year floodlines of the Geluk Mine Property on a topographical map backdrop created from 0.5m LiDAR data

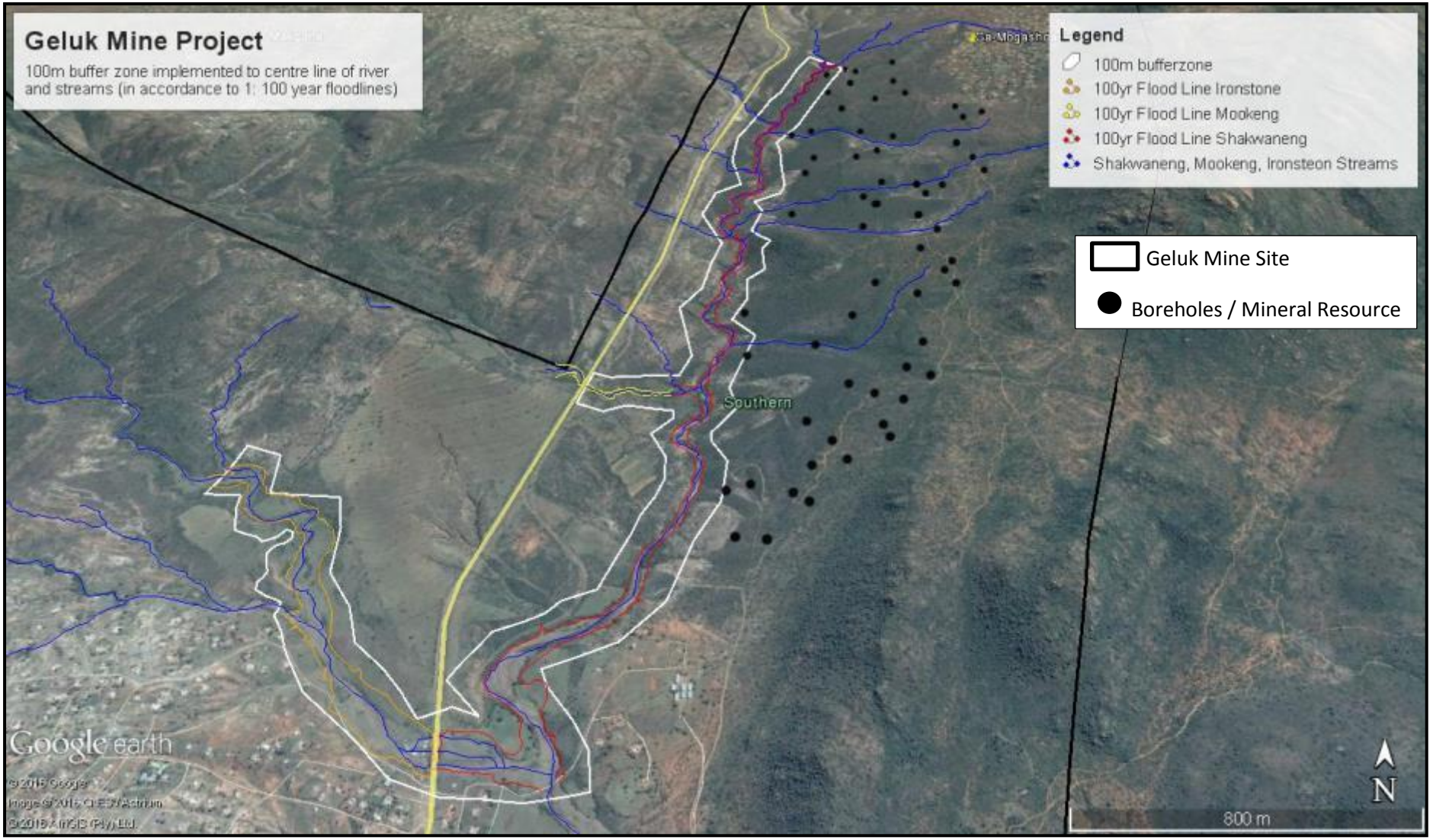


Figure 53: Application of the 100m buffer zone from the centre line of the three streams on Geluk Mine Project Site (Google Earth Pro Aerial Backdrop)

8.10 Geohydrology (groundwater)

Naledzi Waterworks, conducted a Geohydrological Impact Assessment for the Geluk Mine Project. The study objectives were to establish the baseline conditions and develop a hydrogeological conceptual and numerical model for pit dewatering requirements. The results from the study were used to quantify impacts on the groundwater levels, quantity and quality. The Geohydrological Impact Assessment Study is dated May 2016 and attached under Volume 2 – Appendix E.

"Geology governs the mode and occurrence of groundwater, runoff and recharge including the control of water related impacts of seepage and quality. "

8.10.1 Baseline Geohydrology

The gabbros and granites in the area are less prone to weathering and jointly and also lack pegmatitic bodies which tend to contribute extensively to improve the groundwater potential within the granite rocks (Du Toit and Sonnekus 2014). The groundwater potential and storage capacity of the granites is generally poor although the occasional good yield (>5ℓ/s) does occur.

The borehole yield potential of the gabbros and granites is classified as d3 in the 1:500 000 hydrogeological map, indicating that an average borehole yield in the group ranges between 0.5 and 2.0 l/s (du Toit and Sonnekus, 2014).

The depth to groundwater level is reported to be very shallow and seldom exceeds 15 mbgl.

8.10.2 Aquifer Systems

GRIP Limpopo data revealed that there are three dominant aquifer types that occur in the area, namely:

a) Laterally extensive shallow weathered zone aquifer,

This aquifer extends across the entire extent of the study area and ranges between 5 and 20 meters below ground level (mbgl). It's a major aquifer system which stores and transports bulk groundwater recharges the base flow in the area. It is unconfined to semi-confined in nature and highly susceptible to surface induced activities and impacts.

b) Localized fractured aquifer systems;

This aquifer system is high yielding, yet has limited storage capacity and recharge. Most of the groundwater in the fractured aquifer system is drained laterally from the storage within the overlying shallow weathered aquifer systems.

c) Aquifer systems associated with dolerite intrusives

These intrusions can serve both as aquifers and aquicludes. Thick, unbroken dykes inhibit the flow of water, while the baked and cracked contact zones can be highly conductive. These conductive zones effectively interconnect the Roossenekal and Lebowa rocks both vertically and horizontally into a single, but highly heterogeneous and anisotropic unit on the

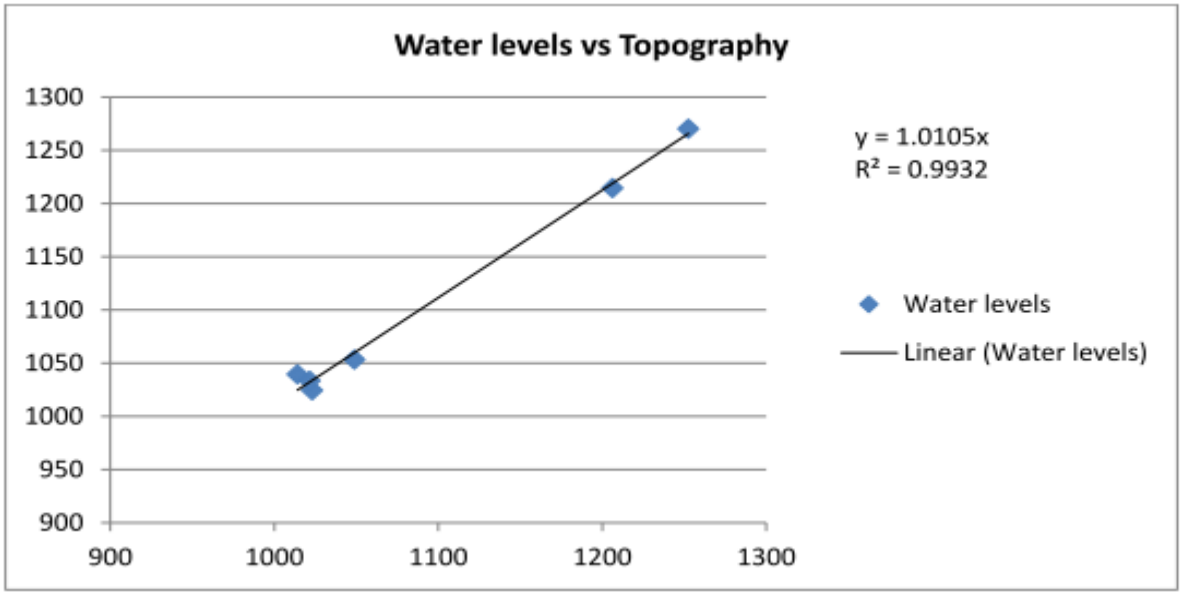
scale of mining. These structures thus tend to dominate the flow of groundwater. Unfortunately, their location and properties are rather unpredictable.

8.10.3 Groundwater levels

Groundwater level data was obtained from several DWS boreholes visited as part of the hydrocensus. The groundwater level from existing boreholes range between 1.3 and 25.42m below ground level (mbgl). Groundwater elevations within the proposed mining area ranges between 1041 and 1252 mamsl.

There are two groundwater level systems, shallow and the deeper in the area. The groundwater flows in both systems are controlled by the topographical settings of the area (Figure 54). The planned mine will only be 20m deep and only go into the top perched/unconfined aquifer.

Figure 54: Correlation between topography and groundwater levels



8.10.4 Hydrocensus Results

A Hydrocensus was undertaken to identify the baseline groundwater use and users within the study area. The groundwater is mainly used for domestic and stock water purposes; hence most boreholes are equipped with hand pumps. Groundwater is a sole source of reliable and clean domestic water. The visited boreholes locations are linked to populated areas and are presented in Table 45, and their locations are presented in Figure 55.

During the hydrocensus the following observations were made:

- Groundwater levels were measured in 6 boreholes of a total of 22 boreholes identified with the Geluk Mine study site (mostly settlements);
- The water levels within the existing boreholes ranges between 1.3 and 25.42mbgl;
- The discharge rate of boreholes identified around the proposed mine site show rates of between 0.1 l/s to 0.27l/s;
- The hydraulic conductivity of the geological formations on site ranges between 0.15m/d in the north to 0.5m/d in the south (Figure 56);

- Based on the above data the areas with shallow groundwater levels and high conductivity can be at risk if contaminants should leach from pollution sources like ore stockpiles, waste rock dumps.

Modelling of the Groundwater flow and contaminant transport, indicates that seepage from the stockpiles is likely to migrate in south westerly direction towards the Y 26-30 mining block and the Shakwaneng River. Only 16 % of the initial 100 % concentration at the source is predicted to reach the groundwater table beneath the stockpiles. Less than 2% may end up in the Shakwaneng River, and no borehole is predicted to be impacted.

Table 45: Details of borehole visits in Geluk Mine study area

Borehole Number	Longitude [WGS84]	Latitude [WGS84]	Elevation (mamsl)	Borehole depth [m]	Water level [mbgl]	Discharge rate [l/s]	Duty cycle [hours]	Daily Abstraction [m^3/day]	Equipment	Quality	Comment
H02-0963	29.98532	-24.8117	1270.3	101.58	17.82	0.15	24	12.96	Hand pump	CLASS 4	Old Hand pump
H02-0964	29.98713	-24.8026	1306.3	1.23	0	0	0	0	Hand pump	-	BLOCKED, inside a yard
H02-0965	29.9898	-24.804	1325.7	0	0	0	0	0	No equipment	-	BLOCKED, inside a yard
H02-1010	29.98978	-24.8041	1326.1	72	0	0	0	0	No equipment	-	DRY-INFO, inside a yard
H02-1011	29.98717	-24.8026	1306.4	72	0	0	0	0	No equipment	-	DRY-INFO, inside a yard
H02-1946	29.98622	-24.8074	1290.2	0	0	0	0	0	Hand pump	-	PRIVATE
H02-3073	29.98714	-24.8083	1294.5	0	0	0	0	0	No equipment	-	BLOCKED
H02-1204	29.96713	-24.8561	996.9	0	0	0	0	0	Hand pump	-	Inside a private yard
H02-1206	29.96832	-24.8527	1001.5	0	0	0	0	0	Submersible pump	-	Not found during Hydrocensus
H02-1207	29.96123	-24.8466	1053.2	22.1	4.44	0.15	24	12.96	Hand pump	CLASS 3	Not found during Hydrocensus
H02-1908	29.97193	-24.8527	1024.3	65.5	1.3	0.27	24	23.33	No equipment	-	Not found during Hydrocensus
H02-1998	29.95003	-24.8523	1214.4	61.5	8.2	0.14	24	12.1	Hand pump	CLASS 1	Inside a private yard
H02-1999	29.96789	-24.8588	984.4	0	0	0	0	0	No equipment	-	Inside a private yard
H02-2000	29.96743	-24.8585	990.8	0	0	0	0	0	No equipment	-	Not found during Hydrocensus
H02-2265	29.95727	-24.8613	1024.4	0	0	0	0	0	Hand pump	-	PRIVATE
H02-2269	29.97167	-24.8476	1033.6	0	0	0	0	0	No equipment	-	Inside a private cultivated land
H02-2273	29.96897	-24.8571	992.5	0	0	0	0	0	No equipment	-	Inside a private cultivated land
H02-2276	29.95708	-24.8512	1084.2	0	0	0	0	0	Hand pump	-	Inside a private yard
H02-2636	29.96138	-24.8556	1035.6	0	0	0	0	0	Hand pump	-	Inside a private yard
H02-3198	29.96041	-24.8561	1039.6	47.32	25.42	0.1	3	1.08	Hand pump	CLASS 3	Inside a private yard
H02-3199	29.95679	-24.8602	1033.5	47.56	11.87	0.8	24	69.12	Hand pump	CLASS 3	Inside a private yard
H02-3240	29.96751	-24.8585	990.3	0	0	0	0	0	No equipment	-	Inside a private cultivated land

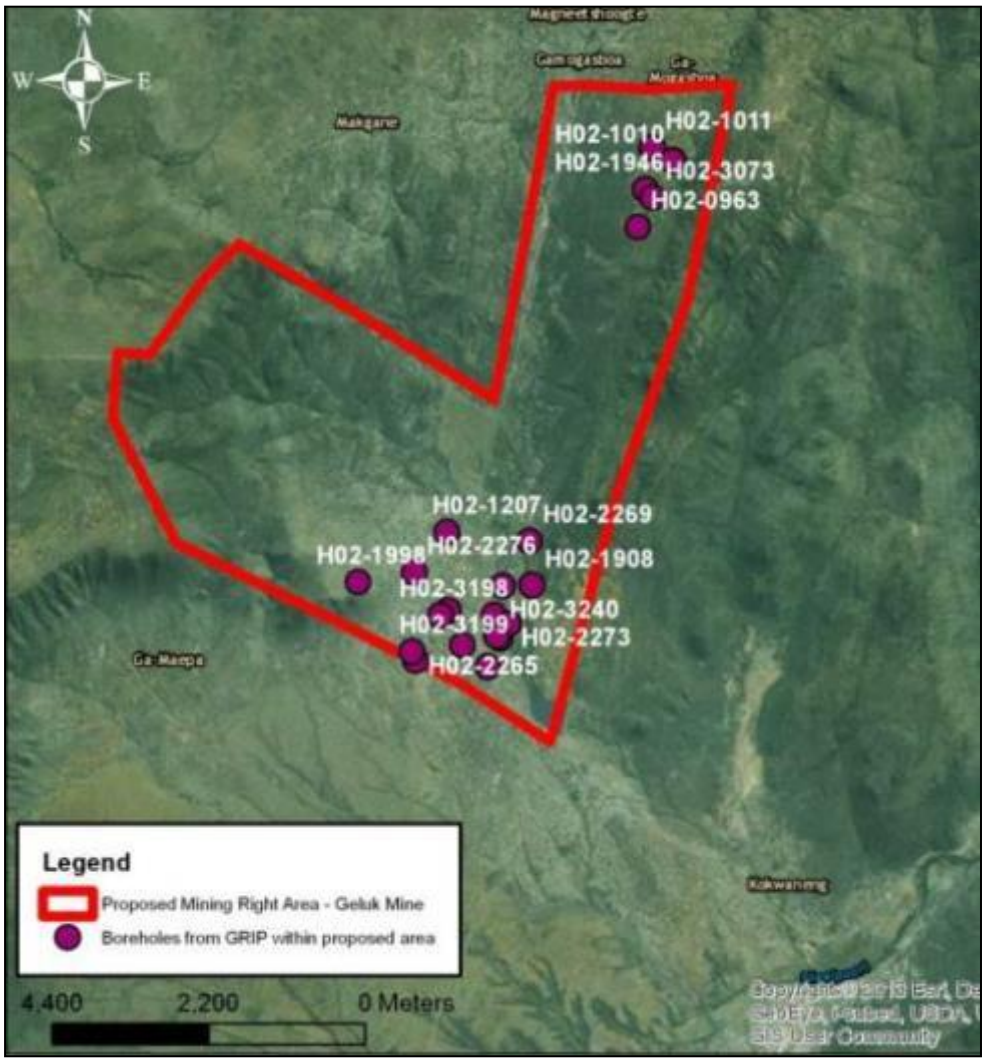


Figure 55: Aerial Map indicating positions of visited boreholes

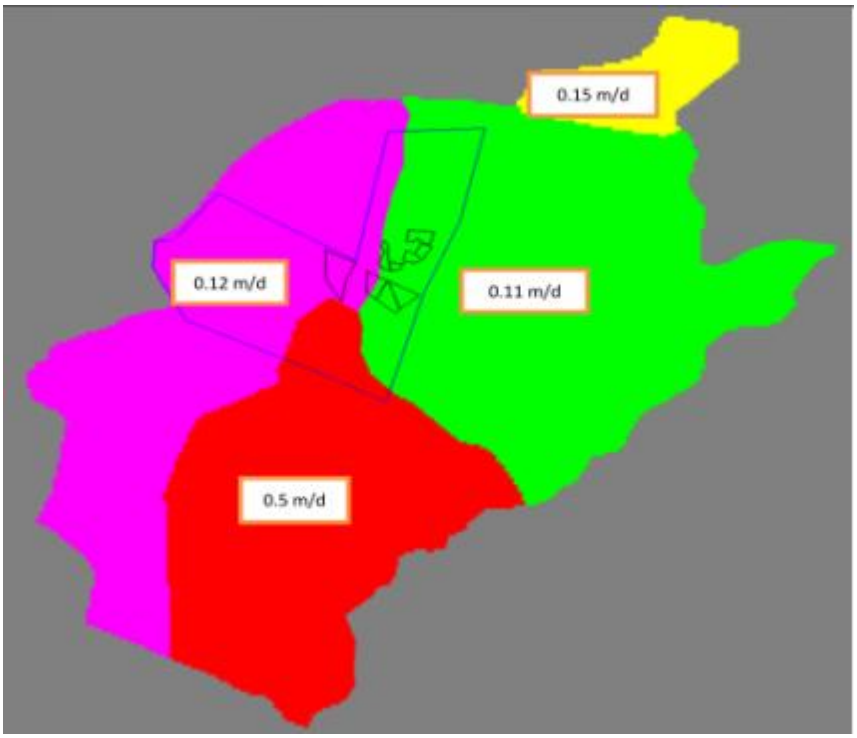


Figure 56: Hydraulic conductivity zones

Furthermore, the mining at Geluk will progress below the regional water level and dewatering will be required to provide a safe working environment. An estimation inflows ranging between 0 and 297 m3/day into the proposed pits is anticipated. A drawdown cone will result due to inflows into the pit; it is predicted to extent 1km east and west of the pit walls. The drawdown cone will extend a maximum radius of 4km over the mining years. Some groundwater users within the predicted cone will be affected.

8.10.5 Groundwater Quality

No groundwater samples were collected as access to most boreholes was restricted (private property). Existing information from the GRIP Limpopo database show groundwater quality in the area is of poor quality and majority of boreholes in the area are classified as Class 3 in the DWS Domestic Drinking Guidelines. The groundwater in the area was also reported to be of a sodium-chloride-bicarbonate type.

The Desktop Geochemistry Assessment Study conducted by Digby Wells Environmental Consultants (2016), attached under Volume 2-Appendix F indicated the following:

- The pH of ore samples indicate a neutral range with low electrical conductivity values confirming the low metal leach (ML) potential from waste material;
- Waste material to be generated by the mine was classified as a Type 3 waste (Moderate risk/hazardous) due to some elements being above the ideal concentrations.

The waste material and ore to be generated as part of the project needs to be sampled and analysed in accordance with the NEM: WA and DWS legislative guidelines. Any potential pollution from waste facility may infiltrate the groundwater system and impact on the groundwater quality.

8.10.6 Subsurface Hydrogeological units

The subsurface was envisaged to consist of the following hydrogeological units:

Layer 1- The upper weathered zone few meters below surface consist of weathered material. The layer has a reasonable high hydraulic conductivity, but in general unsaturated. However, a seasonal aquifer perched on the bedrock probably does form in this layer, especially after high rainfall events. Flow in this perched aquifer is expected to follow the topography.

Layer 2 – This zone underlines the weathered zone. This zone is slightly weathered, highly fractured with a low hydraulic conductivity. The groundwater flow direction in this unit is influenced by regional topography and locally by the geological structures and in the project area the flow would be in general from high lying areas towards the nearby drainage systems.

Groundwater, originating from the vertical infiltration of rainwater through the upper layer(s) up to the groundwater level, will flow mostly horizontally in the directions as discussed above. Water flow volumes and velocities will, on average, decrease gradually with depth.

See Figure 57 for a simulation of groundwater flow in the Geluk Mine Study area.

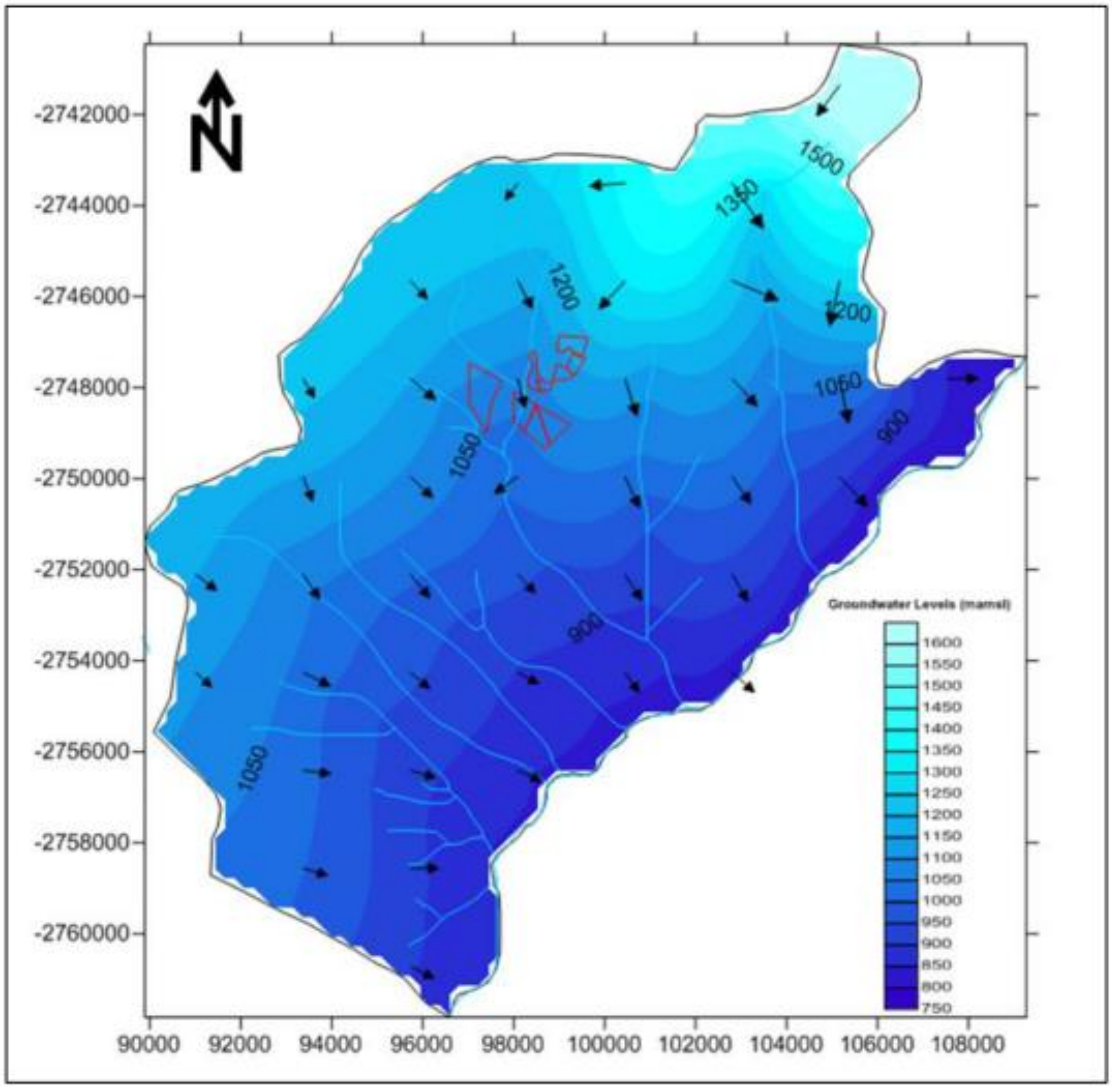


Figure 57: Simulation of groundwater flow in the Geluk Mine study area

8.11 Air quality and dust

The services of Airshed Planning Professionals were commissioned to conduct an Air Quality and Dust Impact Assessment for two components of the project, namely:

- **Proposed Geluk Mine project site** (farms Geluk 512KS, Geluk Oos 513KS and Ironestone 847KS);
- **Product Stockpile yard at the Roossenekal Rail Siding** (Roossenekal Train station)

The investigation reviews site-specific atmospheric dispersion potentials, and existing ambient air quality in the region, in addition to the identification of potentially sensitive receptors. Air Quality Impact Assessment, Airshed is attached under Volume 2 – Appendix G

8.11.1 Baseline Air Quality

The main existing sources of particulate emissions in the area are agricultural activities and vehicle entrainment. Gaseous emissions (viz. SO2, CO, carbon dioxide (CO2), oxides of nitrogen (NOx) and hydrocarbons) will derive from combustions sources such as vehicles.

The main contribution from these sources can be summarised as follows:

- Agriculture
- Biomass Burning
- Household fuel burning (wood burning, use of paraffin):
- Vehicle tailpipe emissions

No ambient monitoring or dust fallout data are available to inform the background air quality. Typical background PM10 concentrations for South Africa as a country is given as 20.54 µg/m³, assumed to be presented as an annual average for the period 2006.

8.11.2 Sensitive Receptors

Various sensitive receptor areas are located in the Geluk Mine study area, namely:

- **Proposed Mining Right Area and surroundings**: Magneetshoogte, Makgane, Ga-Maepa, Ga-Masha, Maphopha, Mphofotse and Mantlhenyane (Figure 58).
- **Roossekenal Railsiding:** Individual residential dwellings are in close proximity to the railway siding (Figure 59).The ROM will be crushed at the mining site and then transported ~40 km south to a railway siding where it will be transferred to rail and transported to Vanchem for further processing.

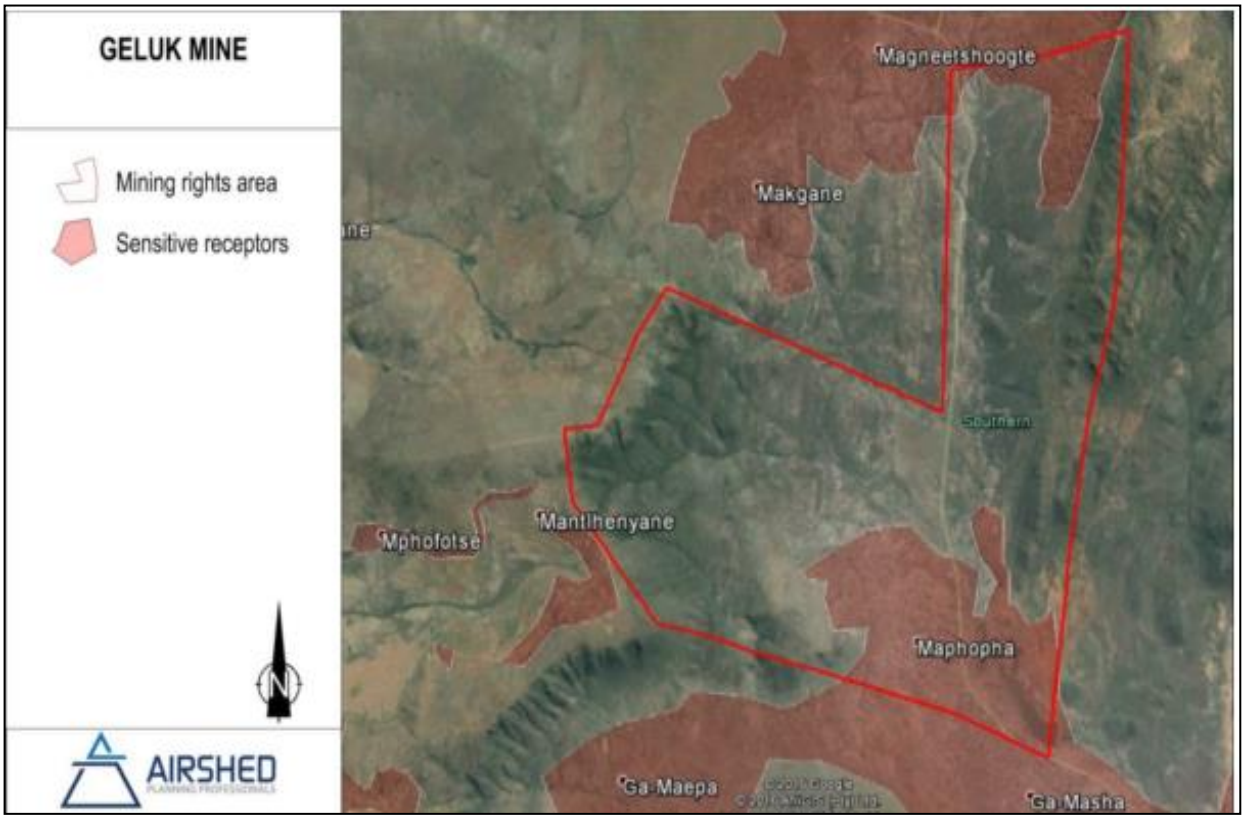


Figure 58: Sensitive receptors in Geluk Mine study area:

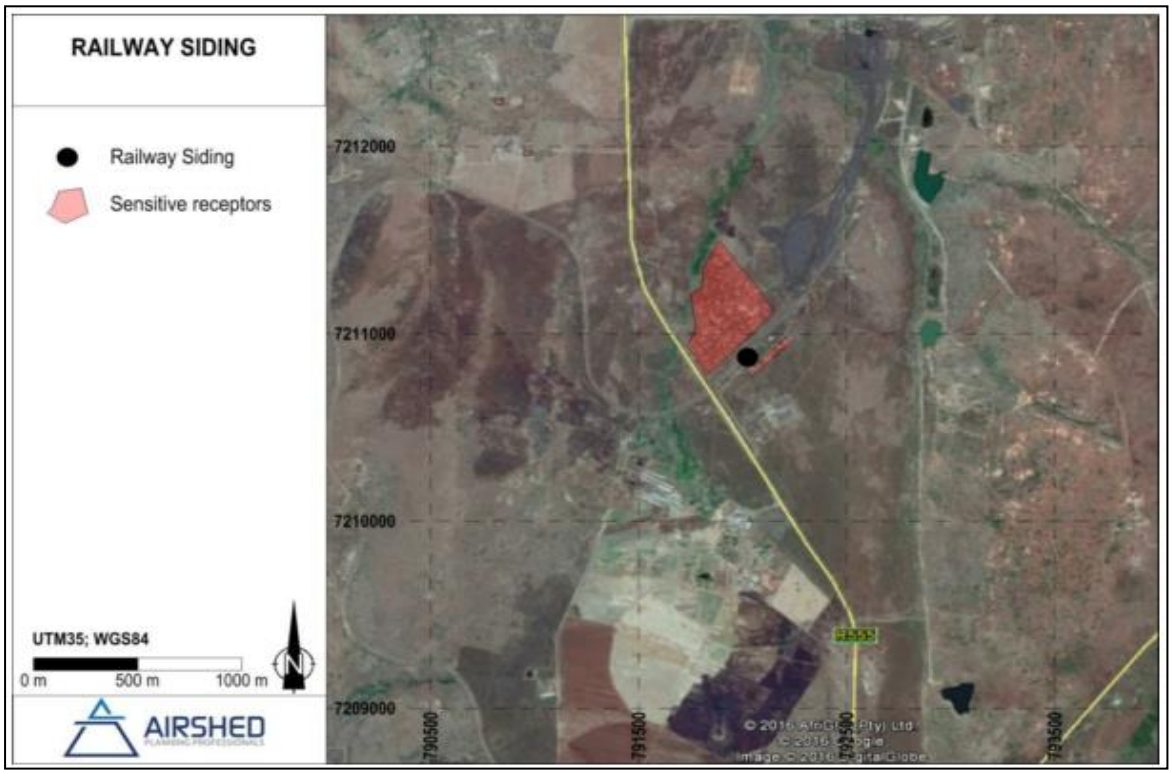


Figure 59: Sensitive receptors surrounding the Roossenekal Rail Siding:

8.11.3 Atmospheric conditions at the study area

MM5 modelled atmospheric data was obtained for the study site (Jan 2013- Dec 2015). The results of the data were as follows:

- Wind Direction and Speed: The predominant wind direction for the area is east-northeast and northeast. Wind speeds generally vary between 2m/s and 5m/s with an average windspeed of 3.2m/s;
- Ambient Air temperature: The annual average maximum, minimum and mean temperatures for the study site is 22.9°C, 13.2°C and 17.5°C, respectively, based on the 2013 to 2015 modelled MM5 data. Average daily maximum temperatures range from 27.2°C in February to 17.2°C in July, with daily minima ranging from 16.9°C in December to 8.4°C in July. (Figure 60)
- Atmospheric stability: Stable atmospheric conditions are anticipated during night time (11pm – 6am) at the proposed Geluk mine site. Fluctuating atmospheric conditions are expected from 7am -10am, with the most unstable conditions anticipated from 11am-15pm. Night times are characterised by weak vertical mixing and the predominance of a stable layer, providing for a stable atmospheric conditions. At daytime, the layer is characterised by thermal turbulence due to heating of the earth surface, resulting in unstable conditions. (Figure 61)

8.4.3 Expected contribution from Mining operation to atmospheric emissions

Unmitigated construction activities will potentially impact on local communities, primarly due to the nuisance and aesthetic impacts associated with fugitive dust emissions. On-site dustfall may also present a nuisance to employees at the mine.

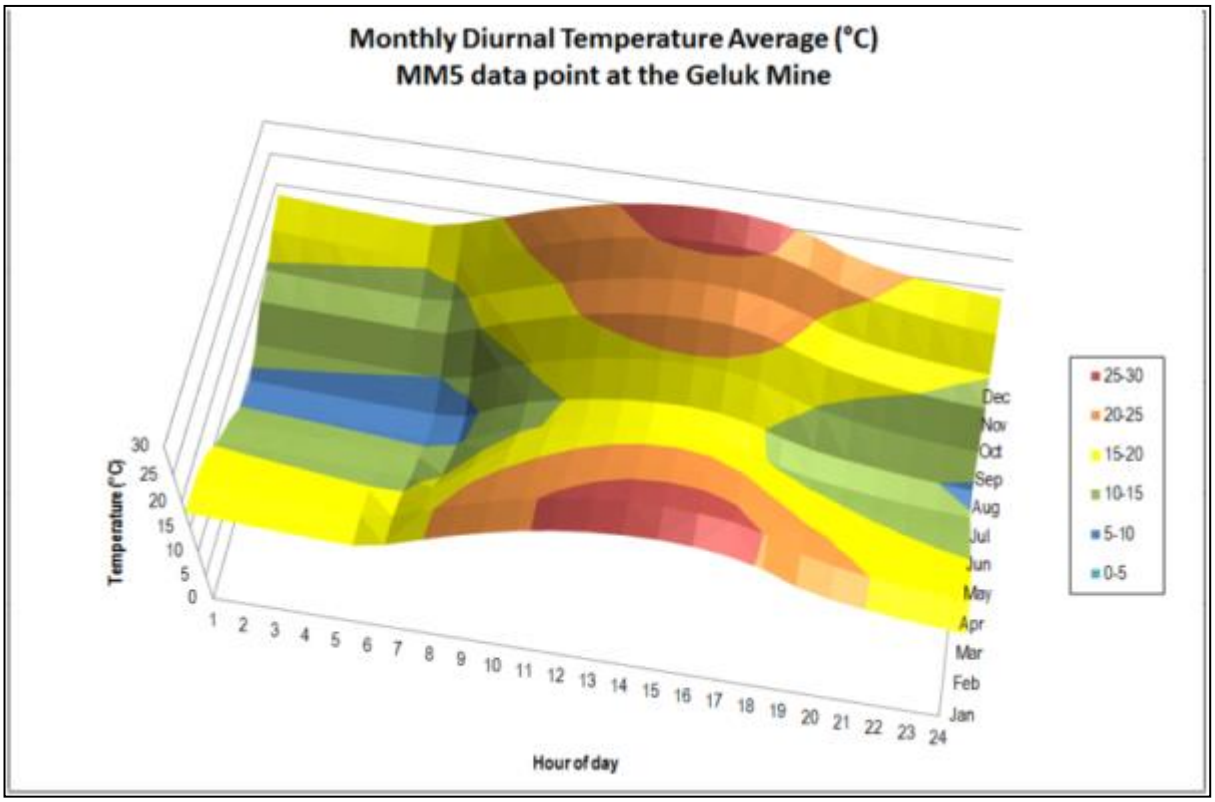


Figure 60: Diurnal Temperature Average at Geluk Mine site:

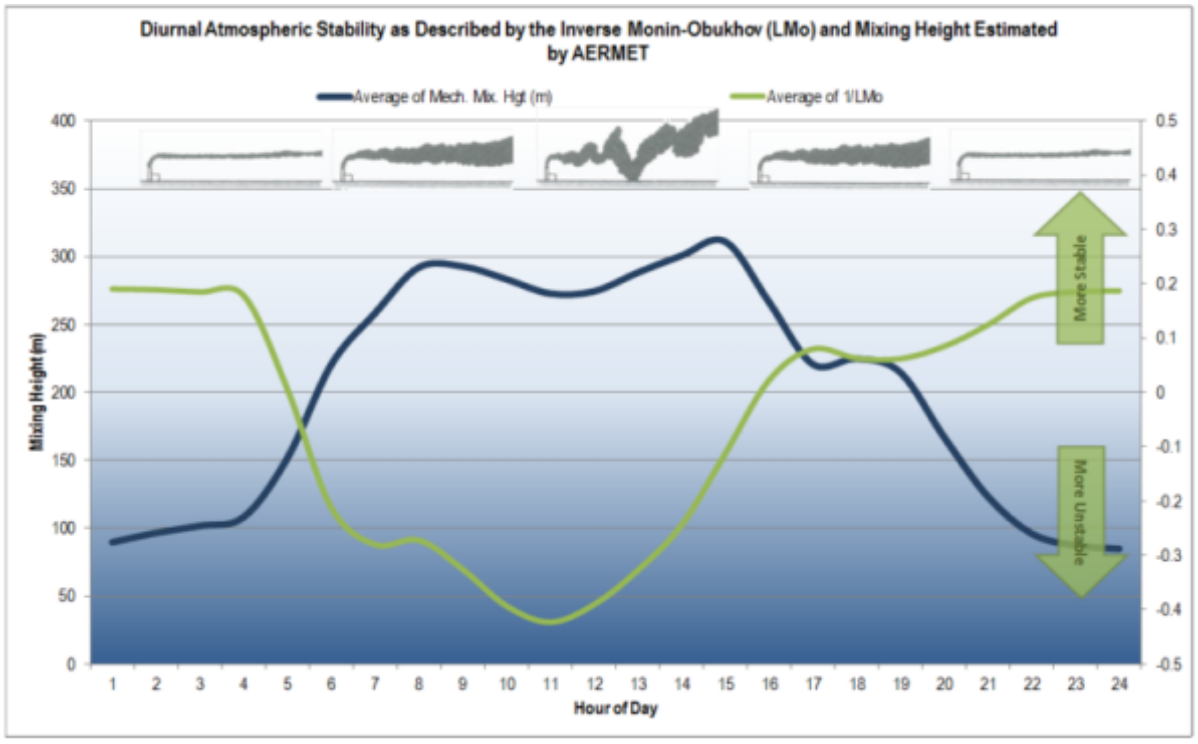


Figure 61: Diurnal Atmospheric Stability at the Geluk Mine site

Sources of atmospheric emissions at the Geluk Mine will include:

- Gasses emissions from vehicle tailpipes;
- PM10 and PM2.5 from stockpile areas and open pits as well as transport infrastructure;
- Railway Transportation – transportation of final product
- Vehicle activity on unpaved roads
- Material handling
- In pit mining operations
- Storage piles

The most significant sources of particulate emissions at the mine will be vehicle entrainment on unpaved roads and the crushing and screening activities. The main contributing sources of particulate emissions at the rail siding will be vehicle entrainment on unpaved surface roads.

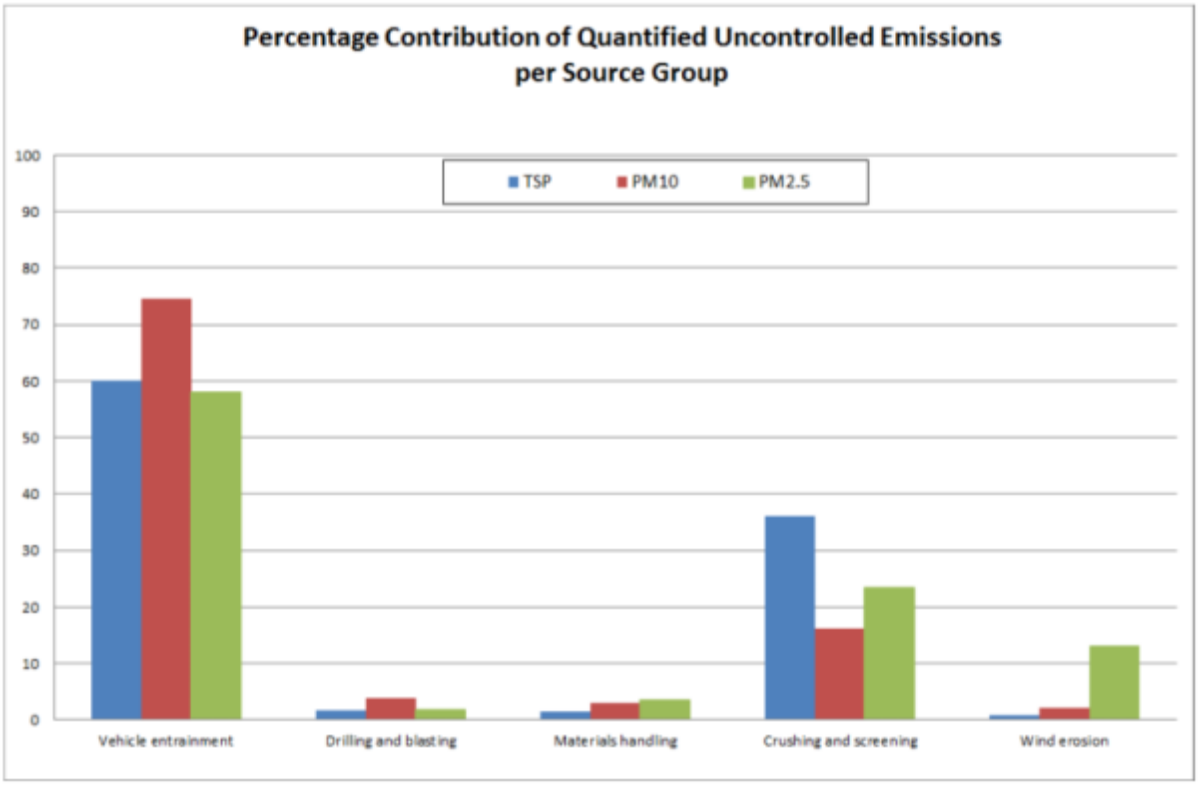


Figure 62: Source contributions of particulate emissions due to unmitigated mining operations:

8.12 Noise and ground vibration

A Noise and Vibration Impact Assessment was undertaken for the study area by dBAcoustics during December 2015. The report is attached under Volume 2-Appendix H)

The noise survey was conducted in terms of the provisions of SANS 10103 of 2008. The following instruments were used for the noise survey:

- Larsen Davis Integrated Sound Level meter Type 1 – Serial no. S/N 0001072;
- Larsen Davis Pre-amplifier – Serial no. PRM831 0206;
- Larsen Davis ½" free field microphone – Serial no. 377 B02 SN 102184;

Larsen Davis Calibrator 200 – Serial no.5988.

8.12.1 Noise Measuring Points

Twelve measuring points were selected for the study site, representative of the prevailing ambient noise levels, which included noise sources such as traffic, domestic type noises. (Figure63). The development site is characterised by urban sprawl in its northern and southern extent, with the D2219 Jane Furse feeder road bisecting the proposed mining right area from north to south.

Figure 63: Noise measuring points for the study area

The measuring points with physical attributes are detailed in Table 46. The L_{Aeq} was measured over a sampling period exceeding 10minutes over each point. The noise survey was carried out during the day and night time period being 06h00 to 22h00 for the day time and 22h00 to 06h00 for the night time period.

Table 46: Measuring points and coordinates for the study area

Point	Longitude	Latitude	Remarks
1	24°51,971 S	029° 58,606 E	Eastern side of Ga-Masha Village. Distant traffic and domestic noise contributes to the prevailing ambient noise level.
2	24°51,814 S	029° 58,160 E	In the vicinity of Tiba Moshito primary School. Distant traffic and domestic noise contributes to the prevailing

			ambient noise level.
3	24°51,469 S	029° 57,801 E	In the vicinity of Maphopha Primary school. Distant traffic and domestic noise contributes to the prevailing ambient noise level.
4	24°51,971 S	029° 58,232 E	Maphopha Village. Distant traffic and domestic noise contributes to the prevailing ambient noise level.
5	24°50,689 S	029° 58,313 E	In the vicinity of Sengange High School. Distant traffic and domestic noise contributes to the prevailing ambient noise level.
6	24°49,998 S	029° 58,655 E	At the crusher stock area. Distant traffic and domestic noise contributes to the prevailing ambient noise level.
7	24°49,752 S	029° 59,909 E	Next to the D2219 road. Intermittent traffic noise contributes to the prevailing ambient noise of the area.
8	24°48,290 S	029° 58,105 E	Makgane Village. Domestic noise contributes to the prevailing ambient noise level.
9	24°47,849 S	029° 58,461 E	Magneetshoogte and in vicinity of the D2219 road. Distant traffic and domestic noise contributes to the prevailing ambient noise level of this area.
10	24°47,939 S	029° 58,973 E	Ga-Mogashoa Village. Distant traffic and domestic noise contributes to the prevailing ambient noise level.
11	24°47,890 S	029° 59,539 E	Ga-Mogashoa Village. Distant traffic and domestic noise contributes to the prevailing ambient noise level.
12	24°48,636 S	030° 59,232 E	Ga-Mogashoa Village. Distant traffic and domestic noise contributes to the prevailing ambient noise level.

8.12.2 Noise Receptors

There are five residential areas within the mine boundaries and in the vicinity of the proposed mine activities (Figure 64).

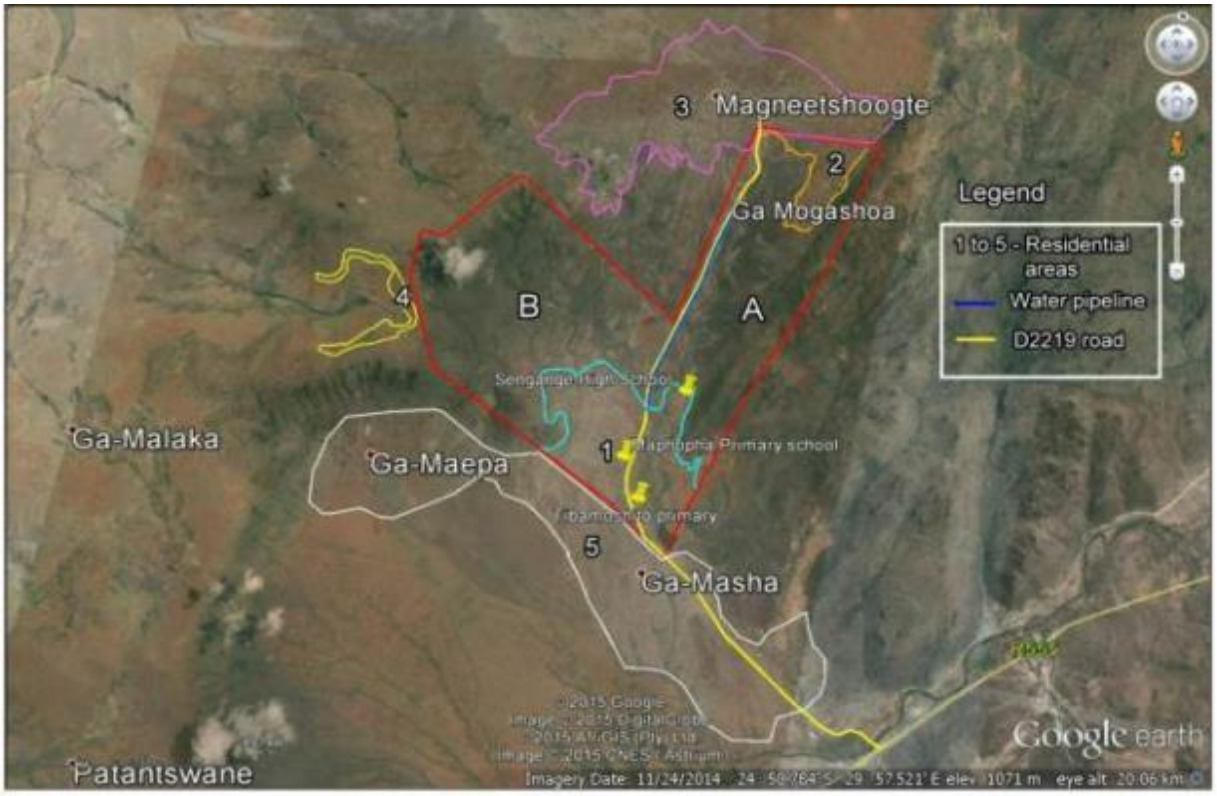


Figure 64: Residential areas within proximity of the mine

The noise sensitive areas are detailed in Table 47 and include direction and distance to mine boundary. Also a 500m restriction to mine to residential areas will be implemented.

Table 47: Residential areas within proximity of the mine

Area	Sensitive Area	Village	Distance to mine boundary to nearest boundary of residential area (m)	Direction from mine
A	1	Maphopha	Within mine boundary	South
	2	Mogashoa	Within mine boundary	North
		Ga-Mogashoa	Within mine boundary	North
B	3	Magneethoogte	Within mine boundary to 1210	North-west
		Makgane	1860	North-west
		Tshehlwaneng	2914	North-west

	4	Mphofotse	2340	West
		Matlhehyane	430	West
	5	Ga-Masha	200	South
		Ga-Malekana	3851	West
		Kokwaneng	3618	South-East
		Ga-Maepa	624	South-East

8.12.3 Baseline noise

The main ambient noise levels of the study area are owed to:

- Traffic noise (heavy duty vehicle noise, distance traffic noise from the D2219);
- Domestic type (Amplified noise from Shebeens, domestic noise)
- Natural noises (insects, birds and wind noise).

Table 48: Noise levels for the day and night in the study area

Position	Day time				Night time			
	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks
1	41.9	56.8	32.6	Distant traffic.	41.0	63.4	35.9	Distant traffic & insects.
2	44.9	62.3	35.6	Traffic.	39.5	52.6	34.7	Distant traffic & insects.
3	49.4	68.8	38.0	Traffic.	39.0	52.8	33.5	Distant traffic & insects.
4	36.0	54.2	28.7	Traffic.	32.9	54.0	25.8	Distant traffic & insects.
5	38.5	63.8	33.4	Traffic.	35.2	47.8	30.2	Distant traffic & insects.
6	39.8	65.4	27.1	Traffic.	37.0	47.4	32.5	Distant traffic & insects.
7	56.4	70.9	36.0	Traffic.	53.9	79.7	33.7	Intermittent traffic.
8	43.6	58.5	34.3	Traffic.	36.5	47.3	32.9	Distant traffic & insects.
9	42.7	63.4	29.8	Domestic.	40.1	61.1	34.0	Distant traffic & insects.
10	34.5	54.4	27.3	Domestic.	34.7	56.1	25.9	Distant traffic & insects.
11	33.3	54.1	24.8	Distant prevailing noise sources.	32.7	46.2	27.5	Distant traffic & insects.
12	35.3	53.9	27.0	Distant prevailing noise sources.	34.7	51.4	29.7	Distant traffic & insects.

The prevailing ambient noise level along the D2219 road was 56.4dBA during the day and 53.9dBA during the night. At a distance from the road within the mine boundaries the noise level during the day was 47.2dBA and 39.3dBA during the night. The prevailing noise level at the northern residential area was 34.3dBA during the day and34.0dBA during the night. At Tiba Mashito primary school the noise level during the day was 44.9dBA and 39.0dBA during the night, Maphopha primary school; it was 49.4dBA during the day and 39.0dBA during the night, and at Sengange High school (closest to proposed mining site) the prevailing noise levels were 38.5dBA and 35.2dBA respectively.

8.12.4 Noise Survey of Mine Machinery

A noise survey was carried out at a crusher plant and the following noise levels were recorded at different distances from the plant:

- 5m from the crusher plant – 94.1dBA;
- 50m from the crusher plant – 82.0dBA;

- 150m from the crusher plant – 69.2dBA;
- 200m from the crusher plant – 65.1dBA;
- 550m from the crusher plant – 47.7dBA;
- 750m from the crusher plant – 46.5dBA;
- 1 000m from the crushing plant – 42,4dBA.

Various sound pressure levels of construction machinery to be used in development of the mine, were investigated to define anticipated noise levels. The sound pressure levels were taken certain distances from the source (15m, 60m to 1920m) to illustrate the reduction in noise over a distance from the source. Engineering control measures and topography can have an influence on how the noise level is perceived by the occupants of nearby noise sensitive areas. The cumulative noise level of the machinery and equipment to be used for the construction of the mine will be 64.9dBA at 60m and 40.8dBA at 960m from the construction area if all the machinery operates in a radius of 30m at one time. This will seldom happen and the cumulative noise level will therefore be lower.

8.5.1 Ground Vibration

There was no ground vibration levels measured during the time of the noise survey. The biggest contributor to vibration will be the blasting process at the mine. Heavy duty machinery/vehicles can create ground vibration depending on ground type and distance between activity and receptor. Blasting will be done using ANFO (Ammonium Nitrate Fuel Oil) in development and production operations to uplift overburden soil and the ore body and gel cartridges or pumpable slurry would be used under wet conditions. The noise and vibration impact from a blast lasts for 3 seconds only. A typical blast impact at 900m from the blast is illustrated in Figure 65.

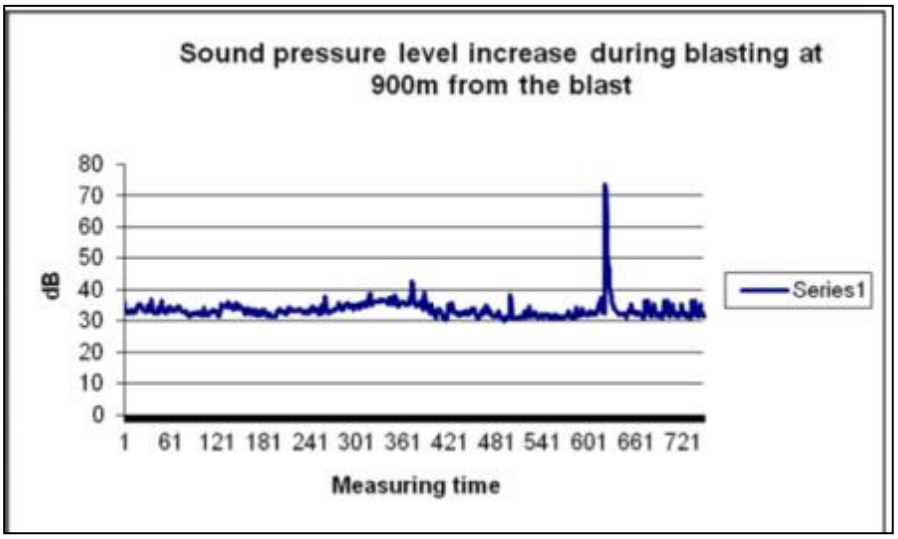


Figure 65 : Increase in ambient noise levels during a blast:

The noise increase from the mine blasting operations will be twice a week with an instantaneous impact only. A 500m blasting restriction will be implemented to residential areas. Ground vibration levels at a seam blast 500m from the blast area (20m below ground) has a tested vibration level of 4.28mm/s, which is well below the limit where structural

damage will occur. During a 700m and 500m overburden blast noise&vibration test no fly rock was experienced at the measuring points, yet visible from measuring points.

8.12.5 Noise contours

The mine site is in a valley with mountains in the west and east. Hence noise spreads in a south western direction. The noise levels at source will be 65dBA to 85dBA. The noise leel 1000m from the activity is 40dBA to 50dBA. How residences perceive mine activity noise and spread thereof depends on the terrain and wind direction.

The peak noise level (as per Figure 66 sound level pressure increase) will be audible at a distance and may create vibration which is experienced by rattling windows. It will be of short duration after which prevailing ambient noise level for the specific area will be maintained. Figure 67 illustrates the peak noise level contour during a blast.

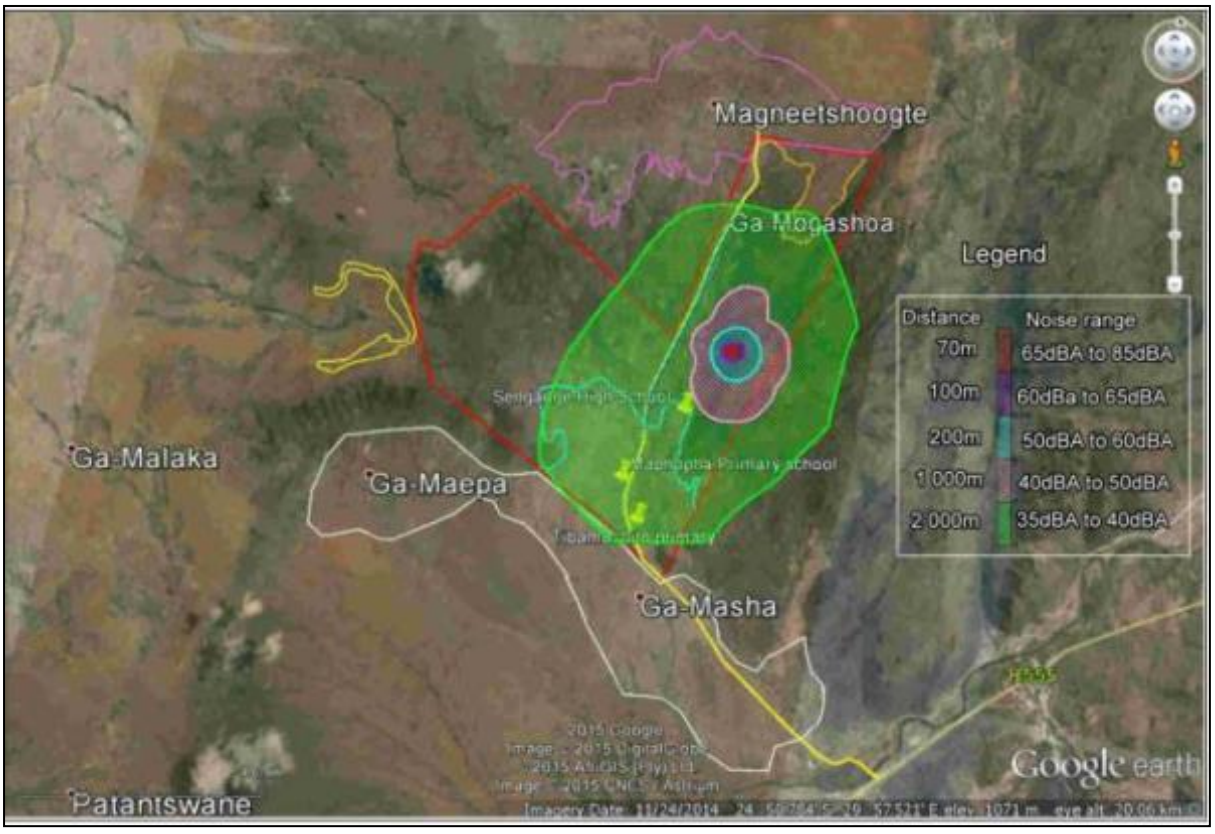


Figure 66: Noise contours during mine activity

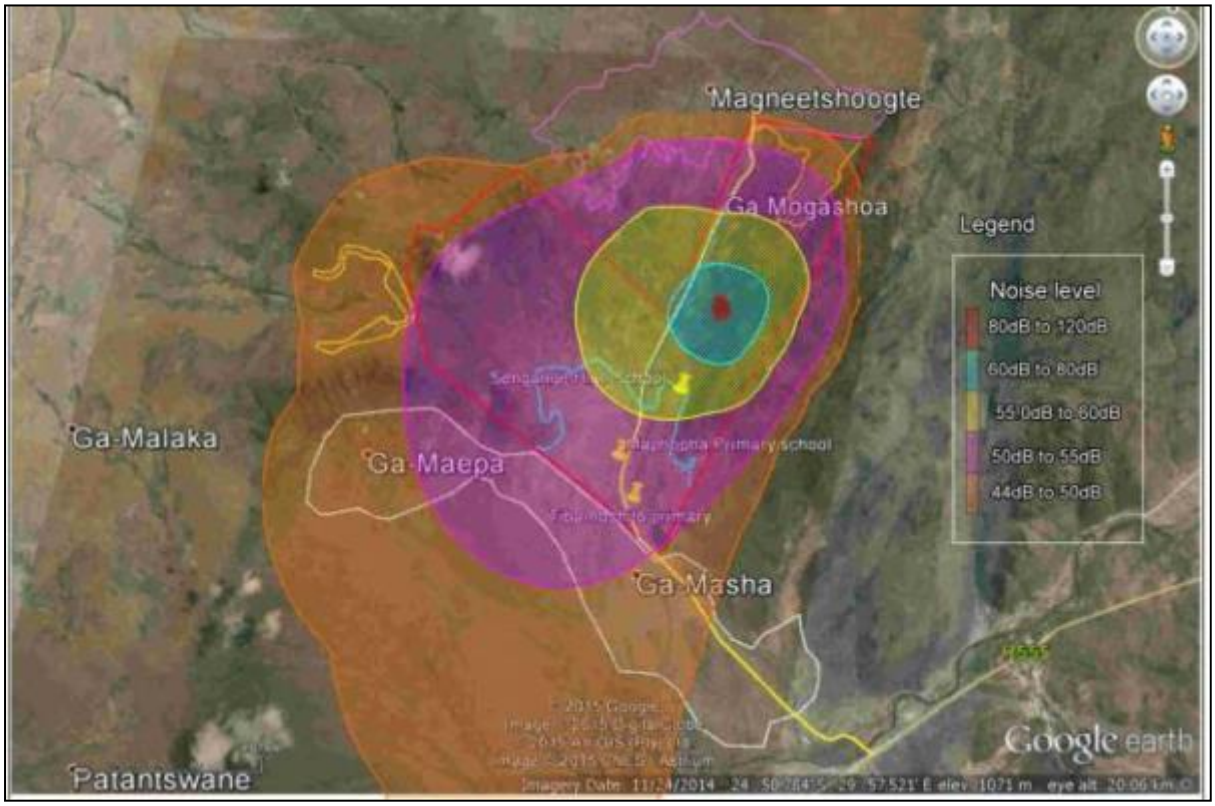


Figure 67: Noise contours during a blast

8.13 Visual aspects

A Visual Impact Assessment was carried out by Axis Landscape Architecture CC in November 2015. The VIA is attached under Volume 2 – Appendix I. The specialist study aims to describe the baseline visual aspects and zones of influence, identify potential impacts and management measures. The baseline environment comprises of the visual resource, which refers to the physical landscape, and the visual receptors that include the viewers that experience views to the site.

8.13.1 Landscape Character

Landscape Character Assessment (LCA) is concerned primarily with the observable elements, components and features within a landscape that individually and collectively define the landscape characteristics.

The study area is mountainous, undulating with relatively strong topographic variation. Shallow valleys with the Shakwaneng River meander through the landscape. Mining activities, residential settlements and small scale mining dominate the study area. Mining manifests itself through presence of mines, large stockpiles, severe scarring of the landscape.

8.13.2 Visual Characteristics of Area

Visual character is based on human perception and the observer's response to the relationships between and composition of the landscape, the land uses and identifiable elements in the landscape.

The project site can be described as mountainous and undulating with strong topographic variation. Land cover is made up of a mixture of mining activities related to Steelpoort, cultivated land and bushveld (Figure 68- 71). Land is composed of mining, information settlements and vacant/unspecified land. The area has a rural character with the mines forming a development hub within the landscape.

Figure 68: Facing west - Maphopha village and mountainous area seen from Dr Eiselen Dam

Figure 69: The Shakwaneng River - facing north:

Figure 70: Existing vegetation on study site - facing east:

Figure 71: Topography of the study site - facing east from D2219 Road:

8.13.3 Visual Quality of the regional landscape

Visual quality is a qualitative evaluation of the composition of landscape components and their influence on scenic attractiveness.

The area has a moderate-low visual quality, due to areas of high human intervention with minimal natural features. The regional visual quality is impacted by agricultural practice and encroaching of mining.

8.13.4 Visual Absorption Capacity

Visual Absorption Capacity (VAC) signifies the ability of the landscape to accept additional human intervention without serious loss of character and visual quality value. VAC is founded on the characteristics of the physical environment.

The VAC for the area is low. It has a very limited screening capacity for the particular project due to the land cover and predominantly low vegetation. Less prominent project components (access roads) are likely to be visually absorbed to a greater degree in the landscape. The small scape and extent of project components will not create major alterations to the landscape character.

8.13.5 Visual Receptors

The most significant impacts will occur during the construction period when bushveld is cleared for mining areas, roads and stockpiles. Change in surface cover from bushveld to exposed soils will have a highly severe impact which will diminish the bushveld character. Impacts will abate when disturbed areas are rehabilitated. Visual receptors which will be mostly affected are residents within a 5km distance of the project site (Figure 72). Residence will experience high level of visual exposure to their proximity.

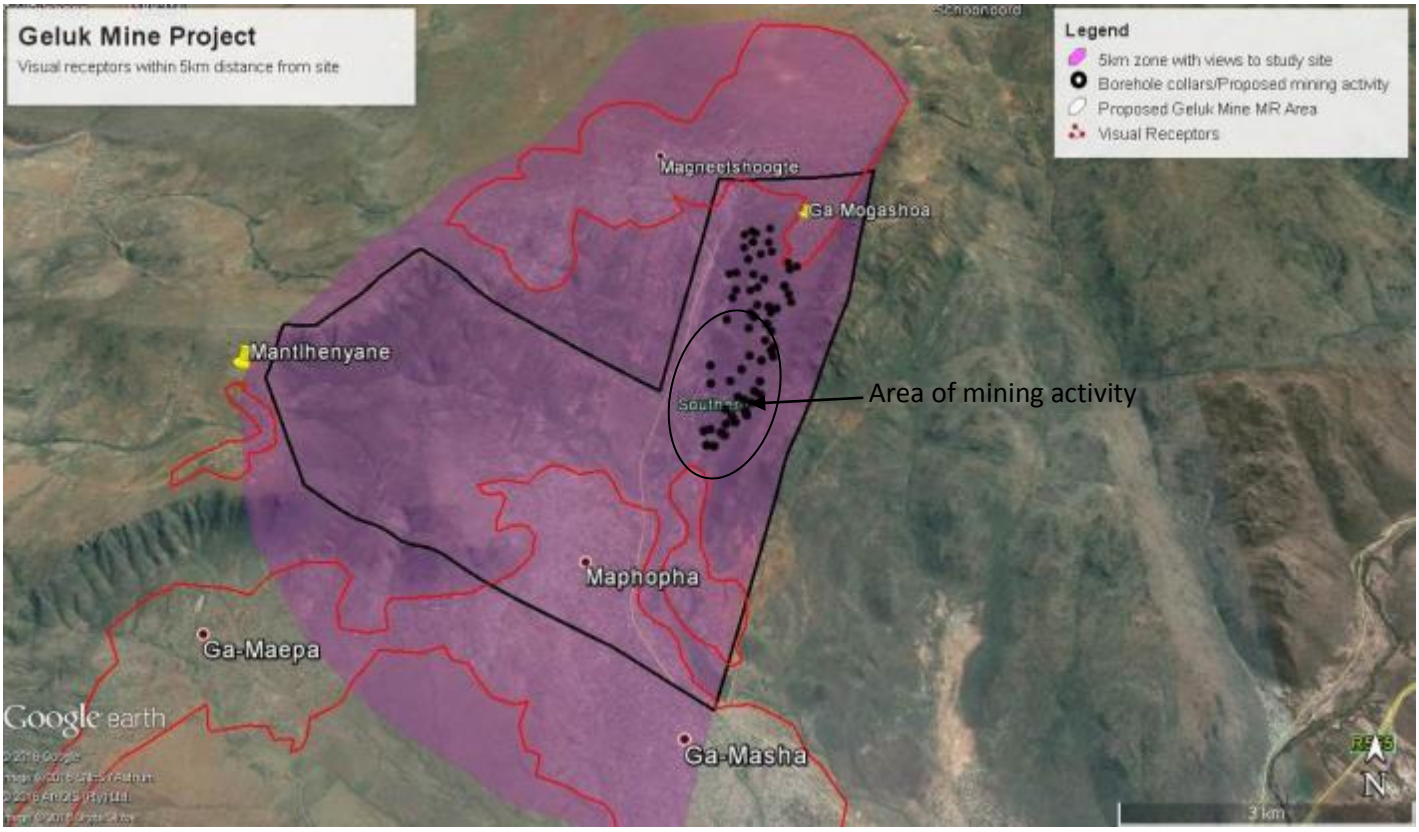


Figure 72: Visual receptors within 5km distance from site

The visual receptors within a 5km distance from site include the following:

- Ironstone Settlement forming part of Maphopha (closest receptors within mining boundary-directly south)
- Ga-Mogashoa (within mining right boundary- north)
- Maphopha (within mining right boundary-south)
- Magneethoogte, Makgane (outside mine boundary – north)
- Ga-Masha (outside mine boundary – south)
- Ga-Maepa (outside mine boundary – south west)
- Mantlhenyane (outside mine boundary – west)

8.14 Traffic

An Engineering Traffic Impact Assessment was conducted by ITS Engineers (Pty) Ltd for the proposed project. The Traffic Impact Assessment Report is attached under Volume 2: Appendix J

The study involved:

- Identification of affected external roads, conducting traffic counts;
- Assessment of basic road network (road conditions, alignment, existing signage and cross sections);
- Investigate and assessment status quo of internal and external road network;
- Capacity analysis of the existing road network;
- The investigation and assessment of the existing, future private and public transport requirements related to the proposed development;
- Assessment of proposed access intersection sight distance, spacing in relation to proposed access intersection
- Assessment of road safety conditions (access positions, street lighting)

8.14.1 Influence Area

The mining development will influence the following existing external road network in the study area:

- R555 Road (Steelpoort/Stofberg Road);
- D2219 Road (Jane Furse Road including the Malekane Steelbridge)
- D1392 Road
- Road to Schoonoord

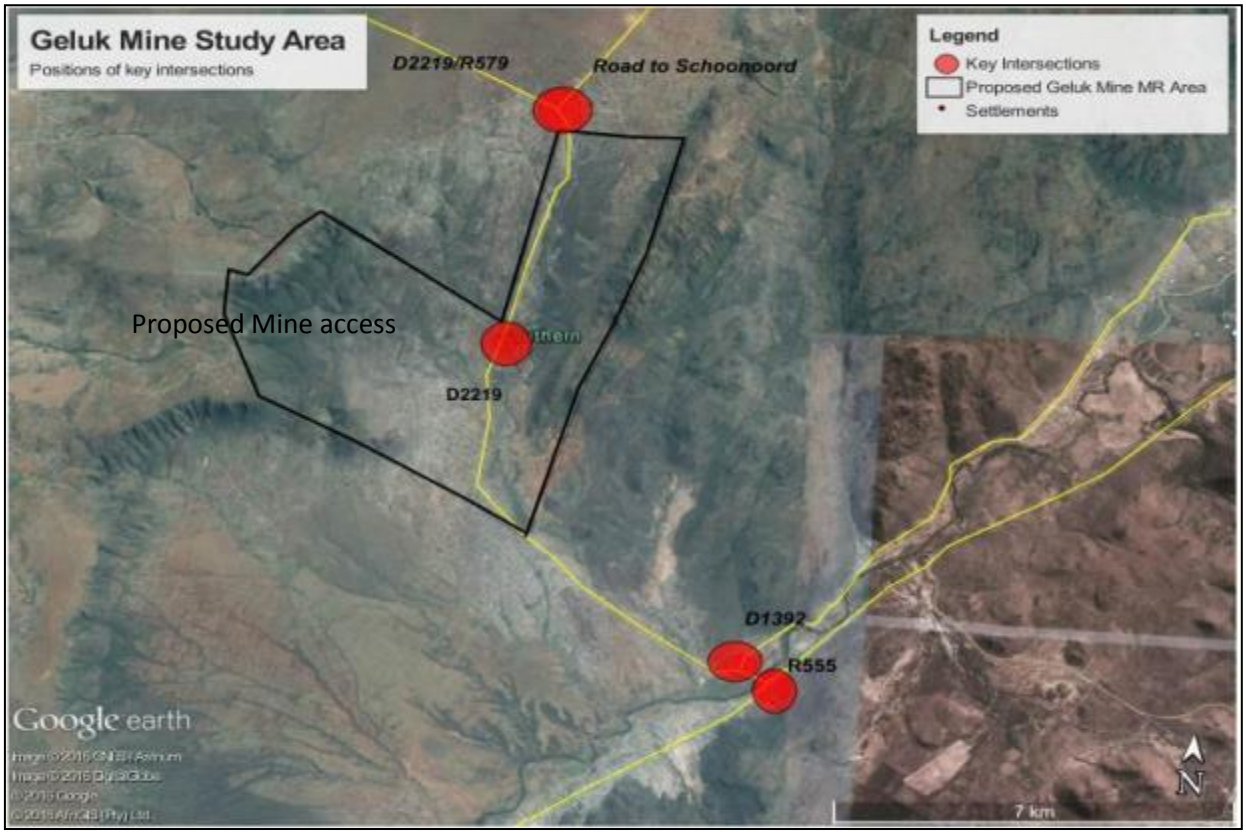
The above roads are paved and in fair condition. The mine will generate traffic along these routes due to shipping of ore by interlink tipper trucks from the mine (D2219) via the R555 to the Roossenekal Rail siding. This includes trips by mine employees from villages and towns nearby. The D2219-R555 is the preferred haulage route as it is the shortest route at 55km. The D2219 road crosses the Steelpoort River via the Malekane Steelbridge to the R555.

The mine access will be from the D2219 road via a class 5 intersection, 2-way priority stop controlled intersection. A proposed access road intersection upgrade will be constructed. The intersection sight distances are acceptable without constraints. The terrain is flat and road alignment does not pose any hazardous locations along the route.

The following 6 key intersections were investigated to assess the mine's impact on external roads (Figure 73):

- Intersection 1: R555/D2219 Road;
- Intersection 2: D2219/D1392 Road
- Intersection 3: D2219/Road 2 towards Schoonoord
- Intersection 4: R555 Road/Access Road to Roossenekal train station;
- Intersection 5: R555 Road / Access road to farm
- Intersection 6: D2219/Access road to the mine

Traffic counts were conducted on 2nd December 2015 at the above intersections within the vicinity of the study area and rail siding. **The AM and PM peak hour was recorded as 06:45 – 07:45 and 16:15-17:15. PM Peak hour is the most critical.**



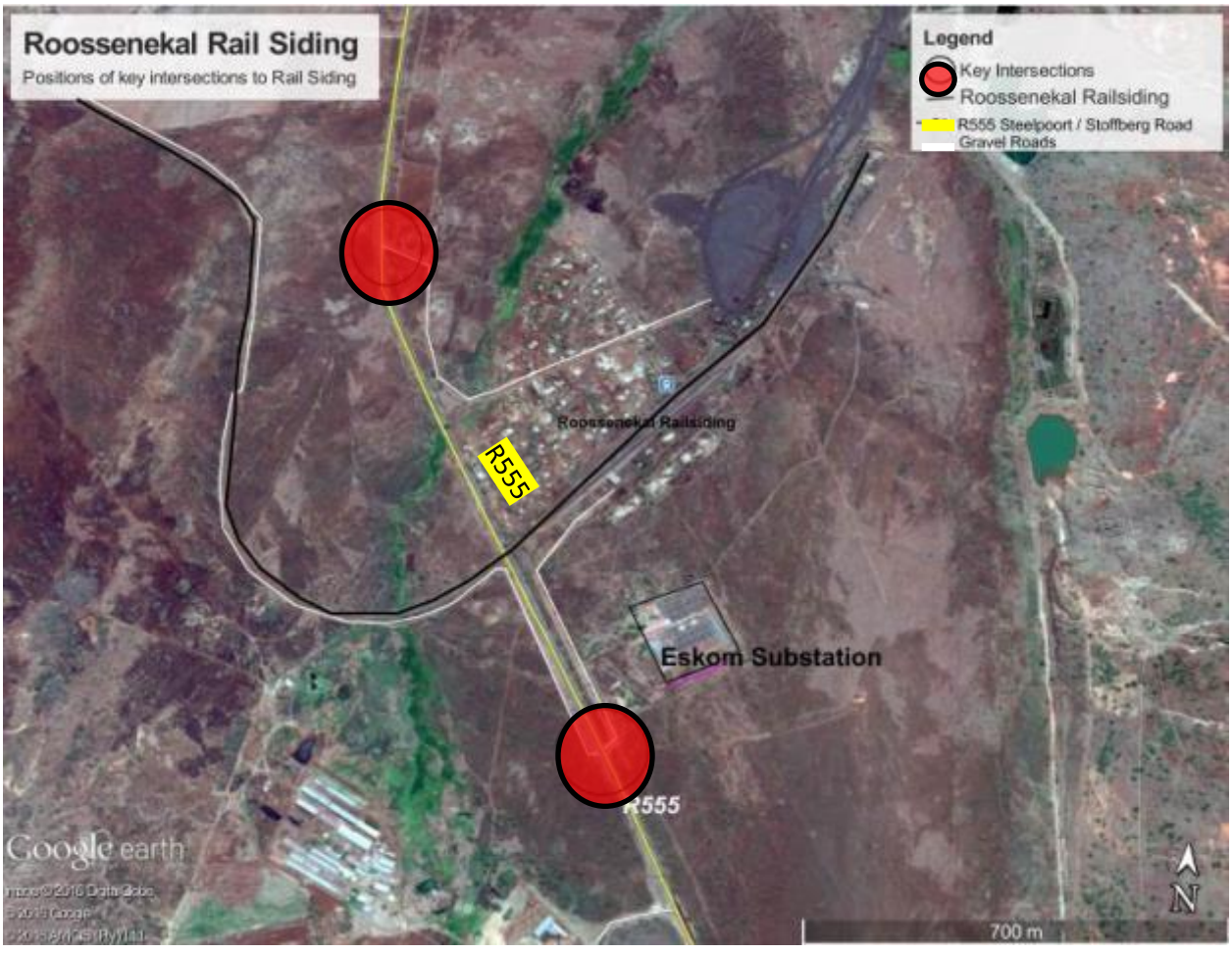


Figure 73: Six Key Intersections investigated:

8.14.2 Baseline traffic conditions

The traffic counts were classified into the following categories:

- light vehicles,
- heavy vehicles (typically 2-4 axels)
- very heavy vehicles (typically 5 and more axels) for each intersection counted

The traffic count survey indicated heavy vehicles account for 12% of all vehicles on the network and 88% were light vehicles during AM traffic. During PM traffic 11% were heavy vehicles and 89% were light vehicles.

8.14.2.1 Level of Service Analysed (LOS)

In traffic analysis:

- The capacity of a road (C) is the number of vehicles that can reasonably be expected to traverse the road under prevailing traffic and control conditions;
- The volume (V) is the number of vehicles that arrive at an intersection per hour; and
- The level of service (LOS) is expressed as the average delay (D) that a driver experiences at an intersection

The LOS definitions for un-signalled intersections as shown in Table 49 below.

Table 49: LOS definitions based on vehicle delay

LEVEL-OF-SERVICE DEFINITIONS BASED ON VEHICLES DELAY		
Level of Service	Control Delay per vehicle in seconds	Level of Acceptability
A	d≤14.5	Desirable
B	14.5 < d ≤ 28.5	Desirable
C	28.5 < d ≤ 42.5	Desirable
D	42.5 < d ≤ 56.5	Desirable
E	56.5 < d ≤ 70.5	Not Desirable
F	70.5 < d	Not Desirable

In rural and urban areas overall rating of A to D are normally considered acceptable. Levels of service C or better are considered desirable and levels of service E and F are normally undesirable (Committee of Transport Officials, 2014).

8.14.2.2 Capacity Analysis results - Intersections

The capacity was analysed using scenarios:

- Scenario 1: 2015 Background peak AM and PM traffic volumes (existing traffic volumes on road network);
- Scenario 2: 2020 Background peak AM and PM traffic volumes (future traffic volumes on road network plus a 2% growth rate per annum applied to 2015 volumes)
- Scenario 3: 2025 Background peak AM and PM Traffic volumes (Geluk Mine operation phase – 2025 traffic volumes when in full production – development demand on road capacity)

The mine's transport requirements and expected trip generation were pivotal to the capacity analysis. The daily transport requirements for the mine are set out according to production years as follows:

- **Year 1-3:** 46 trips (37 heavy vehicles, 8 private vehicles, 1 public transport vehicle)
- **Year 4-5:** 63 trips (54 heavy vehicles, 8 private vehicles,1 public transport vehicle)
- **Year 5-30**:92 trips (78 heavy vehicles , 11 private vehicles,2 public transport vehicle)
- **Year 31-32** (decommissioning phase): 50 trips (40 heavy vehicles, 9 private vehicles, 1 public transport vehicle)

The expected AM and PM peak hour trip generation for the mine was determined in Table 50) to inform the LOS rating of the key intersections.

Table 50: Mine expected trip generation expected during AM and PM

Expected PM Peak Hour Trip Generation													
Analysis scenario	Assumptions	2016 - 2019 Operational Phase Year 1-3			2020 - 2021 Operational Phase Year 4-5			2021 - 2046 Operational Phase Year 5-30			2047 - 2048 Closure/ Decommissioning Phase		
		Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out
Heavy vehicle (vph)	15% of total traffic (20/80 Split)	6	5	1	8	2	6	12	2	10	6	1	5
Private vehicle (vph)	2 shifts (40/60 split)	8	3	5	8	3	5	11	4	7	9	4	5
Public transport (vph)	2 shifts (50/50 Split)	1	1	0	1	0	1	2	1	1	1	0	1
Total number of vehicles		14	9	5	17	10	12	25	7	18	16	7	11

Expected AM Peak Hour Trip Generation													
Analysis scenario	Assumptions	2016 - 2019 Operational Phase Year 1-3			2020 - 2021 Operational Phase Year 4-5			2021 - 2046 Operational Phase Year 5-30			2047 - 2048 Closure/ Decommissioning Phase		
		Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out
Heavy vehicle (vph)	15% of total traffic (40/60 Split)	6	2	3	8	3	5	12	5	7	6	2	4
Private vehicle (vph)	2 shifts (60/40 split)	8	5	3	8	5	3	11	7	4	9	5	4
Public transport (vph)	2 shifts (50/50 Split)	1	1	0	1	0	1	2	1	1	1	1	0
Total number of vehicles		14	10	3	17	8	9	25	12	12	16	8	8

The capacity analysis results for the scenarios under evaluation are summarised in Table 51 and Table 52.

Currently all the intersections operate at an acceptable level of service with an **LOS Rating A during both the AM and PM peak hour**. The road capacity analysis shows that even after the development traffic is added to the 2025 background traffic the V/C ratio will still be well below the maximum acceptable thresholds of 0.95.

The capacity analysis for scenario 2 and scenario 3 were done with the proposed access intersection road upgrade in place.

Legend:

Background Traffic : projected traffic without development traffic
V/C : Volume to capacity ratio
Del (s) : Delay (in seconds)
Level of service (LOS) : A,B,C,D *Acceptable LOS*
E and F *Unacceptable LOS*

Table 51: Capacity Analysis results AM Peak Hour

No	Intersection	Scenario 1: 2015 Background Traffic Demand (Fig 3)			Scenario 2: 2020 Background Traffic Demand (Fig5)			Scenario 3: 2025 Background Traffic + Development Traffic Demand (Fig 8)		
		LOS	Del (s)	v/c	LOS	Del (s)	v/c	LOS	Del (s)	v/c
1	R555 / D2219	A	5	0,20	A	5	0,22	A	6	0,28
2	D2219 / D1392	A	2	0,09	A	2	0,09	A	2	0,12
3	D2219 / Road 2 towards Schoonoord	A	5	0,13	A	5	0,14	A	5	0,17
4	R555 / Access Road to Roossenekal Train Station	A	0,4	0,06	A	0,4	0,06	A	1	0,08
5	R555 / Access Road to a Farm	A	0,3	0,05	A	0,3	0,05	A	0,3	0,06
6	D2219 / Access Road to the proposed Mine	A	0	0,07	A	0,4	0,07	A	1,2	0,08

Table 52: Capacity Analysis results of PM Peak Hour

No	Intersection	Scenario 1: 2015 Background Traffic Demand (Fig 3)			Scenario 2: 2020 Background Traffic Demand (Fig 5)			Scenario 3: 2025 Background Traffic + Development Traffic Demand (Fig 8)		
		LOS	Del (s)	v/c	LOS	Del (s)	v/c	LOS	Del (s)	v/c
1	R555 / D2219	A	7	0,42	A	8	0,50	A	9	0,61
2	D2219 / D1392	A	1	0,19	A	1	0,21	A	2	0,24
3	D2219 / Road 2 towards Schoonoord	A	5	0,13	A	5	0,14	A	5	0,15
4	R555 / Access Road to Roossenekal Train Station	A	0,3	0,07	A	0,3	0,08	A	1	0,09
5	R555 / Access Road to a Farm	A	0,3	0,07	A	0,3	0,07	A	0,3	0,08
6	D2219 / Access Road to the proposed Mine	A	0	0,08	A	0,3	0,09	A	1	0,1

8.14.2.3 Road Link Capacity

The Road link capacity analysis by ITS Engineers showed that the routes analysed are expected to accommodate the existing and future traffic demand (up to the decommissioning phase of Geluk Mine) without requiring additional road upgrades. All the roads analysed in this study still have enough spare capacity. Available spare capacity ranged from 0.59 to 0.93 in both directions/lanes per roadway. See Table 53.

Table 53: Road Capacity Analysis Results

Road	Section of the road	Direction and Lane Requirements	Operational Phase: 2025 Background Traffic +Development Traffic	Existing nr. of lanes per direction	Utilization (v/c ratio) during horizon year (2025 Traffic + Development Traffic)	Available spare capacity per lane
R555 / D2219	North of the R555	Northbound	230	1.0	0.15	0.79
		Southbound	365	1.0	0.24	0.71
	South of the R555	Northbound	210	1.0	0.14	0.81
		Southbound	355	1.0	0.24	0.71
	West of the D1261	Eastbound	315	1.0	0.26	0.69
		Westbound	305	1.0	0.25	0.70
D2219 / D1392	North of the D1392	Northbound	70	1.0	0.06	0.89
		Southbound	30	1.0	0.03	0.93
	East of the D2219	Eastbound	230	1.0	0.19	0.76
		Westbound	435	1.0	0.36	0.59
	West of the D2219	Eastbound	235	1.0	0.20	0.75
		Westbound	400	1.0	0.33	0.62
D2219 / Road 2 Towards Schoonoord	North of the Road 2	Northbound	225	1.0	0.19	0.76
		Southbound	200	1.0	0.17	0.78
	East of the R557	Eastbound	170	1.0	0.14	0.81
		Westbound	205	1.0	0.17	0.78
	West of the D1261	Eastbound	285	1.0	0.24	0.71
		Westbound	295	1.0	0.25	0.70
R555 / Access to Train Station	North of the R555	Northbound	105	1.0	0.07	0.88
		Southbound	170	1.0	0.11	0.84
	South of the R555	Northbound	100	1.0	0.07	0.88
		Southbound	160	1.0	0.11	0.84
R555 / Access to a Farm	East of the R555	Eastbound	145	1.0	0.10	0.85
		Westbound	120	1.0	0.08	0.87
	West of the R555	Eastbound	145	1.0	0.10	0.85
		Westbound	120	1.0	0.08	0.87

Note 1: Lanes required to accommodate the demand on the roads, are based on a lane capacity of: 1 500 vph for R555 and R557 roads and 1 200 vph for the D2219, D1392 road.

8.14.2.4 Logistical issues identified on baseline traffic infrastructure

The Malekane Steelbridge crossing the Steelpoort River is located 150m from the main route (R555). In order for the Geluk mine trucks to join the R555, it will have to cross the steelbridge. The bridge is a one lane bridge, 3.7m wide by 100m long and can only accommodate trips from one direction at a time. It is not suitable for mine haulage trucks.

Figure 74: Malekane Steel Bridge

The bridge will need to be replaced with a new two lane (one per direction) bridge. The cost implication is R 20 million. This could be a joint effort from all the mines in the area and mines to be established in future.

Two alternative transportation routes were considered to avoid the bridge. Haulage trucks can either (i) divert from the D2219 before the existing steel bridge by turning left onto the D1392 or; (ii) turn north from the mine access and proceed straight with the D2219. Alternative I is 100km distance and Alternative II a 125 km distance. The shortest route, Alternative 1, is understandably preferred.

However, calculation of the total expenses of fuel and time over the 30 LoM using the alternative routes are deemed not the optimal choice. Replacing the bridge will save Rakhoma significant operating costs over the LoM period.

8.15 Sites of achaeological importance

A Phase 1 Archaeological Impact Assessment (AIA) study, as required in terms of Section 38 of the National Heritage Resources Act (No25 of 1999), was undertaken by Millenium Heritage Group (Pty) Ltd with the aim to:

- Establish whether any of the types and range of heritage resources outlined in Section 24, 35 and 36 of the NHRA do occur in the project area, if so, to determine the nature, extent and significance of the remains;
- Determine whether such remains will be affected by the propsed project and, if so, determine appropriate mitigation measures;

The AIA is attached under Volume 2 – Appendix K

The cultural heritage of the study area has been shaped by almost continuous occupation over the past 500 000 years. This occupation stretched through the early Stone Age period through the Iron Age to colonial settlement in the 1840s.

The Archaeological and heritage studies in the region indicate that the area is of high prehistoric and heritage significance. It is in fact a cultural landscape where Stone Age, Iron Age and historical period's sites contribute the bulk of the cultural heritage of the region (Calabrese, 1996; Huffman, 2007)

In terms of the regional history of the Ba-Pedi. The Pedi are of Sotho origin. The Tswana chiefdom form part of the larger group of Sotho people, while the Sotho group itself is one of three sub-divisions of Bantu speaking people. The first is the Batswana of western Sotho, second is Basotho of Lesotho, third comprise Bapedi / northern Sotho. The Bapedi is the one that dominates in the study area within the Sekhukhune district. All these tribes call themselves Sotho. The Transvaal Sotho has been subdivided into a number of groups. These are the eastern Sotho, particularly the Kutswe, Pai and Pulana; the north eastern Sotho, particularly the Phalaborwa, Mmamabolo and Lobedu the northern Sotho, particularly the Kgaga, Birwa,Tlokwa and some Koni and Tau. Historical documents and Sotho oral tradition suggest that they originated from the Great Lakes in central Africa. Their migration occurred in succession of waves over many years under the leadership of king Kgalakgadi who settled in Botswana in the early 13th centuries. The next group to have arrived in the early period seems to have been the Digoya who were the first group to cross the Vaal River, little is known of their history and they were finally absorbed by the Ba-Taung tribe. The majority of the proper Sotho followed two three migration of the Ba-Rolong, Ba- Fokeng and Ba- Hurutshe.

According to the 19th century settlement of this region, the Sotho speaking Pedi arrived relatively late, they did however build powerful kingdom in time of Thulare 1790-1820. One of the reasons was availability of excellent pasture and good landscape. Historians suggest that in the course of their migration in and around the valley, cluster of people from diverse origin had gradually concentrated themselves under nucleus group with various totems, Tau, Kolobe, Kwenaand others. Smaller tribes were absorbed in to the nation, outsiders and refugees were admitted, women from neighboring clans were married into the tribe forming the Pedi stronghold state. The Pedi oral traditions suggest that Pedi chief Thulare maneuvered to the top of the ladder through his superb military tactics and became undisputed paramount chief of the

region. Thulare is believed to have died in 1824, soon after the death, the whole Ba-pedi empire was crushed by the Matabele under Mzilikazi.

Sekwati the senior living son of Thulare, established the Paramountcy of Bapedi at Phiring near Pokwani on a rocky hill which is known today as Magalis Location. By 1828 the new Pedi chief Sekwati had returned to the area, and over the next ten years rebuilt the Pedi stronghold. When Sekwati died in 1862 he was succeeded by his son who came to power using military force, emerged (King Sekhukhune- named Matsebe), he acquired the name Sekhukhune as a nickname due to his outstanding role in fights against Boers. During the reign of Sekhukhune money obtained from headman employment taxes was used to purchase guns and cattle in an attempt to increases Marota' s wealth.

Site of Archaeological Importance

A 6 day site investigation was undertaken on the Geluk mine project site where systematic inspections of the site were covered by linear transacts covering the maximum of the area. Visual inspections were supplemented by written source and communication with local communities from the surrounding area. 5 Sites of significance were identified within the proposed Mining Right Area and will be demarcated during site establishment. (Table 54)

Table 54: Identified sites of archaeological significance

Sites	Coordinates	Significance	Remarks
Stone wall & possible grave	S24°.48', 02.04" E 29°.58'.35.01"	Medium	Possibly Affected
Remains of stone wall structures	S24°.48', 02.03" E 29°.58'.40.02"	Medium	Possibly Affected
Ga Mogashoa Cemetery 1	S24°.48', 04.29" E 29°.59'.17.89"	High	Within built up area
Maphopha Cemetery 2	S24°.50', 39.85" E 29°.57'.03.81"	High	Within built up area
Maphopha Cemetery 3	S24°.51', 16.57" E 29°.58'.14.39"	High	Within built up area

See Figure 75 for the location of identified archaeological sites within the Geluk Mine project area. Both stone wall structures are located within the 500m restriction to mining area; hence, will not be impacted by the Geluk Mine Development. All the identified cemeteries are located within the built up areas and will not be impacted by development. Cemeteries are characterised by more than 100 burial grounds most of which are marked with tombstones, headrests, parked stone. See Figures 76-78 for photos of the sites

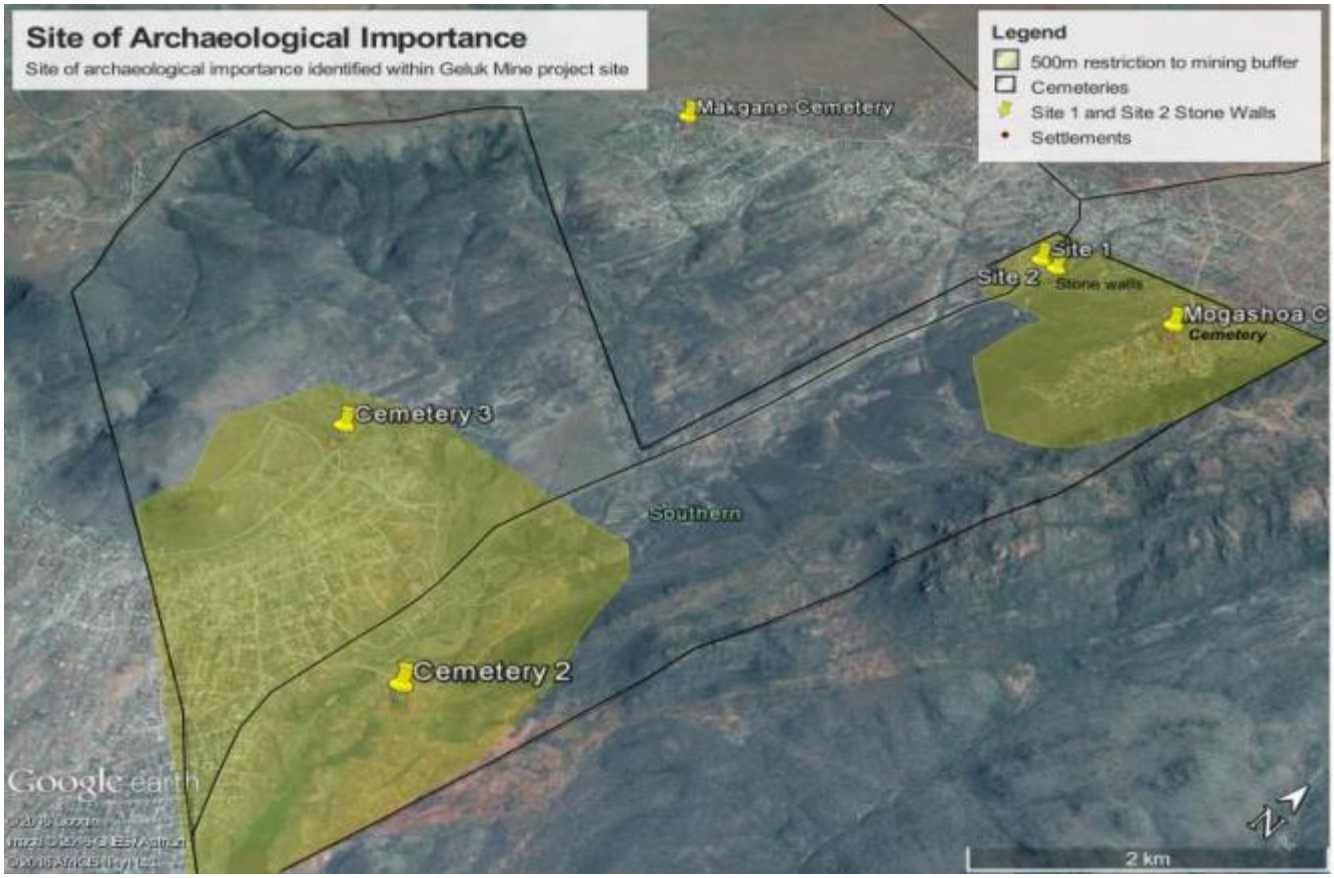


Figure 75: Location of sites of archaeological importance on Geluk Mine site

Figure 76: Stone wall site 1 identified east of the D2219 Road and west of the Shakwaneng River

Figure 77: Stone wall site 2 identified on the western bank of the Shakwaneng River

Figure 78: Maphopha village cemetery located east of D2219:

All the identified archaeological sites are within the 500m mining restriction area, hence will not be affected by mining. The two stone wall sites are located within the 200m buffer zone being recommended to the Shakwaneng River and also will not be affected.

8.16 Dominant sector in the regional area

The local economy (Steelpoort/Burgersfort) has a high concentration of mining activity. Currently 17 operational mines are found within the district, with the majority of activity situated along the Dilokong Corridor (R37 and R555). It stretches across the Fetokgomo and Greater Tubatse LM's. Major mining companies include Anglo Platinum, Xstrata, BHP Billiton, Implants, ASA Metals and Marula Platinum. Mining in the district has not yet reached full production limits; consequently, a number of new developments are expected to take place. These include (Table 55)

Table 55: Mining Activities either operating or prospecting in the Greater Tubatse LM area:

Mine Name	Owner	Locality
Dwarsrivier	Assmang	Shaga
Helena	Glencore Xstrata	Dithamaga
Thorncliff	Glencore Xstrata	Shaga
Mototolo	Glencore Xstrata	Shaga
Lion Ferrochrome	Glencore Xstrata	Steelpoort
Twickenham	Angloplat	Maotsi
Doomboch Mine	Samancor	Makgameng
Tubatse F/Cr	Samancor	Steelpoort
Modikwa		M/Shoek
Tweefontein	Samancor	Shaga
Lannex	Samancor	Steelpoort

Two Rivers Platinum Mine	African Rainbow Minerals	Shaga
Lwala	Samancor	Manyaka
Asa Metals / Dilokong		Maroga
Rhino Metals		Modubeng
Phokathaba Australia	Platinum Australia	M/Shoek
Spitzkop	Samancor	Steelpoort
Grootboom	Boyton	Steelpoort
Annesley Havercroft Mine		Segorong
Der Brochen	Angloplat	
Elephants River Granite		Tjate
Mooihoek		Maroga
Nkwe		M/Shoek
Sebatakgomo		Tjate
Saringa		K/Tswane
Steelpoortdrift (Mining Right awarded recently)	Vanadium Resources Pty Ltd	Ga-Malekane (Steelpoortsdrift)

8.17 Socio-economic environment

A Social & Economic Impact Assessment (SEIA) Study was undertaken by Demacon Market Studies and it represents the key socio-economic characteristics of the study area. The SEIA is attached under Volume 2 – Appendix L.

8.17.1 Administrative Setting

The Geluk Mine project site is located within the Sekhukhune District Municipality in the jurisdiction of both Makhuduthamaga and Greater Tubatse LM's. The site is located some 20km west of Steelpoort, 36km south west of Burgersfort and some 10km south east of Jane Furse. (Figure 79 overleaf)

The Greater Sekhukhune District Economy contributed 17.4% to the Limpopo Province. Greater Tubatse local economy contributes approximately 48.6% to the total district economy and Makhuduthamaga local economy contributes approximately 10.3%.

The district and local economies have experienced varied growth from 1998 – 2013 due to dependence on the mining sector. The average growth rate of the district economy was 5.5% per annum over 15 year period (Table 56)

Table 56: Economic Growth Rate

Period	Greater Sekhukhune	Greater Tubatse	Makhuduthamaga
15 years (1998 – 2013)	5.5%	7.1%	3.0%
10 years (2004 – 2013)	5.3%	6.2%	4.5%
5 years (2008 – 2013)	3.0%	3.5%	2.4%

Source: Demacon ex. Quantec 2013

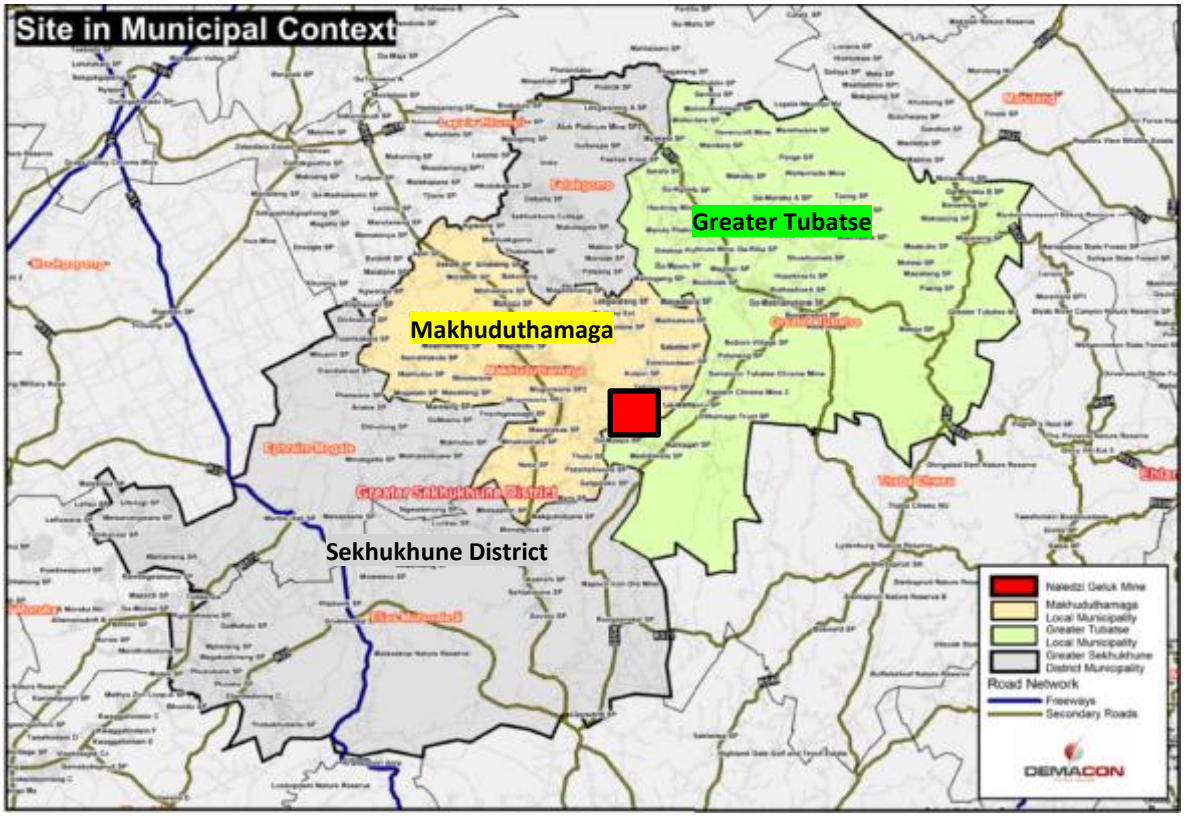


Figure 79: Project site in municipal context:

Greater Tubatse is a strong economic centre within the Sekhukhune District, primarily due to its mining sector. It is a major source of employment and economic growth in Tubatse. The mining sector has an economic contribution of 64% followed by finance and business services at 10.5%. Minerals found here include platinum, chrome, vanadium, andalusite, slica and magnetite. The mining sector is growing rapidly, with Burgersfort being one of the fastest developing towns in SA. Retail, trade, services and agriculture also contribute to the Greater Tubatse economy and are major employers. Agricultural products cultivated in this area include citrus, vegetables, corn and maize. Livestock farming include cattle, goats and game.

The Makhuduthamaga Municipality promotes agriculture, tourism and mining as the key growth sectors. There are number of mining exploration exercise that are taking place within the municipality. If mining does indeed prove feasible, it will have an added impetus on the creation of much needed jobs in particular and the growth of the economy in general.

The decision to locate the District Municipality in Jane Furse will provide substantial growth impetus, perhaps at the cost of Elias Motsoaledi Local Municipality. Furthermore, the agricultural and tourism potential of the municipality have yet to be exploited fully. At the moment limited forms of agricultural and tourism activities are taking place. The major economic drivers are trade at 29.7% followed by general governmental services at 22%.

8.17.2 Local Setting

The application farms are state owned (DRDLR) and allocated to 3 tribes, also under joint jurisdiction of 25 chiefs. The Geluk mine study site local economy is characterised as rural while the main nodes is at Steelpoort and Jane Furse.

There are two settlements within the Geluk project site, Maphopha in the south and Ga-Mogashoa in the north. The main uses of the mining area are housing and limited subsistence farming on account of topography. Subsistence farming plays a crucial role in the unaccounted informal economy of the area. From a cultural and natural perspective, the mine will be situated on vitally important land. The study site is a green park area/public park at which surrounding communities conduct social and socio-cultural activities.

An estimated total of 62 030 people and 14 666 households are located within the study area during 2016. Although Jane Furse is expanding, the population in the trade area is decreasing. This can be attributed to rural-urban migration due to a lack of job opportunities and low living standards.

The education profile of the area indicates that literacy levels are low, and there is a large number of people locally with no formal education. This could bode well for the low skill requirements for some of the mining occupations. The mine has the potential to play a crucial role in eradicating poverty in the area.

Local unemployment levels (62.0%) are below the national average of 22%, while income levels indicate that households are predominantly low income earners. The income level of household has a direct impact on the demand for goods and services. As new mining developments take place and new employment is created, demand in goods and services will continue to increase, thereby strengthening the local market.

Population, Household and Age Profile

In 2011 the study area had 63 892 people and 14 072 households with an average household size of 4.5 people. This has decreased approximately 62 030 people and 14 666 households in 2016 with an average household size of 4.2 people. See Table 57 for Population and Household total.

Table 57: Population and Household Total:

Sub-Places	Population	Households	Household size
Total 2011	630892	14 072	4.5
Total 2016	62 030	14 666	4.2

Source: Census 2011, Stats SA &Quantec, 2016.

Figure 80 Illustrates the age profile for the study area. The majority of people living in the study area are younger than 20 years of age; of which 53.9% of males and 44.6% of females are aged 0 to 19 years. 28.0% of males and 28.9% of females are aged 20 to 39 years. 13.7% of males and 17.6% of females are aged between 40 to 64 years. 4.4% of males and 9.0% of females are older than 65 years. This illustrates a young population with the majority of people younger than 40 years. This indicates that a large labour force exists.

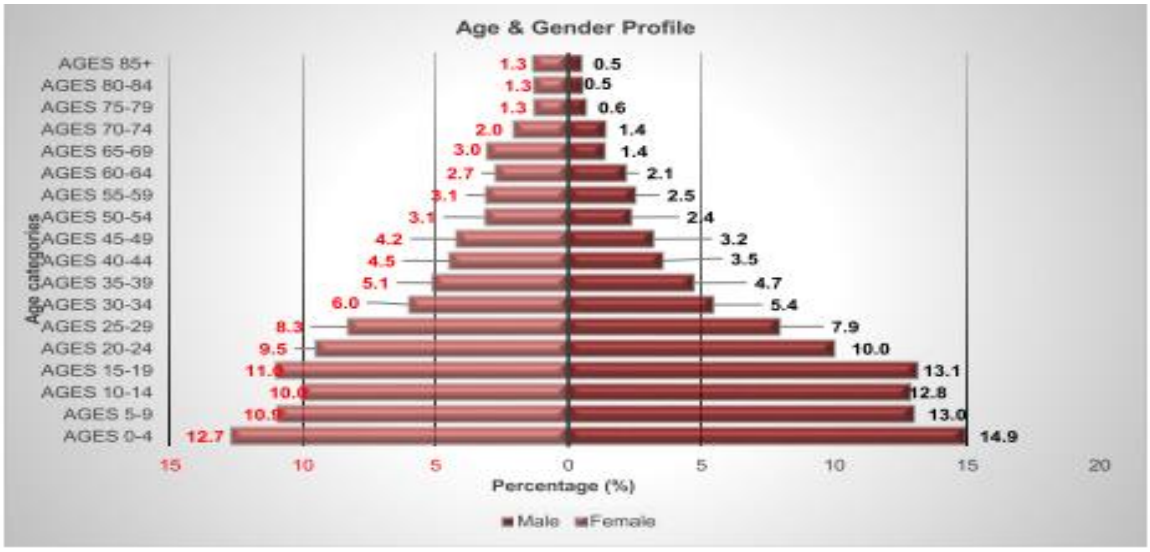


Figure 80: Age and Gender profile for study area (Source: Demacon ex Census 2011)

Education Profile

The level of employment is also an important indicator, impacting on the level of human development as well as on the level of disposable community income. The population in the primary market area falls within the following education levels:

- Higher: 4.2%
- Grade 12 / Std 10 / Form 5: 18.0%
- Some secondary: 41.1%
- Complete primary: 3.8%
- Some primary: 9.9%
- No schooling: 23.0%

A large segment of the adult market population is uneducated and it is anticipated that this will be reflected in the employment and overall living standard profile of the market. The higher education segment amounts to only 4.2%. The area reflected lower than average education levels and higher than the national average level for no schooling.

Employment Status

Only 42.5% of the market area population is economically active. 38.0% of the economically active population are currently employed, 62.0% are unemployed.

The primary market is characterised by a small economically active market segment with high levels of unemployment (higher than the national average of 25.0%), reflecting high dependency ratios.

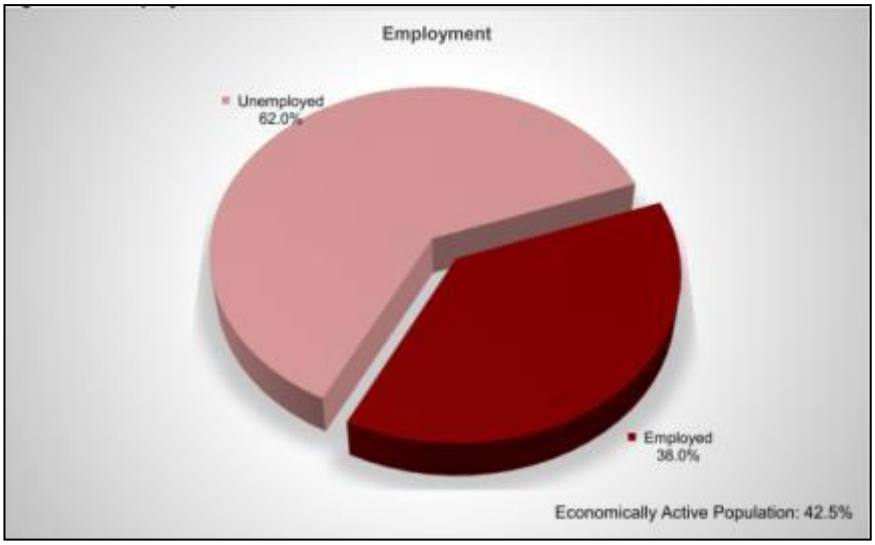


Figure 81: Employment in the study area (Source: Demacon 2016)

Dwelling types and Tenure Status

The majority of the population in the study area (85.5%) is occupying a house of brick structure on a separate stand or yard. This is followed by 4.7% of households living in an informal dwelling not a backyard and 32.9% of households living in an informal dwelling in a backyard. 4.6% of households living in a traditional dwelling.

The majority of the population (79.1%) in the study area owns a residence which is fully paid, in relation to 2.3% who owns a residence which is not yet fully paid off. 10.4% of the population is occupying a residence rent free and 8.2% is renting a residence.

Annual Household Income

The dominant segment (22.2%) of households in the study area earn between R9 601 and R19 200 annually, followed by 22.0% earning between R19 201 and R38 400 per annum. The weighted average annual household income in the primary area for 2016 amounts to:

- R53 545 per annum, which translates into R4 462 per month
- R136 563 per annum, which translates into R11 380 per month

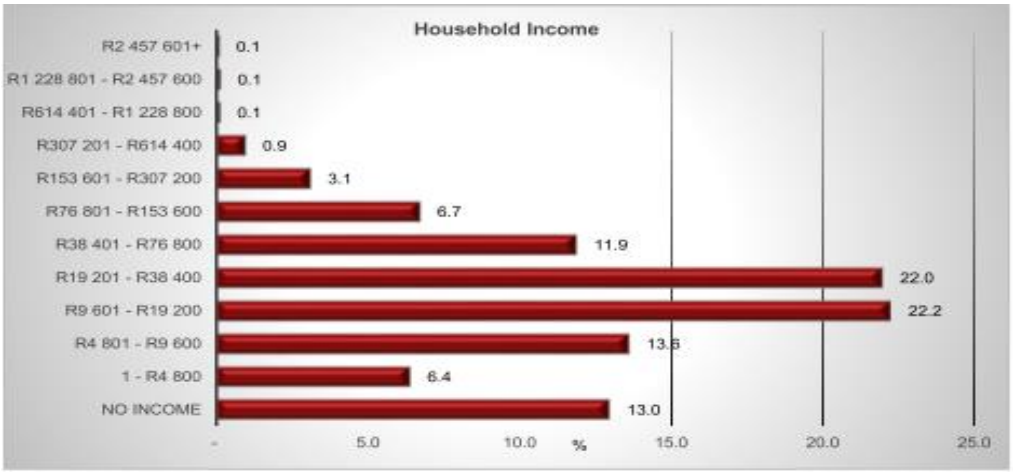


Figure 82: Annual Household income (Source: Demacon 2016 - based on the new 2011 Census figures):

8.17.3 Water Availability link to economic activity

Presently land use in Sekhukhune District is dominated by commercial and subsistence farming. This is especially true for MLM and Greater Tubatse LM. However, water scarcity, distorted land ownership patterns, a growing number of land claims, are discouraging agricultural expansion.

The communities within and surrounding the proposed Geluk Mining right area are dependent on borehole water, raw water from the Shakwaneng River and Dr Eiselen Dam. This is a water scarce area which lacks proper water services. There is social tension due to conflicting social and economic demands for water, an increasingly scarce resource in the district. It is a tension that will need to be mediated through future IDP processes.

Downstream, communities are similarly influenced by water availability and associated availability thereof for cultivation of land next to water courses.

SECTION 7: PUBLIC PARTICIPATION PROCESS

9 PUBLIC PARTICIPATION PROCESS

The Public Participation Process forms the corner stone for detailing the Scoping Report and Environmental Impact Assessment Report. The process identifies potential interested and affected parties on the project and solicits inputs and comments pertaining to the matter/activity proposed from such parties. Public Participation allows the public to contribute to the project and provides for better decision making by collective inputs from stakeholders, organs of state and specialists. In terms of the EIA Regulations 2014, Appendix 3 (3 [h][ii-iii]), a EIR must contain details of the public participation process undertaken for the project and a summary of issues raised by interested and affected parties.

The public participation process is conducted in accordance to Regulation 41 to 44 of Government Notice R982 of the NEMA Regulations. The process provides the public access to necessary information on the project throughout the scoping and EIA phase of the study. It provides sufficient, transparent and accessible information to I&APs in an objective manner in a phased approached as per the EIA process conducted. The objectives are outlined per phase below.

Table 58: Objective of consultation during different phases of the EIA Process

Scoping Phase	Impact Assessment Phase	Decision Making Phase
▪ Provide comments and inputs; ▪ Verify that issues have been recorded ▪ Assist in identifying reasonable alternatives	▪ Contribute information and local knowledge to the impact assessment ▪ Verify that issues have been considered in the Environmental Impact	Provide I&APs with the outcome of the environmental authorisation (DMR decision), how the decision can be appealed

▪ Contribute local information and knowledge to help identify environmental impacts	Report & EMPr ▪ Comment on the findings of the Environmental Impact Report	

9.1 Identification and Registration of Interested and Affected Parties (I&APs)

9.1.1 What is an interested and affected party?

- Any party interested and or affected by the activity
- Organs of state who have jurisdiction in respect of the activity

9.1.2 Identification and Registration of I&AP's

In terms of Regulation 40, 41 -44 of the EIA Regulations of 2014 of NEMA the Environmental Assessment Practitioner (EAP) managing the application must:

1) Provide access to information to all information that reasonably has or may have the potential of influence any decision and must include consultation with-
   (a) The competent authority
   (b) Every state department that administers a law relating to a matter affecting the environment relevant to an application for environmental authorisation;
   (c) All organs of state which have jurisdiction in respect of the activity;
   (d) All potential, or, where relevant registered interested and affected parties
   (e) Registered landowners;
   (f) Occupiers of the proposed application site;
   (g) Person in control of the proposed application site;
   (h) Owners, persons and occupiers of land adjacent to the site where the activity is to be undertaken;
   (i) Municipal ward councillor for the project area, ratepayers organisation representing the community in the area;
   (j) Municipality in which jurisdiction the application falls;

Consultation with communities and interested and affected parties are also required in terms of the MPRDA, 2002 this has been defined in terms of the act as:

'consultation' means a two way communication process between the applicant and the community or interested and affected party wherein the former is seeking, listening to, and considering the latter's response, which allows openness in the decision making process.

'**community'** means a group of historically disadvantaged persons with interest or rights in a particular area of land on which the members have or exercise communal rights in terms of an agreement, custom or law: Provided that, where as a consequence of the provisions of the Act negotiations or consultations with the community are required, the community shall

include the members or part of the community, directly affected by prospecting or mining, on land occupied by such members or part of the community.

'Interested and affected' parties include, but are not limited to; –

(i) Host Communities
(ii) Landowners (Traditional and Title Deed owners)
(iii) Traditional Authority
(iv) Land Claimants
(v) Lawful land occupier
(vi) The Department of Land Affairs,
(vii) Any other person (including on adjacent and non-adjacent properties) whose socio-economic conditions may be directly affected by the proposed prospecting or mining operation
(viii) The Local Municipality,
(ix) The relevant Government Departments, agencies and institutions responsible for the various aspects of the environment and for infrastructure which may be affected by the proposed project.

9.1.3 Announcement of Registration I&AP's and Identification

IDENTIFIED I&APS

i. **Competent Authorities:**

- Department of Mineral Resources: Limpopo Region is responsible for the environmental authorisation, waste management license and awarding the Mining Right;
- The Department of Water and Sanitation is the responsible authority for issuance of the WUL;
- The Limpopo Department of Economic Development, Environment and Tourism is the key commenting authority

ii. Registered Land owner:

The farms Geluk 512KS, Geluk 513KS and Ironstone 847KS is state owned. The Department of Rural Development and Land Reform (DRDLR) Limpopo Region has been identified. The project area is within Sekhukhune District and therefore the Head of Department and Chief Director for Management of State Owned land in DRDLR has been notified, Mr Julius Mashuphu.

The project application and notifications area is however being handled by Ms Susan Molefe. She is the Senior Manager for state owned land in the Sekhukhune District. An application for a mining surface lease will need to be submitted to LPBSC. The mining development on the project farms will be regulated in terms of the Interim Protection of Informal Land Rights Act, 1996.

The DRDLR: Limpopo Region is the former Department of Land Affairs thus falls within this category of I&APs identified. It has been indicated that the land has been allocated to 3 tribes.

iii. Lawful occupiers of the land:

The land is under custodianship of local traditional authorities. Allocation rights have been provided to:

- Tswako (Maepa) Traditional Authority in terms of Government Notice 680/1968
- Hlakwana (Rantho) Traditional Authority in terms of Government Notice 687/1968
- Bahlawana ba Maphopha in terms of Government Notice 1402/1966

There are also several Kgoshi's and Kgoshigadi's certificates from various traditional councils to utilise the proposed Mining Right area. These traditional authorities and chiefs are considered lawful occupiers of land, traditional authorities.

iv. Host Communities

The site is populated in its southern and northern extent by Maphopha village (south) and Ga-Mogashoa (north) and these are considered the host communities.

v. Land Claimants:

The Restitution on Commission on Land Rights: Polokwane has been identified and notified of the proposed project. Land Claim results from the Commission on Restitution of Land Rights indicate the farms Geluk 512KS and Geluk Oos 53KS has no land claims. The farm Ironstone 847KS has 5 claimants. The claimants are as follows:

- Bahlakwana Ba Maphopha (KRP 1552);
- Mogaswa-Manamane Tribe (KRP 1851/2497);
- Tau Nkadimeng-Manganeng (KRP 2542);
- Bakwena Ba Makua Tribe (KRP 1642);
- Manganeng Tribe (KRP 2542)

vi. Local Municipality

The project site is within the district of Sekhukhune District Municipality and within the municipal areas of Makhuduthamaga (farm Geluk and Geluk Oos) and Greater Tubatse (farm Ironstone).

These district and local authorities have been identified and notified of the project.

vii. Ward Councillors

The project site falls within Wards 7, 12 and 13 of Makhuduthamaga Local Municipality and Wards 27, 28 and 29 of the Greater Tubatse Local Municipality. The relevant Ward Councillors have been identified and notified.

viii. Agencies and institutions responsible for infrastructure and the environment

This includes the Limpopo Department of Economic Development, Environmental and Tourism, Eskom, Limpopo Roads Agency.

ix. Government Departments

An I&AP database and Organs of State Database has been opened for the project and all identified landowners, interested and affected parties and interested parties have been registered. The lists have been maintained and updated during the Scoping Phase and EIA phase. The database would remain open for the duration of the EIA phase.

Project information notifications regarding stakeholder workshops, public meetings, focus group meetings and documents for review forming part of the EIA process is distributed to registered I&APs only.

9.2 Announcement of the proposed project – SCOPING PHASE

This section summarises the public participation process following during the Scoping Phase of the EIA study.

9.2.1 Public Involvement during Scoping Phase

Call for registration – Project Announcement

Naledzi Group (Pty) Ltd announced the commencement of the Scoping and EIA Study on 24 July 2015.

A newspaper advertisement was published in the Steelburger Newspaper on 27 July 2015. Site notices were posted on site and in the study area. A Background Information Document (BID) was sent to I&AP's, organs of state and tribal authorities on 24 July 2015. The BID was presented in English and distributed via email, hand delivery. It was circulated from 24 July to 20 August 2015.

Notification Letters & BID's were hand delivered to Organs of State on 31 July and 2 August 2015 and to the Tribal Authorities on 4 and 5 August 2015. These letters were stamped by the receivers (organs of state, Tribal Authorities) affected by the mining right application.

Draft Scoping Report

The Draft Scoping Report was made available for 30 calendar day's public review from 14 August 2015 to 11 September 2015. Copies of the report was made available to registered I&APs and organs of state on the I&AP database and at public venues within the study area to allow for review and commenting. The DSR was placed at the following venues for public review:

- Bahlakwane ba Maphopha Village Traditional Council Office (Moshate Section)
- Mogashoa-Ditlhakaneng Tribal Council Office (Magneethoogte)
- Makhuduthamaga Local Municipality offices (Jane Furse)
- Naledzi Group Pty Ltd offices (Polokwane)

A newspaper advertisement was placed in the Steelburger on 21 August 2015 to announce the availability of the DSR. Posters were placed in the study area indicating venues at which the report could be reviewed. An invitation letter announcing the availability of the DSR along with electronic copies of the DSR were distributed to all I&APs and stakeholders on the project database.

The DSR was hand delivered to the organs of state with jurisdiction in matters pertaining to the project, tribal authorities with allocation rights to the proposed mining right area as well as Kgoshi's with certificates to use the property. Kgoshi's without certificates to use the land were notified of the availability of the draft Scoping Report at the above public venues.

Copies and proofs are attached under Volume 1 as follows:

- Appendix 5 – I&AP Database
- Appendix 6 – Newspaper Adverts and Site Notices announcing project and DSR availaibilty
- Appendix 7 – Example of BID, Notification Letter and Proof of BID distribution
- Appendix 8 – DSR Notification letter and Proof fo DSR distribution

9.2.2 Meetings during the Scoping Phase

Traditional Leadership Meeting – 21 August 2015

A traditional leadership meeting was arranged for this phase for 21 August 2015 at Khumula Game Lodge, Burgersfort. This included the tribal authorities of the area and its Kgoshi's and Kgoshigadi's with allocation rights, certificates to use the properties and even non-certificate holders. Invitations were distributed to afore said parties, including DRDLR and DMR's Regional Manager.

Due to community issues the traditional leadership was reluctant and unwilling to participate in the consultation process or attend meetings based on an objection lodged to the DMR against Rakhoma Mining Resources. The meeting was suspended.

DMR was made aware of the project challenges on 18 August 2015. A letter requesting the suspension of the EIA process and calls for action from DMR was submitted. This was however not resolved immediately placing the EIA process under pressure to continue as legislated in terms of the EIA Regulations time frames and directed submission dates for reporting to DMR.

This was documented in the Scoping Report and proofs of consultation attempts submitted to DMR.

Site Meeting with Department of Water and Sanitation

A pre-application WULA site meeting took place with DWS on 21 August 2015. It was highlighted by the department that DWS will provide inputs on the various required Section 21 water uses based on the DEIR content. (Volume 1: Appendix 9 – Minutes of meeting with DWS and attendance register)

9.2.3 Submission of Final Scoping Report (FSR)

The FSR was due for submission to DMR by 31 August 2015 as per the EIA Regulations regulated time frames. The project challenges and issues between Rakhoma, DMR and traditional leadership were not resolved close to date of FSR submission. DMR was silent on the request to pause the EIA process.

Naledzi continued as per the EIA Regulations with the process to avoid project application lapse. All comments and issues raised during the Scoping Phase either via email or telephonically were recorded. After expiry of the public review period, the DSR was updated, finalized and submitted to DMR for approval.

The FSR was approved by the DMR on 9 October 2015.

9.3 Public participation during IMPACT PHASE

Public participation during the impact assessment phase of the EIA entails a review of the findings of the EIA, presented in the Draft EIA Report and Environmental Management Programme (EMPr).

9.3.1 Public Participation challenges of the EIA Phase

The FSR approval letter permitted the EIA Phase to start, yet the project challenges and no permission to stop the EIA process to resolve community issues.

DMR Regional Manager was continuously made aware of project challenges and reluctance of the tribal authorities to participate in the public consultation process for the proposed Geluk Mine project. The challenges included not being able to access the project site nor consult with traditional leadership or communities due to non-conducive circumstances. The majority of challenges were from internal community and traditional leadership issues not related to the environmental process.

The above placed a constraint on the gathering of information from the project site during November to December 2015 to inform the Draft EIR and EMPr. The minority of contracted specialists were able to complete their investigations.

9.3.2 Key Stakeholders Workshop

A Key Stakeholders Workshop (KSW) took place on 4 December 2015 at Masana Lodge in Polokwane as part of the EIA phase. The meeting was arranged to transfer technical project details to organs of state, state departments, agencies and service providers. Its purpose was to assist the EIA project team in identifying key issues and impacts that need to be investigated as part of the EIA study.

The KSW was arranged in Polokwane due to it being the seat to the majority of key authorities for Limpopo Province and the project. Invitations to the meeting were distributed via email on 24 November 2015 to afore said parties.

All issues, concerns and recommended aspects to be assessed as part of the EIA phase were recorded in the minutes of the KSW. The minutes were distributed to the list of invitees and meeting attendees on 15 December 2015

Refer to the following appendices under Volume 1:

- Appendix 10A – KSW Invitation and proof of distribution
- Appendix 10B – Minutes of KSW and Attendance Register

9.3.3 Traditional Leadership Meeting

From December 2015 up to March 2016 the EIA process public consultation and specialist investigation were placed on hold to resolve community issues with traditional leadership.

A Traditional Leadership meeting was arranged on 11 March 2016 at Khumula Game Lodge, Burgersfort. Three entities were presented at the meeting; Rakhoma, traditional leadership and Naledzi. Traditional leadership involved the 25 chiefs of the study area affected by the proposal. The chiefs were each invited respectively as appose to meeting with various

community forums, to realign the consultation process which has been marred by the divisions within the community and the various forums.

The traditional leadership stated their support to the project at the meeting and consented to the continuation of the EIA process, specialist site investigations and scheduling of community meetings. The Minutes of the Traditional Leadership Meeting were approved and signed by traditional leadership on 20 March 2016. (Appendix 11 – Approved Minutes of Traditional Leadership meeting and the Attendance Register)

9.3.4 Notification to Traditional Leadership of Specialist Investigations

A notification letter was issued on 25 April 2016 to the 25 traditional leaders of the study area to request permission to conduct specialist investigations on the Geluk Mine project site. Naledzi was permitted to continue with fieldwork in the week of 20-22 April 2016.

Traditional Leadership arranged for community involvement during this period. A large group of community members from the respective tribal councils received the EIA project team in the study area during this period and moved in small groups with the EIA survey vehicles for the duration of 3 days. During this period community members enquired about the project specifics during which project information was transferred and location of activities were explained. The EIA process and reason for investigations were provided. Photographs were taken to record the community involvement during this period. Refer to Figures 83-86.

It was highlighted that community meetings/information sessions would be scheduled to convey the findings the EIA investigations to the community.

Figure 83 : Member of Naledzi (far left) with small group of community members during site investigations

Figure 84: Community members from study area next to the D2219 Jane Furse Road, next to site:

Figure 85: Community members with Naledzi in Shakwaneng River bed

Figure 86: Two community members indicating edible roots from a tree located on the project site

9.3.5 Focus Group Meetings

A focus group meeting took place with Mr Dilakane Phasha, Senior Manager: Town Planning Division of Makhuduthamaga Local Municipality at the municipal offices in Jane Furse on 21 April 2016. The comments and concerns raised by the town planning division were recorded and summarised in correspondence between Naledzi Group and the municipality. (Volume 1: Appendix 12 – Summarised Email of FGM with Makhuduthamaga LM)

9.3.6 Public Consultation during Environmental Impact Phase

The Draft EIR is the first official approach to the I&APs and organs of state and information submission during the Environmental Impact Phase. It is considered the root for consulting in this phase. The Draft EIR contains all the issues raised throughout the EIA process, findings of the specialist investigations and outcome of the assessment.

During the EIA Phase I&APs are notified of the availability of the Draft EIR and EMPr. The report is distributed for public review and comment for a period of 30 calendar days. This provides I&APs the opportunity to review the findings of the EIA.

The EIR & EMPR is made available for public review from **12 August to 12 September 2016**. Copies of the report are available at the following venues:

Table 59: Public Venues with copies of the Draft EIR for public review

PUBLIC VENUE	CONTACT PERSON	TELEPHONE
MOGASHOA-DITLHAKANENG TRIBAL OFFICE Stand 788, Ga Mogashoa-Dithlakaneng Village Magnet Heights	Ms. Evah Mamaile Tribal Office Administrator	Cell: 072 085 8482
BAHLAKWANA BA MAPHOPHA-MAKGANE TRIBAL OFFICE	Ms Ramontja Tribal Office Administrator	Cell: 082 540 9929

Stand 6745, Moshate Section, Ga Maphopha, Ngwaabe		
BAHLAKWANA BA MALEKANE TRIBAL OFFICE Stand 1, Moshate Section, Ga-Malekane	Ms. Meisie Sello Tribal Office Administrator	Cell: 082 355 0830
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9.3.7 I&AP Correspondence

Comments and Issues raised during the Scoping and EIA phases up to the preparation of the Draft EIR have been captured in an Issues and Response Report (IRR). The comments contained in the IRR are emailed, written comments and issues and concerns raised during meetings.

The Issues and Response Report will consist of versions.

- ✓ Version 1 – IRR appended to Final Scoping Report which is submitted to DMR (appended to this final Scoping Report)
- ✓ Version 2 – IRR will be an updated version of Version 1 which will be submitted to DMR upon lapse of the public review period on 11 September 2015 on the DSR
- ✓ **Version 3 - Draft Environmental Impact Report (EIR)**
- ✓ Version 4 – IRR appended to Final EIR

The current Issues and Response Report (IRR) Version 3 which accompanies the draft EIR reflects comments received to date and would be updated with the expiry of the public review period. (Refer to Volume 1: Appendix 13 – IRR Version 3)

9.3.8 Submission of Final EIR

All comments and issues received during the public review period of the Draft EIR and EMPr would be captured in a Final EIR and submitted to DMR for review and ultimately approval. ***Submission of the Final EIR is anticipated during September 2016***. I &Aps would receive notification of the submission of the final report.

9.4 Public Consultation during Decision making phase

During this phase DMR will review the Final EIR and consult with any other key organs of state eg. the Department of Water & Sanitation (DWS) before granting or refusing an environmental authorisation.

The environmental authorisation will be made available for public review for a period of 20 consecutive calendar days. This provides I&AP's with an opportunity to verify that the decision taken have considered their comments and concerns raised. I&APs are also then informed of the appeal procedure, should they have a reason to appeal.

9.5 Next step in the eia process

The Draft EIR will be finalised and updated with any additional comments received from I&APs on expiry of the public review period. The Final EIA Report and EMPr will be presented to the authorities for approval during September 2016.

10 ENVIRONMENTAL IMPACT ASSESSMENT

10.1 Purpose of the EIA

The purpose of the environmental impact assessment is to assess and address the potential environmental impacts identified during the scoping phase through in depth specialist investigations focussing on each identified impact. The in depth investigations provide mitigations measures to address the identified impacts and also provide for methods to enhance positive impacts. Specialist study findings have been incorporated in the EIR and impacts have been assessed according to its significance, extent to be addressed and adoption of mitigation measures to address the issue.

The assessment includes the consideration of the impacts as per the NEMA Regulations of 2014, GN R982, Appendix 5 (j):

- Cumulative impacts
- The nature, significant and consequences of the impact and risk
- Extent and duration of the impact and risk;
- Probability of the impact and risk of occurring
- The degree to which the impact and risk can be reversed
- The degree which the impact may cause irreplaceable loss of resources
- The degree to which the impact and risk may cause irreplaceable loss of resources;
- The degree to which the impact and risk can be mitigated

A scoring system is utilised to rank the significance of each impact identified. The cumulative effect of the impacts within the local area would also be considered.

In terms of the NEMA, 1998 Chapter 1, sets out the national Environmental Management Principles of which ultimately strive to ensure that development is socially, environmentally and economically sustainable. The core values of an EIA are therefore integrity, utility and sustainability. The EIA would therefore conform to the agreed Environmental Standards and would provide balanced credible information for decision making and result in environmental safeguards.

10.2 Environmental Impact Assessment Process Followed

The EIA Regulations of 2014 pertaining to Environmental Impact Assessment was promulgated under Section 24 (5) and 44 of the National Environmental Management Act, 1998 (Act 107 of 1998). The EIA Regulations of 2014 were gazetted under Government Notice R982 of 4 December 2014 which is the most recent procedures to be followed in order to obtain environmental authorisation for any listed activities pertaining to mining.

Chapter 4, Part 1, specifically Regulation 16 of the EIA Regulations 2014, sets out the requirements for submitting an application for environmental authorisation. Regulation 16 (2)

indicates that if an application for environmental authorisation pertains to mining, the following is applicable:

- It can only be submitted after the acceptance of an application for the right or permit has been accepted in terms of the MPRDA, 2002;
- Where section 24L of the act applies, be submitted in the manner as agreed to by the relevant authorities.

Rakhoma Mining Resources submitted an Application for Environmental Authorisation for listed activities to be triggered by the proposed Geluk Mine Project simultaneous with its Application for a Mining Right to DMR. The application included an application for environmental authorisation and a waste management license under NEM: WA. Hence it was agreed with DMR that an integrated process is followed. Both authorisations require the same process to be followed. The application is subject to an integrated Scoping and Environmental Impact Assessment (EIA) process.

Regulation 21 – 24 of Government Notice R.982 (EIA Regulations 2014) published under NEMA sets out the procedure for the Scoping and EIA Process. It is subject to the following:

- A Public Participation Process in terms of Regulations 40 – 44;
- Scoping Report ito Appendix 2;
- Environmental Impact Report ito Appendix 3;
- Environmental Management Programme ito Appendix 4
- Closure Plan with Financial Provision for rehabilitation ito Appendix 5

10.2.1 Pre-Application meeting with the Competent Authority

A pre-application meeting took place with DMR on 28 July 2015 to discuss the project scale, location and legislative requirements. DMR agreed at the meeting that the Environmental Impact Assessment process followed for the application for environmental authorisation, waste management license and application for water use license may be integrated. Section 44 of NEM: WA makes provision for the integration of processes (EA and WML).

10.2.2 Submission of Application for EA and WML

Rakhoma Mining Resources submitted an application for environmental authorisation to the Department of Mineral Resources: Limpopo Region (Polokwane regional office) on 16 July 2015.

The application for EA was amended on 28 July 2015 to include an application for waste management license allowing Rakhoma to follow an integrated EIA process.

Section 24D (1) of NEMA and Section 24 (3) determines that the Minister responsible for mineral resources is the delegated authority for listed activities relating to mining. A WML is also required for the creation of residue stockpiles/deposits incidental to mining as inserted under the list of waste management activities by GNR 633 of 24 July 2015 published under Section 19 of the NEM: WA. The delegated authority for decisions related to mining waste is DMR.

10.2.3 Public Participation Process

Regulation 40-44 of the EIA Regulations 2014 sets out the procedure to be followed in conducting the public participation process in support of an environmental authorisation process. The public participation process forms the corner stone of the EIA process. The process identifies potential I&APs on the project and solicit inputs and comments pertaining to the matter/activity from such parties. Public Participation allows the public to contribute to the project and provides for better decision making by collective inputs from stakeholders, organs of state and specialists.

The following means were used to consult the public and convey project details and the EIA study findings for the project:

- I&APs were provided with an opportunity to register on the project database and obtain project information;
- Environmental reports prepared as part of the EIA process were made available for public review and comments;
- Comments and inputs on environmental reports were facilitated by conducting public meetings/open house meeting or focus group meetings. During such meetings the findings of the EIA study and significant environmental impacts were discussed;
- Interested and Affected Parties will be notified of the decision made by DMR on the application for environmental authorisation and WML for the project.

The public participation process kicked off in July 2015 and is an on-going process for the duration of the EIA process and extends for the life of the project.

The EIR and EMPR is the most important document of the EIA process. It forms the basis for decision making and is a tool for communicating the findings of the EIA study with I&APs. It will be subject to a 30 day public review period. The public and registered I&APs will be notified of the availability of the EIR& EMPr for comment and electronic -and hard copies of the reports will be made available to organs of state, key stakeholders and the public.

10.2.4 Information Gathering

An initial assessment of the Geluk Project site was undertakening during the Scoping phase paired with a baseline site investigation. Potential impacts were identified on the basis of the baseline site investigation, desktop analysis, aerial photography and use of tools such as Geographical Information Systems (SANBI BGIS, LCP's) by specialists to assess the project site. It was evident from onset that the site comprised a senstive mountainous landscape interspersed with a multitude of people.

Naledzi have, through the Scoping Report, identified the need to undertaken a highend environmental assessment due to the sensitivity of the project site, close proximity of settlements and dependence of the the community on raw water sources due lack thereof. Environmental baseline data have been obtained from visual assessments, vegetation surveys, aqautic ecosystem and wetland surveys, animal surveys, soil surveys, testing of surface and groundwater quality and quantities, conducting a hydrocensus to inform geohydrological data and modelling, measurements of ambient noise levels and air quality modelling. Half meter contour data was obtained from the client to study the topogrpahy of the project site and determine the 1-100 year flood zones of the project site and potential for flooding. From all the information obtained it was possible to determine the agricultural pointeial and also land

capability of the site. The indepth look into the economic potential of the project site for alternative land uses such as tourism potential, subsistence farming including conservation were weighed. Traffic counts and road capacity studies were undertaken to determine the road network capacity and need for any upgrades. The baseline data was informated by several specialist investigations. The combined data obtained from the specialist investigations is considered sufficient to gain an understanding of the pre-mining environment and make reliable conclusions on potentia impacts and management measures required. The specialist investigations, finding and recommendaitons have informed the EIR and have been referenced throughout the report. The specialist investigations conducted include:

- Air Quality and Dust Impact Assessment
- Visual Impact Assessment
- Noise and Vibration Impact Assessment
- Ecological Impact Assessment (Fauna and Flora)
- Aquatic Ecosystem and Wetland Impact Assessment
- Soil, Agricutural Potential and Land Capability Impact Assessment
- Geohydrological Impact Assessment
- Traffic Impact Assessment
- Heritage Impact Assessment
- Social and Economic Impact Assessment

10.2.5 Scoping Phase

Regulation 21 of the EIA Regulations 2014 states that if a S&EIA is applied to an application, the applicant must within 44 days of application submission submit a scoping report to the competent authority.

The application was accepted on 16 July 2015, the 44 days period expired on a Saturday 29 August 2015. If the last day falls on a weekend the expiry date moves the the Monday 31 August 2015. The Geluk Mine Project Scoping Report was submitted to DMR on 31 August 2015.

The draft Scoping Report was subjected to 30 days public review from 14 August 2015 to 11 September 2015. The comments received up to the 44 day expiry date on the Scoping Report was submitted to DMR. Any comments received thereafter up to 11 September 2015 was submitted as supplementary informationt o DMR for consideration.
Regulation 22 states the competent authority must within 43 days of receipt of the Scoping Report provide approval. The Scoping Report was approved on 9 October 2015.

10.2.6 EIA Regulations 2014 Regulated Time Frame

The EIA Reuglations 2014 stipulates that the Scoping and EIA process timeframe is regulated at 300 days for a non-substantive process and 350 days for a substantive process.

The Geluk Mine project had various challenges pertaining to an objection lodged to DMR by disgruntled community forums regarding the mining permit of Rakhoma, including community resistence to access the project site for investigations and furthermore the

reluctance of the community to partake in public participation. The challenges placed constraints on the EIA process progess and were tabled to DMR. The challenges were considered special circumstances which motivated the need to follow an adjusted EIA process timeframe versus the regulated time frame of 300 days.

Chapter 2, Regulation 3 of the EIA Regulations of 2014 stipulates that "in the event of exceptional circumstances can be demonstrated , the competent authority may, prior to lapsing of the relevant prescribed timeframe, in writing, extend the relevant prescribed time frame and agree with the applicant on the length of such exention".

Hence, Naledzi Group applied on behalf of the applicant to DMR to follow an adjusted EIA timeframe versus the regulated time frame. A revised submission date for the Final EIR&EMPr was requested. A meeting took place on 3 March 2016 at DMR: Polokwane regional office to discuss and motivate the request. DMR consented thereto.

The final EIR&EMPr submission date was postponed to 16 September 2016.

10.2.7 Environmental Impact Phase

Regulation 23 of the EIA Regulations of 2014 stipulates that an applicant must submit the EIR&EMPr to the competent authority within 106 days from the Scoping Report acceptance. The 106 days expiry date was on 21 January 2016. As indicated and motivated in the above sections the submission date was postponed.

DMR consented to the submission of the final EIR& EMPr by 16 September 2016.

The EIR and EMPr will be subject to public participation and made available to I&APs for a 30 day commenting period from 12 August to 12 September 2016.

10.2.8 Decision Making Phase

In accordance to Regulation 24 of the EIA Regulations the competent authority will within 107 days of receipt of the EIR & EMPr grant or refuse environmental authorisation in respect of the activity applied for.

Interested and Affected parties will be notified of the outcome of the decision within 12 days from issuance.

10.3 Impact Assessment Methodology

After a list of potential impacts has been identified the aim of the EIA process is to predict the nature of the impact, rank and quantify it. From the rating system the impacts of most significance can be highlighted.

According to the EIA Regulations of 2014 a **significant impact means**:

"an impact that may have a notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds, targets and is determined through rating the positive and negative effects of an impact on the

environment based on criteria such as duration, magnitude, intensity and probability of occurrence".

The list of identified impacts for the Geluk Mine project will be evaluated by considering several rating scales as listed below. These ratings include: extent, duration, intensity, significance, status of impact, probability. The significance of impacts will be calculated as follows:

Significance = (Extent + Duration + Intensity) X Probability

The rating system is described below.

"Extent" defines the physical extent or spatial scale of the potential impact

Table 60: Assessment Methodology

Criteria: EXTENT		
"Extent" defines the physical extent or spatial scale of the potential impact		
RATING		**DESCRIPTION**
1	Site specific	Impacts extending only as far as the activity, limited to the site and its immediate surroundings
2	Local	Impacts extending within 5km from site boundary
3	Regional	Impacts extending to the district (20km from boundary of the site) of Steelpoort/Sekhukhune District
4	Provincial	Impacts extending to provincial scale eg. Limpopo Province / Mpumalanga Province
5	National	Impacts extending to within the country i.e. South Africa.
6	International	Impacts extending beyond international boder / the borders of South Africa
Criteria: DURATION		
"Duration" defines the temporal scale		
RATING		**DESCRIPTION**
1	Immediate	Less than 1 year
2	Short term	1-5 years
3	Medium term	6-15 years
4	Long term	Between 16 – 30 years
5	Permanent	Over 30 years. Where mitigation either by natural processes or by human intervention will not occur in such a way or in such time span that the impact can be considered transient.

Criteria: INTENSITY			
"Intensity" establishes whether the impact would be destructive or benign.			
Status	**RATING**		**DESCRIPTION**
Negative	0	Negligible	Where impacts do not really affect the environment and no mitigation is required
	1	Low	Where impacts will result in short term effects on the social and/or natural environment. These impacts are not deemed largely substantial and are likely to have little real effect. (marginally affected)
	2	Medium	Where impacts will result in medium term effects on the social and/or natural environment. These impacts will need to be considered as constituting a fairly important and usually medium term change to the environment, these impacts are real but not substantial. Impacts are fairly easy to mitigate
	3	High	Whereby effects will be long term on social, economic and/or bio-physical environment. These will need to be considered as constituting usually long term change to the environment. Mitigation is considered challenging and expensive
	4	Very High	Where impacts should be considered as constituting major and usually permanent change to the environment, and usually result in severe to very severe effects. Mitigation would have little to now effect on irreversibility
Criteria: INTENSITY			
Status	**RATING**		**DESCRIPTION**
Positive	0	Negligible	Where impacts affect the environment in such a way that natural, cultural and social functions and processes are not greatly and in instances no mitigation measures will be required. (environment not really affected)
	1	Low	Minor improvement are anticipated over a short term on the social and/or natural environment.
	2	Medium	Where moderate improvements are anticipated over a medium- to long-term on the social and/or natural environment.
	3	High	Where large improvements are anticipated over a long term on social, economic and/or bio-physical environment.
	4	Very High	This results in permanent improvements ot the social/or natural environment.

Criteria: STATUS
"Status of impact" - describes whether the impact would have a negative, neutral or positive effect on the affected environment

RATING		DESCRIPTION
+	Positive	Benefit to the environment
=	Neutral	Standard / impartial
-	Negative	cause damage to the environment

Criteria: PROBABILITY		
"Probability" describes the likelihood of the impact occurring.		
RATING		**DESCRIPTION**
0	Improbable	Where the possibility of the impact occurring is low.
1	Probable	Where there is a distinct possibility that the impact will occur.
2	Highly probable	Where it is most likely that the impact will occur.
3	Definite	Where the impact will occur regardless of any prevention measures.

Criteria: SIGNIFICANCE		
"Significance"- attempts to evaluate the importance of a particular impact with mitigation measures included and also excluded. The significance was calculated using the following formula: **Significance = (Extent + Duration + Intensity) X Probability**		
RATING		**DESCRIPTION**
0-4	Very Low	Where the impacts will not influence the development, social , cultural or natural environment
5 -12	Low	Where impacts will result in short term effects on the social and / or natural environment. The impacts merits attention however are not deemed largely substantial are likely to have little real effect
13-25	Medium	Where impacts will have a medium-term effect on the social and/or natural environment. These impacts need to be considered as constituting a fairly important and usually medium term change to the environment, these impacts can be mitigated by implementing effective mitigation measures.
26-44	High	Whereby effects will be long term on social economic and or bio-physical environment. The impacts could have a major effect on the environment. This may bring forth the consideration of no-go areas/open areas on the

		development land regardless of mitigations implemented. Mitigation is however possible.
45	Very High	Whereby effects will be permanent on the social economic and or bio-physical environment. Such impacts cannot be mitigated.

10.4 Findings of the Environmental Impact Assessment

The purpose of this section is to provide information on the environmental consequences of given activities to be undertaken as part of the proposed project so as to inform decision-making. The impact analysis will identify and predict the likely environmental, social and other related effects of the proposal. An evaluation of the significance will be undertaken to determine the relative importance and acceptability of residual impacts (impacts that cannot be mitigated).

Mitigation and impact management will establish the measures that are necessary to avoid, minimize adverse impacts and where appropriate incorporate these into the EMPr.

The findings of the specialist studies outlined are summarised in this section. All specialist studies referred to are contained under Volume 2 of this report.

10.4.1 Phases of the Geluk Mine project

The project proposal will consist of three phases during which environmental risks/impacts may occur, namely:

- Construction Phase
- Operational Phase
- Decommissioning and Closure Phase

10.4.2 Discussion on impacts/risks of the Geluk Mine project

10.4.2.1 Geology

Approximately 400 hectares of mineral resources have been modelled for extraction over the proposed 3165 hectare mining right area.

10.4.2.1.1 Construction Phase
The opening up of mining strips will remove overburden, waste rock (if any) and ore. No mitigation is required. The impact is

10.4.2.1.2 Operational Phase
The strip mining operation will remove the economical viable reserve of ore from the proposed mining right area.

All overburden removed and ore fines from ore crushing will be backfilled into mining strips as part of a concurrent rehabilitation plan.

10.4.2.1.3 Closure and Rehabilitation Phase
No impact on geology is foreseen during this phase as mining operations would have ceased. Final rehabilitation of strips would take place (backfilling of overburden and ore fines).

10.4.2.2 Geochemistry

The assessment of the waste products are done according to the NEM: WA Act 59 of 2008. It requires laboratory tests to determine the mineralogical and chemical nature of the material and its potential to be hazardous to the environment.

No waste and ore material were available for laboratory testing. The methodology for the study was to perform a desktop review of similar case studies of similar projects in the local and regional Bushveld complex area; also extracting vanadium bearing ore. No groundwater water quality

The worst case scenario based on the specialist's experience and conclusions from the desktop review was applied. It is recommended that laboratory testing be undertaken for an accurate geochemistry assessment.

The gabbro-norite dominated formations of the study area and the magnetite rich ore body are mostly dominated by the following minerals:

- Othopyroxene (Enstatite ($MgSiO_3$) and ferrosilite ($FeSiO_3$));
- Plagioclase $(Na, Ca)Al_2Si_2O_8$;
- Magnetite (Fe_3O_4);

Trace amounts of:

- Olivine at the base of the ore body (end-members - forsterite (Mg_2SiO_4) and Fayalite (Fe_2SiO_4));
- Apatite $(Ca_{10}(PO_4)_6(OH,F,Cl)_2)$;
- Muscovite $(KAl_2(Si_3Al)O_{10}(OH,F)_2)$;
- Chlorite $((Mg,Fe)_5Al(AlSi_3O_{10})(OH)_8)$; and
- Siderite ($FeCO_3$).

Rakhoma provided the assay results for the tested material, as well as the core borehole logs which confirm the mineralogy and chemistry of the site. From the assay results (XRF tests on the ore material) the ore body and associated mineralogy is dominated by Fe, Al_2O_3, SiO_2 and TiO_2. Smaller amounts of Cr_2O_3, CaO, MnO and V_2O_5 are also present. The minerals are mostly dominated by large percentages of silicate and clay minerals which are mostly neutralising. The magnetite zones of the Upper Zone are however dominated by the end-members of orthopyroxene and olivine that are rich in iron along with the iron containing magnetite layers.

The groundwater levels from DWS boreholes in surrounding areas indicate water levels range between 1.3 mbgl to 25.42 mbgl. The hydraulic conductivity on site ranges between 0.15m/d in the north and 0.5m/d in the south.

Potential impacts during construction and operation:

- Shallow groundwater levels and higher conductivity can be at risk if contaminants should leach from pollution sources like ore stockpiles, waste dumps;
- The pH all samples showed a neutral range with low electrical conductivity values confirming the low metal leach (ML) potential from the waste material;
- The results of sample classification was a Type 3 waste for all samples (Moderate risk/hazardous)

- The main parameters of concern in the total concentration results were Ba, Cd, Co, Cu, Ni, Sb, V and F.

Recommendations:

- Waste material and ore generated as part of the project needs to be samples and analysed as per NEM:WA. 30 samples per material type (waste rock, ore, overburden) is required to conclude accurate results;
- A monitoring programmes should be development for the site to monitor pre-operational, operation and post-operation water qualities in boreholes for groundwater purposes as well as any surface water streams on and around site;
- Waste and ore is classified of moderate risk/hazardous. Class C landfill site (Old GLB+ landfill facilities) must be established for waste and ore pads.

10.4.2.3 Air Quality Impact

Note: PM stands for particulate matter. PM10 and PM2.5 are particulates with an effective aerodynamic diameter of 10 and 2.5 microns respectively. These are considered fine particulates. TSP is total suspended solids measured as dust fallout.

10.4.2.3.1 Construction Phase

During construction a series of activities including land clearing, topsoil removal, material loading and hauling, stockpiling, grading, bulldozing and compaction will have potential for dust generation. It has the potential to impact on local communities, due to nuisance and aesthetic impacts associated with fugitive dust emission. On-site dustfall may also present a nuisance to employees. The extent of dust emissions would vary from day to day based on the level of activity, specific operations and meteorological conditions.

The key emissions during construction will be PM10 and PM2.5 and total suspended particulates (TSP – as dust fallout). There will also be emissions from exhaust gases from construction vehicles to the atmosphere.

The air quality impacts would be localised (near site) for a short duration. The following mitigation measures are recommended:

- Wet suppression where feasible on stockpiles and materials handling activities;
- Minimise extent of disturbed areas
- Reduction of frequency of disturbance
- Early re-vegetation of disturbed areas
- Chemical Stabilisation of disturbed soil
- Reduction of surface wind speeds through the use of windbreaks and source enclosures
- Enforce low vehicles speeds on unpaved roads

Due to close proximity of sensitive receptors chemical binders should be applied to unpaved roads such as Dustex or Dust-a-side. Application of the recommended mitigation measures would reduce the impacts.

10.4.2.3.2 Operational phase

a) Standards and Guidelines

Air Quality standards and guidelines are effective for air quality management. It indicates safe daily exposure levels for people and is given for specific averaging / exposure periods. Applicable standards used are:

- National Ambient Air Quality Standards (NAAQS)
- National Dust Control Regulations (NDCR)

NAAQS ambient standards for PM10 were published on 24 December 2009 in the Gazette No. 32816, with the ambient standards for PM2.5 published on 29 June 2012 in the Gazette No. 35463. The NAAQS for particulates used for screening criteria in the current assessment is provided in Table 61.

Table 61: National Ambient Air Quality Standards

Molecular formula	Averaging period	Concentration (μ/m^3)	Frequency of exceedance	Compliance date
PM2.5	24 hours	65	4	31/12/2015
		40	4	01/01/2016-31/12/2029
		25	4	01/01/2030
	1 year	25	0	Immediate – 31/12/2015
		20	0	01/01/2016-31/12/2029
		15	0	01/01/2030
PM10	24 hours	120	4	Immediate – 31/12/2014
		75	4	01/01/2015
	1 year	50	0	Immediate – 31/12/2014
		40	0	01/01/2015

Dustfall is assessed for nuisance impact. The NDCR prescribes measures for control of dust in residential and non-residential areas. Dustfall rates as measured from boundary of premises where dust originates are given in Table 62.

Table 62: Acceptable dustfall rate

Restriction area	Dustfall rate ($mg/m^2/day$, 30 day average) (D)	Permitted frequency of exceedance
Residential area	D < 600	Two within a year, not sequential months
Non-residential area	600<D < 1200	Two within a year, not sequential months

b) Identified Operation phase impacts

The key pollutants during the operational phase will be particulates PM10 and PM2.5 and TSP arising from dust entrainment from vehicles on unpaved haul roads and ore crushing & screening at the Geluk Mine Site. The mine activities are not stationary sources of emissions (mine strips, roads, and stockpiles, crushing plant). The stockpiles and mobile crushing and screening plant at the mine will move as mining progresses.

The main source of particulates emissions at the Roossenekal Rail siding will be dust entrainment from 34/35 ton tipper trucks transporting ore to the loading station on unpaved road surfaces (78 heavy vehicles trips to siding). This will be a stationary source (road and loading station).

Aspects identified that will impact the ambient air quality during the operation of the mine are as follows:

Table 63: Operational aspects anticipated to impact on air quality

Aspects	Source	Activities
Railway Transportation		
Gaseous and particulate matter; fugitive dust	Railway transportation of product to Vanchem	Transportation of product
Vehicle Entrainment		
Gaseous and particulate matter; fugitive dust	Vehicle activity on paved and unpaved roads	• Transportation of ROM from strips to crusher plant; • Transportation of product to railway siding
Material handling		
Fugitive dust	Materials handling operations	• Remove ROM from pit • Tip ROM at primary crusher • Tip from crusher to product stockpile; • Reclaim from stockpile • Tipping of product at load out area (to load to trains) • Crushing of ROM material
In pit mining operations		

Fugitive dust	Mining operations within open pit	• Topsoil removal • Drilling and blasting of seam • Removal of ROM by excavator and loading of haul trucks • Overburden replacement • Grading of covered pit areas
Storage piles		
Fugitive dust	Wind erosion	• Windblown dust from ROM stockpiles • Windblown dust from product stockpile

Particulate emissions calculated for various source types are given in Table 64. Both unmitigated and mitigated (applying 75% control efficiency on unpaved road surfaces and 50% control efficiency on crushing activities (control efficiency through water sprayers) conditions were assessed.

Table 64: Particulate emissions from various sources at the mine and rail siding

ACTIVITY	Emissions (tpa)			% Contribution			Rank
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP
Mine							
Unmitigated							
Vehicle entrainment	298.99	82.33	8.23	60.00	74.52	57.97	1
Drilling and blasting	8.43	4.39	0.25	1.69	3.97	1.78	3
Materials handling	7.21	3.41	0.52	1.45	3.09	3.64	4
Crushing and screening	180.00	18.00	3.33	36.12	16.29	23.45	2
Wind erosion	3.72	2.35	1.87	0.75	2.13	13.16	5
TOTAL	**498.35**	**110.47**	**14.20**	**100.00**	**100.00**	**100.00**	
Mitigated: control efficiency of 75% applied to unpaved roads; 50% applied to crushing activities							
Vehicle entrainment	74.75	20.58	2.06	41.55	54.84	33.01	2
Drilling and blasting	4.22	2.19	0.13	2.34	5.84	2.03	4
Materials handling	7.21	3.41	0.52	4.01	9.08	8.28	3
Crushing and screening	90.00	9.00	1.67	50.03	23.98	26.70	1
Wind erosion	3.72	2.35	1.87	2.07	6.26	29.98	5
TOTAL	**179.89**	**37.53**	**6.24**	**100.00**	**100.00**	**100.00**	
Railway Siding							
Unmitigated							
Vehicle entrainment	97.37	25.12	2.51	97.62	95.68	92.49	1
Materials handling	2.29	1.08	0.16	2.30	4.13	6.05	2
Wind erosion	0.08	0.05	0.04	0.08	0.19	1.46	3
TOTAL	**99.74**	**26.25**	**2.72**	**100.00**	**100.00**	**100.00**	
Mitigated: control efficiency of 75% applied to unpaved roads							
Vehicle entrainment	24.34	6.28	0.63	91.12	84.70	75.49	1
Materials handling	2.29	1.08	0.16	8.59	14.63	19.75	2
Wind erosion	0.08	0.05	0.04	0.29	0.67	4.76	3
TOTAL	**26.71**	**7.41**	**0.83**	**100.00**	**100.00**	**100.00**	

GELUK MINE OPERATION IMPACTS

Due to mining operations being mobile (move around as mining progresses) and distance of sensitive receptors in proximity of mining operations impacts assessed are provided in distances from various mining activities.

Crushing activities and vehicle entrained dust from unpaved road surfaces represented the highest impacting particulate sources from the proposed operations.

The daily predicted PM10 ground level concentrations, in exceedance of the NAAQS, extended ~1300 m (unmitigated) to ~420 m (mitigated) from active unpaved roads, ~500 m (unmitigated) to ~310 m (mitigated) from active pit activities, ~900 m (unmitigated) to ~600 m (mitigated) from crushing activities and ~40 m from storage pile activities.

The daily predicted PM2.5 ground level concentrations, in exceedance of the NAAQS, extended ~460 m (unmitigated) to ~60 m (mitigated) from active unpaved roads, ~140 m (unmitigated) to ~30 m (mitigated) from active pit activities, ~450 m (unmitigated) to ~300 m (mitigated) from crushing activities and ~20 m from storage pile activities.

The dustfall rates, in exceedance of the NDCR for residential areas, extended ~65 m (unmitigated) to ~30 m (mitigated) from active unpaved roads, ~60 m from active pit activities, ~260 m (unmitigated) to ~200 m (mitigated) from crushing activities and ~50 m from storage pile activities.

The following mitigation measures are recommended to be in line with local air quality standards:

VEHICLE ENTRAINMENT

- **for transport of RoM**

Recommended distances of residential dwellings from unpaved haul roads

- ✓ Unmitigated – 1200m
- ✓ Mitigated – 310m

- **for transport of product**

Recommended distance of residential dwellings from unpaved road

- ✓ Unmitigated – 680m
- ✓ Mitigated – 140m

- **for transport of product and RoM**

Recommended distance of residential dwellings from unpaved road

- ✓ Unmitigated – 1300m
- ✓ Mitigated – 420m

Recommended mitigation measures for unpaved roads are water sprayers (75% control efficiency). Yet, due to close proximity of sensitive receptors (mining right area and rail siding) chemical suppressants should be applied to unpaved roads close to sensitive receptors (>75% control efficiency).

CRUSHING AND SCREENING ACTIVITIES

- Recommended distance from residential dwellings
  - ✓ Unmitigated – 900m
  - ✓ Mitigated – 600m

It is recommended that water sprayers (50% control efficiency) be implemented at the crusher plant to minimise the impact at source.

ACTIVE MINING PITS

- Recommended distance of residential dwellings from active mining pits
  - ✓ Unmitigated – 500m
  - ✓ Mitigated – 310m

STOCKPILE AREAS

Recommended distance of residential dwellings from stockpile areas is ~50m.

A 500m restriction to mining areas will be implemented to for drilling and blasting. No mining will take place within 500m from residential areas.

RAIL SIDING OPERATIONS IMPACTS

- For unmitigated operations, PM10 daily and annual NAAQS were exceeded at the closest sensitive receptors. For mitigated operations, impact areas are significantly reduced with PM10 daily NAAQS exceeded at the closest sensitive receptors.
- For unmitigated operations, PM2.5 daily NAAQS were exceeded at the closest sensitive receptors. For mitigated operations, impact areas are significantly reduced with no exceedences of PM2.5 NAAQS at the closest sensitive receptors.
- Dustfall rates due to the railway siding operations were less than 400 mg/m²/day (well within NDCR for residential and non-residential areas

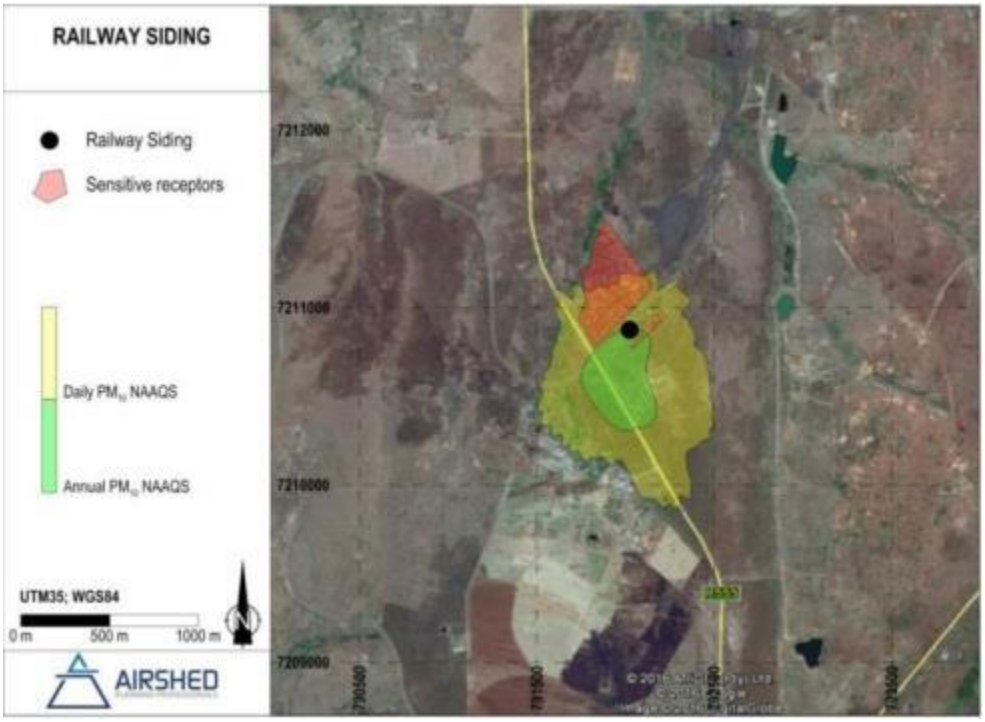

Figure 87: Areas of exceedance of PM10 NAAQS due to unmitigated railway siding operations

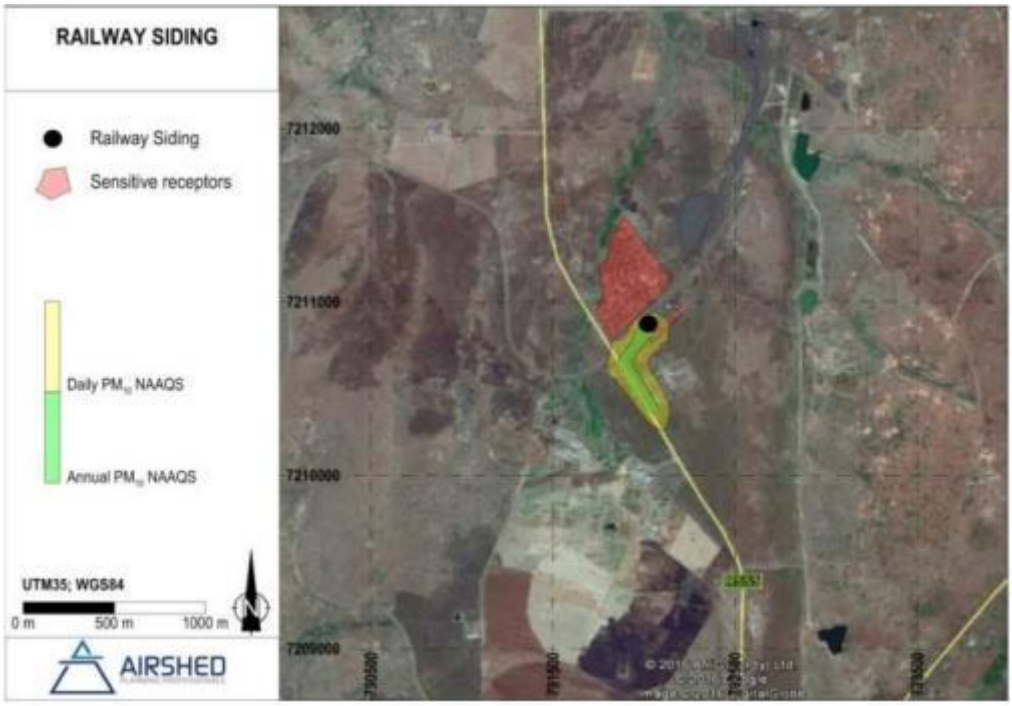

Figure 88: Area of exceedance of PM10 NAAQS due to mitigated railway siding operations

Figure 89: Area of exceedance of PM2.5 NAAQS due to unmitigated railsiding operations

Figure 90: Area of exceedance of PM2.5 NAAQS due to mitigated railsiding operations

It is recommended that a dust fallout monitoring network be implemented at the proposed project mine (7 dustfallout buckets) and railway siding (3 dustfallout buckets) sites in order to monitor the impacts from the proposed project activities. This is to be on-going monitoring

Due to the close proximity of sensitive receptors to the proposed project activities, it is recommended that mitigation measures on the main sources of fugitive dust be implemented to minimise impacts as far as possible and that sensitive receptors be placed a minimum distance from the mining activities in order to reduce health impacts.

For unpaved roads on-site of the mine it is recommended that dustfall in the immediate vicinity be <1 200 mg/m2/day and dustfall at sensitive receptors to be <600 mg/m²/day. PM10 and PM2.5 concentrations at the closest sensitive receptor should be within NAAQS.

For the Crushing and Screening Plant, the absence of visible dust plume at all tipping points and outside the crushers during ore crushing operations would be the best indicator of effective control equipment in place. In addition the dustfall in the immediate vicinity of various sources should be <1 200 mg/m2/day and dustfall at sensitive receptors to be <600 mg/m²/day. PM10 and PM2.5 concentrations at the closest sensitive receptor should be within NAAQS.

Progressive backfilling and rehabilitation efforts must be implemented during the operation and closure of the mine.

IMPACTS ON ANIMALS AND VEGETATION

European studies indicate potential for reduced growth and photosynthetic activity in Sunflower and Cotton plants exposed to dust fall rates greater than 400 mg/m²/day.

In context of the mine there is subsistence farming along the Shakwaneng River towards populated areas in the south. Recommended distances to mining activities from crop activities due to unmitigated operations must be 320m and mitigated operations 230m.

No recommendations are made for the railsiding as dust fall rates at the siding does not exceed 400 mg/m²/day.

10.4.2.3.3 Closure and Rehabilitation Phase Impacts

It is assumed that all the operations will have ceased by the closure phase of the project. The potential for impacts during this phase will depend on the extent of rehabilitation efforts during closure.

Key pollutants will be particulates (PM10, PM2.5 and TSP) generated from rehabilitation activities at open surfaces and demolishing of offices and buildings. Exhaust emissions from heavy vehicles operating during the closure activities will be generated.

Mitigation Measures recommended:

- Short term controls include wet suppression and chemical suppressants
- Long term controls include re-vegetation of disturbed areas with locally indigenous grass species, indigenous trees
- On a monthly basis measure dust fall by means of dust fall collection buckets until vegetation cover is well established;
- Continuously monitor PM10 concentrations
- Progressive backfilling and rehabilitation efforts

10.4.2.4 Noise Impacts

Two aspects are important when considering potential noise impacts, namely:

- Increase in noise level
- Overall noise level produced

Noise or sound is part of our daily exposure to different sources which is part of daily living and some of the sounds which are intrusive such as traffic noise forms part of the ambient noise that people get accustomed to without noticing the higher sound levels.

Any person in the workplace and at home is exposed to the following noise levels as given in Table 65. These are the average noise levels in the workplace and at home that will mask noise from a source introduced into the area:

Table 65: Different noise levels in and around the house, workplace that a person is exposed to on a daily basis

	Activity	dBA
Communication	Whisper	30.0
Communication	Normal Conversation	55.0-65.0
Communication	Shouted Conversation	90.0
Communication	Baby Crying	80.0
Communication	Computer	37.0-45.0
Home/Office	Refrigerator	40.0-43.0
Home/Office	Radio Playing in Background	45.0-50.0
Home/Office	Background Music	50.0
Home/Office	Washing Machine	50.0-75.0
Home/Office	Microwave	55.0-59.0
Home/Office	Clothes Dryer	56.0-58.0
Home/Office	Alarm Clock	60.0-80.0
Home/Office	Vacuum Cleaner	70.0
Home/Office	TV Audio	70.0
Home/Office	Flush Toilet	75.0-85.0
Industry	Industrial activities	85.0-95.0
Home/Office	Ringing Telephone	80.0
Home/Office	Hairdryer	80.0-95.0
Home/Office	Maximum Output of Stereo	100.0-110.0

10.4.2.4.1 Standards and Guidelines

- Provincial Noise Control Regulations
- SANS 10103 of 2008
- SANS 10210 of 2004
- Environmental, Health and Safety Guidelines of IFC of World Bank

The noise impact on receptors are evaluated in terms of ***SANS 10103 guidelines*** for sound pressure. The noise level standards are listed in Table 66.

Table 66: Noise level standards for various districts

Type of District	**Equivalent continous rating Level $L_{Req.T}$ for ambient noise - dBA**					
	Outdoors			**Indoors with windows open**		
	Day-night	Daytime	Night time	Day-night	Daytime	Night time
Rural districts	45	45	35	35	35	25
Suburban – limited road traffice	50	50	40	40	40	30
Urban traffic	55	55	45	45	45	35
Urban districts – some	60	60	50	50	50	40

workshops, business premises and main roads						
Central business district	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

The World Bank in the Environmental Health and Safety Regulations has laid down the following noise level guidelines:

- Residential area – 55dBA for daytime and 45dBA for the nighttime period;
- Industrial areas – 70dBA for the day-and nighttime periods.

The ambient noise level will differ throughout the study area, depending on the region and the measuring position in relation to areas with existing mining activities. Communities/people exposed to an increase in the prevailing ambient noise levels will react differently to the noise levels and the responses are given in Table 67.

Table 67: Estimated community response when ambient noise levels are exceeded

Exess $L_{Req.T}$ dBA	**Response**
0	No reaction
0-10	Sporadic complaints
5-15	Widespread complaints
10-20	Threat of community / group action
>15	Vigerous community / group action

10.4.2.4.2 Construction Phase Impacts

The prevailing ambient noise levels of the study area are owned to traffic noise, domestic and natural noises. The cumulative noise level of the machinery and equipment to be used for the construction of the mine will be 64.9dBA at 60m and 40.8dBA at 960m from the construction area if all the machinery operates in a radius of 30m at one time. This will seldom happen and the cumulative noise level will therefore be lower. The significance of impacts during this phase will be moderate-high unmitigated. With implementation of control measures the impact will be of moderate-low significance.

The machinery that will be used during the construction phase of the project will be excavators, dozers, graders, earth-moving equipment, cranes, dump trucks, generators and TLB's, which will work at specific areas at a time and the noise levels are illustrated under Section 8.12.4.

The following activities will generate noise during the construction phase of the project:

- Ground works;
- Civil construction activities;
- Construction of internal haul roads;
- Building activities;
- Hauling of material to and from the specific areas;
- Construction of the pipe system, soil stock pile and rain water dam.

Recommended mitigation:

- Machinery with low noise levels complying with manufacturers specifications to be used;
- Activities should take place during day time period only;
- Noise monitoring should take place on a quarterly basis

10.4.2.4.3 Operational Phase Impacts

The project site is in a valley with high mountains to the east and west. Noise will be propagated to the south-west. Noise levels at source will be between 65.0dBA to 85.0dBA whereas the noise level at 1 000m from the activity will be 40.0dBA to 50.0dBA. Factors such as topography, barriers, other noise sources, wind direction will influence spread of noise and how it is perceived by residents.

The noise sources within the property that may create increased noise levels on a temporary and/or permanent basis during the operational phase of the project:

- Additional traffic to and from the different sites;
- Diesel emergency generators;
- Blast hole drilling;
- Open cast blasting;
- Hauling of material to the crusher;
- Crushing activities;
- Hauling of waste rock to the rock waste dump;
- Hauling of ore to Roossenekal rail siding some 55km along the R555 road between Stoffberg and Steelpoort by 35 ton linkers per day (27 trips per day and will increase to 77 trips per day when production is 700kt/annum);
- Maintenance activities at the different sites.

Added traffic, use of diesel generators and blasthole drilling will result in a noise impact of Medium-High significance. Implementation of management measures will lower the impact to medium-low significance.

Recommended mitigation measures include:

- Emergency generators to be placed in such a manner that it is 500m away from any residential area;
- Drilling with drilling rig to be done in such a manner and must be 500m away from any residential area;
- A noise management plan must be implemented and noise monitoring to be done on a quarterly basis;
- Crushing activities to be monitored and noise survey to be done on a monthly basis after which the frequency can change to a quarterly basis.
- Blasting is to take place under controlled conditions and by using safe blasting methods at all times;
- A distance of 500m must be maintained between residential area, water pipeline and the blast site and an earthberm of 10.0m to be erected in the vicinity of residential properties;

- Blasting activities to be monitored and ground vibration and noise survey to be done on a monthly basis after which the frequency can change to a quarterly basis;
- The feeder road D2219 is to be closed for traffic during blasting;
- Permanent ground vibration to be carried out at the abutting noise sensitive areas;
- Crushing activities to be monitored and noise survey to be done on a monthly basis after which the frequency can change to a quarterly basis.
- Regular feedback to the community leaders of baseline noise and vibration monitoring should take place. A system by which complaints are recorded and investigated must be in place.

10.4.2.4.4 Closure and Rehabilitation

The following activities are associated with the rehabilitation phase:

- Back fill of mined areas;
- Planting of grass and vegetation at the rehabilitated areas;
- Removal of infra-structure.

The noise impact from the above activities is of medium-high significance. With implementation of control measures the significance can be lowered to medium-low.

Recommended management measures include:

- Use machinery with low noise levels which complies with manufacturers specifications;
- Activities are to take place during daytime period only;
- Noise monitoring must be implemented on a quarterly basis.

10.4.2.5 Blasting and Ground Vibration

10.4.2.5.1 Operational Phase

There were no ground vibration levels measured during the time of the noise survey. Blasting will be done in pits by using Ammonium Nitrate Fuel Oil (ANFO) in both the development production operations to uplift the overburden soil and ore body and gel cartridges or pumpable slurry would be used under wet conditions. The blasting causes ground vibration, air blast noise and can cause fly rock.

Rakhoma will be blasting twice a week at 13H00. It will be an instantaneous impact only taken place at the strip mining area. If the prevailing ambient noise level is higher at the receptor the noise impact will be lower.

Two sound pressure levels should be adhered to such as 120dB and 140dB at the blasting area during a blast and it depends on the amount of rock to be dislodged. The typical impact of a blast at 900m from the blast above the prevailing noise level will be for a period of 3 seconds only.

With the implementation of a 500m restriction to mining from residential areas the ground vibration level of 4.28mm/s will be experienced which is well below the limit where structural damage can occur. People in a radius of 800m from the blast will experience air pressure more than what the ground vibration is noticed.

The over-air pressure noise level during a blast will be for a short period not exceeding 2 to 3 seconds and there is a pre-blast noise level and a post blast noise level which will not be audible. The peak noise level will be audible at a distance and may create vibration which is experienced by rattling windows.

There were no fly rock experienced at the 500m measuring point from blasting, yet it was visible from the measuring point, the fly rock was site specific only. It is however evident that no blasting must take place during the night time period.

Blasting of the ore seam will have a noise impact of high significance. It can be lowered with control measures to medium-low significance

Recommended mitigation measures:

- Drilling with drilling rig to be done in such a manner and must be 500m away from any residential area;
-
- Blasting activities to be monitored and ground vibration and noise survey to be done on a monthly basis after which the frequency can change to a quarterly basis;
- The feeder road D2219 is to be closed for traffic during blasting;
- Air over pressure levels at source should be minimized by proper blasting design;
- Individual blasts should not exceed 25mm/s in the vicinity of properly constructed buildings and the average level should not exceed 10mm/s in the vicinity of poorly constructed buildings;
- Maintain communication with community leaders regarding blasting times and effects;
- Maintain a system for receiving, recording and responding to complaints.

10.4.5.5.2 Closure and Rehabilitation

None of the closure activities require blasting, and vibration from heavy vehicles is not anticipated to affect communities. Therefore ground vibration is considered to be a negligible impact during this phase.

10.4.2.6 Visual Impact

The visual impact expected from the proposed project is assessed against the visual attributes of the site, namely:

- The study area is mountainous, undulating with relatively strong topographic variation;
- Land is composed of mining, information settlements and vacant/unspecified land;
- The area has a moderately-low visual quality due to high human intervention with minimal natural features. The regional visual quality is impacted by agricultural practice and encroaching of mining;
- The visual absorption capacity of the area is low. It has limited screening capacity for the project type due to land cover and predominantly low vegetation.

The following landscape receptors will be affected by the development:

- Bushveld and vegetation patterns of the proposed site; and

- Shakwaneng River as well as its tributaries.

10.4.2.6.1 Construction Phase impacts

The following project components will occur during the construction phase of the project and are identified as elements that may cause a potential landscape and/or visual impact:
Construction Stage:
- Establishment of construction camp;
- Clearing site of vegetation;
- Grading the site;
- A mobile office (4x10m);
- Mining pit areas must first be cleared and prepared;
- Off-loading and stockpiling; and
- Construction of the roads and services.

A. Impacts on Landscape Character

The most significant landscape impacts will occur when bushveld is cleared and a change in surface cover takes place. The construction stage will diminish the bushveld character of the site and cause a highly severe impact due to:

- Exposed soil
- Construction components (construction camps, roads)

The extent of disturbance will affect a large footprint area. Visual receptors mostly affected are residents within a 2km radius. They will experience a high level of visual exposure. Due to the low VAC of the area it will result in a moderately severe landscape impact. With the implementation of mitigation measures the severity can reduce to moderate severity.

Recommended mitigations:

- Sensitive placement of the construction camp,
- Limited surface disturbance and prompt
- Rehabilitation

B. Visual impacts on residents

Residents from the surrounding residential settlements will be affected most severely by the construction of the new mine due to their proximity to the site. The active operation of construction equipment may generate dust clouds and noise that will increase resident's awareness of the operation. It will cause unsightly views as the soils are exposed and the disorganised arrangement of stockpiles, a site office and mining equipment dominate the scene.

The duration of the potential visual impact will be temporary which will result in an anticipated moderate significance.

The residents outside the 5 km radius zone will not experience the full extent of the development and may only be exposed to fragmented views of the construction phase and mining activities due to the topography that screens most of the site. The visual intrusion is considered to be moderate and the distance between the observers and the proposed

development is in itself a mitigating factor. The severity of visual impact for both stages of the development will be moderately high.

C. Visual impact on recreational users/ tourists

There are a limited number of recreational users/tourists in the area. Visual intrusion caused by exposed soil and construction activities will be low. The duration of views of the activities will be short. The visual impact on recreational users/tourists is expected to be low and can be mitigated with relative ease.

D. Visual impact on motorists

Major routes in the study area are the D2219 and R555. Secondary and tertiary routes form a loose network of gravel roads linking smaller settlements. Views of the mine and its activities will be visible from the D2219. The presence of construction equipment and yard will create unsightly views. Motorists' visual exposure to the impact will be brief. The significance of the impact is expected to be moderate.

Recommended mitigation measures:

- Locate the construction camp in areas already disturbed, or where it isn't necessary to remove established vegetation;
- Keep the mining site and camp neat and organised to portray tidy appearance;
- Remove rubble off site as soon as possible / place in a container to keep site free from additional unsightly elements;
- Rehabilitate / vegetate disturbed areas as soon as practically possible after construction. Implemented to restrict longs stages of exposed soil and possible erosion resulting in indirect landscape and visual impacts;
- If mining activities are undertaking during night time, direct light sources away from residential units and roads;
- Dust suppression procedures should be implemented especially on windy days;
- Screen the construction camp and lay-down yards by enclosing the entire area with dark green / black shade cloth of no less than 2m height.

10.4.2.6.2 Operational Phase

The following project components will occur during the operational phase of the project and are identified as elements that may cause a potential landscape and/or visual impact:

- Mining pit areas;
- The crushing and screening plant;
- Large haulage trucks and tipplers;
- Mining equipment: drill rigs, dozers, excavators, dump trucks, a grader, a water cart and a rock breaker;
- Waste rock dumps;
- Product stockpiles; and
- Pollution control dams.

A. Impacts on Landscape Character

Surface disturbances created during construction may remain for an extended period during the operational phase. These are seen as residual affects carried forward from the

construction phase and can be substantially mitigated if treated appropriately during the construction phase.

The operational phase will introduce alternative land uses to the site that will alter the existing bushveld character. The exposed soil, roads and stockpiles will replace most of the bushveld. The undulating bushveld and the associated openness of the study area are considered as a landscape amenity that provides the study area with a unique and valued sense of place. This quality of the landscape will be lost due to the development this scale and extent. The topography and vegetation have a low VAC and high landscape character sensitivity but the surrounding mining activities of reduce landscape character sensitivity will result in a low to moderate significance of landscape impact.

B. Visual impacts on residents

The residents around the proposed mine may experience a high degree of visual intrusion due to their proximity to mining activities. Visual intrusion will decrease as the mining activities near completion and the site is cleared of mine infrastructure and mine strips rehabilitated. Visual exposure is considered high due to the proximity of the development to the residential areas and the high level of visibility that can be expected.

C. Visual impacts on tourists / recreational users

The visual exposure and intrusion of mining activities will be low due to the limited viewers and time spent in the area. The severity of the visual impact will be moderately-low, causing moderately low significant visual impact.

D. Visual impact on motorists

The severity and significance of visual impact on motorists will be moderate. The topography of the terrain will not screen the mining activities. The speed at which motorists travel also have a moderating effect on the severity of the visual impact and reduces visual exposure. It also reduces their sensitivity and contributes to short periods of visual exposure which results in a moderate significance of visual impact.

Recommended mitigation measures:

- Routinely conduct rehabilitation of scarred areas rehabilitation of stripped mined areas;
- Maintain the landscape to a high aesthetic standard to retain a high visual quality for visitors and observers; and
- Refrain from installing permanent lighting where light is required intermittently;
- Dust suppression procedures should be implemented especially on windy days;

10.4.2.6.3 Closure and Rehabilitation Phase

The activities undertaken during this phase will be similar to those of the construction phase; will however be a short duration. No overburden or waste piles will remain as permanent features of the landscape. Strip mining and simultaneous rehabilitation will be undertaken during the operational phase where overburden, rock and ore fines are backfilled into the strip mined areas. The significance without mitigation is considered to be moderate and low with implementation of the following mitigation measures:

- Implement dust suppression with water or chemicals;
- Limit vehicle movement at night;
- Post-mining the topography is the most important factors to be considered. Generally contouring of the filled-in areas must aim to achieve the approximate original contours that existed before mining;
- Vegetate rehabilitated areas with indigenous grasses and indigenous trees;

10.4.2.7 Ecological Impact

The ecological impact pertains to the impact on plant and animal life which exists on the proposed Geluk Mine project site.

The area where mining is proposed is largely natural and comprises Sekhukhune Mountain Bushveld. A mountain /ridge form the eastern boundary of the project site. The Shakwaneng River flows from north to south through the eastern portion of the site. From a floral and faunal viewpoint, the health of the Sekhukhune Mountain Bushveld and the riverine system are important for biodiversity.

The majority of the proposed mine and associated infrastructure fall within the mountainous vegetation unit, considered to be ecologically pristine with very high sensitivity. The mine proposal is expected to have a serious long term negative impact on the project site and the surrounding environment.

Two plant species of conservation concern were identified during the site visit along the Shakwanang River. *Crinum macowanii* and *Ilex mitis*, both are classified as declining by the SANBI Red Data List. The rrelatively unspoilt habitat proposed for the mine supports the majority of plant and mammal species. The Serval and Brown Hyena are considered keystone species for the study area. The majority of the birds seen on the survey were in the mountains and along the riverine system. Four red listed avifaunal species have been recorded on site, Eupodotis senegalensis, Sagittarius serpentarius and Gyps coprotheres with Ciconia nigra being observed on site.

Amphibian species are susceptible to the possible deterioration of water quality around the human inhabited area which may have resulted in their decline in the study area. This is of particular concern, the risk for acid mine drainage, from the potential mine, into the Shakwanang River will result in the drastic decrease of amphibian species in the river.

With an increase in the number of roads and traffic in the potential mine area, reptile species will become even more vulnerable to being run over by vehicles, while moving from one area to another. Reptile species of concern are the Soutspansberg Flat Lizard, Sekhukhune flat lizard (subspp. Fitzsimons) and South African Rock Python.

A number of potential impacts relating to the loss of indigenous vegetation, floral habitat and ecological structure, loss of floral diversity and ecological integrity, proliferation of alien invasive species, loss of plant species of conservation concern, loss of faunal habitat, direct faunal impacts and disturbance to fauna are predicted to occur as a result

of the proposed Geluk Mine. These impacts will cause permanent damage to the environment and can never be fully reversed or mitigated. Albeit mitigation is proposed, but are likely to be inadequate as irreversible damage will occur to the receiving environment should the project proceed.

10.4.2.7.1 Potential impacts from the construction, operation of the mine include:

A. Proliferation of alien invasive species

Alien plants pose an ecological threat alter habitat structure and lower biodiversity. It will negatively affect the ability of disturbed areas to maintain indigenous floral diversity.

B. Loss of indigenous vegetation, flora and faunal habitat and ecological structure

Mining and associated activities will directly impact on the following:

- Ecological condition of natural vegetation and habitat availability
- Impact on foraging, breeding and roosting ecology of faunal and avifaunal species

The impacts that will results include:

- Destruction of vegetation;
- Destruction of flora habitat
- Complete loss of faunal and avifaunal habitat.

Cumulative impacts will include:

- Decrease of floral habitat and ecological structure (lead to spread of alien species and loss of red listed plant species);
- Habitat fragmentation
- Destruction of wildlife corridors
- Overall decrease in species richness in the area

The large land surface alterations will also change the composition of the ecosystem on the edge of structures. This will result in a loss of cohesiveness between larger fragments of habitat limiting gene exchanges and resources between these areas.

Loss of vegetation, in the case of a mine is irreversible, and although rehabilitation will take place after the mine is closed, restoration of the natural habitat on site cannot be achieved. This is particularly significant in an ecologically sensitive area where endemism of both flora and fauna is considered high.

C. Loss of floral diversity and ecological integrity

Removal of vegetation with the study area will result in:

- Loss of floral diversity
- Loss of groundcover, exposing soil leading to soil degradation
- Loss of ecological connectivity
- Habitat fragmentation which disrupt ecological functioning, negatively affecting ecological integrity of the area

An extinction debt may be present in cleared or fragmented areas, whereby, as a consequence to reduced floral diversity and disturbance to population structure, future extinction of local populations is unavoidable.

D. Loss of species of conservation concern

Red listed plant species were identified in the study area, namely Crinum macowanni and Ilex mitis. These plants require specialised habitats and their removal will have cumulative impacts of reduced species richness and composition.

From a faunal perspective, endemic species and species of concern have specific habitat requirements and the impacts of the proposed mine will have significant effects on these species. Of particular concern from a faunal perspective are Serval, Borwn Hyena, Soutspansberg Flat Lizard, Sekhukhune flat lizard (subspp. Fitzsimons) and South African Rock Python. The reptile species are slow moving and will likely be targeted while setting up infrastructure, moving onto site and during the operational phase.

During all phases the proposed project the significance of all the above listed impacts are very high.

The following ***mitigation measures may marginally reduce the severe impacts***. However, it must be noted that impacts will remain at a critically high level and the proposed mine area can never be fully rehabilitated and ecologically restored to its pre-mining condition.

Significant mitigation measures:

- ✓ Establish an ***Exclusion Zone to maintain biodiversity***: A 200m buffer zone is recommended from the edge of all rocky outcrops and is to include the entire mountain range on the eastern side of the study site;
- ✓ No activities are to infringe on upon the riparian habitat along the Shakwaneng River. All activities should remain within the demarcated mine footprint area;
- ✓ Once the proposed mine boundaries, blocks and infrastructure locations are pegged, a qualified botanist must walk the site to identify all conservation-important species;
- ✓ Species of conservation concern must be translocated to suitable habitat outside the construction footprint, prior to any construction activities;
- ✓ Plant permits must be obtained from LEDET prior to construction activities commencing;
- ✓ Removal permits for protected trees identified on site must be obtained from DAFF prior to construction activities commencing;
- The mining footprint should be kept as small and as linear as possible

Routine mitigations:

- Avoid known areas of faunal and floral species of special concern as indicated on the relevant maps.
- Avoid sensitive landscapes such as wetlands and ridges on site.
- During the construction phase, workers must be limited to areas under construction and access to the undeveloped areas must be strictly controlled.
- Edge effects of all phases, such as erosion and alien plant species proliferation, which will affect faunal habitats adjacent to the development area, need to be strictly managed. This can be achieved through the chemically and mechanically removing

alien invasive vegetation within the mining footprint. The removal of this vegetation will provide job opportunities for community members;
- Any natural areas beyond the development footprint, which have been affected by the construction activities, must be rehabilitated using indigenous plant species. Rehabilitation must take place concurrent to operations, and post-closure.
- The clearing of vegetation, during the construction phase, must be kept to a minimum and must be within the project boundaries.
- Harvesting and collection of any flora must be strictly prohibited.
- Erosion control measures must be implemented in areas sensitive to erosion such as exposed soil, edges of slopes (including trenches cut for construction) etc. These measures include but are not limited to - the use of sand bags, hessian sheets, silt fences and retention or replacement of vegetation;
- Maintain topsoil biological activity by stockpiling soils without compacting them. This keeps the seed bank in the topsoil viable if the topsoil is replaced within a year. This viable seedbank will create an effective basis for rehabilitated areas where these soils are used;
- Education and awareness campaigns on faunal species and their habitat are recommended to help increase awareness, respect and responsibility towards the environment for all staff and contractors;
- Disturbed areas must be rehabilitated immediately after construction has been completed in that area by planting appropriate indigenous plant species;
- Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas to a ground of cover of at least 85%.

10.4.2.7.2 Closure and Rehabilitation

If rehabilitation is undertaken incorrectly, soil pollution can occur during closure and is likely to be colonised by weeds and invader species. This will lead to further adverse impacts of high significance. Although rehabilitation will be undertaken post mine closure the site can never be ecologically restored to its pre-mining condition. Mitigation measures will only slightly reduce the impact.

- Remove all mine infrastructure and dispose of it in accordance with applicable regulatory requirements;
- Remove all weeds and alien plants from the site and which has established on newly exposed soils, on an ongoing bases for atleast 3 years;
- Rip compacted soils and shape the surface of the site to be free draining;
- Rehabilitated areas must be monitored to ensure establishment of re-vegetated areas to a ground cover of at least 85%
- Rehabilitation must take place concurrent to operations and post-closure

10.4.2.8Impact on Aquatic Ecosystems and Wetlands

Although impacts, predominantly impoundments, sewage and urban runoff are present upstream of the current sampling sites, the water quality is not overly impacted and sensitive species particularly macroinvertebrates were found in both rivers. The impacts of most concern as a result of the proposed Geluk Mine relate to water quality and water quantity. Any water quantity restriction occurring from the proposed project will likely have knock on water quality impacts, as the dilution and transport potential of the system is

reduced. Reducing flows will also reduce the amount of habitat inundated and may contribute to a reduction in the biodiversity of the systems.

A number of potential impacts relating to extensive erosion and sedimentation, pollution and the possible spread of alien invasive species will occur as well as impacts on both sub-surface and surface flows of groundwater/stormwater. ***Any acid generating potential of the ore appears to be low to negligible*** however there are many other potential aquatic ecology impacts associated with mining and as such the use of adequate buffers and biomonitoring throughout the life of mine as well as during closure should be carried out.

<u>During the construction and operational phase all identified impacts were rated as high significance.</u>

Main impacts pertaining to the project include:

- ***Sedimentation and Soil erosion:*** Soil erosion will result in the deposition of sediment into the Shakwaneng and Steelpoort rivers. This poses a risk to the rivers functional integrity;
- ***Pollution of water resources and soil:*** Changes to water quality could result in changes to the ecosystem structure and function including potential loss of biodiversity. Any substance entering and polluting the Shakwaneng River will directly impact downstream ecology through surface runoff during rainfall events, subsurface water movement.
- ***Spread of Alien invasive species:*** Minimal alien species are currently present in the area. Species are likely to spread during surface disturbance, which pose an ecological threat to riparian habitat. The results in an overall impact on hydrological functioning of the system.

Minimisation of the spatial footprint of the project must be implemented, with special reference to avoiding erosion, silting and sedimentation next to the aquatic system during both construction and operation.

10.4.2.8.1 Construction Phase impacts:

- **Key Impacts**
- Increased sediment runoff and erosion
- Decreased water quality due to accidental spills; and
- Habitat loss associated with river diversion

There is a potential for surface water pollution of which siltation of watercourses is focussed on.

a) Sedimentation and soil erosion impact

- Pose risk to the functional integrity of rivers by affecting natural fluctuations in water and sediment regimes, which structure aquatic environments.
- The extent of bare soil associated with road construction poses a particularly high erosion risk due to its instability and susceptibility to transportation by surface run-off;

- .Clearing of the naturally vegetated landscape will affect physical and biological relationships with adjacent streams;
- Result in changes in habitat structure and species composition;
- Fish and aquatic macro invertebrate species that prefer fast flowing riffle and rapid habitats would disappear due to the deposition of sediment in these habitats. Whereas species that are tolerant of modified habitat structure or that have wide range of habitat preferences would benefit.
- Increased erosion of wetland soils and river banks may occur due to concentrated flows during summer months (high runoff); resulting in high suspended sediment concentrations, impacting on aquatic biota in small watercourses;
- Key biological effects related to the deposition of sediment and suspension of fine sediment within the water column of river/wetlands includes:
    - Habitat alteration downstream of crossing points due to increased sediment load;
    - Reduction in photosynthetic activity and primary production;
    - Reduced density and diversity in benthic invertebrate communities due to habitat degration, blanketing of fish spawning sites, establishment of more tolerant taxa/exotic species;
    - Changes to behaviour and feeding ability of fish

b) Pollution of water resources and soil

- Spills from hydrocarbons, solids, pathogens and potential AMD may generate from number of sources and can negatively affect aquatic ecosystems impacting the water quality, resulting in localised exclusion of sensitive species/localised extinction;
- Deteriorating water quality can affect sustainability for domestic/agricultural use and have far reaching impacts for local communities relying on rivers/wetlands for water supply.

c) Alien invasive species

- Disturbance of existing indigenous wetland/river vegetation by machinery and workers, where road alignment intersects aquatic habitat will impact directly on ecological condition of vegetation and availability of natural habitat;
- Clearing and disturbance impacts will include areas used by machinery and workers to access site, construct ancillary infrastructure (road drainage, erosion control measures);
- Complete loss and or partial loss of indigenous vegetation communities may take place, impacting on ecological condition and functionality of ecosystems;
- Construction activities in vicinities of rivers will result in decreased bank stability, resulting in localised erosion and sediment delivery to aquatic resources. Vegetation removal within these areas can destabilise banks, making it prone to erosion and collapse;
- River bank soils will be disturbed and compacted should access be permitted to the river channel;
- Alteration of cross sectional and longitudinal profiles of wetlands and rivers may also result from bulk earthworks stimulating erosion, as well as potential sedimentation of downstream habitats and a change to water regimes of adjoining wetland and riparian habitat.

Areas that are mainly natural/intact would be most affected by these impacts.

10.4.2.8.2 Operational Phase impacts

- **Key Impacts**
- Increased sedimentation and water quality impairment due to runoff from waste rock dump like acid mine drainage;
- Water quality contamination due to runoff or seepage from tailings storage facility (if any);
- Alteration of natural flow regime due to discharge of pit water; and
- Increased utilization of aquatic resources by local population.

a) Sedimentation and soil erosion impact

- Rainwater likely to filter through waste rock dump may accumulate particles and pollutants that may pose a risk to surrounding water courses;
- Sediment wash off from waste dump during periods of rainfall may contribute to increased sedimentation in the aquatic environment;
- Increased storm water flood peaks due to increased impermeable surfaces result in erosion and sedimentation impacts eventually resulting in alterations in hydrological regimes;
- Increase in peak discharges may increase stream power, increasing the risk for erosion and resulting in sedimentation of watercourses.

Local site factors such as soil erodibility, vegetation cover, gradient of local slopes and regional rainfall/runoff intensity will affect the probability and intensity of erosion impacts.

Results of erosion & sedimentation on water resources may include:

- Locally increased channel slopes;
- Loss of in-stream biotope diversity due to scouring or blanketing of sites with sediment; Localised scouring at storm water discharge points into watercourses;
- Headcut migration upstream and subsequent deepening of river channels (where base level lowering has occurred);
- Lowering of the local water table and subsequent desiccation of adjacent wetland and riparian areas;
- Relatively higher channel banks that may exceed critical height resulting in bank failure/collapse;
- Addition of sediment to the water column (increased turbidity) affecting suitability for aquatic organisms; and
- Deposition of large masses of sediment downstream causing localised channel braiding, instability of the river banks and alterations in water distribution and retention patterns in wetlands.

b) Pollution of water resources and soil

- The impact on water quality will have several upsets in the system. Including:

    - change ecosystem structure and function and result in potential loss of biodiversity;

- Modification of species composition;
- Uncontrolled release of tailings (if any) smother habitats and organisms and change to chemical environment detriment to biota;
- Water quality impacted from potential acid mine drainage may change community composition or result in complete elimination of aquatic fauna of river systems;
- Runoff from roads may diffuse pollution contaminating receiving waters (nutrients, heavy metals, polycyclic aromatic hydrocarbons (PAHs), Volatile Organic Compounds (VOCs)

c) Alien invasive species

As per construction impacts.

Rehabilitating and restoring the environment to natural condition will be nearly impossible, given the high ecological importance and sensitivity (EIS) this study area possess. The proposed Geluk Mine operation is expected to have irreversible and severe long term negative impacts on these sensitive environments.

Significant Mitigation Measures:

- A 200m buffer zone is strongly recommended to be implemented for the Shakwaneng River and 100m from drainage channels within the project boundary (Figure 91). This control measure must be used to limit the significance of these impacts on the functionality and hydrology of the Shakwaneng River and drainage channels associated with the Geluk Mine;
- Design and implementation of a suitable storm water system must be undertaken;
- Toe trenches and silt traps must be built below mine strips/pits to stop run-off water and siltation draining into water features and the river;
- A Pollution control dam must be constructed on the mine site;

- Ongoing aquatic biomonitoring (insitu water quality, habitat assessment, SASS 5 where/if flow conditions allow for effective sampling of Diatom analysis) must take place once prior and once after construction to determine trends in ecology and assess any impacts requiring addition mitigation (till one (1) year after construction).

<u>Routine mitigations:</u>

- All waste must be disposed of at an appropriate facility and proper management and disposal of construction waste must occur through the construction- and operational phase;
- Progressive rehabilitation of mine strips and rehabilitation of disturbed areas must be undertaken;
- Limit in stream sedimentation;
- Minimise pollutants entering the watercourse;
- Implement a programme for the clearing/eradication of alien species including long term control of such species;

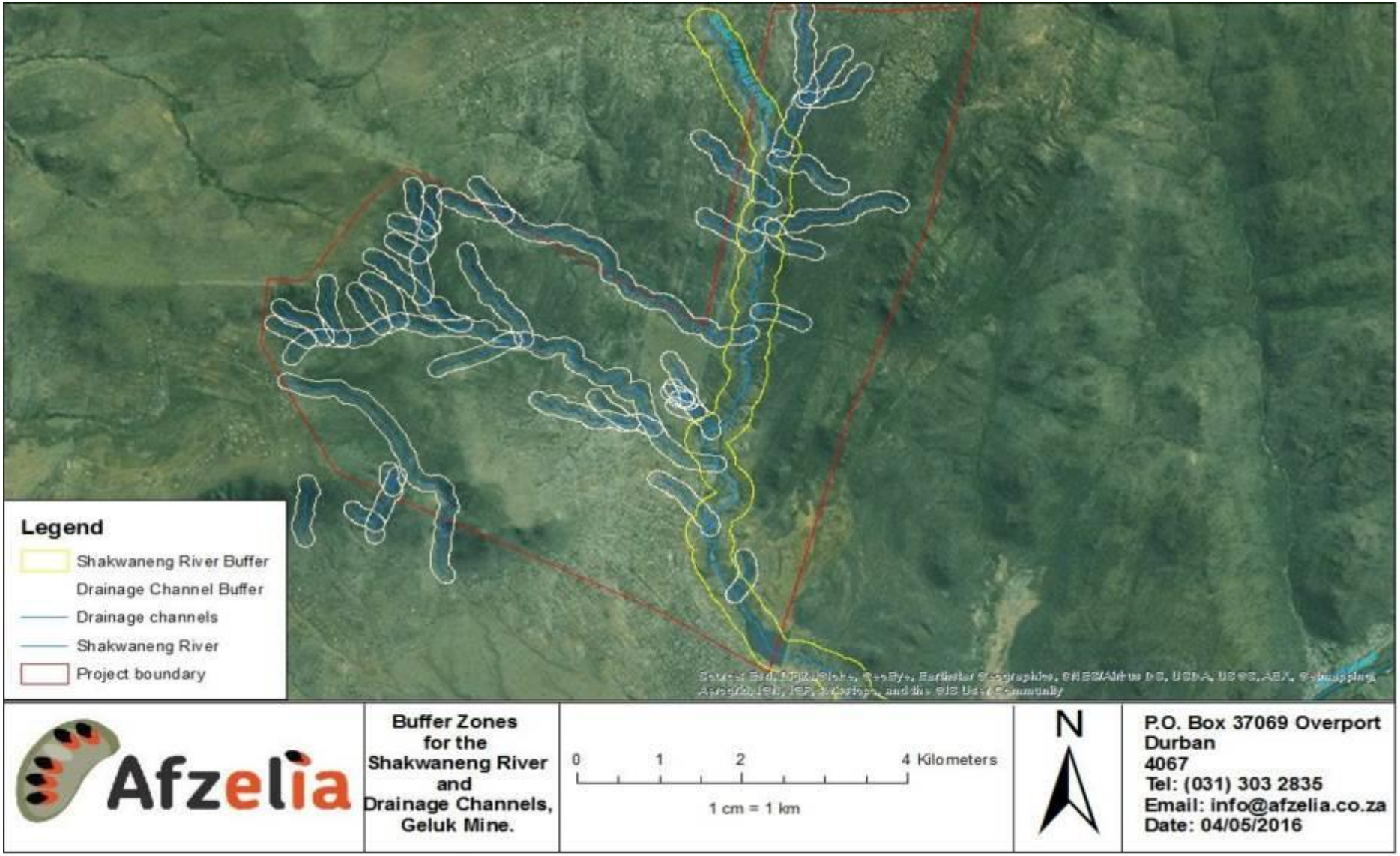

Figure 91: Proposed 200m buffer zone from Shakwaneng River and 100m from drainage lines

10.4.2.9Impact on Soil, Agricultural Potential and Land capability

The proposed mine is not expected to have an impact on agricultural production in this area due to the agricultural limitations of the site. Apart from the existing small scale subsistence gardens, there is no agricultural production in this area.

Several negative environmental impacts pertaining to the soil resources within the site were identified. These impacts are associated with soil compaction leading to erosion, soil pollution and the continued spread of alien invasive vegetation due to mining related disturbance.

10.4.2.9.1 Construction and Operational Phase

a) Soil disturbance and soil compaction

- The use of heavy machinery or vehicles during construction of the infrastructure as well as during the operation of the mine will lead to the compaction of disturbed soils;
- Exposure of soil will lead to erosion on steep slopes of the site (compacted soils will erode quicker than natural soils)
- Loss of topsoil will take place due to shallow nature of soil this will have knock on effects to vegetation structure on site;
- Lack of maintenance of soil stockpile will lead to erosion, sedimentation of downstream drainage channels during operation;
- Exposure of soil within stockpiles in long term lead to change in chemical and biological properties;
- Topsoil stripping will lead to mixing of soil layers and result in meagreness to use as rehabilitation soil.

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During construction the impact significance will be high and can be mitigated to moderate significance by implementing prescribed mitigation measures.

During operation the impact significance will be high and can only be marginally reduced by control measures and remains of high significance.

Recommended Mitigation measures include:

- The creation of any new roads in the site must take into account all sensitive areas and must work around these areas.
- Erosion control measures must be implemented in areas sensitive to erosion and where erosion has already occurred such as edges of slopes, exposed soil etc. These measures include but are not limited to - the use of sand bags, hessian sheets, silt fences, retention or replacement of vegetation and geotextiles such as soil cells which must be used in the protection of slopes.
- Do not allow surface water or storm water to be concentrated, or to flow down slopes without erosion protection measures being in place.
- Vegetation clearing must not be undertaken more than 10 days in advance of the work front. The entire construction area for the new infrastructure must not be stripped of vegetation prior to commencing construction activities.

- All disturbed areas around the new infrastructure including offices, workshops etc must be rehabilitated as soon as construction in this area is complete or near complete and not left until the end of the construction phase of the project to be rehabilitated.
- Where any construction will take place adjacent to any drainage channels or the Shakwaneng River, install sediment barriers along the edge of the construction servitude to contain sediment and spoil within the construction area.
- All stockpiles must be maintained and progressive rehabilitation must take place during the operational phase of the mine.
- Adhere to soil stripping guidelines which must form part of the Environmental Management Programme for the mine.

b) Pollution of soil resources

Mismanagement of waste and pollutants like hydrocarbons, construction waste and other hazardous chemicals will result in these substances entering the soil resources and polluting sensitive natural environments either directly through surface runoff during rainfall events, or subsurface water movement through the soil profile. This is particularly so during the operational phase of the mine.

The pollution of soil resources is considered an impact of high significance both during construction and operational phases. Anticipated negative impacts can be significantly lowered by implementation of mitigation measures lowering the significance of the impact to moderate during both phases.

Recommended Mitigation Measures include:

- All waste generated during construction is to be disposed of as per an Environmental Management Programme (EMPr) and no washing of containers, wheelbarrows, spades, picks or any other equipment adjacent to or in any of the channels including the Shakwaneng River is permitted.
- Proper management and disposal of construction and operational waste must occur during the lifespan of the mine. No release of any substance i.e. cement, oil, that could be toxic.
- Ensure pollution sources are isolated through clean and dirty water separation and monitor this throughout the lifespan of the mine.
- Place the construction camp during the construction of the infrastructure or any depot for any substance which causes or is likely to cause pollution outside of sensitive areas including the steep slopes.
- Spillages of fuels, oils and other potentially harmful chemicals must be cleaned up immediately and contaminants properly drained and disposed of using correct solid/hazardous waste facilities (not to be disposed of within the natural environment). Any contaminated soil must be removed and the affected area rehabilitated immediately.

c) Alien invasive species

- Encroachment of alien invasive species and further erosion may take place with removal of soils and vegetation. Alien invasive species occur extensively throughout the proposed mining area and quickly spread to disturbed areas; (remain in environment after decommissioning phase)

Management options:

- Protect as much indigenous vegetation as possible;
- Rehabilitate disturbed areas post construction;
- Apply re-vegetation

Site preparation:

- Utilise erosion and sediment control techniques where needed.
- Grade the disturbed area to a stable uniform slope. Vegetative cover will not develop on an unstable slope.
- Plant when the weather will permit e.g. suitable temperatures and moisture for plant growth. Spring plantings give the best results.
- Use soil saver on unstable soil to protect bare soil before the planted vegetation has become established;
- Alien invasive management programme must be incorporated into an EMPr;
- Ongoing alien plant control must be undertaken during the operation phase. Ongoing eradication must be implemented.

Mitigation measures recommended in this report are key to lowering the significance of these impacts. Provided mitigation measures are implemented through an environmental management programme (EMPr) and the significance of any impacts reduced, the proposed mine can be managed to have limited negative impact on the surrounding agricultural resources.

10.4.2.10 Topography

The proposed mine site has natural and steep terrain with mountain ranges on the western and eastern portions. The terrain is undulating. The proposed mining activities will correspond mostly to the eastern portion of the proposed Mining Right Area.

10.4.2.10.1 Construction Phase

Construction of surface infrastructure will have a moderate effect on topography and will be of moderate significance during construction.

Activities that will impact on the features on site:

- Construction/creation of 10m earth berm in vicinity of residential properties as mitigation for noise impacts, blast (over air pressure);
- Construction of permanent haulage road and other access roads, topsoil stockpiles

10.4.2.10.2 Operational Phase

The strip mining and specifically the rehabilitation and landscaping of pits will have an impact on the topography (higher terrain than before mining). During operation the impact is considered of high significance due to the sensitive landscape.

- Creation of strip mining pits will impact the topography along with creation of temporary waste rock dumps (if any), overburden yards/piles. Gradual change will take place as mining progresses and piles (temporary piles) grow.

Mitigation proposed:

- Concurrent rehabilitation must be undertaken with strip mining;
- Contouring of the filled-in areas must aim to achieve the approximate original contours that existed before mining.

10.4.2.10.3 Closure and Rehabilitation Phase

Closure and Rehabilitation will aim to restore some of the original topography. The final topography post-mining is expected to be higher than the pre-mining topography (result in a higher terrain that before mining). The impact is of high significance and with mitigation can be lowered to moderate significance.

Activities that will impact on the topography include:

- Constructing, contouring and landscaping of mining pits/strips

Recommended mitigation measures:

- The topography design of the rehabilitated areas is to ensure that there is no water ponding experienced and will ensure a free draining environment.
- The mined out areas are to be filled with all the available material, thereafter, a gentle gradient of less than 1:7 will need to be created so that surface flow drains away from rehabilitated areas;
- Final topography and slope of the constructed landscape is to be verified by a surveyor;
- A detailed topography design is to be investigated in detail during the life of mine;
- Topography achieved during rehabilitation should be monitored and compared to the planned topography;
- Final profile achieved should be acceptable in terms of surface water drainage requirements and the end land use objectives and there should be an alignment of actual final topography to agreed planned landform.

10.4.2.11 Groundwater Impact

The geohydrologist from Naledzi Waterworks indicated the overall simulated heads coincide well with actual heads, confirming the model as a good predictive tool to simulate the aquifer system in the project area. (Figure 92)

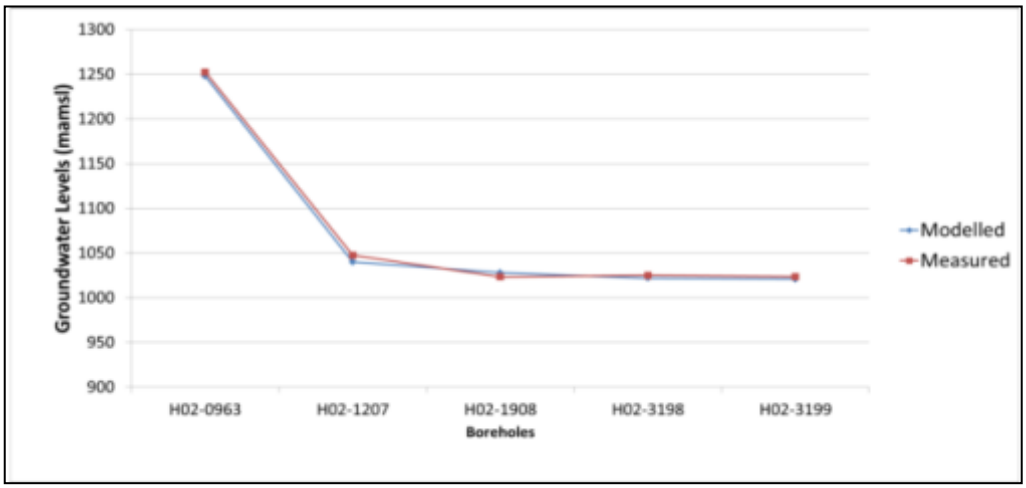

Figure 92: Modelled versus measured water levels

Limitations of the current model

- Aquifer parameters such as transmissivity and storage were taken from literature and are assumed to be applicable to the site environment;
- Recharge values were taken from literature. The values are assumed to be applicable to the site environment; and ;
- For the transport model, mass transport parameters were taken from literature for the region and assumed to be applicable for the site environment;
- A numerical model does not provide a unique solution. Therefore, numerical modelling will always have inaccuracies due to the uncertainty in data, the capabilities/limitations of numerical modelling code to describe the natural processes and the factors selected by the modeller to resolve the non-unique solution. The modelling was performed within the limitations of the scope

Impact Assessment

Potential impacts that will affect the groundwater resources and hydrogeological regime fo the proposed study site during the construction, operation and closure of the mine have been identified as follows:

- Change of natural groundwater flow system and lowering of natural water level due to dewatering of mining pits/blocks;
- Reduction of base flow due to dewatering of mining pits/blocks;
- Seepage of contaminated water from the waste rock dumps and stockpiles into the groundwater resources;
- Contamination of water resources due to discard of waste material in the waste disposal sites;
- Spillages of chemicals and fuels;
- Aquifer contamination due to the back filling of the mining pits/strips;
- Decanting of the contaminated water due to the rebound of the water level after closure.

The impacts are elaborated on in the sections below.

10.4.2.11.1Construction Phase

- ***Impact on Groundwater Quantity***

The groundwater quantity may be impacted, locally by groundwater abstraction (if used for water supply). The impact is rated as low, no mitigation is proposed.

The borehole abstraction should be monitored and water levels at the abstraction borehole and nearby boreholes monitored regularly for any negative water level trends.

- ***Groundwater Quality***

Potential risks to groundwater quality include:

- Groundwater quality may be impacted during construction by localized hydrocarbon spills occurring at the workshop, yellow metal laydown areas and at hydrocarbon storage zones. The impact is rated as high as the magnitude and probability of occurrence are both relatively high;
- Domestic waste generated by the construction phase contractors and client staff may contaminate the groundwater resource. This is rated as low impact activity.

Possible mitigation measures include:

- The training of staff working in workshop, laydown areas at hydrocarbon storage zones on appropriate response action to spillages and ensuring each area is supplied for appropriate spill response kits which reduce the activity to a low impact rating.
- Dispose of all domestic waste at a dedicated, suitably constructed landfill site.

10.4.2.11.2Operational Phase

Operational impacts include the impact on the groundwater quantity and quality:

- ***Impact on groundwater quantity***

The simulated inflows into the mining blocks range between 0 and 297 m3/day. The simulated pit inflows over the operational phase of the mine are summarised in Table 68 and shown in Figure 93. The simulated inflows have been calculated for a LoM of 50 years, calculated for mining the majority of the proposed mining right area east and west of the D2219. The LoM is however indicated throughout the EIR as 30 years.

Table 68: Simulated inflows of groundwater into mining blocks

Mining Years	***Inflow Rate (m^3 / day)***
Year 1-5	6
Year 6-10	0
Year 11 – 15	6
Year 20-25	31
Year 26-30	161
Year 31-35	16
Year 36-40	63
Year 41-45	228
Year 46-50	297

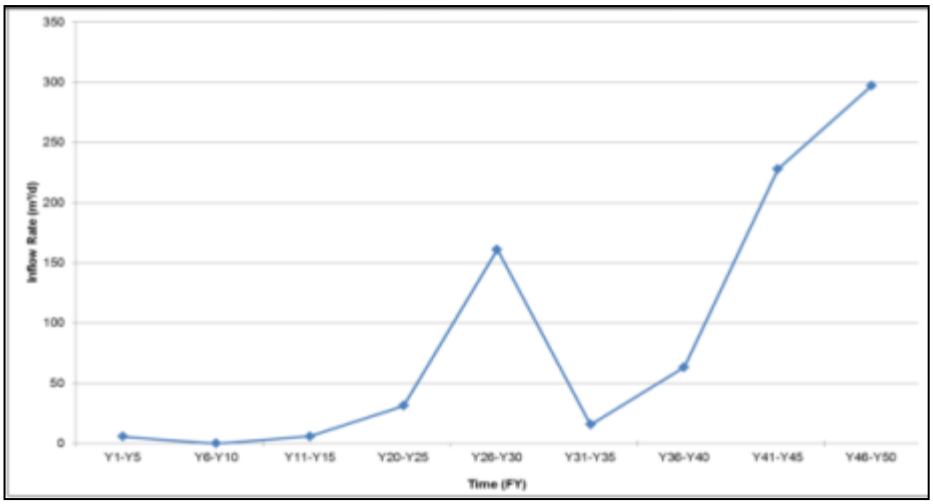

Figure 93: Simulated inflow rate of groundwater into mining pits during LoM

The predicted drawdown cones for the mine blocks are given in Figure 94 to Figure 101 overleaf. A 5 m drawdown has been used to quantify mine dewatering impact zones as natural variations in recharge patterns may induce drawdowns of up to 5 m.

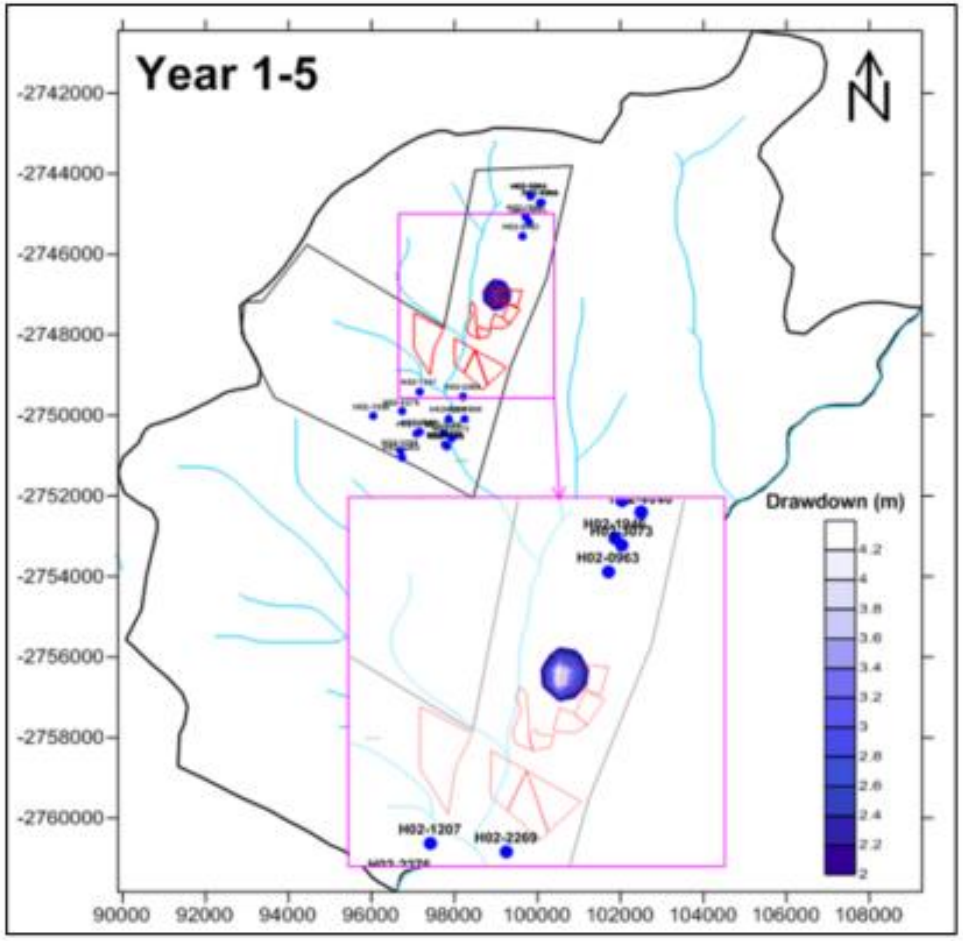

Figure 94: Predicted drawdown cone Y1-5

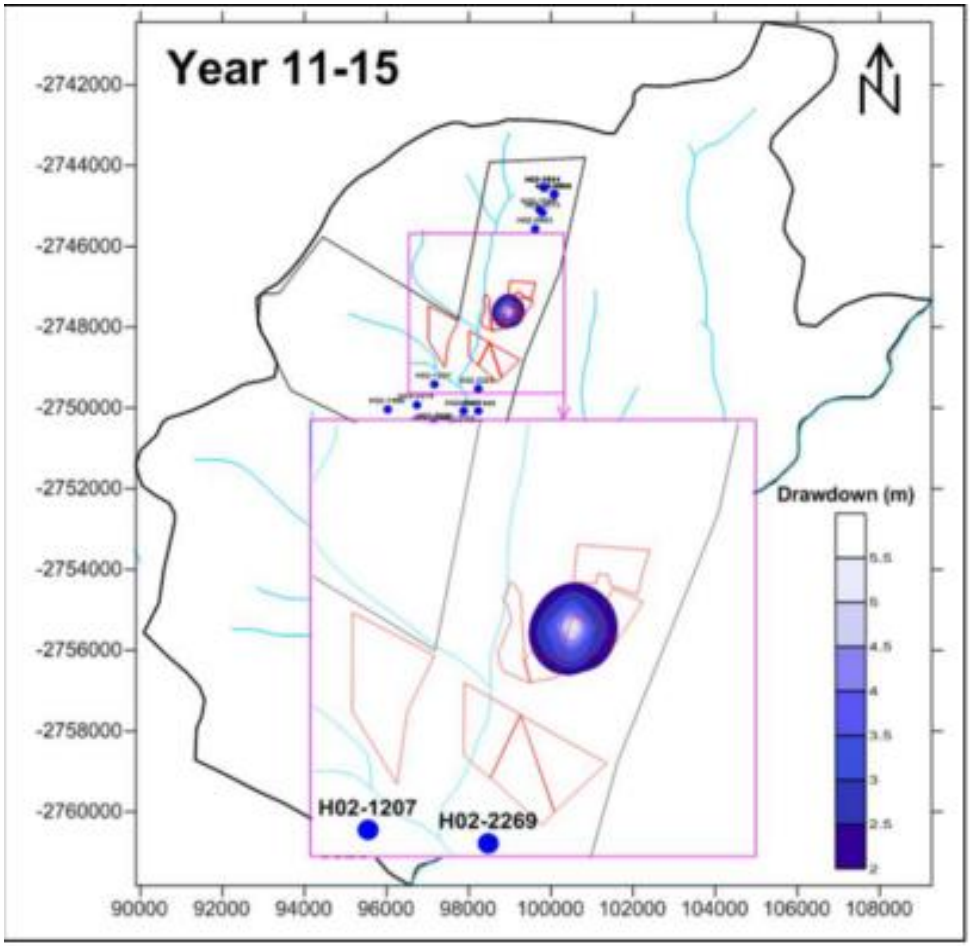

Figure 95: Predicted drawdown cone Y11-15

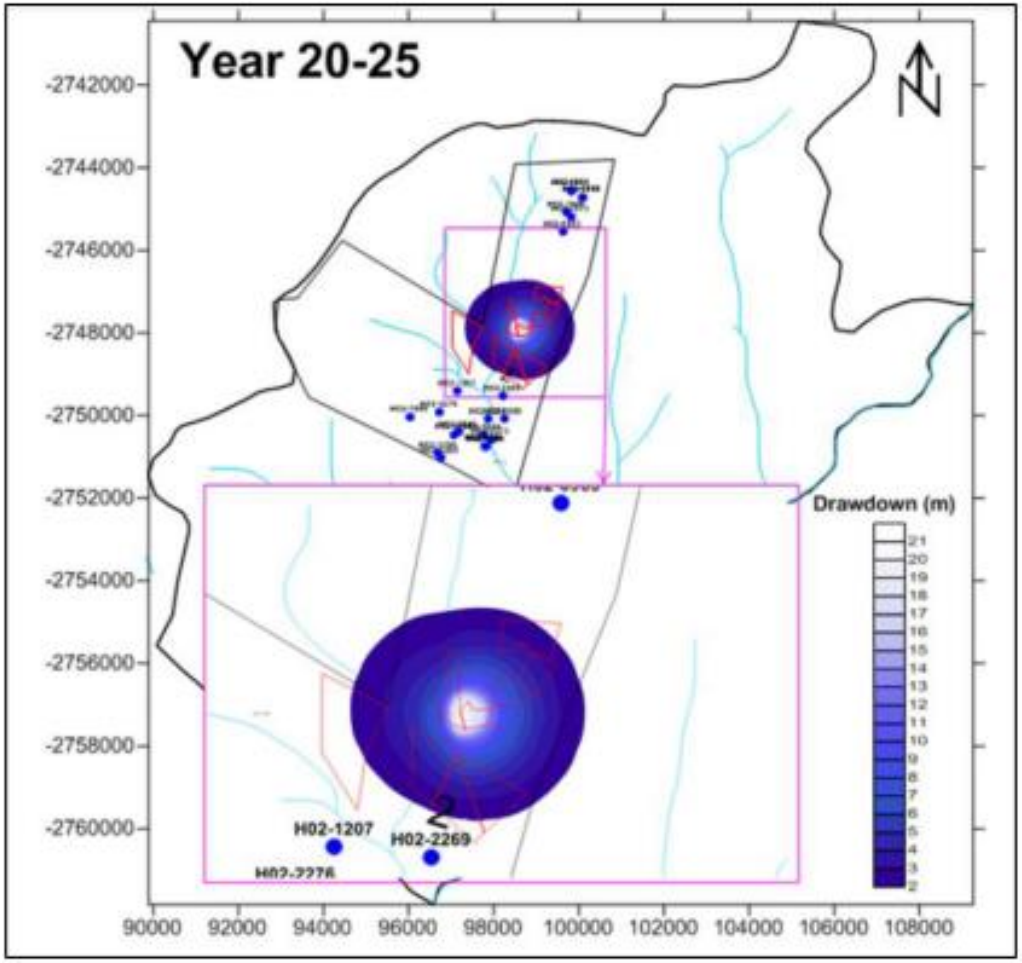

Figure 96: Predicted Drawdown cone Y 20-25

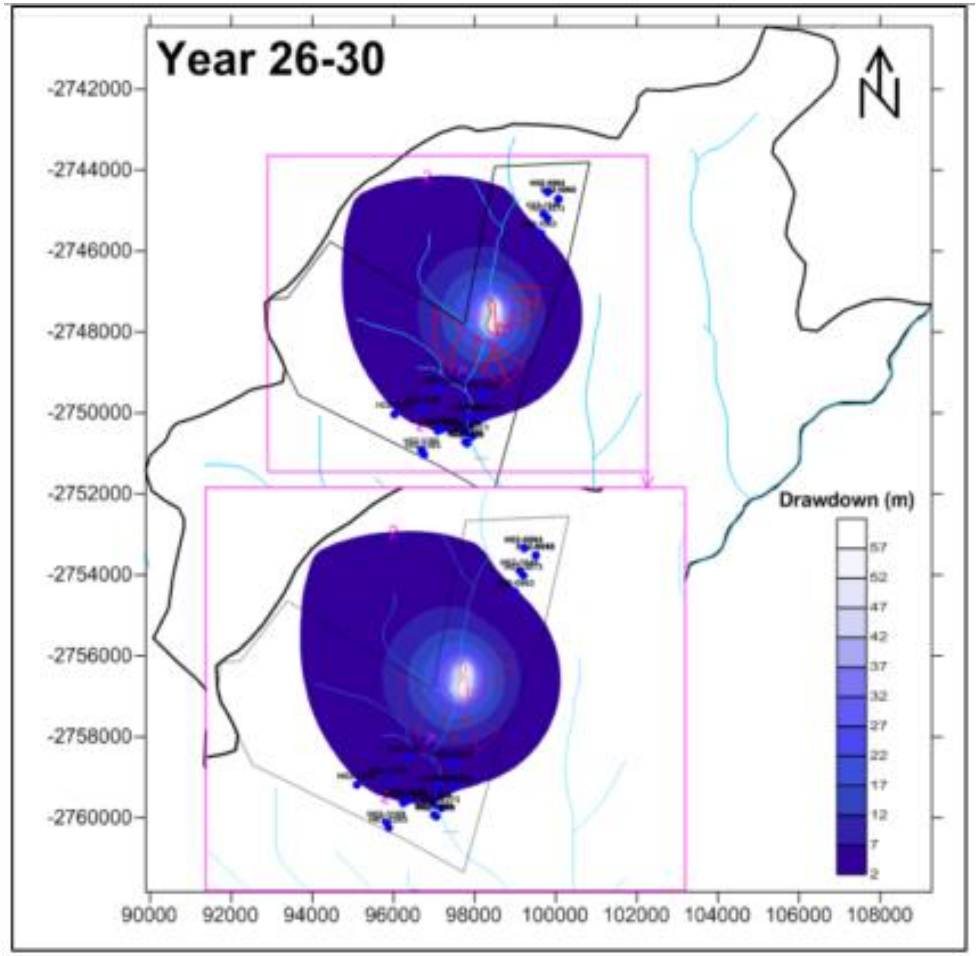

Figure 97: Predicted drawdone cone Y26-30

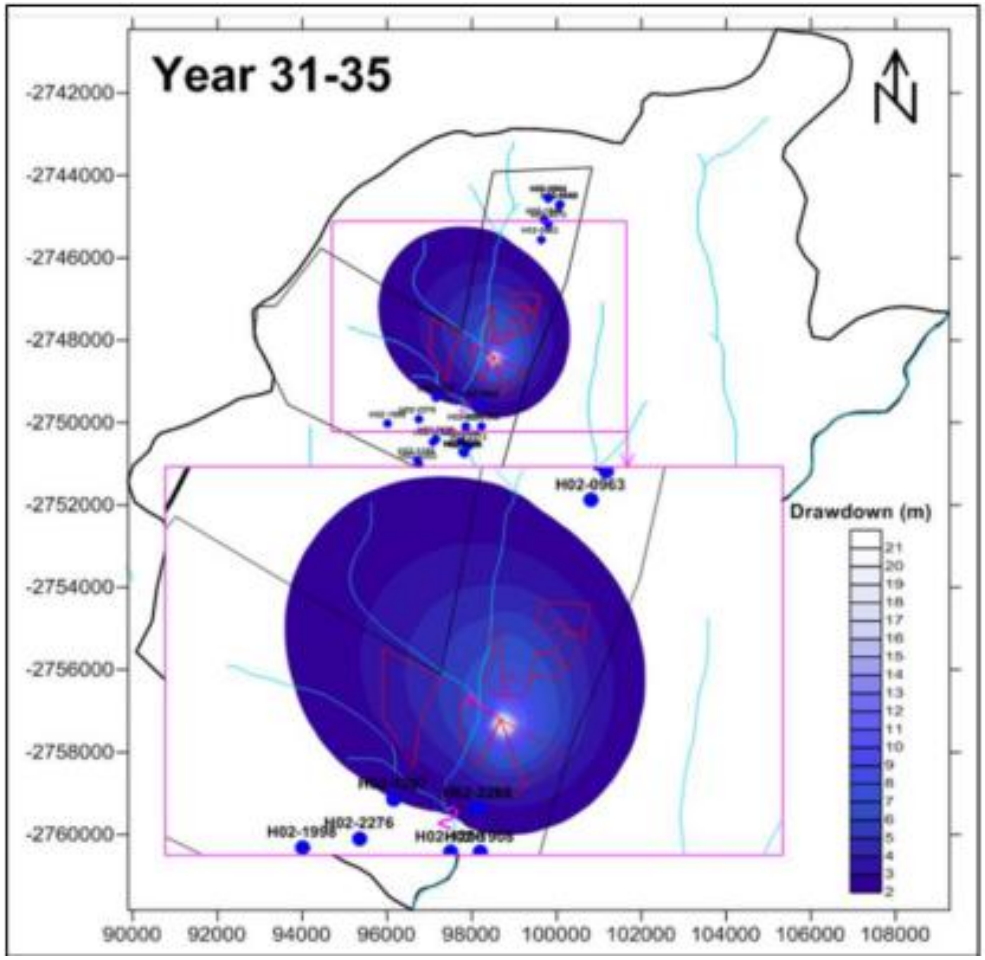

Figure 98: Predicted drawdone cone Y31-35

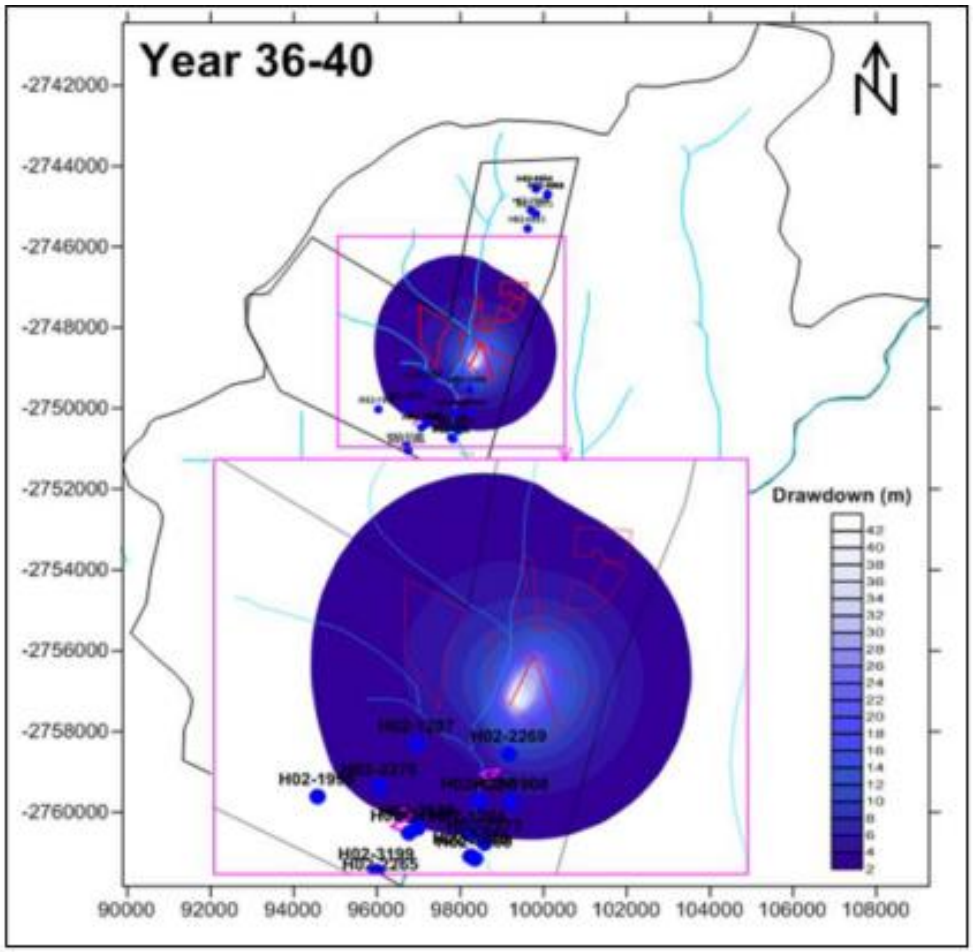

Figure 99: Predicted drawdone cone Y36-40

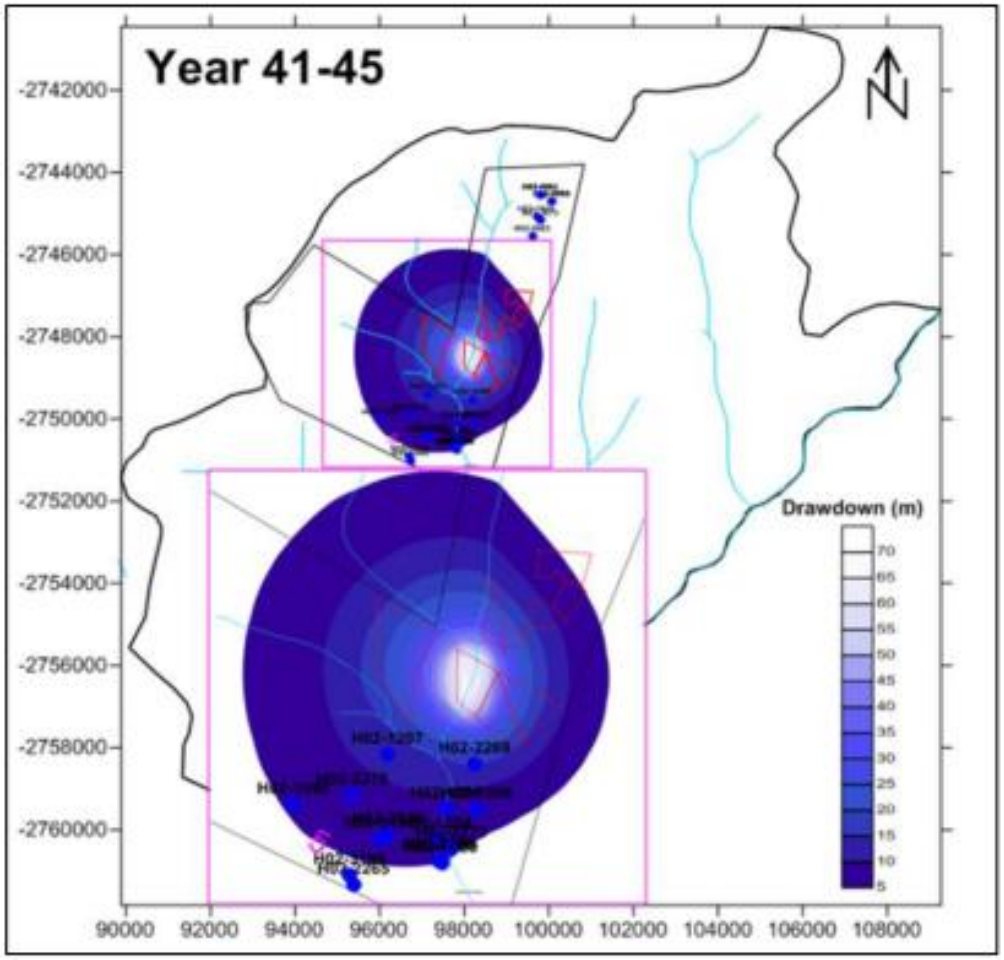

Figure 100: Predicted drawdown cone Y41-45

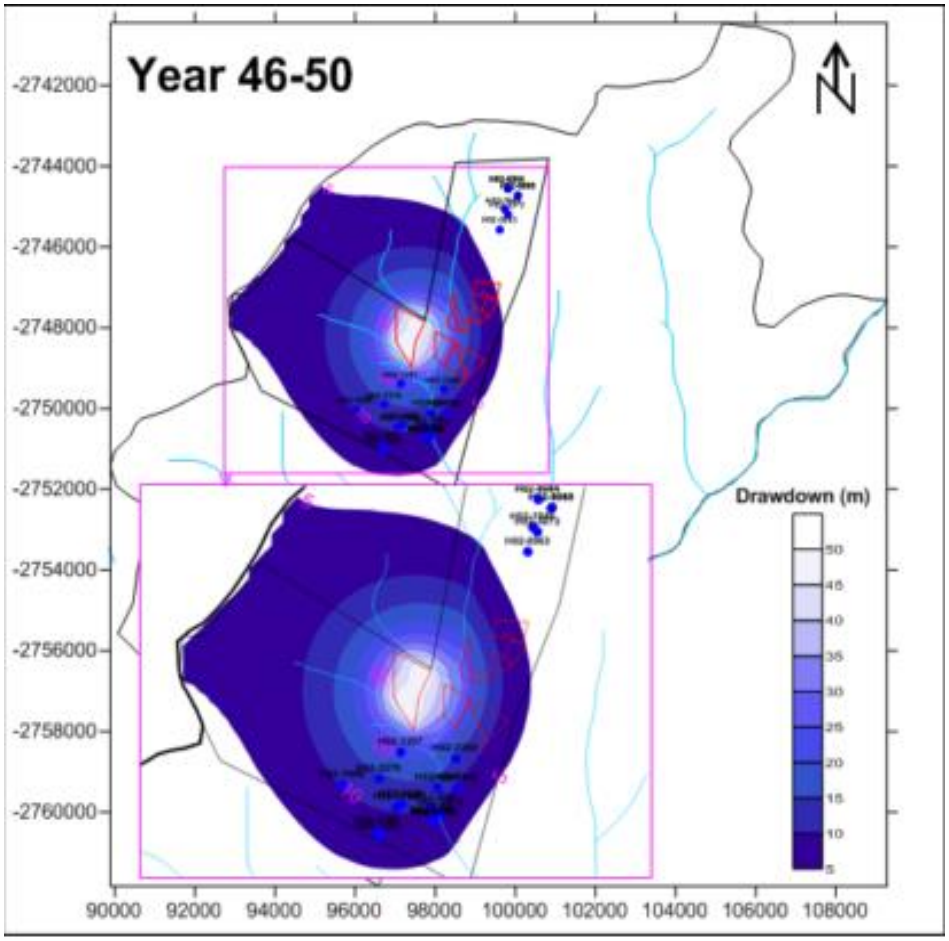

Figure 101: Predicted drawdown cone Y46-50

The key findings from the predicted drawdown cones for the respective mining blocks are as follows:

- Mining of Year block 1-5 is predicted to create a 4m deep drawdown cone as only a quarter of the mining block is predicted to breach the water table. As illustrated the drawdown impact during Year 1-5 is unlikely;
- No drawdown cone is predicted for Year 6-10 as the pit floor is predicted to lie above the groundwater table;
- The 5m draw done cone in Year block 11-15 will be centred around the north western corner of the mining block;
- Mining in Year 20-25 is predicted to create cone with a maximum drawdown of 21m. The 5m drawdown is predicted to fall within the project area an no private borehole is predicted to be impacted;
- Mining Year blocks 26-30 and 41-45 is indicated as impacting on the Shakwaneng River. It may appear that there is a need to divert the river, however a 200m buffer zone will be implemented from the Shakwaneng River and 100m buffer from drainage lines within the site boundary. Hence no mining may take place within these buffer zones.
- Mining in Year block 26-30 is predicted to create a cone with a cone with a maximum drawdown of 57m. The 5m drawdown cone is predicted to extend approximately 2 km to the northwest outside the project area and 300m east of the project area. No private borehole is predicted to be in the impacted zone;
- The zone of impact due to mining in Year block 31-35 is predicted to the limited within the project area. No private borehole is within the predicted zone of influence;
- Borehole H02-2269 is predicted to fall within the one of influence during mining of Year block 36-40. Up to 8m of drawdown is predicted for the borehole;
- Apart from boreholes H02-3199 and H02-2265, all private boreholes south of the mining blocks are predicted to fall within the zone of influence due to mining in Year block 41-45. The dewatering cone is predicted to extend 2km northwest outside the project area;
- The drawdown cone due to mining in Year 46-50 is predicted to extend 500m south east of the project area and approximately 4km northwest. All private boreholes south of the mining blocks are predicted to fall within the zone of influence.

The result of the simulation indicates that for the applied 30 year Life of Mine for the Geluk project, Low inflow rates of groundwater can be expected (in year Y1-5 and Y11-15 a daily inflow rate of $6m^3$/day is expected. In year 6-10 none is expected. In Year 20-25 a daily inflow rate of $31m^3$/day is expected with inflows increasing by Year 26-30 to $161m^3$/day. No impact on surrounding/private boreholes / groundwater quantity is thus predicted in the 30 year LoM period.

- ***Impact on Groundwater quality***

- The waste rock along with low grade ore stockpiles at site, may release poor quality seepage into the groundwater environment;
- The waste rock dumps and stockpile areas are anticipated to be low impact areas during mining, both are kept relatively small and will not result in large amounts of seepage;

Hard and soft overburden stockpiles will be stored for a short time span to avoid oxidation of material. The ground under laying the waste rock dumps and stockpiles will be lined/bunded to minimise infiltration of rainwater and runoff. (Class C Landfill site design).

Plume simulation from the stockpiles indicates that potential leachates will likely migrate in south-westerly direction towards the Y 26-20 mining block and the Shakwaneng River (Figure 102).

Only 16 % of the initial 100 % concentration at the source is predicted to reach the groundwater table beneath the stockpiles. Less than 2% may end up in the Shakwaneng River, and no borehole is predicted to be impacted.

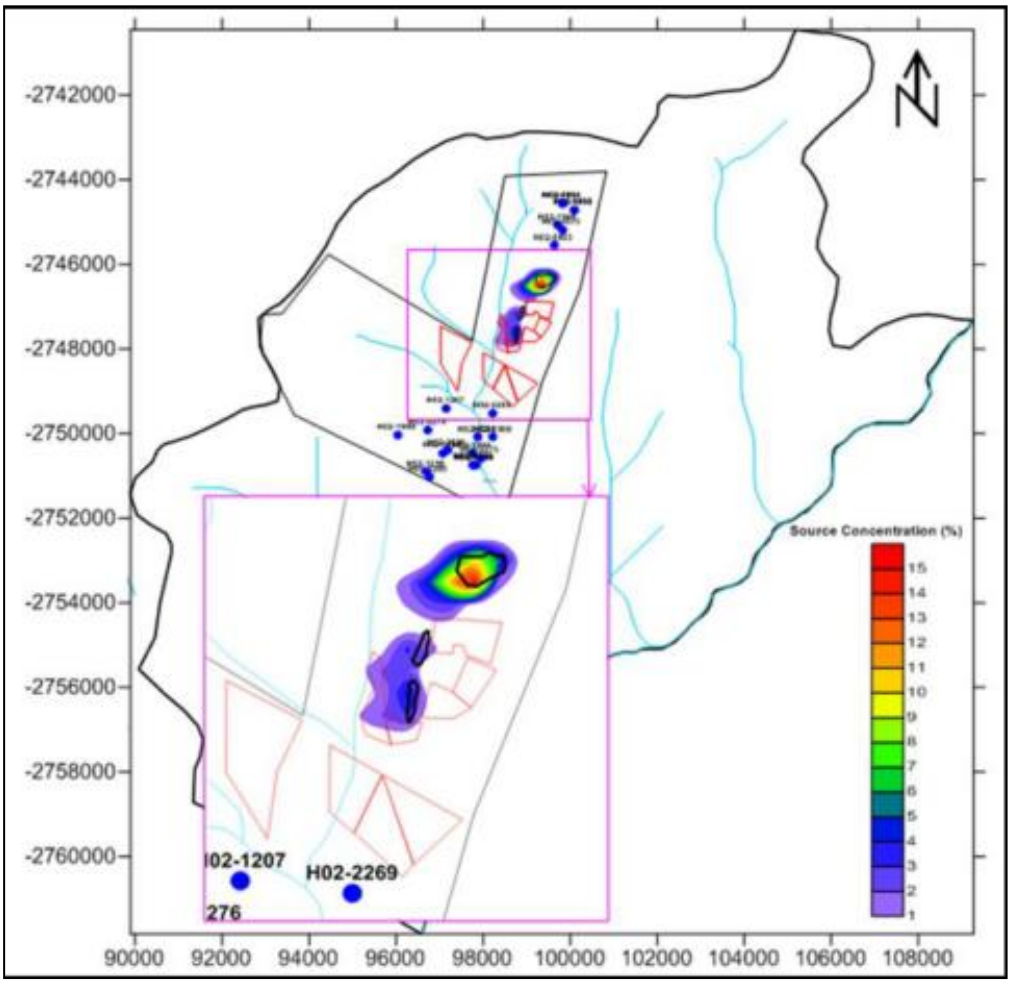

Figure 102: Contaminant plume at end of mining operations

10.4.2.11.3Closure Phase

The key impacts during mine closure include impact on groundwater quality and quantity.

- ***Impact on Groundwater Quantity***

Groundwater levels will recover during the closure phase towards their original state. Probability of decant occurring at the site is low, yet should decant occur it would at the area of lowest surface elevation where the pit/strip shell of the mining blocks intersect surface topography. The decant volume would be in order of 0.5l/s (max).

There are no mitigation measures for groundwater level rebound and the impact would be of low significance. The open pits should be backfilled using suitably graded materials to mimic the natural groundwater environment as far as possible.

- ***Impact on Groundwater Quality***

The stockpile areas should be cleared and vegetated during the closure phase, while the waste rock dump slopes should be vegetated and graded to allow runoff and prevent infiltration of rainwater to the material. The overall impact rating for these features after closure is rated as low.

A summary of the recommended mitigation measures for all phases include:

- Minimise mine and waste sites footprints;
- Chemicals should be stored in an appreciate facility that includes bunding;
- Immediate clean-up after accidental spillages;
- Divert run-off from haul roads should be channeled into the lined pollution control dams;
- Pollution control dams need to be well designed and lined;
- Leakages and spills should be prevented;
- Compact footprint area for the waste rock dumps and stockpiles to minimise groundwater infiltration;
- Contain run-off in dirty water dams;
- A detailed geochemical study should be completed for the site, allowing for the determination of any contaminants that may emanated from the mining, processing and/or waste disposal activities. The results of this study should be used to update the numerical groundwater model.

Groundwater monitoring boreholes should be installed and monitoring should start before mining start. The monitoring programme should be implemented as soon as possible so that pre-mining groundwater level and quality will be gathered. The groundwater monitoring network design should comply with the risk based source-pathway-receptor principle. A groundwater-monitoring network should contain monitoring positions which can assess the groundwater status at certain areas.

Groundwater monitoring should be conducted to assess the following potential impacts:

- Groundwater Quantity: which will be achieved by monitoring the pit dewatering volumes during operations and the groundwater levels of monitoring boreholes at the site area; and
- Groundwater Quality: This will be achieved through sampling of the groundwater in the boreholes at the recommended frequency.

Frequency of monitoring should be undertaken on a quarterly basis, however indicator analyses are proposed during January and July. Some 12 monitoring boreholes are proposed as sampling points on the project site. (See Figure 103)

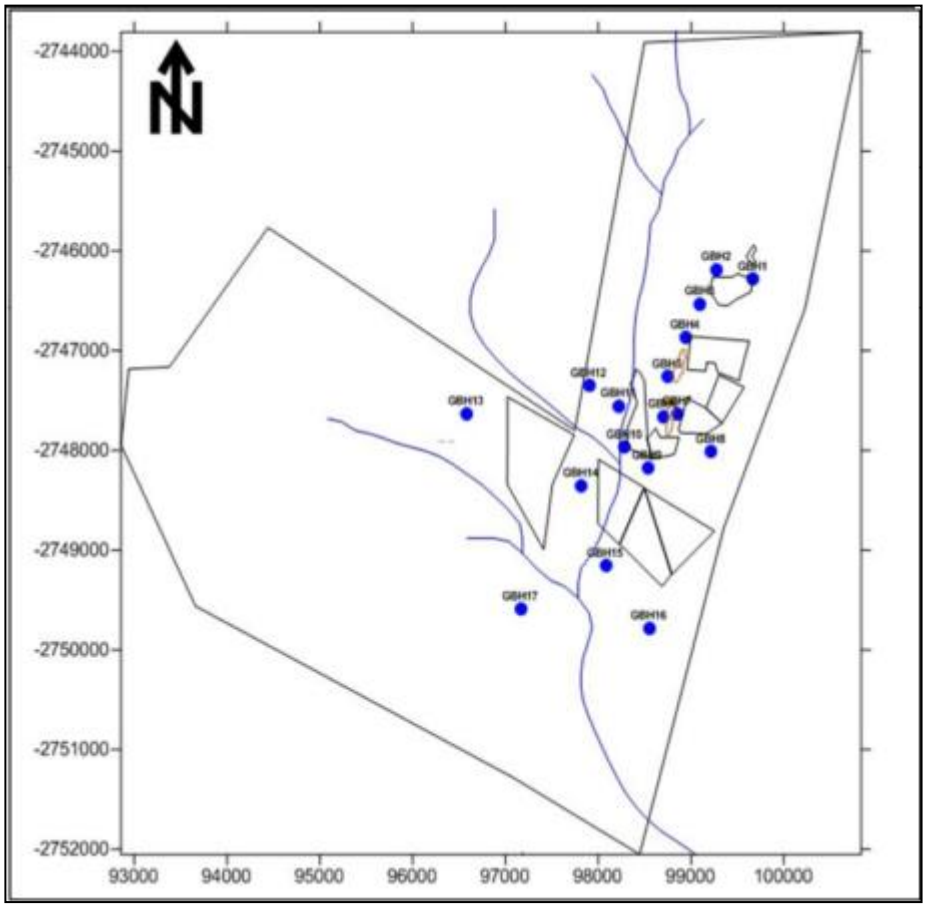

Figure 103: Proposed positions of monitoring boreholes on the Geluk Mine Study site

10.4.2.12 Impact on Hydrology (Surface water impact)

The impacts of most concern from the Geluk Mine project relate to water quality and water quantity. Any water quantity restriction occurring from the proposed project will likely have knock on water quality impacts, as the dilution and transport potential of the system is reduced. There is the potential of extensive erosion and sedimentation of the Shakwaneng River.

Any acid generating potential from the waste rock dumps and ore piles appear to be low to negligible. From the water quality high levels of electrical conductivity it was evident that

elevated dissolved substances were present within both the Shakwaneng and Steelpoort rivers as a result of associated anthropogenic pressures. Yet the water quality of the Shakwaneng River was not overly impacted.

Key impacts foreseen on the hydrology of the study area relate to:

- Impact on water quality
- Impact on water quantity
- Erosion and sedimentation of the river

10.4.2.12.1Storm water management

Rainwater falling and flowing onto the mining area will be managed through a Water Management Plan which will be submitted to DWS. Storm water management infrastructure is to be established as required in terms of GNR. 704 under the National Water act. The regulation requires that a mine site is divided into clean areas, away from any dirty area where runoff can be contaminated by operation activities on site. Dirty water must be impounded in pollution control dams or recycled/treated before being released into the environment. Clean water may be released into the environment.

The mine will have a properly constructed storm water management system which will separate clean and dirty storm water from the catchment areas and trap silt and sediment from its operations.

Toe trenches will be created below strip mine areas and silt traps will be built to stop run-off water from entering the river and its tributaries. All raw ore laydown areas will be designed with storm water control and a liner, an impervious layer. The storm water system will capture all contaminated storm water from the stockpiles and convey it to the silt traps and finally the Pollution Control Dam (PCD). This will prevent ingress of contaminants into the groundwater and material from running into the water bodies.

The reuse of "dirty water" will be maximized at the mine. Dirty water will be collected in a pollution control dam.

Any Mine return water from the mining operations will be pumped back to surface via a return water system. The return water will comprise water used by drill rigs, wash down water and groundwater encountered in mining pits. The mine return will be recycled and used as mine service water; this will allow maximum re-use of water in the mine process.

The PCD will be designed to have the capacity for a 1:50 year flood event (with 0.8m freeboard), as stipulated in Regulation 704.

10.4.2.12.2Flood line

The study found that 90% of the 1:100 year flood lines are less than 100m from the centre line of the streams. Therefore a 100m buffer zone would need to be applied to the river and streams as regulated in Government Notice 704 under NWA.

It is being highlighted that the steep topography have contributed to highly flashy nature of the 1: 100 year floods. The time from the beginning of the storm until its maximum discharge

is reached (flooding) is just over 1 hour down to ½ an hour for all four streams. This limits evacuation times for mining machinery and infrastructure removal (if mobile).

10.4.2.12.3Construction phase impacts

The construction activities could lead to runoff with high sediment load, lead to erosion and carry contaminants such as fuel, hydraulic fluids, degreaser, other chemicals and cement into the river. The impact on the hydrology is of high significance. The following measures are recommended to reduce the potential impact to one of moderate significance.

- Construct toe trenches, silt traps, pollution control dam, clean water diversion system and dirty water collection channels first, before undertaking any activities;
- Service vehicles in workshops;
- Refuelling of vehicles and construction equipment from a tanker/tank must be done in a designated dirty area and spill kits must be available on site;
- Spillages should be cleaned up immediately and contaminated soil must be remediated/disposed of at a licensed landfill site.
- Sanitation facilities must be provided in the form of chemical toilets that are serviced regularly;
- No construction equipment, fuel tanks, associated infrastructure may be placed below the 1: 100 year flood line or 100m from the centreline of the river or drainage lines as per Regulation 704 of NWA;
- Providing environmental awareness training to construction staff and workers on site is essential.

10.4.2.12.4Operational phase impacts

The ore, waste rock dumps appear to have a low to negligible potential for acid generating drainage. The ore and waste material has provisionally being classified as a type 3 waste (moderate risk/hazardous). There is a low metal leach potential from the waste material.

During operational activities increased sedimentation and soil erosion will impact the Shakwaneng River and its tributaries. Water quality impairment due to runoff from waste rock dumps may also take place. Surface contamination may also result due to spillages of fuels, lubricants, hydraulic fluids and chemicals.

The potential impact on the local surface water resources is of high significance. The proposed Geluk Mine operation is expected to have irreversible and severe long term negative impacts on these sensitive environments (Shakwaneng River and its tributaries).

The following mitigation measures are recommended to reduce the predicted impact.

- All ore laydown areas need to be designed with storm water control and a liner, an impervious layer. The storm water management system should capture all

contaminated storm water from the stockpiles and convey it through silt traps and finally the PCD;

- A freeboard of 0.8meters should be maintained in the PCD above the full supply capacity;
- Water quality in the PCD should be monitored on a monthly basis.
- Silt is to be removed from the PCD on a regular basis to maintain storage capacity;
- Toe trenches and silt traps is to be regularly cleaned. Sediment, soil and silt in trenches and traps can be left to dry and used as part of the backfill material for mining strips;
- Chemical toilets used during the operational phase of the mine must be emptied on regular bases (vacuumed from toilets by vacuum trucks) by a waste collector. Once emptied the sewage waste must be disposed of at the closest Waste Water Treatment Plant;
- Vehicles servicing must take place in a workshop;
- Refuelling of mine machinery must take place in designated dirty areas and a spill kit and clean up team must be available on site;
- Spillages should be cleaned up immediately and contaminated soil must either be remediated insitu or disposed of at an appropriately licensed landfill site;
- Monitoring of the mine/process water should be conducted throughout the operational phase in order to identify any poor quality water that may be released into the environment;
- The storm water management measures should be implemented and be updated as new surface infrastructure is implemented;
- Ensure that oil traps are well maintained, if oil traps are utilised;
- All hazardous waste should be removed by a suitably qualified service provider and disposed of to an approved permitted landfill site;

10.4.2.12.5Closure and Decommissioning impacts

The closure and decommissioning activities will have very similar activities to construction phase hence similar impacts. These include:

- Sedimentation and erosion of river and its tributaries due to backfilling and landscaping shaping, contouring of strip mined areas;
- Pollution from fuel, hydraulic fluids, degreaser, other chemicals;

The impact on surface water resource is of high significance. The following measures are are recommended to lower the impact to one of moderate significance.

- Hydrocarbons and hazardous substances must be stored in bunded areas and refuelling should take place in contained areas, when rehabilitation activities are undertaken;
- The water management system (clean water, dirty water collection channels and PCD) must be last structures to be demolished;
- Vehicles and heavy machinery used during closure and rehabilitation should be serviced and checked on a regular basis to prevent leakages and spills;

- Ensure that the drainage on the recreated profile (contoured mining strips/pits) are correct and detect early when any drainage structures are not functioning efficiently. These structures are to be repaired or replaced before significant erosion damage is caused;
- Rehabilitated areas must be shaped to be free-draining;
- A monitoring programme should be developed for the site to monitor post-mining water qualities;

10.4.2.13 Impact on heritage and cultural resources

10.4.2.13.1 Construction Phase

The cultural and heritage specialist identified 3 cemeteries within the built up areas (Mogashoa, Maphopha west, Mapohopha east) and two stone wall sites in proximity to the Shakwaneng River towards Mogashoa. These finds are to be conserved.

The cemeteries are located in built up areas and will not be impacted. The stone wall sites are between the Shakwaneng River and D2219 road within the 500m mining restriction zone. Accordingly, no impacts are expected.

There is however a possibility of an unexpected heritage features being encountered during mining phase. Immediate reporting is crucial to relevant heritage authorities of any heritage resource discovered during Mining process. This recommendation should also be incorporated into the Environmental Management Plan for the proposed project.

- Cease work in the vicinity of the heritage feature find;
- Demarcate the area with barrier tape/other visible means;
- The find should be reported to the South African Heritage Resources Agency (SAHRA) and Limpopo Heritage Resources Agency (LIHRA) immediately;
- An accredited archaeologist (ASAPA registered) must be commissioned to assess the find and determine mitigation measures required.
- If there is a need to relocate the find permits/ authorisation will be required from SAHRA / LIHRA;

10.4.2.13.2 Operational Phase

Various surface earth moving operations are proposed for the mining operation. Hence there is a possibility of unearthing buried cultural and heritage features during operational activities. The above procedures for unexpected heritage finds apply. No impact is anticipated up to an unexpected find.

In case of the Built up areas with associated cemeteries it is strongly recommended that a 500 meters restriction to mining is implemented to safe guard the populated areas and the creation of safety or buffer zones for drilling and blasting which include fly rock and ground vibration that could end up damaging people' s houses.

10.4.2.13.3 Closure Phase

The likelihood of unearthing any buried cultural and heritage resources during this phase is very low, unless earth moving takes place on site which were not undertaken during the construction or operational phases.

If any cultural or heritage features are found or unearthed the procedures for finds must be followed as stipulated for construction phase.

10.4.2.14 Impact on traffic and surrounding road networks

The proposed Geluk Mine project will gain access from the D2219 Jane Furse road via a proposed access intersection (2-way priority stop intersection). The project transportation logistics will include transporting ore from the mine site via the D2219 to the R555 heading south towards Roossenekal Rail siding. This involves some 6 intersections and road linkages. The intersections include:

- Intersection 1: R555/D2219 Road;
- Intersection 2: D2219/D1392 Road
- Intersection 3: D2219/Road 2 towards Schoonoord
- Intersection 4: R555 Road/Access Road to Roossenekal train station;
- Intersection 5: R555 Road / Access road to farm
- Intersection 6: D2219/Access road to the mine

The road linkages include:

- R555 Steelpoort/Stoffberg Road/ D2219 Jane Furse Road;
- D2219/D1392;
- D2219/Road 2 to Schoonoord
- R555 / Access to farm
- R555 / Access to the Roossenekal Rail Siding

Currently all intersections operate at an acceptable level of service (A – rating) during both AM and PM peak hour traffic. The road link capacity analysis shows that even after the development traffic is added to the 2025 background traffic is well the maximum acceptable threshold of 0.95 volume/capacity ratio. It will accommodate existing and future traffic demand (up to decommissioning stage of the Geluk Mine) without requiring additional upgrades. All roads analysed in the study area have enough spare capacity.

The traffic impact assessment undertaken by ITS Engineers (January 2016) analysed/added the existing 2015 traffic volumes, the proposed 2020 background projected traffic as well as the proposed 2025 background project traffic demand to the existing road network in the study area.

10.4.2.14.1 Traffic volumes due to the Geluk Mine

The Geluk Mine would operate, in its first 5 years of production, with only 1 day shift. From year 6-30 the mine will operate a day and night shift of 8 hours each.

The daily transport requirements and expected trip generation for the mine are set out according to production years as follows:

(Construction – Operational Phase Stage 1)

- **Year 1-3:** 46 trips/day (37 ore trucks, 8 private cars, 1 public transport bus)

(Operational Phase Stage 2)

- **Year 4-5:** 63 trips/day (54 ore trucks, 8 private cars, 1 public transport bus)

(Operational Phase Stage 3)

- **Year 5-30**:92 trips/day (78 ore trucks, 11 private cars, 2 public transport buses)

(Decommissioning phase)

- **Year 31-32:** 50 trips/day (40 heavy vehicles, 9 private cars, 1 public transport bus)

It is estimated that, at peak of mine operation 92 additional vehicle trips will be generated daily.

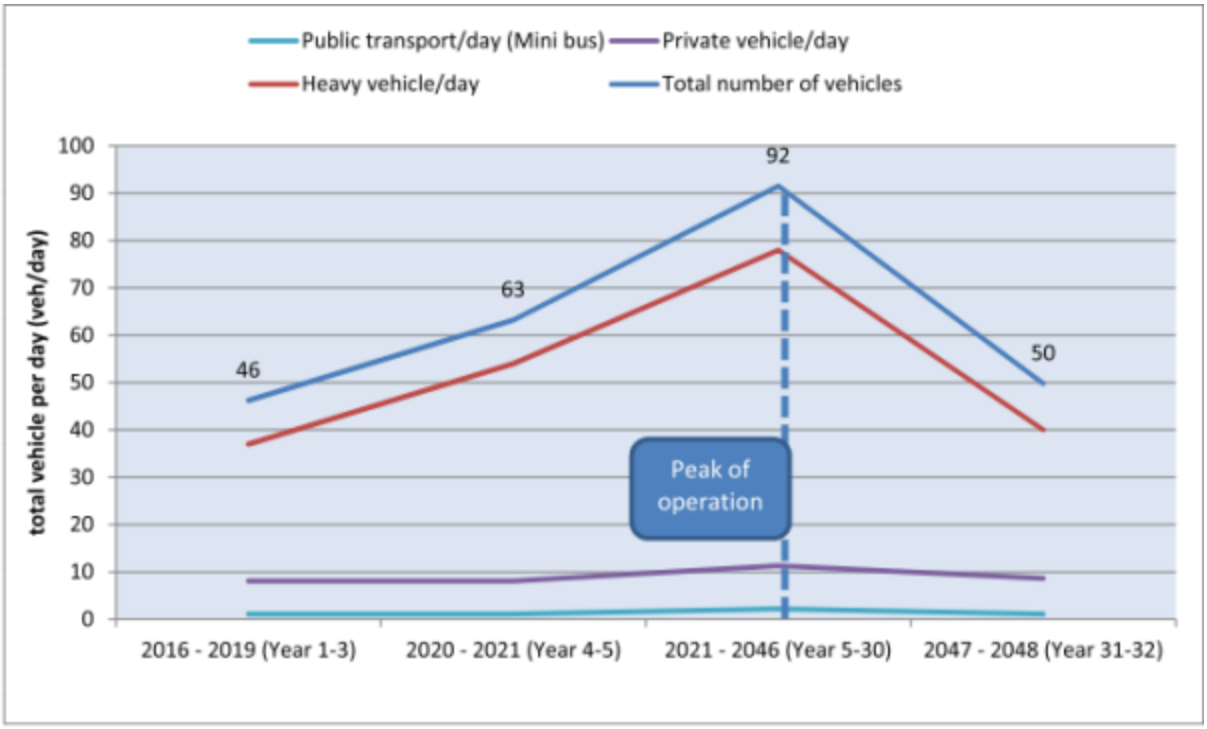

Figure 104: Daily transport requirements for all phases of the mine

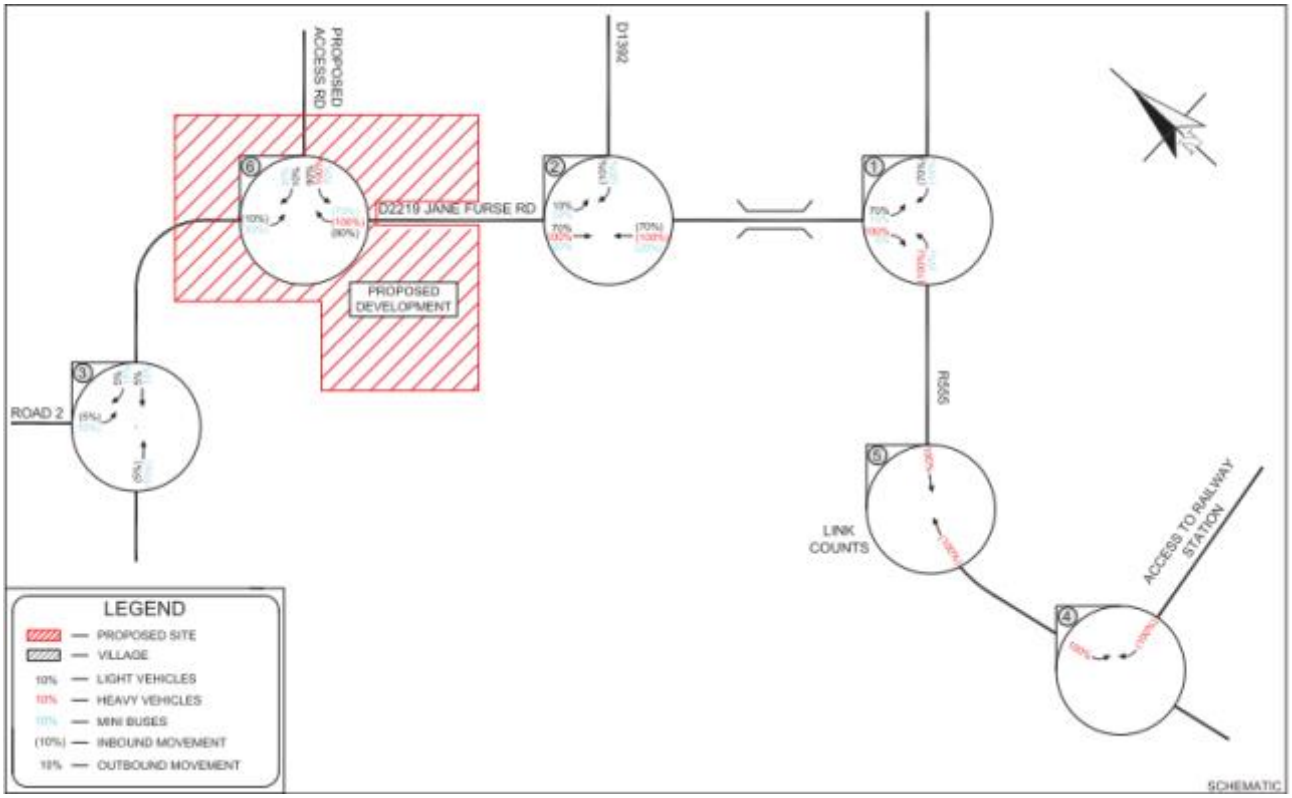

Figure 105: Trip distribution of proposed Geluk Mine traffic

10.4.2.14.3 Proposed Access Road to Geluk Mine

The D2219 is a class two road with one lane / direction. The speed limit ranges from 40km/h to 100km/h. Speed calming measures are in place along the road (speed bumps) every 1km. The location for the access intersection to the next intersection meets the requirements for provincial roads. No safety issues are envisaged. The distance between the proposed access and next intersection is 2km. The road alignment where the access is proposed is fairly flat and straight. A 2 way priority stop access intersection is proposed. (Figure 106)

Figure 106: Conceptual layout of proposed acess intersection

The Malekane Steelbridge on the D2219 used to cross the Steelpoort River linking with the R555 is not suitable for mine haulage trucks. The bridge would need to be replaced with a new two lane bridge. This is a joint effort required from all mines in the area. Alternative routes were considered to divert from the bridge, yet haulage distances doubled and expenses of using such routes over the 30LoM was not deemed the optimal choice.

10.4.2.14.2 Construction – Operation Phase Impact (Stage 1)

There will be an impact on road safety and increased traffic on the R555 and D2219 during this phase. The impact will derive from transportation of ore and goods (deliveries) from/by 34 ton-interlink tipper trucks, construction vehicles, private vehicles and public transport mini buses. This phase will involve the 1st three years of production (240 000 tons/annum) which will run simultaneous to the construction phase.

The main traffic increase will come from the 27 ore truck trips generated to move product to the Roossekenkal rail siding.

The traffic impact significance during this phase is moderate without mitigation. With implementation of mitigation measures the impact can be reduced to low significance.

The following upgrades were proposed for safety purposes and also to accommodate additional heavy vehicles on the road network:

- Construction of the D2219 /Access Road to mine intersection: A two way priority stop controlled intersection, with priority on the D2219 Road. The access intersection will be constructed with exclusive turning lanes on the D2219 Road.
- Approval must be obtained from Limpopo Roads Agency for the construction of the proposed road upgrades along the D2219;
- Provision of street lighting for safety purposes at the access to the mine intersection.
- Provision of road signage and road markings.
- Construction of public transport bays in the vicinity of the mine's access intersection.
- Construction of a new bridge to replace the existing Malekane Steelbridge.
- The construction of this bridge should be a joint project between all the existing and future mine in the vicinity. The construction of the bridge will be beneficial to both the mines and the community.

It must be noted that the proposed road improvement is recommended to be implemented at the start of the Geluk Iron and Vanadium Ore mine activities (Year 1 - 3 of construction and operations).

10.4.2.14.3 Operational Phase (Stage 2-3)

The will form the critical stage of the project at which the risk for road safety impacts and the traffic increase is at its peak. The impacts will derive from 34 interlink tipper trucks transporting ore and commuter trips (private and public transport).

This phase involves the production rate of the mine from 480 000 tons/annum and peak operation of 700 000 tons/annum. The main traffic increase will derive from 54 heavy vehicle trips/day in year 4-5 and 78 heavy vehicle trips/day from year 6-30 generated to move product to the Roossenekal rails siding. The transport demand will vary each day depending on the production of Iron and Vanadium Ore in each day and other unforeseen circumstances.

Commuter trips are expected to be generated daily from the origins surrounding the mine. The commuter trips will be split into private transport and public transport.

The impact on road safety and traffic increase on the R555 and D2219 will be of low significance as the capacity of the roads are sufficient to carry the existing traffic, added development traffic and future demand traffic. There is however mitigation measures that need to be implemented for roads safety and upgrade to the Malekane Steelbridge which is not suitable for mine haulage trucks. Once mitigation is implemented the impact will be a very low significance.

The mitigation measures implemented in the Construction and operational phase stage 1 will serve all the phases of the mine's life span. Therefore no upgrades are proposed for this stage.

10.4.2.14.4 Closure & Decommissioning Phase

Traffic volumes during this phase will be considerably lower than the operational phase and therefore it is expected that the traffic impact will be negligible. It is expected that some 50 vehicles trips will be generated during the closure phase comprising heavy vehicles and commuter trips. The significance of this impact is low.

The mitigation measures implemented in the Construction and operational phase stage 1 will serve all the phases of the mine's life span. Therefore no upgrades are proposed for this stage.

10.4.2.15 Socio-Economic Impact

10.4.2.15.1Construction Phase

The proposed Geluk Mine construction phase will comprise site establishment and mining operations commencing simultaneously within the 1st year of operation. The mine will be opened up as a small scale mining operation. Rakhoma indicates an estimated capital expenditure of R 5 million for the construction phase as indicated in their Mining Works Programme (March 2015). Rakhoma will mobilize the skills and capital equipment in preparation for the commencement of mining activities.

The construction workforce will consist of approximately 30 staff (including contractors); resulting in 30 direct employment opportunities. The staff component will comprise 7-8 staff members with some 22 core contractors. The construction will require semi-unskilled labour of which the study area has an abundant supply.

The social setting of the proposed Mining Right Area comprises populated areas in the northern and southern portions of the study site. **The proposed mining infrastructure and operations (therefore related construction) will be focused to unoccupied areas.** A 500m restriction to mining from residential dwellings (500m bufferzone) will be upheld from settlements (as per current status quo of Ga-Mogashoa and Mapopha). **Rakhoma has stated that no resettlement of communties will take place.**

However, during construction activities, directly and surrounding communities residing near the project are likely to be affected by dust, noise which may result in impact on the quality of lifestyles, sense of place and pose health impacts such as sinusitis (as a result of increased

dust). Traffic will increase along local roads which are likely to present safety impacts for pedestrian and motorists.

There will also be positive socio-economic impacts which are listed below.

Positive socio-economic impacts resulting from the construction phase:

- Creation of limited, yet new employment opportunities for a short term (workforce will mainly come from the local community)
- Increased demand for goods and services in the area which will strengthen the local market
- Eradication of poverty in the area: positive impact on the livelihoods of future employees in the neighbouring and labour sending communities;

Negative socio-economic impacts:

- Due to low personal income, lack of housing supply, squatting might increase near the mine due to perception of work (jobseekers);
- The impact on subsistence farming and grazing on the project area will cease on the construction areas (impact on traditional economic activities);
- Demand for subsidy and low cost rentals is expected within the local economy;
- The construction activities will result in dust fall out, increased traffic, noise, visual intrusion which will cause a nuisance to local communities due to their close proximity to construction activities;
- Safety issues may arise as a result of construction vehicles which pose a threat to the community safety and health due to potential dust from earthworks and vehicle accidents as a result of poor signage;
- There may be a risk for community protests due to a lack of consultation and engangement from the proposed mine management in terms of construction activities which may impact on communities;
- Key impacts expected during construction are safety and impact on the sense of place due to the presence of construction workers and job seekers including noise generation (rural and quiet nature of the area);

The total loss of economic-activity on-site as a result of the proposed mining is negligible as there is currently limited activity taking place.

During site establishment there may be a perception of work due to the mine operations/construction resulting in potential squatting from job seekers. This impact is of negative low-medium significance.

The study area is characterised by a scenic environment which is quiet and rural in nature. Residents residing in proximity of the project are likely to be affected by noise, dust and will experience a visual intrusion. Dust from construction activities may pose a health impact by resulting in sinusitis. The impact will be of short duration and would be of moderate-high significance.

The presence of construction workers/contractors may potentially result in the integration with local communities. This impact will be low-moderate as construction staff and contractors staff quota are limited and would be for a short duration during operation.

The economic value and temporary injection of economic activity including demand for services and goods that form part of the construction phase will have positive impact of medium significance.

Mitigation

- Local labour should be used as far as possible for construction
- Control dust and noise at source and implement monitoring programmes on surrounding communities as recommended under Air Quality and Noise Impact management measures;
- Regular consultation and engagement with traditional leadership and the establishment of a Community Forum must take place to discuss issues/impacts arising from construction and manners in which impacts are to be addressed and by when such will be addressed on a regular basis;
- Adequate road signage must be placed along the D2219 for construction vehicles turning towards the project site and implement recommendations for road upgrades as per the Traffic Impact Assessment must be implemented within the first 3 years of construction and operation;
- Goods and services should be as far as possible procured locally

10.4.2.15.2Operation Phase

As stated under construction phase no resettlement of communities will be required for the proposed Geluk Mine project. Mining will be focussed to unoccupied areas outside the 500m mining restriction area from settlements.

Key positive impacts foreseen for the operational phase include:

- New employment opportunities will be created
- The mine activity will create additional GVA in an area with limited development;
- Establishment of the mine may bring forth infrastructure development;
- As the case with learnerships, local community members will be in incorporated in the mine where possible. Rakhoma will provide several job specific and up-skilling training interventions to its immediate communities, which will allow them to be incorporated into the mine with trained skills;

Negative socio-economic impacts are also foreseen for the project. During operation the present sense of place of the study area will be significantly altered and may impact on the quality of life of surrounding communities. The study area comprises a scenic environment and is rural in nature.

As per the construction phase, operational activities are likely to impact on directly and surrounding communities by noise, dust and vibration from blasting. The clearance of bushveld vegetation and presence of mine infrastructure (also illumination of mine site at night) will affect the surrounding communities due to their visual exposure to the project.

There is also the potential for health impacts experienced by surrounding communities and mine workers as a result of PM10 and PM2.5 particulate matter/dust (fine dust) blown over from blasting and dust generating operations (due to unmitigated conditions) such as sinusitis

and bronchitis. Hence the control of dust, PM10 and PM2.5 at source will be critical and continuous monitoring thereof at communities will need to be undertaken.

The increased mine traffic on the local roads may pose a safety impact to the community and cattle due to vehicle accidents and trucks running over cattle. This impact is of moderate significance.

There is also the risk for community protests, as per construction phase, due to a lack of regular consultation/engangement with local communities on mining operations and unresolved issues/demands (water, dust and noise control). The probability of occurrence is high (area renowned for its protests between 2015-2016) and would be of high significance should it occur.

As per the Geohydrological Impact Assessment by Naledzi Waterworks, it is not predicted that any private /surrounding boreholes/ groundwater quantity will be affected (drying up) during the 30 year LoM period. Water availability is however a current challenge in the area. Communities are dependant on borehole water and raw water from the Shakwaneng River and Dr Eiselen Dam due to a lack of water reticulation in these areas. Any contamination of water sources through mining activities will have direct impact on these communities.

The presence of the mine may result in an influx of mine workers/contractors, job seekers in villages and may also bring forth social problems such as safety and crime. The impact would be of moderate significance.

There is a potential for urban sprawl further onto the proposed mining right area. The impact will be moderate and will need to be controlled by local authorities.

Blasting activities are discussed in detail in the Noise and Ground Vibration Impact Asssessment Report by dBAcoustics. It is not predicted within the report findings that blasting would result in damage to residential units. However with the knowledge of an approved mining right next to Geluk, also intending to use drilling and blasting in their mining methods, the addition (cumulative effect) of drilling and blasting from the proposed Geluk Mine may give rise to cracking of houses.

Agricultural activities will cease on built areas and on the whole area on the long term. The impacts will be localised within the site boundary.

Mitigation measures to be implemented:

- Local labour must be employed from surrounding and direct communities as far as possible;
- No recruitment must be undertaken at the Geluk Mine premises;
- Monitoring programmes on dust, noise and blasting must be undertaken (as per the air quality, dust, noise and vibration impact section) for the LoM and regular consultation and engangement must take place through a Community Forum meetings;
- Monitor and prevent further urban sprawl onto the mining right area by strict enforcement of an urban edge by local authorities and or fencing the mining right area to restrict urban expansion;

- Cattle will be able to graze in areas within the proposed mining right area not occupied by infrastructure or being mined. There will be large areas within the mining right area which will not be mined for long periods due to mining schedule.
- The local authorities are to enforce clustering requirements on the villages of Maphopha and Ga-Mogashoa;
- Compensation for loss of water resource (in the event of drying up of boreholes-negligable to very low probability of occurring);
- Blasting schedules must be communicated with surrounding communities and pre-blast warnings must be implemented;
- Access to the mine must be strictly controlled to prevent crime;
- Provision of street lighting for safety purposes at the access to the mine intersection including provision of road signage and markings must be implemented;
- Construct public transport bays in vicinity of the mine's access intersection;
- Progressive rehabilitation must be undertaken of opencast areas to increase the success of the rehabilitation and lower the potential of total degradation of land;
- Unskilled job opportunities should be provided to people from the surrounding communities;
- A skills training programme will be undertaken at Geluk Mine, where several job specific and up-skilling training interventations to its immediate communities will be provided, which will allow them to be incorporated into the mine with trained skills

10.4.2.15.3Closure and Decommissioning Phase

Negative impacts:

- Decommissioning will have an impact on employment as people will have to find other work;
- The local economy will be expanding with continued growth in demand for various land uses mainly driven by the mining sector. Once mining activities reduce with mine closure the impact is expected to be high.
- Impact on agriculture – agricultural activity will not be able to continue to the full extent as before and limited employment opportunities will be created;
- The topography will be contoured with a slightly higher terrain as pre-mining and may have a negative impact on the scenic environment (formerly experienced by the surrounding communities) whilst being colonised by vegetation (exposure to bare soils). The significance of the impact will be high until the area is fully rehabilitated, stable and fully colonised by indigenous vegetation
- It is expected that similar impacts to the construction phase can be expected on surrounding communities in terms of noise, dust and traffic. The impact is considered of moderate significance;
- There will be an impact on the land use of the mining right area as its pre-mining use was natural. The aim during closure will be to create an acceptable land use after mining suitable for grazing. The significance of the impact is considered to be moderate-high.

Positive impacts:

- The local community will have shares in Geluk Mine through with contributions towards its Community Development Fund. The Community Development Fund would have grown substantially over the 30 year Life of Mine period with the residual benefit of infrastructure brought on during the LoM including benefits from Local

Economic Development Programmes undertaken by Rakhoma during the period of mine operation.

Mitigation:

Efforts should be made to diversity the local economy to reduce the dependence on the mining sector. Once mining operations are finished the sudden impact of employment loss from mining could be absorbed if the locality economy diversifies.

The local municipality should be made aware of this possible impact of mine closure.

The post-mining landscape will create a sustainable topography. The pre-mining topography will be constructed to be as close as possible to the original landscape as possible. Final topography monitoring will take place during rehabilitation and closure.

All recommended control measures for the rehabilitation and closure phase for noise, dust, vibration and traffic, visual exposure must be implemented.

Consultation and engagement through the Community Forum meetings must continue intill closure activities cease on the proposed Mining right area.

The physical aspects of rehabilitation should be carefully monitored during the operation phase as well as during the progress of establishment of the desired final ecosystem.

10.4.2.16 Cumulative Impacts

Cumulative impacts are defined as the combination of multiple impacts from existing projects, the proposed project, and/or anticipated future projects that may result in significant adverse and/or beneficial impacts that would not be expected in case of a stand-alone project.

An assessment of cumulative impacts therefore considers the proposed project within the context of other similar land uses, in the local study area and greater regional context.

Residual impacts are those impacts that remain significant following the application of mitigation measures. The specialist studies to be conducted as part of the impact assessment phase of EIA will identify and provide an assessment of both the cumulative and residual impacts which are likely to occur as a result of the proposed project.

The following cumulative impacts have been identified:

- **Noise**

There will be a cumulative noise impact from the open cast mine, related activities. The cumulative impact on the abutting noise sensitive areas, road network and prevailing environmental noise levels will be of medium-high significance. With mitigation the impact can be lowered to medium-low significance.

Mitigation measure recommended:

- Actively manage the process and noise & vibration management plan must be used to ensure compliance with the noise & vibration regulations and or standards. The levels are to be evaluated in terms of the baseline noise and ground vibration levels.

- **Air Quality**

The annual and daily cumulative ground level concentrations may increase with a further 20 µg/m³ and 40 µg/m³ respectively. The impact is considered of moderate significance.

- **Traffic Impact**

There will be a cumulative impact on road safety and increase in traffic on the R555 and D2219 as a result of existing traffic volumes on the road network and intersection usage. The significance of the cumulative impact will be high. The impact can be mitigated to low significance with construction of the D2219 access road, new bridge to replace the Malekane Steelbridge and provision of street lighting at the vicinity of the mine access.

- **Visual Impact**

The increase in mining activites in the local and regional area result in negative visual intrusion, impact on landscape character, impact on residents. The impact significance is considered of moderate-High significance.

- **Impact on surface water quality**

Increased hardened surfaces from the settlments areas and the proposed mine site will increase soil erosion and runoff resulting in sedimentation in the Shakwaneng River

The impact on considered of high significance.

- **Ecological Impact**

Removal of red listed plant species will have a cumulative impact of reduced species richness and composition. Further the decrease in floral habitat and ecological structure will lead to profileration of alien invasive species, habitat fragmentation, and decrease in species richness.

The impact is considerd of high significance.

10.4.3 IMPACT ASSESSMENT TABLES - OUTCOME OF EIA

10.4.3.1Construction Phase Impact Table

Table 69 Summarises the impacts related to the Construction phase of the proposed Geluk Mine project, it provides the significance rating pre-mitigation and post mitigation.

Table 69: Construction Phase Impacts

IMPACT	PRE-MITIGATION							POST MITIGATION						
	Status	Probability	Extent	Duration	Intensity	Significance Score	Rating	Status	Probability	Extent	Duration	Intensity	Significance Score	Rating
Geology														
Site establishment and opening of mine pits will require removal of soft and hard overburden and ore	Negative	3	1	5	3	27	High	Negative	3	1	5	3	27	High
Topography														
Site establishment, digging of toe trenches, PCD including the creation of a earth berm (noise barrier) will have moderate affect to the topography.	Negative	2	1	4	2	14	Mod	Negative	2	1	4	2	14	Mod
Air Quality & Dust														
Fugitive particulate emissions PM10 and PM2.5 and vehicle exhaust gasses will result from clearing of vegetation, creation of transport infrastructure, earthworks and leveling of terrain. It has the potential to impact on local communities due to nuisance	Negative	3	1	1	3	15	Mod	Negative	2	1	1	1	6	Low

of emissions. Onsite dustfallout may present a nuisance to construction employees														
Noise impact														
During site establishment, groundworks, civil construction activities, creation of internal haulage roads, building activities, haulage of material, construction of waste rock dumps, soil and material stockpiles will have a cumulative niose increase of 64.9dBA at 60m and 40.8dBA at 960m if all machinery operate in radius of 30m at one time. Yet seldom to happen and noise will be lower.	Negative	3	1	3	4	24	Mod	Negative	3	1	2	1	12	Low
Ground Vibration and Blasting														
Blasting may pose a safety hazard, noise and ground vibration and danger for fly rock. (2-3 second blast impact)	Negative	3	2	2	4	24	Mod	Negative	2	2	2	2	12	Low
Visual Impact														
Altering the landscape Character - Construction activities will result in clearing of bushveld vegetation and the change in surface cover (construction camps, infrastructure). Visual receptors affected are residents within a 2km radius experiencing high levels of visual exposure.	Negative	3	2	5	3	30	High	Negative	3	2	3	2	21	Mod
Impact on Landscape Character due to alteration of tributaries	Negative	2	2	5	3	20	Mod	Negative	1	2	3	2	7	Low
Visual Impact on residents - Clearing of bushveld vegetation	Negative	3	2	3	4	27	High	Negative	3	2	3	2	21	Mod
Visual impact on residents - change	Negative	3	2	4	2	24	Mod	Negative	2	2	3	1	12	Low

in surface cover														
Visual impact on residents - alteration of tributaries	Negative	2	2	4	4	20	Mod	Negative	2	2	3	1	12	Low
Visual impact on tourists - Due to exposed soils causing unsighly views	Negative	1	3	2	1	6	Low	Negative	1	2	2	1	5	Low
Visual impact on motorists - Intruding on existing views of the landscape	Negative	3	2	2	2	18	Low	Negative	1	2	2	2	6	Low
Ecological Impact														
Profileration of alien invasive species will take place due to site establishment. Alient plants will pose an ecological threat to habitat structure and lower biodiversity. Extend to site and surrounding local area bordering site. It may have long term to permanent impact.	Negative	3	2	4	10	48	Very High	Negative	3	1	4	8	39	High
Loss of indigenous vegetation, floral and faunal habitat and ecological structure will take place due to site establishment and mining activities which will directly impact the ecological condition of natural vegetation and habitat availability and have an impact on foraging, breeding and roosting ecology of faunal and avifaunal species. The proposed mining operation will result in the destruction of vegetation, floral habitat and the complete loss of faunal and avifaunal habitat. . Impact will extent to site and local surrounding area	Negative	3	2	4	10	48	Very High	Negative	3	1	4	8	39	High

Loss of floral diversity and ecological integrity - Site establishment is likely to have a negative impact in terms of loss of ecological connectivity through the clearing of vegetation. This will extent to the site and its local surrounding area	Negative	3	2	4	10	48	Very High	Negative	3	1	4	8	39	High
Loss of species of concervation concern - Establishment of mine infrastructure, removal of vegetation may result in loss of specialised habitat for red listed plants species (Crinum macowanni and Ilex mitis).Impact on Faunal endemic species may take place due to habitat removal. Species of concern include Serval, Borwn Hyena, Soutspansberg Flat Lizard, Sekhukhune flat lizard (subspp. Fitzsimons) and South African Rock Python. The reptile species are slow moving and will likely be targeted while setting up infrastructure, moving onto site.	Negative	3	2	4	10	48	Very High	Negative	3	1	4	8	39	High
Impact on Aquatic Ecosystems														
Soil erosion will result in the deposition of sediment into the Shakwaneng and Steelpoort rivers; posing a risk to the river's geomorphological/functional integrity.	Negative	3	2	3	8	39	High	Negative	3	2	3	4	27	High
Pollution of water resources and soil - Contaminants (hydrocarbons, solids, pathogens) may generate during construction from a number of sources (petrol/diesel, oil/grease, paint, cement/concrete and other hazardous substances). Any acid	Negative	2	3	4	10	34	High	Negative	2	3	4	4	22	Mod

generating potential of the ore appears to be low to negligible.														
Spread of Alien Invasive Species - habitat can be impacted directly by complete removal/partial disturbance of existing indigenous riverine vegetation by machinery, workers accessing the site or directly where the road alignment intersects aquatic habitats, impacting directly on the ecological condition of vegetation and availability of natural habitat.	Negative	2	3	5	8	32	High	Negative	2	2	4	4	20	Mod
Soil, Agricultural Potential and Land Capability						0							0	
Soil disturbance, erosion and compaction	Negative	3	2	2	8	36	High	Negative	2	1	2	8	22	Mod
Pollution of soil resources	Negative	3	2	2	8	36	High	Negative	2	1	2	6	18	Mod
Alien invasive species occur extensively through project site, alien invasive species will quickly spread to disturbed areas and result in further soil erosion	Negative	3	2	2	8	36	High	Negative	2	1	2	6	18	Mod
Groundwater Impact														
Fuel and Hydrocarbon Spillages; Groundwater reduction due to groundwater use during construction of mine facilities	Negative	1	2	2	1	5	Low	Neutral	0	1	1	0	0	Very Low
Groundwater contamination from fuel and hydrocarbons spillages from transporting vehicles and storages	Negative	1	2	2	1	5	Low	Neutral	0	1	1	0	0	Very Low
Surface Water and drainage														
Potential pollution of the Shakwaneng and Steelpoort Rivers due to runoff with high sediment load, contaminated runoff from fuel, hydraulic fluids,	Negative	3	3	2	4	27	High	Negative	2	3	2	2	14	Mod

degreaser other chemicals														
Heritage and Cultural Impact														
The potential impact on cemeteries would be negligable as it is situated with settlements and unlikely to be impacted by construction activites	Negative	1	1	1	0	2	Very Low	Neutral	0	1	1	0	0	
There is a potential for impact on the stonewall sites	Negative	1	1	5	3	9	Low	Neutral	0	1	1	0	0	
Potential unearthing of heritage resources during construction excavations	Negative	3	1	5	4	30	High	Negative	1	1	2	2	5	Low
Impact on Traffic														
Road safety and increase in traffic on R555 and D2219	Neutral	3	4	2	2	24	Mod	Neutral	1	4	2	1	7	Low
Socio-Economic Impact														
There may be a **potential for squatting near the mine** due to the perception of work. Demand for subsidy housing and low cost rentals within the local economy mayincrease.	Negative	2	2	2	3	14	Mod	Negative	2	2	1	1	8	Low
Impact on agricultural activities (grazing, subsistance farming) due to loss of income (feed for animals), cease of agricultural activity on project site. Total loss of economic-activity onsite is negligible as current activity is limited.	Negative	3	2	5	1	24	Mod	Negative	3	1	5	1	21	Mod
There will be a temporary **injection of economic activity** in the area, **demand for services and goods will increase**	Positive	3	2	2	2	18	Mod	Neutral						
New employment opportunities will be created in the local economy	Positive	3	4	2	1	21	Mod	Neutral						

Dust fallout, noise, increased traffic, visual intrusion will cause a nuisance to local communities due to their proximity to the project site (site establishment activities)	Negative	3	2	2	4	24	Mod	Negative	3	2	2	1	15	Mod
Presence of construction workers, job seekers, noise and dust generation will impact on the study area sense of place and on the quality of lifestyle ofdirect property owners and surrounding community's lifestyles	Negative	3	2	3	4	27	High	Negative	3	2	2	2	18	Mod
Potential integration of construction workers/contractors within local communities	Negative	2	2	2	3	14	Mod	Negative	2	1	2	2	10	Low
Potential safety impact on local roads due to construction vehicles and haulage of abnormal mine equipment to site	Negative	2	2	2	3	14	Mod	Negative	1	2	2	2	6	Low
Potential for squatting near mine site due to perception of work	Negative	2	2	2	3	14	Mod	Negative	1	2	2	2	6	Low

10.4.3.2Operational Phase Impact Table

Table 70 Summarises the impacts related to the Operational phase of the proposed Geluk Mine project, it provides the significance rating pre-mitigation and post mitigation.

Table 70: Operational Phase Impacts

OPERATIONAL PHASE IMPACTS	PRE-MITIGATION							POST MITIGATION						
	Status	Probability	Extent	Duration	Intensity	Significance Score	Rating	Status	Probability	Extent	Duration	Intensity	Significance Score	Rating
Geology														
The strip mining of vanadium bearing magnetite ore will result in the permanent removal of the available economic reserve of ore from the proposed mining right area. Access to the ore will be obtained by the temporary removal of soft and hard overburden.	Negative	3	1	5	4	30	High	Negative	3	1	5	4	30	High
Topography														
Strip mining and specifically rehabilitation of mine pits/strips will result in a higher terrain that the pre-mining topography. (strip mining with concurrent rehabilitation will be undertaken, where overbuden is piled next to pits and backfilled once seam ore is depleted within strip). Further growing in height of product stockpiles, overburden piles and use of a sound/noise buffer berm may impact	Negative	3	1	5	3	27	High	Negative	3	1	5	1	21	Mod

the topography. Impact rated high due to site sensitivity														
Air Quality & Dust - Mining Operations														
Key emission pollutants from the mining operations include TSP (dustfall out), PM10 and PM2.5 arising from dust entrainment from vehicles on unpaved haul roads and ore crushing and screening at the mine. Crushing activities and vehicle entrained dust from unpaved road surfaces represented the highest impacting particulate sources from the proposed operations.	Negative	3	2	4	3	27	High	Negative	2	1	4	1	12	Low
Air Quality & Dust - Railway Siding Operations														
Main contributing particulate emissions from rail siding operations will be vehicle entrainment on unpaved roads. Dust fallout will be less than 400mg/m2/day (well within the NDCR for residential and non residential areas.) The operations will impact on individual residential units in proximity of rail siding and adjacent Vlaklaagte settlement if unmitigated. If mitigated the impact will be reducted to site.	Negative	2	2	4	3	18	Mod	Negative	1	1	4	1	6	Low
Noise impact														
Noise will increase from additional traffic to and from different mine operations (pit, crushing and screening, weighbridge), blast hole drilling	Negative	3	1	5	1	21	Mod	Negative	1	1	3	1	5	Low
Operation of Diesel Emergency Generator	Negative	3	1	3	2	18	Mod	Negative	1	1	3	1	5	Low

Haulage of waste rock to waste rock dump	Negative	3	1	3	2	18	Mod	Negative	1	1	3	1	5	Low
Haulage of ore to mobile crusher	Negative	3	1	3	2	18	Mod	Negative	1	1	3	1	5	Low
Crushing activities	Negative	3	1	3	2	18	Mod	Negative	1	1	3	1	5	Low
Haulage of ore to Roossenekal Rail siding	Negative	3	1	3	2	18	Mod	Negative	1	1	3	1	5	Low
Maintenance activities at the different sites at the mine	Negative	3	1	3	2	18	Mod	Negative	1	1	3	1	5	Low
Ground Vibration and Blasting														
Blasting at open cast mine	Negative	3	2	4	4	30	High	Negative	3	2	4	2	24	Mod
Visual Impact														
Altering the landscape Character - Negative impact on visual quality of landscape: Operational phase introduce alternative landuse, altering existing bushveld character. The quality of landscape will be lost due to development scale and extent. Residences within a 2km radius experiencing high levels of visual exposure.	Negative	3	2	4	2	24	Mod	Negative	1	2	4	1	7	Low
Visual Impact on residents - Loss of bushveld and vegetation patters. The visual exposure is considered high due to the proximity of development to residential areas and high level of visibility expected.	Negative	3	2	4	3	27	High	Negative	2	2	3	2	14	Mod
Visual impact on residents - change in surface cover	Negative	3	2	4	2	24	Mod	Negative	2	2	3	1	12	Low
Visual impact on residents - alteration of tributaries	Negative	1	2	4	1	7	Low	Negative	1	2	3	1	6	Low
Visual impact on tourists - Visual exposure and intrusion of mining activities will be low due to limited viewers and time spent in the area. Yet	Negative	1	3	4	1	8	Low	Negative	1	3	3	0	6	Low

considered negligable as this rural area is not a tourist destination.														
Visual impact on motorists - Intruding on existing views of the landscape. Topography of terrain will not screen mining activities. Motorists will have short period of exposure.	Negative	3	2	1	2	15	Mod	Negative	2	2	1	1	8	Low
Ecological Impact														
Profileration of alien invasive species will take place due to disturbance of soils and natural vegetation. Alient plants will pose an ecological threat to habitat structure and lower biodiversity.	Negative	3	1	4	10	45	Very High	Negative	3	1	4	8	39	High
Loss of indigenous vegetation, floral and faunal habitat and ecological structure: Loss of vegetation, in the case of a mine is irreversible, and although rehabilitation will take place after the mine is closed, restoration of the natural habitat on site cannot be achieved. This is particularly significant in an ecologically sensitive area where endemism of both flora and fauna is considered high.	Negative	3	1	4	10	45	Very High	Negative	3	1	4	8	39	High
Loss of floral diversity and ecological integrity - Mining operations will have a negative impact in terms of loss of ecological connectivity through the clearing of vegetation.	Negative	3	1	4	10	45	Very High	Negative	3	2	4	6	36	High

Loss of species of concervation concern - During the mining operation, removal of vegetation may result in loss of specialised habitat for red listed plants species (Crinum macowanni and Ilex mitis).Impact on Faunal endemic species may take place due to habitat removal. Species of concern include Serval, Borwn Hyena, Soutspansberg Flat Lizard, Sekhukhune flat lizard (subspp. Fitzsimons) and South African Rock Python. The reptile species are slow moving and will likely be targeted while setting up infrastructure, moving onto site.	Negative	3	1	4	10	45	Very High	Negative	3	2	4	6	36	High
Impact on Aquatic Ecosystems														
Soil erosion will result in the deposition of sediment: During the operational phase of the mine rainfall is likely to filter through into the waste dump. This water is likely to accumulate particles and pollutants that may pose a risk to the surrounding water courses. Sediment that washes off the waste dump during periods of rainfall may contribute to increased sedimentation in the aquatic environment. This will result in increased ecosystem function and may have a limiting effect on aquatic biota.	Negative	3	3	4	6	39	High	Negative	2	3	4	6	26	High

Pollution of water resources and soil - The impacts of decreased water quality may range from subtle changes in community composition in less severe cases, to the complete elimination of aquatic fauna from the river systems. Road run-off has been identified as a significant source of diffuse pollution contaminating receiving waters and may contain significant loads of nutrients, heavy metals, polycyclic aromatic ydrocarbons (PAHs), Volatile Organic Compounds (VOCs) such as benzene, toluene, ethylbenzene, xylene, and methyl tert-butyl ether	Negative	3	3	5	6	42	High	Negative	3	3	5	6	42	High
Spread of Alien Invasive Species - habitat can be impacted directly by complete removal/partial disturbance of existing indigenous riverine vegetation by machinery, workers	Negative	3	3	5	6	42	High	Negative	3	3	5	6	42	High
Soil, Agricultural Potential and Land Capability														
Soil disturbance, erosion and compaction	Negative	3	1	5	6	36	High	Negative	2	1	5	4	20	Mod
Pollution of soil resources	Negative	3	1	5	8	42	High	Negative	2	1	5	6	24	Mod
Alien invasive species occur extensively through project site, alien invasive species will quickly spread to disturbed areas and result in further soil erosion	Negative	3	1	5	8	42	High	Negative	2	2	4	6	24	Mod
Groundwater Impact														
Pit inflows, reduction in borehole yield and groundwater contamination from stockpiles	Negative	1	2	3	2	7	Low	Negative	0	1	2	1	0	Very Low

Surface Water and drainage														
Potential pollution of the Shakwaneng and Steelpoort Rivers due to runoff with high sediment load, contaminated runoff from fuel, hydraulic fluids, degreaser other chemicals. Stockpiles areas have a low (less than 2%) potential for contaminating the Shakwaneng River.	Negative	3	3	4	3	30	High	Negative	2	3	4	2	18	Mod
Heritage and Cultural Impact														
Potential unearthing of heritage resources during excavations of mining pits during the operation phase. Possiblity is very low as the soils are very shallow and a thick ore seam is close to surface making for any burials.	Negative	1	1	5	4	10	Low	Negative	1	1	5	0	6	Low
Should any cultural or heritage resource be uncovered during operational excavations (the impact would be high).	Negative	3	1	5	4	30	High	Negative	1	1	2	2	5	Low
Impact on Traffic - Operational Phase Stage 3														
Road safety and increase in traffic on R555 and D2219	Neutral	1	4	4	1	9	Low	Neutral	1	4	4	1	9	Low
Socio-Economic Impact														
New employment opportunities will be created during the operation phase: contractors, skilled and unskilled employment for the LoM (30 years)	Positive	3	2	4	2	24	Mod	Neutral	0					
Production at the mine will create additional GVA in an area with limited development. Impact will be for the duration of LoM (30 years)	Neutral	3	1	4	3	24	Mod	Neutral	0					

Agricultural employment will cease on the built up areas and on the whole area on the long term. The impacts will be localised within the site boundary.	Negative	2	2	5	1	16	Mod	Negative	2	1	2	1	8	Low
Agricultural production will cease on the proposed mining right areas.	Negative	2	2	5	1	16	Mod	Negative	2	1	2	1	8	Low
Dust fallout, noise, increased traffic, visual intrusion will cause a nuisance to local communities due to their proximity to the project site (mining operations)	Negative	3	2	2	4	24	Mod	Negative	3	2	2	1	15	Mod
Impact on sense of place and quality of lifestyle of direct and surrounding communities through noise, dust generation, visual exposure to project and vibration from blasting	Negative	3	2	4	3	27	High	Negative	2	2	4	2	16	Mod
Safety impact to community and cattle due to increased traffic on local and surrounding road network potentially resulting in accidents and livestock fatalities	Negative	2	2	1	4	14	Mod	Negative	1	2	1	2	5	Low
Safety impact due to influx of mine workers, job seekers, contractors may increase crime and affect safety of local residents	Negative	2	2	4	4	20	Mod	Negative	2	2	3	2	14	Mod
Lack of regular community consultation and engagement culminating in unresolved issues/demands/impacts (water, dust, noise, third party losses) may result in community protests.	Negative	3	3	2	4	27	High	Negative	2	2	2	3	14	Mod
Lack of control of PM10 and PM2.5 (fine particulate matter) blown over from blasting and dust generating operations may pose health impacts to direct and surrounding communities such as sinusitis and bronchitis.	Negative	2	2	2	3	14	Mod	Negative	1	2	2	1	5	Low

Contamination of groundwater will be negligable during operation. Contamination of the Shakwaneng River may take place due to siltation and sedimentaiton from mining operations. Use of water by the mine can potentially impact on the water availablity in the area.	Negative	3	2	4	4	30	High	Negative	1	2	4	1	7	Low

10.4.3.3Decommissioning and Closure Phase

Table 71 summarises the impacts related to the Decommissioning and Closure Phase of the proposed Geluk Mine project, it provides the significance rating pre-mitigation and post mitigation.

Table 71: Decommissioning and Closure Phase

	PRE-MITIGATION							POST MITIGATION						
DECOMMISSIONING AND CLOSURE PHASE IMPACTS	**Status**	**Probability**	**Extent**	**Duration**	**Intensity**	**Significance Score**	**Rating**	**Status**	**Probability**	**Extent**	**Duration**	**Intensity**	**Significance Score**	**Rating**
Geology														
Soft and hard overburden and potential waste rock will be backfilled into strip mined areas concurrent to mining and any remaining stockpiles will be used as backfill material during rehabiliation and closure. No impact on geology is foreseen.	Neutral	0	1	5	0	0								
Topography														
The decommissioning and closure phase will aim to restore the site topography by contouring filled-in areas to achieve approximate original contours as pre-mining. A slightly elevated (higher terrain to pre-mining) will be the end result of the terrain. No residual topographical features are anticipated to remain. yet the site pre-mining is considered of high sensitivity	Negative	3	1	5	3	27	High	Negative	2	1	4	2	14	Mod
Air Quality & Dust														
Generation of PM10 and PM2.5, gaseous emissions from vehicle tailpipes due to	Negative	3	2	3	3	24	Mod	Negative	2	2	2	2	12	Low

rehabilitation activities, demolition of structures.														
Noise impact														
Backfill of mined out areas	Negative	2	1	3	4	16	Mod	Negative	1	2	3	2	7	Low
Planting of grass and vegetation at rehabilitated areas	Negative	2	1	3	3	14	Mod	Negative	1	2	3	2	7	Low
Removal of infrastructure	Negative	2	1	2	4	14	Mod	Negative	1	1	3	2	6	Low
Ground Vibration and Blasting														
No blasting will take place during this phase. Ground vibration from heavy vehicles backfilling and demolishing structures would be negligable.	Negative	1	1	2	0	3	Very Low	Negative	0	1	2	0	0	Very Low
Visual Impact														
Restoration of the landscape and topography will take place. Residents within a 5km radius of the site will experience visual intrusion. Residents in close proximity will experience a higher visual intrustion due to their proximity. Similar activites will take place as during the construction phase.	Neutral	3	2	2	2	18	Mod	Neutral	2	1	2	1	8	Low
Ecological Impact														
The proposed mine is expected to have a serious long term negative impact on the project site and its surroundings. The project site can never be fully rehabilitated and ecologically restored to its premining state. Incorrect rehabilitation can lead to further degradation of the ecology on site	Negative	3	2	5	8	45	Very High	Negative	3	2	5	6	39	High
Impact on Aquatic Ecosystems														

Rehabilitating and restoring the aquatic environment to natural condition will be nearly impossible due to the present ecological importance and sensitivity (EIS). The Geluk Mine is expected to have irreversible and severe long term negative impacts. Soil erosion and sedimentation from bare surface and runoff into the Shakwaneng River may take place.	Negative	3	3	4	8	45	High	Negative	2	3	4	6	26	High
Soil, Agricultural Potential and Land Capability														
Incorrect topsoil stripping during the mining process may lead to mixing of soil layers making soil difficult to use as rehabilitation soil and would have adverse impacts	Negative	2	1	5	8	28	High	Negative	1	1	5	4	10	Low
Groundwater Impact														
Groundwater contamination, rebound of water levels within backfill material which may decant. Pollution plume may affect down gradient water use.	Negative	1	2	3	3	8	Low	Neutral	0	1	2	1	0	Very Low
Surface Water and drainage														
Increased sedimentation of the Shakwaneng and Steelpoort Rivers may take place due to erosion of bare soils. Spillages from hydrocarbons and hazardous substances, refuelling during rehabilitation activities. The potential for contamination of the Shakwaneng River due to leachate is less than 2%.	Negative	3	3	4	4	33	High	Negative	2	3	4	2	18	Mod

Heritage and Cultural Impact														
If no heritage of cultural resources were found during the operational phase other than the 2 stone wall sites (within the 500m mining restriction area). It is not likely that any other features would be unearthed as backfilling of pits will take place from overburden piles and ore fines. No further excavations will be required.	Neutral	0	1	5	0	0	Very Low	Neutral	0	1	5	0	0	Very Low
Impact on Traffic														
Road Safety and increase in traffic on R555 and D2219. Traffic is set to decrease during the decommissioning and closure phase. Transport of ore will cease.	Neutral	1	4	2	1	7	Low	Neutral	1	4	2	1	7	Low
Socio-Economic Impact														
Sudden loss of employment / jobs, local spending on goods and services	Negative	3	3	3	3	27	High	Negative	2	3	3	2	16	Mod
Mine closure / production stop will result in weakening in local economy	Negative	3	3	3	3	27	High	Negative	2	3	3	2	16	Mod
Agricultural activity will not be able to continue to full extent and limited employment will be available from this land use	Negative	2	2	3	1	12	Low	Negative	1	2	3	1	6	Low
Impact on sense of place due to dust fallout, noise, increased traffic, visual intrusion will cause a nuisance to local communities due to their proximity to the project site (closure activities, demolish of structures, landscaping, infilling of areas)	Negative	3	2	2	4	24	Mod	Negative	2	2	2	1	10	Low
Impact on land use and surroundign land uses as pre-mining was natural environmental and post mining will be grazing with a slightly higher terrain as before mining	Negative	3	2	5	3	30	High	Negative	3	2	5	1	24	Mod

Substantial Community Development Trust Fund which have grown over the period of the LoM and infrastructure improvements in the local communities remaining long after mining has ceased	Positive	3	2	4	3	27	High	Neutral	0						

10.4.3.4Cumulative Impacts

Table 72 Summarises the impacts related to the Cumulative Impacts of the proposed Geluk Mine project, it provides the significance rating pre-mitigation and post mitigation.

Table 72: Cumulative Impacts

CUMULATIVE MPACTS	PRE-MITIGATION							POST MITIGATION						
	Status	Probability	Extent	Duration	Intensity	Significance Score	Rating	Status	Probability	Extent	Duration	Intensity	Significance Score	Rating
Air Quality & Dust														
The annual and daily cumulative ground level concentrations may increase with a further 20 µg/m³ and 40 µg/m³ respectively.	Negative	2	2	4	3	18	Mod	Negative	1	2	4	1	7	Low
Noise impact														
Cumulative noise impact from open cast mining operation, related activities will impact on the abutting noise sensitive areas, road network and prevailing environmental noise.	Negative	2	1	5	2	16	Mod	Negative	1	1	3	1	5	Low
Visual Impact														
The increase in mining activities in the local and regional area result in negative visual intrusion, impact on landscape character, impact on residents. (change in land use from rural to rural / mining)	Negative	3	3	4	3	30	High	Negative	2	3	4	3	20	Mod

Ecological Impact														
Cumulative impact on red listed plant species (Crinum macowanni and Ilex mitis.Removal will have a cumulative impact of reduced species richness and composition.	Negative	3	2	4	8	42	High	Negative	2	2	4	8	28	High
A decrease in floral habitat and ecological structure will lead to the profileration of alien invasive species, habitat fragmentation, and decrease species richness on site.	Negative	3	2	4	8	42	High	Negative	2	2	4	8	28	High
Surface Water and drainage														
Currently the surface over of the local area has been changed from natural to settlements creating increased hardened surfaces increasing soil erosion resulting in sedimentation into the Shakwaneng River.	Negative	3	3	4	4	33	High	Negative	2	3	4	3	20	Mod
Impact on Traffic														
Increased mining activities with urban traffic in the local area will increase risk for road safety and result in increased traffic on R555 and D2219	Neutral	3	4	4	2	30	High	Neutral	1	4	4	1	9	Low

10.5 SYNOPSIS OF SPECIALIST REPORTS

Appendix 3 of the EIA Regulations of 2014 stipulates that a summary of findings of the recommendations of any specialist reports must be indicated and how it has been applied in the EIR.

This section summarises the conclusions of the several specialists commissioned as part of the EIA process to assess the multiple biophysical and social impacts identified.

10.5.1 Noise and Ground Vibration Impact Assessment

The proposed construction of the open cast mine will take place in an area where there is a feeder road, water pipeline and residential properties and the risk assessment indicated that the management system will have to be improved by means of the recommended acoustic screening measures. Noise and ground vibration monitoring must take place on a monthly basis during the construction and operational phases of the project after which the frequency of monitoring may be changed to a quarterly basis.

The mine is situated in a valley with high mountains to the east and west with the result that the noise will be propagated to the south-west. The noise level at the source will be between 65.0dBA to 85.0dBA whereas the noise level at 1 000m from the activity will be 40.0dBA to 50.0dBA. Noise impact from construction and operation machinery, excavations will be site specific (within the mining boundary and immediate residential surroundings. The impact from blasting will be a very high instantaneous impact of some 2-3 seconds at 120-140 dBA, yet will be perceived as 58.1dBA at a distance of 500m from blast. The impact will affect the local area (within a 5km radius). The vibration level of the blast will be below the structural damage limit and will be experienced as rattling windows.

The noise and management plan must be used to either intensify the monitoring programme or to maintain the monitoring programme.

There will be a shift in the immediate noise levels of the proposed activities on a temporary basis during the construction phase and a permanent basis during the operational phase and the communities will have to be briefed and informed of this during the public participation process. Regular feed-back to the community leaders during the operational phase of the project of the baseline noise and ground vibration monitoring must take place. A system whereby complaints are recorded and investigated must be made available.

The possible noise intrusion from the blasting and mine activities can however be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles and compliance to the Local Noise By-laws, and the International Finance Corporation's Environmental Health and Safety Guidelines.

Main Control measures to be implemented:

- Blasting is only to be undertaken during daytime

- A 500m restriction to mining from residential areas, water pipeline the blast site is to be implemented;
- An earthberm of 10.0m is to be erected in vicinity of residential properties;
- The feeder road D2219 is to be closed for traffic during blasting at which also blasting schedules should be displayed at control points; (the schedule must be available to communities)
- Permanent ground vibration to be carried out at abutting noise sensitive areas;
- Noise monitoring to be done on a quarterly basis, crushing activities and noise survey is to be done on a monthly basis.

10.5.2 Air Quality Impact Assessment

Crushing activities and vehicle entrained dust from unpaved road surfaces represent the highest impacting particulate sources from the proposed mining operations.

- ✓ The daily predicted PM10 ground level concentrations, in exceedance of the NAAQS, extended ~1300 m (unmitigated) to ~420 m (mitigated) from active unpaved roads, ~500 m (unmitigated) to ~310 m (mitigated) from active pit activities, ~900 m (unmitigated) to ~600 m (mitigated) from crushing activities and ~40 m from storage pile activities.

- ✓ The daily predicted PM2.5 ground level concentrations, in exceedance of the NAAQS, extended ~460 m (unmitigated) to ~60 m (mitigated) from active unpaved roads, ~140 m (unmitigated) to ~30 m (mitigated) from active pit activities, ~450 m (unmitigated) to ~300 m (mitigated) from crushing activities and ~20 m from storage pile activities.

- ✓ The dustfall rates, in exceedance of the NDCR for residential areas, extended ~65 m (unmitigated) to ~30 m (mitigated) from active unpaved roads, ~60 m from active pit activities, ~260 m (unmitigated) to ~200 m (mitigated) from crushing activities and ~50 m from storage pile activities.

The main sources of emissions at the railway siding were vehicle entrained dust from unpaved road surfaces.

- ✓ For unmitigated operations, PM10 daily and annual NAAQS were exceeded at the closest sensitive receptors. For mitigated operations, impact areas are significantly reduced with PM10 daily NAAQS exceeded at the closest sensitive receptors.

- ✓ For unmitigated operations, PM2.5 daily NAAQS were exceeded at the closest sensitive receptors. For mitigated operations, impact areas are significantly reduced with no exceedences of PM2.5 NAAQS at the closest sensitive receptors.

- ✓ Dustfall rates due to the railway siding operations were less than 400 mg/m²/day (well within NDCR for residential and non-residential areas).

Main control measures to be implemented:

- Establish a dust fallout monitoring network comprising 7 single dust buckets at mine site and 3 single dust buckets at railway siding. Dust fallout rates is to be below 1200mg/m2/day in non-residential areas and 600mg/m2/day in residential areas, averages over 30 days;
- Chemical suppressants are to be applied to unpaved haulage roads in proximity to sensitive receptors (mine site and railway siding) to reduce impacts from the source by 60-80% control efficiency.
- For the mobile crushing plant, feasible management include water sprayers on crushing activities and telescopic chute with water sprayers;
- Sensitive receptors (residential dwellings should be placed a minimum distance from mining activities to reduce health impacts. The recommended distances are as follows:

Table 73: Recommended distances to sensitive receptors

Mining Activity	Recommended distance UNMITIGATED	Recommended distance MITIGATED
Unpaved haul roads used to transport RoM	1200m	310m
Unpaved haul roads used to transport product	680m	140m
Unpaved haul roads to transport RoM and product	1300m	420m
Crushing and screening operations	900m	600m
Active mining pits	500m	310m
Stockpile areas (windblown dust and handling material)	Not stated	50m

10.5.3 Visual Impact Assessment

Due to the rolling topography, homogeneous vegetation and existing land-use the area has a low Visual Absorption Capacity (VAC).

The removal of parts of the bushveld during the construction stage as well as the low VAC of the area will result in a moderately severe landscape impact.

The severity of the landscape impact can however be mitigated to a moderate severity. Sensitive placement of the construction camp, limited surface disturbance and prompt rehabilitation are prerequisite conditions if the severity of impact is to be reduced. Surface disturbances created during construction may remain for an extended period during the operational phase. These are seen as residual affects carried forward from the construction phase and can be substantially mitigated if treated appropriately during the construction phase.

The operational phase will introduce alternative land uses to the site that will alter the existing bushveld character. The exposed soil, roads and stockpiles will replace most of the bushveld. The undulating bushveld and the associated openness of the study area are considered as a landscape amenity that provides the study area with a unique and valued sense of place. This quality of the landscape will be lost due to the development this scale and extent.

The topography and vegetation have a low VAC and high landscape character sensitivity but the surrounding mining activities of reduce landscape character sensitivity will result in a low to moderate significance of landscape impact.

The residents around the proposed development may experience a high degree of visual intrusion due to their proximity to the mining activities Visual intrusion will decrease as the mining activities near completion and the site is cleared of construction elements and rehabilitated.

Visual exposure is considered high due to the proximity of the development to the residential areas and the high level of visibility that can be expected.

The visual exposure and intrusion of the mining activities for tourists will be low due to the limited viewers and the times spend in the area. The severity of the visual impact will be moderately-low severity, causing a moderately-low significant visual impact.

The visual receptors that will be mostly affected are the residents within a 2 km distance from the site.

10.5.4 Traffic Impact Assessment

An access intersection was proposed along the D2219, the intersection will be priority stop controlled with priority on the D2219.

The existing Malekana Steelbridge is a one lane bridge that will not be able to accommodate the mine's haulage trucks, therefore it is proposed that a new bridge be constructed to replace the existing one. The construction costs are estimated at R40 million. It is further proposed that the construction of the bridge be a joint project between all the mines in the vicinity, as it will be beneficial for all mines and the community.

Three phases were analysed and it was determined that the third stage of the operational phase is the critical one, it will generate the highest volume of additional trips. The

trips generated during this phase was estimated at 92 vehicle trips per day and 25 vehicle trips per hour during both the AM and PM peak hours.

Three scenarios were analysed, all the intersections operate at an acceptable level of service.

The following upgrades were proposed for safety purposes and also to accommodate additional heavy vehicles on the road network:

- ✓ Construction of the D2219 /Access Road to mine intersection: A two way priority stop controlled intersection, with priority on the D2219 Road. The access intersection will be constructed with exclusive turning lanes on the D2219 Road.
- ✓ Provision of street lighting for safety purposes at the access to the mine intersection. Provision of road signage and road markings.
- ✓ Construction of public transport bays in the vicinity of the mine's access intersection.
- ✓ Construction of a new bridge to replace the existing Malekane Steelbridge. The construction of this bridge should be a joint project between all the existing and future mine in the vicinity. The construction of the bridge will be beneficial to both the mines and the community.

The traffic engineers found that the Geluk Mine project will not have a negative impact on the existing road networks within the project area. Yet mitigation measures have been recommended to accommodate the background traffic demand and the proposed mine's development traffic and also for safety purposes.

10.5.5 Heritage Impact Assessment

- ✓ Three isolated cemeteries were identified in association with built up areas. These should be avoided and not disturbed and considered NO-GO areas.
- ✓ Two stone wall sites were noted and geo-referenced one in close proximity to a soccer field and the other one at the western river bank, these stone walling sites seem to represent recent past activity periods.

These sites must be avoided by the Mining activities. A 50m bufferzone from stone wall structures on the northern extent of the project site must be implemented. The 500 meter restriction to mining is supported to safe guard the populated areas and the creation of safety or buffer zones for drilling and blasting which include fly rock and ground vibration that could end up damaging people' s houses.

The two stone wall sites would then fall within the 500m restriction to mining zone and no impact is foreseen on heritage or cultural resources accept if chance finds occurring during construction, operation due to earthmoving activities.

If the recommendations are followed there are no objections to the proposed mineral exploration and archaeologist recommends to Limpopo Provincial Heritage Resources Authority or the South African Heritage Resource Agency to approve the project as planned.

10.5.6 Soils, Agricultural Potential and Land Capability

The majority of the study site falls within an area with a hilly terrain with steep slopes, shallow rocky soils and a climate not conducive to large scale crop production. The area is used extensively for livestock grazing particularly goats and cattle. The majority of the site has been categorised as Class VII indicating that most of the site has severe limitations for successful crop yields due to the shallow, rocky soil types. Small areas of the site adjacent to the Shakwaneng River and with arable Hutton and Oakleaf soil forms are classified as Class III and the wetter soils classified as Class V.

The proposed mine is not expected to have an impact on agricultural production in this area due to the agricultural limitations of the site. Apart from the existing small scale subsistence gardens, there is no agricultural production in this area.

Several negative environmental impacts pertaining to the soil resources within the site were identified. These impacts are associated with soil compaction leading to erosion, soil pollution and the continued spread of alien invasive vegetation due to mining related disturbance. Mitigation measures recommended in this report are key to lowering the significance of these impacts.

It is not envisaged that any future large scale agricultural production will occur on this site due to the abovementioned limitations. The proposed mine can be managed to have limited negative impact on the surrounding agricultural resources.

10.5.7 Ecological Impact Assessment

The dominant vegetation type of the study site isSekhukhune Mountain Bushveld. The site corresponds to CBA's and ESA's. The CBA's must be protected in their natural state and ESA are required to prevent degradation of CBA's.

Declining red listed plant species *Crinum macowanii* and *Ilex mitis*, were seen along the Shakwanang River. Two plant species of conservation concern were identified during the site visit. Four vegetation units were identified:

- Vegetation surrounding the Dr Eiselen Dam
- Riverine vegetation corresponding to the Shakwaneng River
- Mountainous vegetation (Sekhukhune Mountain Bushveld)
- Disturbed bushveld

The majority of proposed mine and infrastructure fall within the mountainous vegetation, considered to be ecologically pristine with very high sensitivity. From a floral and faunal viewpoint the health of this vegetation unit and the riverine system are important for biodiversity.

Three red listed avifaunal species have been recorded previously on site, Eupodotis senegalensis, Sagittarius serpentarius and Gyps coprotheres and Ciconia nigra were

observed during the survey. Reptile species of concern are the Soutspansberg Flat Lizard, Sekhukhune flat lizard (subspp. Fitzsimons) and South African Rock Python.

From a mammalian perspective, the Serval and Brown Hyena are considered keystone species for the study area.

A number of potential impacts relating to loss of indigenous vegetation, proliferation of alien invasive species, habitat fragmentation, loss of Red Listed species, loss of faunal habitat, direct faunal impacts and disturbance to fauna are predicted to occur as a result of the proposed Geluk mine.

The proposed mine is expected to have a serious long term negative impact on the project area and the surrounding environment. The proposed mine area can never be fully rehabilitated and ecologically restored to pre-mining condition.

From an ecological (fauna and flora), the establishment and operation of the proposed Geluk Mine is not supported.

If the project is to go-ahead the following exclusion zones must be implemented:

- ✓ Establish an ***Exclusion Zone to maintain biodiversity***: A 200m buffer zone is recommended from the edge of all rocky outcrops and is to include the entire mountain range on the eastern side of the study site;
- ✓ No activities are to infringe on upon the riparian habitat along the Shakwaneng River. All activities should remain within the demarcated mine footprint area;

10.5.8 Aquatic and Wetland Impact Assessment

The Shakwaneng and Steelpoort rivers was found to be of a PES class C rating mostly due to existing open pit mining in the local area, erosion, anthropogenic activities and lack of catchment management. The EIS for the Steelpoort River was determined as high with the presence of the unique Labeobarbus mareqeunsis and the flow and water related water quality sensitive Chiloglanis pretoriae. This was based on the various components of the RHP methodologies, such as the class B Steelpoort River's SASS5 score, and for the class D Shakwaneng River.

The overall results of the aquatic assessment concluded that the Shakwaneng River i n the study area is considered to be moderately modified (C Class) PES and moderate EIS with the presence of indigenous protected vegetation species. The findings of the habitat assessment assessed the instream and riparian habitats to be moderately modified (C class) PES and highly suitable for both these river systems.

Artificial seepage wetlands were characterised by the seep from the Dr Eiselen Dam. Surface and sub-surface water flow were evident of flowing in a northern direction, forming part of the Shakwaneng River.

From the water quality high levels of electrical conductivity and species composition from the diatom analysis it was evident that concentrated/elevated dissolved substances were

present within both the Shakwaneng and Steelpoort rivers as a result of associated anthropogenic pressures.

Although impacts, predominantly impoundments, sewage and urban runoff are present upstream of the current sampling sites, the water quality is not overly impacted and sensitive species particularly macroinvertebrates were found in both rivers. The impacts of most concern as a result of the proposed Geluk Mine relate to water quality and water quantity.

Any water quantity restriction occurring from the proposed project will likely have knock on water quality impacts, as the dilution and transport potential of the system is reduced. Reducing flows will also reduce the amount of habitat inundated and may contribute to a reduction in the biodiversity of the systems.

A number of potential impacts relating to extensive erosion and sedimentation, pollution and the possible spread of alien invasive species will occur as well as impacts on both sub-surface and surface flows of groundwater/stormwater. During the construction and operational phase all identified impacts were rated as high.

Any acid generating potential of the ore appears to be low to negligible yet there are many other potential aquatic ecology impacts associated with mining and as such the use of adequate buffers and biomonitoring throughout the life of mine as well as during closure should be carried out.

Rehabilitating and restoring the environment to natural condition will be nearly impossible, given the high ecological importance and sensitivity (EIS) this study area possess. The proposed Geluk Mine operation is expected to have irreversible and severe long term negative impacts on these sensitive environments.

Main layout implications/control measures:

A 200m buffer implemented for the Shakwaneng River and 100m for drainage channels within the project boundary.

10.5.9 Floodline Delineation Report

90% of the 1:100 year flood lines are less than 100m from the centre line of the Shakwaneng River and associated streams. Therefore a 100m buffer zone would need to be applied to the river and streams as regulated in Government Notice 704 under NWA. The topography and velocity of runoff will allow over an 1 hour down to half an hour for evacuation times for mining machinery and infrastructure removal (if mobile).

10.5.10Groundwater Impact Assessment

Two interconnected groundwater systems are on site, shallow and deeper. Flow from both systems is controlled by topographical features. The groundwater resources are classified as Class 3 due to geology of the area.

Mining will progress below the regional water level and dewatering will be required for a safe working environment. Estimated inflows range between 0 and 297 m3/day into the proposed pits. The resulting drawdown cone is predicted to extent approximately 1km east and west of the pit walls. The cone of depression is predicted to extent a maximum of 4km over the mining years (LoM is 30 years, this prediction accounts for LoM 50 years).

Seepage from stockpiles is likely to migrate south west towards the Shakwaneng River. Yet only 16% of initial 100% concentration at source is predicted to reach the groundwater table beneath piles. Less than 2% may end up in the Shakwaneng River, no borehole is predicted to be impacted.

Decant is expected to occur but the date at which the decant will start was not determined. The decant volume would be in the order of 0.5 l/s (maximum).

Groundwater monitoring programme should be implemented as soon as possible so that pre-mining groundwater level and quality will be gathered.

10.5.11Desktop Geochemistry Analysis

Based on the available data the waste and ore material to be generated by proposed mine is classified as Type 3 waste (moderate risk/hazardous), facilities should be designed in accordance with specifications for a Class C landfill site (old GLB+ landfill). The potential for leachate is low to negligible.

- The waste material and ore to be generated as part of the project needs to be sampled and analysed in accordance with the NEM: WA and DWS legislative guidelines for more accurate analysis.
- During construction, the correct liners must be utilised and the legally required material and methods adhered to.
- Site characterising boreholes should be drilled on site, upstream and downstream of potential sources of pollution to be used as monitoring boreholes and to sample current baseline water quality conditions;
- A monitoring programme should be developed for the site to monitor pre-operational, operational and post-operational water qualities.

10.5.12Socio-Economic Impact Assessment

The study area revealed the following pertinent characteristics.

Given the location and rural setting of the proposed mine (southwest of Steelpoort and southeast of Jane Furse) the primary affected area delineated for this project is defined by a 10km radius from the mining site. The site consists of natural areas and steep hilly terrain in its eastern and western portions with low densities.

An estimated total of 62 030 people and 14 666 households are located within the study area during 2016. Although Jane Furse is expanding, the population in the trade area is decreasing. This can be attributed to rural-urban migration due to a lack of job opportunities. There are approximately 3 258 people (687 households) living in the immediate area that will be significantly impacted due to a change in the sense of place, quality of lifestyle as a result of mining impacts namely, dust, noise, vibration, visual intrusion, increased traffic on the local road network.

The education profile of the area indicates that literacy levels are low, and there is a large number of people locally with no formal education. This could bode well for the low skill requirements for some of the mining occupations. The mine has the potential to play a crucial role in eradicating poverty in the area.

Local unemployment levels (62.0%) are far above the national average of 22%, while income levels indicate that households are predominantly low income earners. It should, however, be noted that these figures relate to conventional statistics. There is a strong informal economy – 48.4% of the Makhuduthamaga Local Municipality and 28.2% of the Greater Tubatse Local Municipality are working in the informal sector that should be incorporated into the analysis. The informal economy plays a crucial role in the local area and it their livelihoods will be significantly affected due to the mining on the area they practice subsistence farming.

Alternative use for the site is limited residential expansion, subsistence farming, and localised tourism. The value of mining to output/sales, GGP and employment is higher than agriculture and tourism, but this is an activity that is dependent on local resources and once the resources are depleted the activity seize.

Downstream, communities are similarly influenced by water availability and associated availability of cultivated land next to water courses. The above indicates to an area with strong historic and cultural ties. Mining the area, will negatively impact the livelihoods of the tribes who have been living there for a long period.

From a cultural and natural perspective, the mine will be situated on vitally important land. The study site is a green park area/public park at which surrounding communities conduct social and socio-cultural activities. The community collect firewood, wash clothes in the river, perform Traditional Rituals in the river, have picnics, take wedding photos and possibly also pray at site. It was stated that the mine will have a negative impact on the social activities of the communities. There are approximately 3 000 to 3 5 000 people (700 to 1 000 households) living in the immediate area that will be signficantly impacted.

10.6 ENVIRONMENTAL IMPACT STATEMENT

This section is required in terms of Appendix 3 of the EIA Regulations 2014 (GNR 982 of 4 December 2014) under Section 3l. It summarises the findings of the EIA and provides a comparative assessment of the positive and negative implications of the proposed mine.

10.6.1 Summary of Key Findings

The assessment of the key issues through specialist investigations, site visits have indicated that there are several negative impacts of high and very high significance. These impacts include:

Impact on Ecology (Fauna and Flora)

- The proposed project is to be located within an area considered to be ecologically pristine with very high sensitivity. Features on site such as the Shakwaneng River, vegetation unit (Sekhukhune Mountain Bushveld) and mountain/ridge forming the eastern boundary of the property are important for biodiversity;
- The mine is expected to have a serious long term negative impact on the project area and surrounding environment and can never be fully rehabilitated and ecologically restored to pre-mining state.

Aquatic Ecosystems

- Extensive erosion and sedimentation, pollution and spread of alien invasive species are predicted. Construction and operational impacts were all rated high on the aquatic ecosystem;
- The aquatic ecosystem is of high ecological importance and sensitivity (EIS).
- The Geluk Mine operation is expected to have irreversible and long term negative impacts on these sensitive environments;
- Rehabilitation and restoring the environment to natural condition will be nearly impossible.

Social-economic environment

- Blasting activities will pose a hazard to residential dwellings closer than 500m to mining activities.
- The development of the Geluk Mine will significantly alter the sense of place and impact on the quality of lifestyle of the direct property owners and surrounding communities due to noise, dust and vibration from blasting. There will be a high visual intrusion from the mining activities affecting communities within a 2km radius of the project;
- The influx of construction workers, job seekers, to the area will result in the integration with communities which could bring forth social problems, in turn could result in increased crime and impact on the communities safety;
- Fine particulate matter (PM10 and PM 2.5) blown over from blasting and dust generating operations may pose health impacts to direct and surrounding communities such as sinusitis and bronchitis.
- The increased traffic from mine haulage trucks on the D2219 road and R555 may impact on the safety of the communities and cattle due to road accidents.
- The lack of regular community consultation and engagement during the construction, operation and decommissioning phase of the mine can lead to community protests;
- As per the Geohydrological Impact Assessment done by Naledzi Waterworks, it is not predicted that any private borehole, neighbouring groundwater quantity will be affected by the mining operations (dewatering of pits) during the 30 year Life of Mine. The potential contamination of the Shakwaneng River through siltation and sedimentation from mining operations will directly affect the community, as it is a

sole water source next to boreholes, resulting in an impact on water availability to the communities.
- Control of urban sprawl onto the proposed mining right area will need to be implemented to uphold the 500m restriction of mining from residential dwellings.

The specialist recommendations in this regards are to impose strict exclusion zones on these systems falling within the project boundary:

- **Ecology:** 200m Buffer Zone from the edge of all rocky outcrops and inclusion of the entire mountain range on the eastern side of the study site;
- **Aquatic Ecosystems:** Implement a 200m buffer zone from the Shakwaneng River and 100m from drainage channels within the project boundary over and above other recommended management measures. (legally only 100m from the centreline of a stream or river is required). No diversion of the Shakwaneng River will take place;

  No mining pits are to result in the diversion or any alteration of the Shakwaneng River.

- **Socio-economic environment:** 500m restriction to mining from residential areas is recommended including a 10m earth berm in vicinity of residential dwellings. Monitoring Programmes on noise, dust and blasting on surrounding communities must be undertaken on an ongoing basis. Regular consultation and engagement with communities must be undertaken through Community Forum meetings.

  Local labour must be employed from surrounding and direct communities as far as possible.

  No recruitment must be undertaken at the mine only through consultation with labour sending communities and direct communities. In any event of third party loss, the mine is to provide compensation. The Makhuduthamaga Local Municipality and Greater Tubatse Local Municipality is to enforce an urban edge along Maphopha and Ga-Mogashoa to curb further urban sprawl into the mining righ area.

  Road upgrades are to be undertaken with the first three years of construction – operational phase to ensure adequate signage and road safety measures are implemented along the D2219 to avoid impacts on motorists and the community.

Mining the mineral is feasible from a legal, biophysical and social perspective. Strict control measures are however to be implemented to key significant environmental areas are to be considered NO-GO areas.

The predicted negative impacts can be minimized and the positive effects can be enhanced by implementation of recommended design and mitigation measures. Design and mitigation measures are formalised in the EMPr.

10.6.2 Need and Desirability of the Project

Vanchem/Rakhoma already has an approved Mining Permit within the proposed Mining Right boundary which it wishes to extend over the greater resource available.

The Geluk Mine produce will sustain Vanchem's production and address the local/global demand it supplies for. The timing of the proposal is driven by the recent lack of ore supply and void left by its key ore supplier Mapochs in 2015.

The scale of mine proposed will be based on the company's own ore requirements. The activity and scale proposed is considered Vanchem's most preferred and cost effectiveness approach to obtaining ore supply and restarting its processing plant operations in Witbank.

The alternative land uses for the proposed project site is limited to residential expansion, subsistence farming and tourism. Residential expansion will be restricted by topography and access to basic services/service provision in these areas. Subsistence farming is also undertaken at a limited scale mostly comprising livestock grazing. In context, tourism is not considered viable as the project site/local area is not considered a tourism destination/popular area. It is seen as settlement / rural area.

10.6.3 Construction Phase Impacts identified

Negative impacts

- Increased in ambient noise due to construction activities
- Increase traffic and potential impact to road safety, pedestrians
- Emissions of dust, PM10 and PM2.5 mostly due to vehicle entrainment on unpaved roads;
- Visual impact due to clearing of bushveld vegetation/change of surface cover
- Potential impact on surface and groundwater quality and quantity
- Impact on Ecology (Fauna and Flora) due to removal of vegetation of high sensitivity
- Impact on Aquatic Ecosystem due to high loads and erosion and sediment load expected into the Shakwaneng River;
- Socio-economic impact: Potential squatting close to mine site due to perception of work, nuisance impacts from dust, noise, visual impact, impact on sense of place and quality of lifestyle including potential increased crime and safety impacts.

Positive impacts:

- Creation of job opportunities
- Increased demand for goods and services
- Eradication of poverty

10.6.4 Operational Phase Impacts identified

Negative impacts:

- Emissions of dust, PM10 and PM2.5 from crushing activities and vehicle entrainment from unpaved roads at mine operation;
- Emissions of dust, PM10 and PM2.5 from vehicle entrainment from unpaved access road to Roossenekal Rail siding;
- Increased traffic on the D2219 and R555 and surrounding road network;
- Increased noise levels to crushing activities, strip mining operations, blasting
- Ground vibration from blasting activities (rattling windows – twice a week);

- Visual impact from visible dust fallout, removal of vegetation resulting in change of surface cover; (high impact due to proximity of residential receptors)
- Potential impact on surface and groundwater quality and quantity;
- Impact on Ecology (Fauna and Flora) due to vegetation removal;
- Impact on Aquatic Ecosystems due to potential soil erosion and high sediment load into Shakwaneng River, pollution of the water source, spread of alien invasive species
- Socio-economic impact: Nuisance impacts from dust, noise, visual impact and water availability, altering of the in sense of place, health impacts due to fine dust cuasing sinusitis and bronchitis, safety impacts from influx of job seekers, construction workers and contractors

Positive impacts:

- Creation of job opportunities;
- Eradication of poverty;
- Demand for goods and local services

10.6.5 Closure Phase Impact Identified

Negative impacts

- Impact on topography (higher terrain than pre-mining)
- Generation of PM10 and PM2.5 and gaseous emissions from vehicle tailpipes, demolition and rehabilitation activities;
- "Construction" noise due to backfilling of mined out areas, revegetation, landscaping, removal of infrastructure
- Visual impact / visual intrusion due to bare soils, construction like activities in proximity of settlements;
- Long term negative impact on ecology due to ecology not being able to fully recover to pre-mining state;
- Long term irreversible impact on aquatic ecosystems due to high ecological importance and sensitivity– sedimentation from bar surface and runoff;
- Potential impact on Groundwater and surface water quality and quantity
- Lower traffic volumes will be experienced than the operational phase, yet still an increase from existing volumes on R555, D2219 and local road network;
- Loss of employment, spending on goods and services resulting in weakening of local economy

Positive impact:

- Traffic on local road network will decrease
- Community infrastructure developments brought on by mining available to community post mining;
- Wealth of community post mining due to grown Community Trust Fund and Local Community development plans

10.7 Overall Sensitivity Map

Refer to Plan C attached under Volume 1.

10.8 DESCRIPTION OF UNCERTAINTIES OR GAPS IN KNOWLEDGE

In terms of Appendix 3 (Section 3p) of the EIA Regulations of 2014 (GNR 982) states that the EAP must provide a description of any assumptions, uncertainties and gaps in the knowledge upon which the impact assessment has been based.

- The definite location of mineral resource and scheduling for mining is not known as this was not provided by Rakhoma; (A preliminary drafted plan was provided for the purposed of the EIR)
- The impact approach was to delineate environmentally sensitive areas which is to ultimately guide the location of mining pits and associated infrastructure;
- The impact assessment has assumed the information on the geology, mining method, depth of mineral, and infrastructure requirements provided by Rakhoma through NRR Mining Consultants are basically correct;
- Various Red Data and species of conservation concern could potentially occur within the study site yet was not recorded. Yet the occasional visit by Red listed, species of conservation concern cannot be ruled out;
- No on-site ambient PM2.5 and PM10 baseline measurements were available for assessment. The quantification of sources of emission was restricted to the proposed project activities only.
- In assessment of the aquatic ecology there was an absence of baseflow on certain stretches of the Shakwaneng River, limited invertebrate surveys were carried out, with no/limited historical data and research available for this river system. This however restricted the amount of sites that was being surveyed;
- Only a Geochemistry Desktop analysis was undertaken as no waste and ore material were available for laboratory testing. The desktop analysis is thus conservative in nature and not site specific, and accounts for worst case scenario based on review of similar case studies;
- Groundwater / Aquifer parameters such as transmissivity and storage were taken from literature and are assumed to be applicable to the site environment;
- Aquifer recharge values were taken from literature. The values are assumed to be applicable to the site environment;
- No groundwater level and water quality monitoring programme is currently being undertaken, hence, the baseline water quality and groundwater level is based on existing data gathered from previous studies in the area;

10.9 REASONED OPINION IF ACTIVITY SHOULD BE APPROVED

In terms of the Appendix 3 of the EIA Regulations of 2014 the EAP is to provide a reasoned opinion as to whether the activity should or should not be authorised. If it should be authorised state any conditions that should be made with respect of that authorisation.

Naledzi Group Pty Ltd is of the submission that due process has been followed to form the findings of the EIA study in accordance with the EIA Regulations of 2014. The EIA process undertaken, includes an assessment of potential impacts identified, further analysed by various specialists in their respective fields as part of the EIA team. Public Participation has

been undertaken with interested and affected parties in accordance to the EIA Regulations of 2014 Regulations 40-44.

Potentially significant impacts have been identified, ranked and mitigation measures are proposed for its management and monitoring. Even though negative ecological and aquatic ecosystem impacts have been identified and are deemed long term irreversible, the assessments, the EAP is of the opinion that the Mining Permit already awarded was the precursor for this proposed mining license. From this point forward the EIA process should serve to restrict mining of sensitive areas along the target mineral resource. Exclusion zones to mining (mountain, Shakwaneng River and drainage line buffers) will significantly lower the anticipated impacts and enable Rakhoma to rehabilitate the proposed area of activity to an acceptable land use for grazing purposes.

The project will have negative social economic impacts. It will significantly alter the sense of place of direct and surrounding communities and lower the quality of their lifestyle. The project area comprises a scenie environment, quiet and rural in nature which will be altered during construction and operation of the Geluk Mine. There will be a permanent shift in noise levels during the operation of the mine including high volumes of mine haulage trucks entering and exiting the mine site along the D2219 and R555. The implementation of control measures to mitigate noise, dust and blasting at the source in conjunction with on-going monitoring programmes on noise, dust and blasting will lower the significance of these impacts and its affect on the socio-economic environment. The construction of the road upgrades as recommended by ITS Engineers within the first 3 years of construction and operation of the mine will significantly lower potential safety impacts on the community, pedestrians and motorists along the D2219. Regular consultation and engagement with communities through Community Forum meetings where issues/demands of the local community are discussed and addressed will lower any possible tension/disputes that may arise from nuisance impacts from the Geluk Mine.

The project can have significant positive impacts for the local communities in terms of job creation. Rakhoma will contribute to the upliftment of the local communities surrounding the operation, which currently have a high unemployment rate and low economic activity.

The broader community members will benefit from the project as shares will be allocated and held by a Community Trust. Hence the broader community members/community will have direct economic interest in the mine and benefit economically from the mining activities of Rakhoma.

Naledzi further highlightes that water availability is a long standing challenge within the study area. The De Hoop Dam has been constructed to supply the growing mining sector and provide water to the surrounding communities, distribution thereof to communities has however not taken place yet. The bulk water pipeline has been constructed to Jane Furse along the D2219. Raw water supply is to be treated through the Malekane Steel Bridge Water Treatment Works (which is not ready yet). Distribution of the treated water remains the responsibility of the local authorities (Makhuduthamaga and Greater Tubatse) which is also not in place yet.

The availability of water to the mine for its operations may be a challenge and would need further investigation and consultation with the water services providers. Rakhoma would

need to secure water supply, if not from boreholes on site, from the Lepelle North Water which will obtain its water from the De Hoop Dam raw water supply.

Conditions for inclusion that should be made with respect of the authorisation:

A. The Limpopo Roads Agency must provide approval for the planned two way access intersection stop proposed for the mine including boom gates to be erected along the D2219 to stop traffic for purposes of blasting;
B. 200m buffer zone must be implemented to the Shakwaneng River and 100m buffer zone from drainage channels;
C. A 500m restriction to mining from residential dwellings must be implemented;
D. A 200m buffer zone (exclusion zone must be upheld from the mountain/ridge on the eastern portion of the proposed mining right area;
E. Waste material and ore to be generated as part of the project needs to be sampled and analysed in accordance with NEM: WA and DWS legislative guidelines for accurate Geochemical analysis;
F. Waste rock piles, overburden piles are to be designed as Class C landfill types (old GLB+ landfill sites);
G. During construction correct liners must be utilised and legally required materials and methods adhered to;
H. Site characterising boreholes should be drilled up and downstream of potential sources of pollution to be used as monitoring boreholes and to sample current baseline water quality conditions;
I. A Groundwater monitoring programme should be developed for the site to monitor pre-operational, operational and post-operational water quality and groundwater level.
J. No activities are to infringe on upon the riparian habitat along the Shakwaneng River. All activities should remain within the demarcated mine footprint area;

K. Construction of the D2219 /Access Road to mine intersection: A two way priority stop controlled intersection, with priority on the D2219 Road. The access intersection will be constructed with exclusive turning lanes on the D2219 Road.
L. Provision of street lighting for safety purposes at the access to the mine intersection. Provision of road signage and road markings.
M. Construction of public transport bays in the vicinity of the mine's access intersection.
N. A dust fallout monitoring network comprising 7 single dust buckets at mine site and 3 single dust buckets at railway siding must be implemented. Dust fallout rates is to be below 1200mg/m2/day in non-residential areas and 600mg/m2/day in residential areas, averages over 30 days;
O. Chemical suppressants are to be applied to unpaved haulage roads in proximity to sensitive receptors (mine site and railway siding) to reduce impacts from the source by 60-80% control efficiency.

P. Noise monitoring must be implemented on a quarterly basis, noise survey on crushing activities is to be undertaken on a monthly basis;

Q. The proposed Geluk Mine project should remain in full compliance with the requirements of the EMPr and with all legislative requirements;
R. Any changes to the scope of the Geluk Mine activities or infrastructure must subject to an EIA process paired with public participation (key authorities, I&APs) and result in the amendment of the EMPR.

S. The EMPr should be implemented by a senior qualified environmental practitioner credible to interpret the EIR and EMPR;
T. Community engagement must be maintained during the construction, operation and closure and rehabilitation phases of the Geluk Mine project;
U. Regular feed-back to the community leaders during the operational phase of the project of the baseline noise and ground vibration monitoring must take place. A system where complaints are recorded and investigated must be made;

10.10 PERIOD FOR WHICH THE EA & WML SHOULD BE VALID

Based on the production rate, estimated available mineral resource the proposed Geluk Mine will have a life of mine of 30 years. The period for which the environmental authorisations should be valid is 35 years allowing for unexpected rehabilitation and closure activities.

10.11 FINANCIAL PROVISIONS FOR CLOSURE AND REHABILITATION

Appendix 3 of the EIA Regulations 2014 indicates where applicable details of any financial provisions for rehabilitation, closure and on-going post decommissioning management of negative environmental impacts must be provided in the EIR.

This is also a content requirement of the EMPr. To avoid duplication the financial provision has been included in the EMPR.

10.12 Indication of any deviation from the Scoping Report

No deviations took place. All the specialist studies proposed within the Scoping Report have been commissioned and completed during the Impact Phase. Findings and recommendations have been included in the EIR and EMPr.

10.13 Other information required by the Competent Authority

The EIR and EMPr will be submitted to DMR as per the NEMA EIA Regulations of 2014. No other information has been requested by the competent authority.

10.14 Other matters required in terms of Section 24 (4)(a) and (b) of the Act

Section 24 (4)(a) and (b) of the Act states the following:

4. *Procedure for the investigation, assessment and communication of the potential impact of activities must ensure, as a minimum, with respect to every application for an environmental authorisation –*
   a) investigation of the environment likely to be significantly affected by the proposed activity and alternatives thereto;
   b) investigation of the potential impact of the activity and its alternatives on the environmental and assessment of the significance of that potential impact;

No further investigation or assessment of any environmental attributes of the study site is necessary. The significant identified impacts have been investigated by specialist of several disciplines which has informed the EIR findings. The potential impacts from the proposed Geluk Mine on the pre-mining environment have been assessed and its significance rated. Mitigations for further assessment and monitoring of environmental attributes have been stated and captured in the EMPr.

Any other potential impacts identified during the public participation period (by organs of state, public) of the Impact Phase, not already covered in the EIR, will be considered and the report will be updated accordingly.